PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

SCHOOL OF AGRICULTURE

2023 REGULATION

SKILL DEVELOPMENT
EMPLOYABILITY
ENTREPRENEURSHIP

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

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BACHELOR OF SCIENCE (HONS) IN AGRICULTURE

Academic Regulations and Syllabus

Under Choice Based Credit System (CBCS) withOutcome based Education

2023-24 Onwards

B.Sc. (Hons) Agriculture
PROGRAMME OUTCOME
1. Graduates will acquire detailed basic and applied knowledge on crop cultivation,crop improvement, seed production, management of abiotic-stress, reclamation,plant protection, farm machinery, renewable energy, livestock production and allied socioeconomic aspects concerned with field and horticultural crops and necessary skills and hands on experience for entrepreneurship venture, cost of cultivation, higher studies and research in all frontier areas of agriculture.
2. Graduates will be able to develop expertise in the various techniques and illustrate efficiency in identifying symptoms & pests, farm budgeting, weatheranalysis, irrigation and nutrient management.
3. Graduates will be successful professionals in agro-industries with problem solvingskills, critical thinking, market intelligence and decision-making and will be able toorganize, facilitate and participate effectively and demonstrate innovativeness and creativity.
4. Graduates will function as an effective member or leader in diverse teams of knowledge dissemination regarding various farming techniques and commercialaspects of agriculture.
5. Graduates will learn appropriate traditional/Indigenous/organic and modern techniques and understand the current problems which are necessary for futuregoals in agriculture. Further, they will have absolute idea about energy flow, waste management, environment related enforcements and eco system management.
6. Graduates will gain accurate and relevant analytical skills of problems and willhave capacity to interpret information, analyze data and draw appropriate statistical conclusions, respond and adapt to changing situations and to understand the ethical standards.

PO and Co Mapping Matrix

Correlation levels 1, 2 and 3 are as defined below:

1 – Low, 2- Moderate/ Medium, 3 - Substantial /High

IV Year	Skill and entrepreneurship development (For federating Trading)
I year	Basic and fundamental courses (Traditional)
II Year	Principles (Technology)
III Year	Production system (For improving Talent)

Summary of credit hours

S. No.	Title	Credit
1	Core Courses	137
2	Elective courses	9
3	RAWE & ELP	40
	Total	**186**

Abstract of Distribution Pattern of Courses and Credit

Semester	Number of Courses	Credit
I	11	24 (14+10)
II	10	24 (15+9)
III	11	24 (13+11)
IV	10	25 (14+11)
V	11	24 (13+11)
VI	10	24 (15+9)
VII & VIII	4	41 (0+41)
Total		**186 (85+101)**

Discipline-wise Summary of Credit hours

S.No.	Discipline	Credit
1	Agronomy	23 (12+11)
2	Genetics & Plant Breeding	16 (10+6)
3	Soil Science & Agricultural Chemistry	10 (6+4)
4	Entomology	11 (7+4)
5	Plant pathology	12 (8+4)
6	Horticulture	13 (8+5)
7	Agricultural Microbiology	8 (5+3)
8	Agricultural Economics	11 (7+4)
9	Agricultural Extension	9 (6+3)
10	Animal Husbandry	4 (2+2)
11	Engineering	4 (2+2)
12	Plant Biochemistry and Biotechnology	2 (1+1)
13	Statistics	2 (1+1)
14	Computer Science	2 (1+1)
15	English	2 (2+0)
16	NSS/NCC/Physical Education & Yoga Practices*	2 (0+2)
17	Human Values and Ethics*	1 (1+0)
18	Educational Tour*	2 (0+2)
19	Tamil / Agricultural Heritage*	1 (1+0)

20	Elective courses	9 (6+3)
21	General	2(1+1)
22	Bridge Courses	-
	Total	**146**
23	RAWE & ELP	40
	Total	**186**

* Non-gradial courses

Elective Courses

A student can select three courses out of the following elective courses offered during 4th, 5th and 6th semesters. Student will elect one course in each semester out of them. 3 or 4 elective courses will be offered in each semester i.e. in 4th, 5th and 6th semester.

S.No.	Department	Code	Courses	Credit
1	Agronomy	23ECAGR305	System Simulation and Agro-advisory	3 (2+1)
2	Genetics and Plant Breeding	23ECGPB203	Commercial Plant Breeding	3 (2+1)
3	Soil Science and Agricultural Chemistry	23ECSOL202	Agrochemicals	3 (2+1)
4	Entomology	23ECENT202	Urban Entomology	3 (2+1)
5	Plant Pathology	23ECPAT302	Antagonistic formulations	3 (2+1)
6	Horticulture	23ECHOR301	Hi-tech Horticulture	3 (2+1)
7	Agricultural Microbiology	23ECAGM301	Bio pesticides and Bio Fertilizers	3 (2+1)
8	Agricultural Economics	23ECAEC203	Project Management	3 (2+1)
9	Agricultural Extension	23ECEXT303	Agricultural Journalism	3 (2+1)
10	Animal Husbandry	23ECAHS301	Caprine and Ovine Management	3 (2+1)

Bridge courses

Bridge courses in biology and mathematics will be conducted for those candidates who have not undergone the respective courses during their higher secondary programme. These courses will be offered for 8 weeks @ 2 hours /week from the date of commencement of the programme.

Sl. No.	Semester	Coursecode	Title	Credit
1.	I	23MAT 001**	Elementary Mathematics (Contact Hours 2)	-
2.	I	23GPB 002**	Introductory Biology (Contact Hours 2)	-

Non Gradial Compulsory Courses

Sl. No.	Semester	Course code	Title	Credit
1	I, II	23PEY 111*	Physical Education & Yoga	1(0+1)
2	I, II, III, IV	23NSS 111*/23 NCC 111*	NSS/NCC	1(0+1)
3	I	23TAM 111*/ 23EXT 111*	Tamil / Agricultural Heritage (Agri. Extension)	1(1+0)

4	II	23EXT 112*	Human Values & Ethics (Agri. Extension)	1(1+0)
5	IV	23AGR 211*	Educational Tour I (Agronomy)	1(0+1)
6	VIII	23EXT 411*	Educational Tour II (Agri. Extension)	1(0+1)
			Total	6(1+5)

Department wise List of CoursesAgronomy

S. No.	Semester	Course code	Title	Credit
1.	I	23AGR 101	Fundamentals of Agronomy	3(2+1)
2.	II	23AGR 102	Introductory Agrometeorology & Climate change	2(1+1)
3.	II	23AGR 103	Irrigation management	2(1+1)
4.	III	23AGR 201	Weed management	2(1+1)
5.	III	23AGR 202	Introductory to forestry	2(1+1)
6.	III	23AGR 203	Crop production technology-I (kharif crops)	2(1+1)
7.	IV	23AGR204	Practical Crop Production -I	1(0+1)
8.	IV	23AGR205	Crop Production Technology -II (Rabi crops)	2(1+1)
9.	V	23AGR 301	Practical Crop Production -II	1(0+1)
10.	V	23AGR 302	Rainfed Agriculture, Watershed Management and Secondary Agriculture	3(2+1)
11.	VI	23AGR 303	Farming systems and Organic farming for sustainable agriculture	3(2+1)
			Total	23(12+11)

Genetics and Plant Breeding

Sl. No.	Semester	Course code	Title	Credit
1.	I	23GPB 101	Fundamentals of Crop Physiology	3(2+1)
2.	II	23GPB 102	Fundamentals of Genetics	3(2+1)
3.	III	23GPB 201	Fundamentals of Plant Breeding	3(2+1)
4.	IV	23GPB 202	Principles of Seed Technology	3(2+1)
5.	V	23GPB 301	Crop Improvement-I (Kharif Crops)	2(1+1)
6.	VI	23GPB 302	Crop Improvement-II (Rabi crops)	2(1+1)
			Total	16(10+6)

Soil Science and Agricultural Chemistry

Sl. No.	Semester	Course code	Title	Credit
1.	I	23SOL 101	Fundamentals of Soil Science	3(2+1)
2.	II	23SOL 102	Manures, Fertilizers and Soil Fertility Management	3(2+1)
3.	III	23SOL 201	Problem Soils and their management	2(1+1)
4.	V	23SOL 301	Geoinformatics, Nanotechnology and Precision farming	2(1+1)
			Total	10(6+4)

Entomology

S. No.	Semester	Course code	Title	Credit
1.	II	23ENT 101	Fundamentals of Entomology	3(2+1)
.2	III	23ENT 201	Management of beneficial insects and Introductory Nematology	2(1+1)
3.	V	23ENT 301	Pests of Crops and Stored Grain and their Management	3(2+1)
4.	VI	23ENT 302	Insect Ecology & Integrated pest management	3(2+1)
			Total	11(7+4)

Plant Pathology

S. No.	Semester	Course code	Title	Credit
1.	I	23PAT 101	Fundamentals of Plant Pathology	3(2+1)
2.	IV	23PAT 201	Diseases of Field and Horticultural Crops I	3(2+1)
3.	V	23PAT 301	Diseases of Field and Horticultural Crops II	3(2+1)
4.	VI	23PAT 303	Principles of Integrated DiseaseManagement	3(2+1)
			Total	12(8+4)

Horticulture

Sl. No.	Semester	Course code	Title	Credit
1.	I	23HOR 101	Fundamentals of Horticulture	2(1+1)
2.	II	23HOR 102	Production Technology for Fruit and Plantation Crops	3(2+1)
3.	III	23HOR 201	Production Technology for Vegetables, Spices and Protected Cultivation	3(2+1)
4.	IV	23HOR 202	Production Technology for Ornamental Crops, MAP and Landscaping	3(2+1)
5.	VI	23HOR 302	Post-harvest Management and Value Addition of Fruits and Vegetables	2(1+1)
			Total	13(8+5)

Agricultural Microbiology

Sl. No.	Semester	Course code	Title	Credit
.1	I	23AGM 101	Agricultural Microbiology	3(2+1)
.2	III	23AGM 201	Principles of Food Science & Nutrition	2(1+1)
.3	IV	23AGM 202	Environmental Studies & Disaster Management	3(2+1)
			Total	8(5+3)

Agricultural Extension

Sl. No.	Semester	Course code	Title	Credit
1.	I	23EXT 101	Rural Sociology & Educational Psychology	2(2+0)
2.	II	23EXT 102	Fundamentals of Agricultural Extension Education	3(2+1)
3.	V	23EXT 301	Communication Skills and Personality Development	2(1+1)
4.	VI	EXT 302	Entrepreneurship Development and Business Communication	2(1+1)
			Total	9(6+3)

Animal Husbandry

Sl. No.	Semester	Course code	Title	Credit
1.	III	AHS 201	Livestock Management	2(1+1)
2.	IV	AHS 202	Poultry and Fisheries Management	2(1+1)
			Total	4(2+2)

Civil and Mechanical Engineering

Sl. No.	Semester	Course code	Title	Credit
1.	III	23AEG 201	Introductory Soil and Water Conservation Engineering (Civil)	2(1+1)
2.	VI	23AEG 301	Farm Machinery, Power and Renewable Energy Sources (Mech)	2(1+1)
			Total	4(2+2)

Plant Biochemistry and Bio technology

Sl. No.	Semester	Course code	Title	Credit
1	II	BIO 101	Fundamentals of Plant Biochemistry and Biotechnology	2(1+1)
			Total	2(1+1)

Statistics

Sl. No.	Semester	Course code	Title	Credit
1.	VI	STA 301	Statistical methods	2(1+1)
			Total	2(1+1)

Computer Science

Sl. No.	Semester	Course code	Title	Credit
1.	V	COM 301	Agri- Informatics	2(1+1)
			Total	2(1+1)

English

Sl. No.	Semester	Course code	Title	Credit
1	I	ENG 101	Comprehension & Communication Skillsin English	2(2+0)
			Total	2(2+0)

General

S.NO	Semester	Course code	Title	Credit
1	IV	IKS	Indian knowledge system	2(1+1)

Semester Wise Curriculum

I Semester

S. No.	Department	Course code	Title	Credit
1.	Agronomy	23AGR 101	Fundamentals of Agronomy	3(2+1)
2.	Plant Pathology	23PAT 101	Fundamentals of Plant Pathology	3(2+1)
3.	Agricultural Microbiology	23AGM 101	Agricultural Microbiology	3(2+1)
4.	Soil Science and Agricultural Chemistry	23SOL 101	Fundamentals of Soil Science	3(2+1)
5.	Genetics and Plant Breeding	23GPB 101	Fundamentals of Crop Physiology	3(2+1)
6.	Horticulture	23HOR 101	Fundamentals of Horticulture	2(1+1)
7.	Agricultural Extension	23EXT 101	Rural Sociology & Educational Psychology	2(2+0)
8.	English	23ENG 101	Comprehension & Communication Skills in English	2(2+0)
			Total	**21(14+7)**
9.	Tamil/ Agricultural Extension	23TAM 111*/23EXT 111*	23TAM 101 தமிழ்இலக்கியம் - நவீனத்துவமும் இலக்கியச்சரித்திரமும் Agricultural Heritage	1(1+0)
10.		23NSS 111*/ 23NCC 111*	NSS/NCC	1(0+1)
11.	Physical Education/ Centre for Yoga Studies	23PEY 111*	Physical Education & Yoga practice	1(0+1)
			Total	**3(1+2)**
	Maths	23MAT 001**	Elementary Mathematics	
	Genetics and Plant Breeding	23GPB 002**	Introductory Biology	
			Total	**24(14+10)**

***Non Gradial course, ** Bridge Course**

IISemester

Sl. No.	Department	Course code	Courses	Credit
1	Agronomy	23AGR 102	Introductory Agrometeorology & Climate change	2(1+1)
2	Agronomy	23AGR 103	Irrigation management	2(1+1)
3	Entomology	23ENT 101	Fundamentals of Entomology	3(2+1)

4	Bio chemistry	23BIO 101	Fundamentals of Plant Biochemistry and Biotechnology	2(1+1)
5	Genetics and Plant Breeding	23GPB 102	Fundamentals of Genetics	3(2+1)
6	Soil Science and Agricultural Chemistry	23SAC 102	Manures, Fertilizers and Soil Fertility Management	3(2+1)
7	Horticulture	23HOR 102	Production Technology for Fruit and Plantation Crops	3(2+1)
8	Agricultural Extension	23EXT 102	Fundamentals of Agricultural Extension Education	3(2+1)
9	Agricultural Economics	23AEC 101	Fundamentals of Agricultural Economics	2(1+1)
10	Agril. Extension	23EXT 111*	Human Values & Ethics (Non Gradial Course)	1(1+0)
			Total	**24(15+9)**

IIISemester

Sl. No.	Department	Course code	Courses	Credit
1	Agronomy	23AGR 201	Weed management	2(1+1)
2	Agronomy	23AGR 202	Introductory Forestry	2(1+1)
3	Agronomy	23AGR 203	Crop production technology-I (kharif crops)	2(1+1)
4	Entomology	23ENT 201	Management of beneficial insects and Introductory Nematology	2(1+1)
5	Soil Science and Agricultural Chemistry	23SOL 201	Problematic Soils and theirmanagement	2(1+1)
6	Genetics and Plant Breeding	23GPB 201	Fundamentals of Plant Breeding	3(2+1)
7	Microbiology	23AGM 201	Principles of Food Science and Nutrition	2(1+1)
8	Horticulture	23HOR 201	Production Technology for Vegetables, Spices and Protected Cultivation	3(2+1)
9	Agricultural Economics	23AEC 201	Farm Management, Production & Resource Economics	2(1+1)
10	Animal Husbandry	23AHS 201	Livestock Management	2(1+1)

11	Engineering	23AEG 201	Introductory Soil and Water Conservation Engineering (Civil)	2(1+1)
			Total	24(13+11)

IVSemester

Sl. No.	Department	Course code	Courses	Credit
1	Agronomy	23AGR 204	Practical Crop Production -I (Kharif Crops)	1(0+1)
2	Agronomy	23AGR 205	Crop Production Technology -II (Rabi crops)	2(1+1)
3	Plant Pathology	23PAT 201	Diseases of Field and horticultural Crops and their Management - I	3(2+1)
4	Agricultural Microbiology	23AGM 202	Environmental Studies & Disaster Management	3(2+1)
5	Genetics and Plant Breeding	23GPB 202	Principles of Seed Technology	3(2+1)
6	Horticulture	23HOR 202	Production Technology for Ornamental Crops, MAP and Landscaping	3(2+1)
7	Agricultural Economics	23AEC 202	Agricultural Marketing, Trade & Prices	2(1+1)
8	Animal Husbandry	23AHS 202	Poultry and Fisheries Management	2(1+1)
9	Elective 1	23ECENT202 23ECAEC 203 23ECSAC 202	Urban Entomology (Ent) Project Management (AEC) Agrochemicals (SS&AC)	3(2+1)
10	Agronomy	23AGR 211*	Educational tour I (Non Gradial Course)	1(0+1)
11	General	23IKS201	Indian knowledge system	2(1+1)
			Total	25(14+11)

***** AGR 211 Educational Tour I (0+1) (Agronomy) will be offered either during III or IV semester.

V Semester

Sl.No.	Department	Course code	Courses	Credit
1	Agronomy	23AGR 301	Practical Crop Production -II	1(0+1)
2	Agronomy	23AGR 302	Rainfed Agriculture, Watershed Management and Secondary Agriculture	3(2+1)
3	Entomology	23ENT 301	Pests of Crops and Stored Grain and their Management	3(2+1)
4	Plant Pathology	23PAT 301	Diseases of Field and horticultural Crops and their Management - II	3(2+1)
5	Soil Science and Agricultural Chemistry	23SOL 301	Geoinformatics, Nanotechnology and Precision Farming	2(1+1)

6	Genetics and Plant Breeding	23GPB 301	Crop Improvement-I (Kharif Crops)	2(1+1)
7	Agricultural Economics	23AEC 301	Agri business Management	2(1+1)
8	Agricultural Economics	23AEC 302	Intellectual Property Rights	1(1+0)
9	Agricultural Extension	23EXT 301	Communication Skills and Personality Development	2(1+1)
10	Computer science	23COM 301	Agri- Informatics	2(1+1)
11	Elective II	23ECPAT 302	Antagonistic formulations	3(2+1)
		23ECAGM 301	Bio pesticides and Bio Fertilizers	
		23ECGPB 302	Commercial Plant Breeding	
		23ECHOR 301	Hi-tech Horticulture	
			Total	24(14 +10)

VI Semester

Sl.No.	Department	Course code	Courses	Credit
1	Agronomy	23AGR 303	Farming systems and Organic farming for sustainable agriculture	3(2+1)
2	Entomology	23ENT 302	Insect Ecology & IPM	3(2+1)
3	Plant Pathology	23PAT 303	Principles of Integrated Disease Management	3(2+1)
4	Genetics and Plant Breeding	23GPB 302	Crop Improvement-II (Rabi crops)	2(1+1)
5	Horticulture	23HOR 302	Post-harvest Management and Value Addition of Fruits and Vegetables	2(1+1)
6	Agricultural Extension	23EXT 302	Entrepreneurship Development and Business Communication	2(1+1)
7	Agricultural Economics	23AEC 303	Agricultural Finance, Banking and Cooperation	2(2+0)
8	Statistics	23STA 301	Statistical methods	2(1+1)
9	Engineering	23AEG 301	Farm Machinery, Power and Renewable Energy Sources (Mech)	2(1+1)
10	Elective 3	23ECAGR 305 23ECEXT 303 23EC AHS 301	System Simulation and Agro-advisory (AGR) Agricultural Journalism (AEX) Caprine and Ovine management (AHS)	3(2+1)
			Total	24(15+9)

VII&VIII Semesters

1. Experiential Learning (EL)/Hands on Training (HOT) - 20 credits (24 weeks)
2. Rural Agriculture Work Experience (RAWE) 10 credits (10 weeks)

3. In Plant Training/Industrial attachment - 10 credits (10 weeks)
4. EXT 411* –Educational Tour (0+1) (Agricultural Extension) (Non-Gradial course)

I Semester
Semester wise Curriculum

23 AGR 101 FUNDAMENTALS OF AGRONOMY (2+1)

earning objectives

- To know about the basic principles and practices of crop production
- To gain knowledge on various agricultural development from ancient to modern age
- To understand about various factors affecting crop production
- To acquire knowledge on basic agricultural operations viz., seeds and sowing, after cultivation practices, irrigation and nutrient management
- To obtain awareness on harvesting, cleaning and storage of agriculturalproducts.

Theory

Unit I: Introduction to agriculture and Agronomy

Agriculture- definition, importance and scope-Branches of Agriculture-National and International Agricultural Institutes -Evolution of man and Agriculture. History of Agricultural development in the World, India and Tamil Nadu. Agronomy- definition, importance, meaning and scope.

Unit II: Crop distribution and production

Crop adaptation and distribution of crops – classification of crops - economic and agronomic. Major crops of India and Tamil Nadu. Major soils of Tamil Nadu. Factors affecting crop production; climatic, edaphic, biotic, physiographic and socio economic.

Unit III: Concepts of agricultural operations, planting methods and geometry

Tillage- definition, types, objectives, modern concepts of tillage. Nursery and main field preparation. Seeds-seed rate, sowing methods, crop establishment methods. Planting geometry and its effect on growth and yield. After cultivation, thinning, gap filling.

Unit IV: Weed and irrigation management

Weed- classification of weeds. Weed control methods, integrated weed management. Irrigation source-irrigation methods- macro and micro irrigation. Drainage and its importance inagriculture.

Unit V: Nutrient management and farming systems

Manures and fertilizers (organic, in-organic, green manure) time and method of application- Nutrient Use Efficiency (NUE) – Agronomic interventions for enhancing NUE. Croppingpatterns and cropping systems- Sustainable Agriculture. Integrated Farming System. Organic Agriculture-principles and concepts. Dry farming- principles and concepts. Harvesting and Post-Harvest Technology. Current stream of thoughts.

Practicals

Visit to Experimental farm –Identification of seeds and crops- Crop classification. Identification and study of manures and fertilizers - working out seed rate - Study of seed treatmentpractices. Study of tillage implements (primary, secondary and special purpose)- Practicing methods of fertilizer applications and its calculations - Different methods of sowing - Study of seeding implements - Study of inter-cultivation implements and practice - Participation in ongoing field operations.

Lesson plan

Theory Schedule

1. Definition of Agriculture – meaning and scope of Agriculture
2. Branches of Agriculture and evolution of man and Agriculture –Role of Women inAgriculture
3. History of agriculture and its development in the World and India-Agricultural Institutes of importance.
4. Introduction to Agronomy, meaning, definition and its importance in agriculture

5. Crop adaptation and distribution of crops.
6. Classification and economic importance of crops.
7. Major crops of India and Tamil Nadu
8. Major soils of India and Tamil Nadu
9. Factors affecting crop production - climatic, edaphic and biotic.
10. Factors affecting crop production - physiographic and socio economic factors.
11. Definition of tillage, objectives and types
12. Primary and secondary tillage classification and intercultural operations
13. Modern concepts of tillage – nursery and main field preparations
14. Importance of tillage in agriculture and factors affecting preparatory tillage
15. Seeds - seed rate - sowing methods – time and depth of sowing of agricultural crops
16. **Mid Semester Examination**
17. Crop density – planting geometry – competition of plants
18. Intra and inter plant competition – plant population
19. Effect of plant population on growth and yield
20. Optimum plant density and planting pattern - after cultivation -thinning and gap filling
21. Definition and importance of weeds - classification of weeds
22. Control, eradication of weeds and methods of weed control
23. Different weed management practices – IWM
24. Definition of irrigation, scope and importance of irrigation.
25. Sources of irrigation - methods of irrigation
26. Micro irrigation methods – drip and sprinkler irrigation
27. Drainage and its importance in agriculture
28. Manures and fertilizers (organic, in-organic, green manure) - time and method ofapplication.
29. Nutrient Use Efficiency (NUE) – Agronomic interventions for enhancing NUE.
30. Cropping patterns and cropping systems - Sustainable Agriculture - Integrated FarmingSystems
31. Organic Agriculture - principles and concepts
32. Dry farming - principles and concepts.
33. Harvesting and threshing of major agricultural crops
34. Post-harvest processing - principles and methods and Current stream of thoughts.

Practical schedule

1. Visit to PRIST University Experimental Farm and drawing the layout.
2. Study of farm features and measurements and cropping patterns.
3. Identification of crops and seeds.
4. Practice on different methods of sowing and planting
5. Hands on training of various seed treatment practices.
6. Study of tillage implements; practicing ploughing and puddling operations.
7. Study and practicing of various inter-cultivation implements
8. Identification of manures, fertilizers and practicing fertilizer applications for differentcrops.
9. Calculations on fertilizer requirement of major crops using fertilizers and manures.
10. Foliar application and fertigation practices.
11. Computation of plant population and seed rate for major field crops.
12. Yield contributing characters and yield estimation of crops.
13. Identification of weeds in crops: techniques of weed collection and preservation.
14. Herbicide formulation and identification- herbicide label information.
15. Irrigation methods – surface and sub-surface irrigation
16. Micro irrigations – drip and sprinkler irrigation
17. Practical examination

Course Outcome

CO 1: To understand the basic principles and practices of crop production
CO 2: To gain knowledge on various agricultural development from ancient tomodern age
CO 3: To critically assess the inter relationship between crop production anddifferent factors affecting the production of crops
CO 4: To construct skills on basic agricultural operations viz., seeds andsowing, after cultivation practices, irrigation and nutrient management
CO 5: To understand about harvesting, cleaning and storage of agriculturalproducts.

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	2	-	1	-
CO2	3	-	2	-	-	-
CO3	3	2	1	1	2	-
CO4	3	1	-	-	-	-
CO5	1	-	-	-	2	-

References

1. Balasubramaniyan, P. Palamiappan S.P. 2009, Principles and Practices of Agronomy,Agribios Publishers, Jodhpur.
2. Chandrasekharan, B., K. Annadurai and E. Somasundaram, 2014, Text Book ofAgronomy, Newage international (P) Limited Publishers, New Delhi.
3. ICAR. 2011. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.
4. Maliwal PL and Mundra SL. 2021. Fundamentals of Agronomy. Agrotech Publishing Academy. Udaipur.
5. Yellamanda Reddy .T and G.H. Sankara Reddy.2015. Principles of Agronomy, Kalyani Publishers , New Delhi.

e-resources

1. http://www.hillagric.ac.in/edu/coa/agronomy/lect/Teaching_Manual_on_Introductory_Crop_Production.pdf
2. http://www.newagepublishers.com/samplechapter/001757.pdf
3. https://sites.google.com/a/uasd.in/ecourse/agronomy
4. https://www.nipabooks.com/info/9789385516740/agronomy-principles-and-practices.
5. https://www.hrsacademy.in/wp-content/uploads/2017/02/Principles-of-Agronomy-and-Agricultural-Meteorology.pdf.

23 PAT 101 FUNDAMENTALS OF PLANT PATHOLOGY (2+1)

Learning objectives

- To acquaint with the basic concepts of Plant Pathology and causes of plant diseases
- To know about pathogenesis and plant defense mechanisms
- To acquire knowledge of the general characters and classification of fungal kingdom Protozoa, Chromista, Phylum Zygomycota, Ascomycota and Basidiomycota
- To acquire knowledge of the general characters of Bacteria, Virus, Virusoids, Algae, Phanerogamic parasites, nematodes and abiotic diseases.
- To learn about the growth and reproduction of plant pathogens

Theory

Unit I: Plant pathogenic organisms

Introduction – Definition- Scope and objectives of Plant Pathology – History of Plant Pathology – Koch's Postulates – Causes of plant diseases – Biotic and abiotic factors –Significance of plant diseases – Plant pathogenic organisms – protozoa, chromista,fungi, bacteria, *Candidatus* phytoplasma, spiroplasma, fastidious vascular bacteria, viruses, viroids,

virusoids, algae, phanerogamic parasites and nematodes with examplesof diseases caused by them – Abiotic disorders.

Unit II: General characters and molecular phylogeny of fungi

General characters of fungi – Fungal somatic structures, types of fungal mycelia- Modification of fungal mycelia – Reproduction in fungi (vegetative, asexual and sexual) – Disease cycle – Symptoms of fungal diseases – Classification based on molecular phylogeny. I Kingdom: Protozoa II. Kingdom: Chromista, III. Kingdom: Fungi, Phylum: Chytridiomycota, Phylum: Blastocladiomycota, Phylum: Zygomycota, Phylum:Ascomycota, Phylum: Basidiomycota.

Unit III: Bacteria, Phytoplasma Virus, Viroid, Virusoid, Algae, Phanerogamic Plant Parasites and Abiotic disorders

Classification of bacteria - general characters and symptoms of phytopathogenic bacteria- growth and reproduction - mode of entry and spread- general characters and symptoms of *Candidatus* phytoplasma, spiroplasma, fastidious vascular bacteria, viruses - virus vector relationship-symptoms and transmission of viral diseases - viroids, virusoid, algae- flowering plant parasites - Abiotic disorders.

Unit IV: Nematodes

General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (*Heterodera*, *Meloidogyne*, *Anguina*, *Radopholus* etc.).

Unit V: Growth and reproduction of plant pathogens

Pathogenesis –Pre-penetration, Penetration and Post penetration – Mode of infection, survival and Spread - Effect of pathogen on physiological functions of the plants – Role of enzymes and toxins on disease development – Epidemiological factors affecting disease development - Plant defence mechanisms. Principles and methods of plant disease management. Nature, chemical combinations, classification, mode of action andformulations of fungicides and antibiotics.

Practicals

Study of important taxonomic characters and symptoms produced by *Plasmodiophora*, *Pythium*, *Phytophthora*, *Albugo*, *Sclerospora*, *Peronospora*, *Peronosclerospora*, *Pseudoperonospora* and *Plasmopara*, *Synchytrium*, *Physoderma*, *Mucor*, *Rhizopus*, *Taphrina*, *Capnodium*, *Cercospora*, (*Mycosphaerella*), *Diplodia*, *Botryodiplodia* (*Botryosphaeria*), *Curvularia*, *Drechslera* (*Helminthosporium*), *Alternaria*, *Venturia*, *Erysiphe*, *Phyllactinia*, *Uncinula*, *Leveillula* and *Claviceps*, *Fusarium* (*Gibberella*, *Nectria*), *Verticillium*, *Colletotrichum (Glomerella) Pestalotia (Pestalosphaeria)*, *Pyricularia*(*Magnoporthe*), *Sarocladium*, *Macrophomina*, *Puccinia*, *Uromyces*, *Hemileia*, *Ustilago*, *Sphacelotheca* (*Sporisorium*), *Tolyposporium (Moesziomyces)*, *Exobasidium*, *Sclerotium*, *Rhizoctonia* (*Thanatephorus*), *Ganoderma*, *Agaricus*, *Pleurotus*, *Volvariella* and *Calocybe*. Symptoms of bacterial diseases, *Candidatus* phytoplasma, fastidiousvascular bacteria, viruses, virus vector relationship-symptoms and transmission of viral diseases - viroids, virusoid, spiroplasma, algal parasite, phanerogamic parasites, nematodes (*Heterodera*, *Meloidogyne*, *Anguine*, *Radopholus* etc.) and non-parasitic diseases. Nature, chemical combination, classification, mode of action and formulations offungicides and antibiotics.

Note: Students should submit 50 well-preserved Herbarium specimens**.**

Lesson plan

Theory schedule

1. Definition of Plant Pathology – History of Plant Pathology, Koch's Postulates
2. Causes of plant diseases – Protozoa, Chromista, fungi, bacteria, fastidious vascularbacteria, spiroplasma, *Candidatus* phytoplasma
3. Causes of Plant diseases - virus, viroid, virusoid, algal, phanerogamic plant parasites, nematodes and abiotic disorders
4. General characters of fungi- Mycelia – vegetative resting structures
5. Asexual and Sexual reproduction in fungi

6. Parasitism in fungi- Types of parasitism – parasite, saprophyte, obligate parasite, facultative parasite, obligate saprophytes, facultative saprophyte-biotrophs, hemibiotrophs, perthotrophs/ necrotrophs and symbiosis
7. Classification of Kingdom– Protozoa - important taxonomic characters, symptoms andlife cycle of *Plasmodiophora brassicae* and symptoms of Protozoan diseases
8. Classification of Kingdom Chromista- General characters of Oomycetes - symptoms and life cycle of *Pythium, Phytophthora* and *Albugo*
9. Symptoms and life cycle of *Peronosclerospora, Sclerospora, Perenospora, Pseudoperenospora* and *Plasmopara*
10. Classification of Kingdom– Chytridiomycota and Zygomycota - important characters, symptoms and life cycles of *Synchytrium, Rhizopus, Mucor* and *Physoderma*
11. Classification of Kingdom– Ascomycota- important characters - Symptoms and life cycles of *Taphrina*, *Capnodium, Cercospora*, (*Mycosphaerella*), *Diplodia, Botryodiplodia* (*Botryosphaeria*), *Drechslera* (*Helminthosporium*), *Alternaria, Venturia* and *Macrophomina*
12. Symptoms and life cycles of *Eurotium, Talaromyces, Erysiphe, Leveillula, Phyllactinia, Uncinula, Podosphaera* and *Sphaerotheca*
13. Symptoms and important characters of *Claviceps*, *Fusarium* (*Gibberella*, *Nectria*) and *Verticillium, Colletotrichum (Glomerella), Pestalotia (Pestalosphaeria), Pyricularia* (*Magnoporthe*) and *Sarocladium*
14. Classification of Kingdom - Basidiomycota- important characters, Symptoms and life cycles of *Puccinia, Uromyces* and *Hemileia*
15. Symptoms and life cycles of *Ustilago, Sphacelotheca (Sporisorium), Tolyposporium (Moesziomyces), Tilletia* and *Exobasidium*
16. Symptoms and life cycles of *Athelium, Thanatephorus* and *Ganoderma*
17. Mid Semester Examination
18. Important taxonomic characters of *Agaricus*, *Pleurotus*, *Volvariella* and *Calocybe*
19. Classification and general characters of phytopathogenic bacteria
20. Symptoms of plant pathogenic bacteria
21. Mode of entry, spread and survival of bacterial pathogens
22. Important characters and symptoms of *Candidatus* phytoplasma diseases – phyllody,little leaf, yellow dwarf and sandal spike, fastidious vascular bacteria and spiroplasma
23. Virus - definition, nature and properties of plant virus, single stranded, doublestranded RNA and DNA viruses and transmission of plant viruses
24. Virus vector relationship-symptoms of viral diseases
25. Important characters and symptoms of viroid, virusoid, algal and phanerogamicparasites
26. Non-parasitic disorders
27. General morphology and reproduction of nematodes
28. Symptoms and nature of damage caused by plant nematodes (*Heterodera*,*Meloidogyne*, *Anguina*, *Radopholus* etc.).
29. Pathogenesis – stages in pathogenesis – pre-penetration, penetration and postpenetration
30. Role of enzymes and toxins in disease development
31. Effect of pathogen on physiological functions of the plants- Effect on photosynthesis- transpiration- respiration- translocation of water and nutrients
32. Epidemiological Factors affecting disease development
33. Plant defence mechanisms. Principles and methods of plant disease management.
34. Nature, chemical combination, classification, mode of action and formulations offungicides and antibiotics.

Practical schedule

1. General characters of fungi – Types of mycelia -Types of vegetative, asexual and sexualspores-

asexual and sexual fruiting bodies.

2. Study of important taxonomic characters and symptoms produced by *Plasmodiophora*, *Pythium* and *Phytophthora*.
3. Study of important taxonomic characters and symptoms produced by *Sclerospora*, *Peronospora*, *Peronosclerospora*, *Pseudoperonospora* and *Plasmopara*
4. Study of important taxonomic characters and symptoms produced by *Albugo*,*Synchytrium* and *Rhizopus*.
5. Study of important taxonomic characters and symptoms produced by *Taphrina*, *Capnodium*, *Cercospora* (*Mycosphaerella*), *Diplodia*, *Botryodiplodia* (*Botryosphaeria*), *Drechslera (Helminthosporium)* and *Alternaria*
6. Study of important taxonomic characters and symptoms produced by *Eurotium*, *Talaromyces*, *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uncinula*, *Podosphaera* and *Sphaerotheca*
7. Study of important taxonomic characters and symptoms produced by *Claviceps*, *Fusarium* (*Gibberella*, *Nectria*) and *Verticillium*
8. Study of important taxonomic characters and symptoms produced by *Colletotrichum (Glomerella)*, *Pestalotia (Pestalosphaeria)*, *Pyricularia* (*Magnoporthe*), *Sarocladium* and *Macrophomina*
9. Study of important taxonomic characters and symptoms produced by *Puccinia*,*Uromyces* and *Hemileia*
10. Study of important taxonomic characters and symptoms produced by *Ustilago*, *Sphacelotheca (Sporisorium)*, *Tolyposporium (Moesziomyces)* and *Exobasidium*
11. Study of important taxonomic characters of *Agaricus*, *Pleurotus*, *Calocybe*, *Volvariella* and symptoms produced by *Athelium*, *Thanatephorus* and *Ganoderma*
12. Symptoms of bacterial diseases – leaf blight, leaf streak, canker, scab, crown gall, wilt and soft rot.
13. Symptoms of *Candidatus* Phytoplasma and Algae
14. Symptoms and vectors of viral diseases – mosaic, chlorosis, leaf curl, stem pitting, spotted wilt, necrosis, ring spot, vein clearing, leaf crinkle, rosette and bunchy top – diseases caused by viroids and virusoids
15. Symptoms and nature of damage caused by plant nematodes (*Heterodera*, *Meloidogyne*,*Anguina*, *Radopholus* etc.).
16. Phanerogamic plant parasites and non-parasitic diseases
17. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Assignment: Students should submit 50 well-preserved herbarium specimens.

Course outcome

CO 1: Acquainted with the basic concepts of plant pathology, Host parasite relationship of pathogens

CO 2: Having in depth knowledge of pathogenesis and plant defense mechanisms

CO 3: Having in depth knowledge of fungal kingdom Protozoa and Chromista, PhylumZygomycota, Ascomycota and Basidiomycota

CO 4: Having in depth knowledge of the general characters and pathogenicity of bacteria,virus, virusoids, algae, phanerogamic parasites, nematodes and abiotic diseases.

CO 5: Acquainted with the growth and reproduction of plant pathogens

CO – PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	1	2	-	1	-	-
CO 2	1	2	-	-	-	-
CO 3	2	3	-	-	-	-
CO 4	2	2	-	2	-	-
CO 5	2	2	-	-	-	-

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23AGM 101 AGRICULTURAL MICROBIOLOGY (2+1)

Learning Objectives:

- To enable better understanding of students about the microscopic world aroundthem
- To acquaint students with the basic laboratory techniques and tools ofmicrobiology
- To highlighten the role of soil microorganisms in soil fertility and plant growth promotion
- To develop experimental skills in soil microbiology which includes isolation ofbeneficial microorganisms from soil and plant and their mass production
- To understand biogeochemical cycles through the microbial transformation ofnutrients in soil

Theory

Unit - I: History and concept of Microbiology.

History and development in Agricultural Microbiology-Contributions of Beijerinck, Winogradsky and Waksman; Position of microorganisms in living world; Prokaryotes Vs Eukaryotes-Biogenesis and abiogenesis- Groups of microorganisms;Morphology -Bacterialsize, shape and arrangement - Morphology of fungi and Algae.

Unit-II: Microbiological Techniques.

Microscopy – principles of light microscopy -magnification, resolving power and numerical aperture. -Different types of light and electron microscope; Staining techniques – principle and types of stain- simple, negative and differential staining. Sterilization and disinfection techniques; Principles and methods of sterilization – Physical methods – heat, filters and radiation; Chemical methods; Isolation and pure culture techniques – Enrichment culture, Preservation of microbial cultures.

Unit-III: Microbial growth and Genetics.

Bacterial growth - measurement of growth and factors influencing bacterial growth –Growth curve; Nutritional types; Genetic Recombination –Transformation, Conjugation and Transduction.

Unit-IV: Soil Microbiology.

Distribution and importance of soil microorganisms in soil fertility – factors affecting the activities of soil microorganisms; Rhizosphere microorganisms and their importance, R:S Ratio; Phyllosphere microorganisms; Soil microorganisms Agriculturally beneficial microorganisms and their interaction -Positive and negative interaction. Plant growth promoting Rhizobacteria.

Unit-V: Microbial transformation and bioinoculants

Microbial transformation of nutrients in soil – Nitrogen Cycle-Carbon andPhosphorouscycle; Bioinoculants-importance and types-carrier based, liquid based,

-Mass production, method of applications and quality control of biofertilizers

Lesson plan

Theory Schedule

1. History and development in Agricultural Microbiology
2. Contributions of Beijerinck, Winogradsky and Waksman
3. Prokaryotes Vs Eukaryotes
4. Biogenesis and abiogenesis
5. Groups of microorganisms
6. Morphology of Bacteria- Bacterial size, shape and arrangement
7. Morphology of fungi and Algae.
8. Principles of light microscopy -magnification, resolving power and numericalaperture.
9. Different types of light and electron microscope
10. Staining techniques – principle and types of stain- simple, negative anddifferential staining.
11. Sterilization and disinfection techniques; Principles and methods of sterilization
12. Physical methods – heat, filters and radiation; Chemical methods
13. Isolation and pure culture techniques – Enrichment culturing,
14. Preservation of microbial cultures
15. Bacterial growth - measurement of growth
16. Factors influencing bacterial growth
17. **Mid semester examination**
18. Growth curve
19. Nutritional types
20. Genetic Recombination –Transformation
21. Conjugation and Transduction
22. Distribution and importance of soil microorganisms in soil fertility
23. Factors affecting the activities of soil microorganisms
24. Rhizosphere microorganisms Agriculturally beneficial microorganisms and their importance, R:S Ratio
25. Phyllosphere microorganisms
26. Soil microorganisms and their interactions
27. Positive and negative interaction.
28. Plant growth promoting Rhizobacteria
29. Microbial transformation of nutrients in soil – Nitrogen cycle
30. Carbon and Phosphorous cycle
31. Bioinoculants-importance and types-carrier based; liquid based
32. Mass production of biofertilizers-Bacterial Biofertilizer and AM fungi
33. Method of application and quality control of biofertilizers.
34. Current stream of thoughts

Practical Schedule

1. Introduction to microbiology laboratory and its equipments
2. Principles of microscopy- Study of compound microscope
3. Methods of sterilization.
4. Preparation of culture media and agar slant
5. Buried slide technique
6. Enumeration of microbial population in soil by bacteria, fungi and actinomycetes in soil by standard plate technique

7. Purification of bacteria
8. Purification of fungi
9. Gram staining
10. Negative staining
11. Isolation of Rhizobium from legume root nodule.
12. Isolation of Azospirillum from soil.
13. Isolation of Phospobacteria from soil.
14. Mass production of bacterial biofertilizer and quality control methods
15. Bio gas production technique
16. Microbial composting
17. Practical Examination

Course Outcomes

CO 1: The students would thoroughly understand about the role of microorganisms in soiland their influence on the plant growth production and historical perspectives.
CO 2: Further, they would enrich on the various basic microbiological techniques.
CO 3: The students exposed to soil microbial diversity and microbial genetics. **CO 4:** Thestudents would expose to the beneficial and harmful relationshipsbetween soil microorganism and different parts of plants.
CO 5: The students will gain hands on experience of production and quality control aspectsof different microbial inoculants and to have self-confidence to become successful entrepreneurship.

CO – PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	-	-	-
CO2	3	2	-	-	-	-
CO3	-	-	-	-	2	-
CO4	2	2	-	-	1	-
CO5	-	-	2	1	-	-

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23 SOL 101 FUNDAMENTALS OF SOIL SCIENCE (2+1)

Objectives

- To demonstrate basic knowledge of terms and concepts in soil science, apply this knowledge to new problems and situations.
- To learn the key physical, chemical, and biological aspects of soils and form a basic understanding of formative processes for different soil types and recognition of soil as a natural body.
- To learn the significance of soil microorganisms on its role in organic matter decomposition and nutrient transformation in soil
- To gain knowledge on sources of pollutants and its impact on soil pollution
- To learn the concept of soil organic matter and its role in crop growth and soil fertility

Theory

Unit–I: Earth origin and rocks

Origin of earth – theories – planetesimal and nebular hypothesis – Composition of Earth's crust. Soil forming rocks and minerals – origin – classification. Weathering of rocks and minerals – physical, chemical and biological weathering.

Unit -II: Soil formation and Soil taxonomy

Soil formation – soil forming factors – active and passive. Soil forming processes – fundamental and specific soil forming processes. Soil profile – master horizons, subordinate horizons – Definition of soil – Soil composition Pedalogical and Edaphological concepts. Elementary knowledge of soil taxonomy and classification- Soils of India and Tamilnadu.

Unit-III –Soil physical properties I

Soil physical properties and their significance – Soil texture – classification of soil separates, properties of soil separates, Particle size analysis – Stokes law assumptions and limitations,

textural classes. Soil structure – classification, soil aggregates, evaluation of soil structure, significance. Pore space types, factors affecting porosity, manipulation. Bulk density andparticle density – relationships, factors, significance and manipulation. Soil colour – factors, attributes and significance. Soil consistency – forms, factors, limits and significance.

Unit–IV Soil physical properties –II

Soil water classification, potentials, Soil moisture constants, movement of soil water – saturated and unsaturated flow – Infiltration, hydraulic conductivity, percolation, permeability. Soil air – composition, gaseous exchange, influence of soil air on plant growth. Soil temperature – thermal properties of soils, flow of heat, soil temperature regimes, influence of soil temperature on plant growth.

Unit–V Soil colloids and Soil pollution

Soil Chemical properties – Soil colloids – Properties, types and significance – Layer silicate clays – their genesis and sources of charges – Ion exchange – CEC, AEC and Base saturation – Factors influencing Ion exchange – significance. Soil reaction, Buffering capacity and EC. Soil organic matter – sources – chemical composition – decomposition – humus formation – role and functions of organic matter in soil. Soil organisms – Beneficial and harmful effects.

Soil pollution - behavior of pesticides and inorganic contaminants, prevention and mitigation ofsoil pollution. Current stream of thoughts

Lesson Plan

Lecture Schedule

1. Origin of earth – Theories – Planetesimal and Nebular hypothesis – Geological time scale – Age of earth.
2. Rocks – Definition – Classification – Igneous – Sedimentary rock – Their formation – Classification – Brief description of important rocks.
3. Metamorphic rocks – Their formation, classification and brief description of importantrocks.
4. Composition of earth's crusts – Minerals – Definition – Occurrence-classification –Formation of primary minerals – Ferro and non-ferro magnesium minerals.
5. Secondary minerals – Clay minerals. Non-silicate minerals
6. Weathering of rocks and minerals – Physical, chemical and biological weathering

7. Soil –Definitions – Soil as a natural body – Three dimensional figure – Major componentsof soil by volume – Pedology and Edaphology
8. Factors of soil formation – Active factors – Climate and biosphere
9. Passive factors of soil formation – Topography, Parent material and Time.
10. Soil forming processes-Fundamental pedogenic processes-Disintegration and decomposition of secondary minerals
11. Eluviation and illuviation-Description of typical soil profile- Master and Subordinatehorizons
12. Specific pedogenic processes-Calcification-Decalcification-Salinization- Alkalization-Podzolization-Laterization.
13. Soil taxonomy and its classification - Soils of India and Tamilnadu
14. Physical properties-Soil texture -Soil separates -Textural analysis -International pipettemethod-Stoke's law-Assumption and limitations-Textural classes using triangular diagram
15. Soil structure- Classification- types, classes and grades of soil structure- importance ofsoil structure and management.
16. Soil density - Bulk density -Particle density -Definition-Factors affecting bulk density and particle density.
17. **Mid semester examination**
18. Pore space-Definition of macro and micro pore space-Factors affecting pore space- Soil compaction-internal surface area-Factors influencing soil compaction
19. Soil strength and its importance. Soil colour-Significance- Munsell colour chart-hue, value and chroma-Factors influencing soil colour.
20. Soil consistence- consistence of wet and dry soils- Cohesion-Adhesion- Soil Crusting- Plasticity-Atterberg's constant-Upper and lower plastic limits, plastic number
21. Soil water- forces of soil water retention- pF concept- Soil moisture characteristics curves-Soil air-composition – Factors affecting composition.
22. Soil water potential- components of water potentials – soil moisture constants- Field capacity, wilting coefficient, hygroscopic water and saturation.
23. Available water and methods for determining soil moisture constants- Pressure plate and pressure membrane apparatus.
24. Soil water content- soil water movement- Darcy's law- saturated, unsaturated and vapour flows-infiltration, percolation, and permeability- Distribution of water in profile in different soils- Soil drainage and its importance.
25. Soil temperature- sources of heat- heat capacity and conductivity- factors influencing soil temperature- Soil thermal regimes- Importance on plant growth-Factors influencing soil temperature-Measurement of soil temperature.
26. Soil air- composition – atmospheric and soil air- Gaseous exchange- influence of soil air on plant growth- soil properties and nutrient availability- measurement of oxygen diffusion rate- Measures to improve soil aeration.
27. Soil colloids – Properties- Types-Secondary silicate clay minerals- Kaolinite, Montmorillonite, Illite and chlorite- Allophones.
28. Organic colloids – origin of charge- ion exchange- types- Base saturation- factors affecting ion exchange capacity of soils- importance of cation exchange capacity of soils- calculation of Base Exchange capacity and exchangeable acidity.
29. Soil reaction pH- soil acidity- soil alkalinity- Buffering capacity- effect of pH on nutrient availability.
30. Soil pH – Factors affecting soil pH – Soil pH and nutrient availability- EC – its impact on soil growth
31. Soil humus- definition- synthesis of humus- fractionation of soil humus- importance–carbon cycle-carbon: nitrogen(C:N) ratio – Significance of C : N ratio in soil fertility
32. Soil biology- Biomass- Flora and fauna- Role of beneficial organisms- soil organic matter-composition- properties- Role and functions of organic matter in soil.

33. Soil microorganisms- beneficial effects and harmful effects- Mineralization, immobilization nitrogen fixation, phosphorus solubilization, biological control of diseases, promotion of plant growth substances.
34. Soil pollution- behavior of pesticides and inorganic contaminants, prevention and mitigation of soil pollution. Current stream of thoughts

Practical

1. Identification of common glassware's and analytical equipment's
2. Preparation of standard solution and types of titration
3. Identification of rocks and minerals.
4. A study on soil profile,
5. Collection and processing of soil samples
6. Determination of soil moisture.
7. Determination of soil bulk density, particle density, pore space in soil.
8. Estimation of soil texture (Feel method)
9. Particle size analysis – international pipette method,
10. Estimation of soil texture -Bouyoucos Hydrometer method,
11. Determination of soil colour,
12. Estimation of soil pH (theory and principles of pH meter and principles of estimation ofsoil pH)
13. Estimation of soil EC (theory and principles of EC meter and principles of estimation insoil EC)
14. Estimation of cation exchange capacity in soil.
15. Estimation of anion exchange capacity in soil.
16. Estimation of exchangeable cations and buffering capacity in soil.
17. **Practical Examination**

Course outcomes

CO 1: Students gain the knowledge origin of earth, weathering of rocks and mineralsCO 2: Students learn to explain soil formation and different soil forming processes.
CO 3: Students develop individual skills and ability to analysis the soil for Physical and Chemical properties.
CO 4 : Students learn to understand the role of microorganisms in promoting better soil healthCO 5 : Students gain knowledge on impact of various pollutants causing soil pollution

CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	-	-	1	-
CO2	-	2	-	-	1	-
CO3	2	3	3	1	1	1
CO4	1	1	-	2	2	-
CO5	-	2	-	-	2	-

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23GPB 101 - FUNDAMENTALS OF CROP PHYSIOLOGY (2+1)

Learning objectives

- To impart basic knowledge on various functions and processes related to crop production,mineral nutrition, plant growth regulators and environmental stresses.
- To understand the mechanism of absorption and translocation of water and nutrients fromthe soil.
- To study the different pathways in photosynthesis and respiration
- To study the topics on plant growth regulators and stress physiology
- To impart knowledge about selection of ideal plant type for higher crop productivity.

Theory

Unit I; Plant water relations

Importance of crop physiology in agriculture – Cell organelle- Plasma membrane, chloroplast, mitochondria, peroxisome and vacuole - Structure and role of water –Water potential and its components – diffusion – osmosis – imbibition - plasmolysis – Field Capacity and permanent wilting point- Mechanisms of water absorption – Pathways of water movement – Apoplast andSymplast - Translocation of water – ascent of sap – mechanisms - Transpiration – significance – structure of stomatal pore- mechanisms of stomatal opening and closing – guttation – anti transpirants.

Unit II; plant mineral nutrition

Criteria of essentiality - Classification of nutrients – macro, micro, mobile, beneficial elements and immobile – mechanism of nutrient uptake- Physiological functions, deficiencies and disorders of macro and micro nutrients – Hidden hunger- Foliar nutrition- root feeding and fertigation – Sand culture, hydroponics and aeroponics

Unit III; Photosynthesis and respiration

Light reaction – Photosystems- Red drop and Emerson enhancement effect- Photolysis of water and photophosphorylation - Photosynthetic pathways – C_3 and C_4, CAM – difference between three pathways - Factors affecting photosynthesis- Photorespiration – pathway andits significance - Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and sink strength and their manipulations - Glycolysis – TCA cycle - Oxidative phosphorylation – difference between photo and oxidative phosphorylation – energy budgeting - respiratory quotient.

Unit IV; Growth and development

Growth – phases of growth - factors affecting growth – Hormones- classifications - Biosynthetic pathway and role of auxins - Biosynthetic pathway and role of gibberellins and cytokinins- Biosynthetic pathway and role of ethylene and ABA- Novel and new generation PGR's – Brassinosteroids and salicylic acid - Growth retardants – Commercial uses of PGR's-Photoperiodism - short, long and day neutral plants – Chailakhyan's theory of flowering-Forms of phytochrome - Pr and Pfr - regulation of flowering – Vernalisation - Theories of vernalisation - Seed germination - physiological and biochemical changes - seed dormancy and breaking methods - Senescence and abscission – physiological and biochemical changes -Physiology of fruit ripening- climacteric and non-climacteric fruits - factors affecting ripening- Manipulations

Unit V; Stress physiology

Classification of stresses - Physiological changes and adaptations to drought, flooding, high and low temperature, salinity and UV radiation – compatible osmolytes – membrane properties —

compartmentalization – stress alleviation - Global warming – green house gases – physiological effects on crops - Carbon Sequestration.

Practicals

Preparation of different types solutions -Measurement of plant water potential by different methods - Estimation of photosynthetic pigments- Chlorophylls and Carotenoids - Determination of stomatal index and stomatal frequency - Measurement of leaf area bydifferent methods - Physiological and Nutritional disorders in crops plants -Estimation ofchlorophyll Stability Index - Estimation of Relative Water Content -Determination of photosynthetic efficiency in crop plants – soluble protein - Estimation of Nitrate Reductase activity -Growth Analysis - Bioassay of Cytokinin and GA - Estimation of proline - Demonstration of Practical applications of PGRs. Field visit for foliar diagnosis

Lesson plan

Theory lecture schedule

1. Importance of Crop Physiology in Agriculture – Structure of plasma membrane,chloroplast, mitochondria, peroxisome and vacuole
2. Structure and role of water –water potential and its components – Diffusion – Osmosis – imbibition – Plasmolysis - Field Capacity and Permanent Wilting Point
3. Mechanisms of water absorption – Pathways of water movement – Apoplast and symplast
4. Translocation of water – ascent of sap – mechanisms of xylem transport
5. Transpiration – significance – structure of stomata - mechanisms of stomatal opening andclosing – guttation – anti-transpirants
6. Mineral nutrition – criteria of essentiality - classification of nutrients – macro, micro, mobileand immobile – mechanism of nutrient uptake
7. Physiological functions and disorders of macro nutrients – Hidden hunger
8. Physiological functions and disorders of micro nutrients
9. Foliar nutrition- root feeding and fertigation – sand culture, hydroponics and aeroponics
10. Light reaction – photolysis of water and photophosphorylation
11. Photosynthetic pathways – C_3 and C_4 cycles
12. CAM pathway – difference between three pathways - Factors affecting photosynthesis.
13. Photorespiration – pathway and its significance
14. Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and sinkstrength and their manipulations
15. Glycolysis – TCA cycle
16. Oxidative phosphorylation – difference between photo and oxidative phosphorylation –energy budgeting - respiratory quotient
17. **Mid semester examination**
18. Growth – phases of growth – factors affecting growth – Hormones- classifications
19. Biosynthetic pathway and role of auxins
20. Biosynthetic pathway and role of gibberellins and cytokinin
21. Biosynthetic pathway and role of ethylene and ABA
22. Novel growth regulators – Brassinosteroids and salicylic acid – New Generation PGR's
23. Growth retardants and inhibitors -commercial uses of PGR's
24. Photoperiodism - short, long and day neutral plants – Chailakhyan's theory of flowering
25. Forms of phytochrome - Pr and Pfr - regulation of flowering
26. Vernalisation - theories of vernalisation – Lysenko and Chailakhyan's theories
27. Seed germination - physiological and biochemical changes - seed dormancy and breakingmethods
28. Senescence and abscission – physiological and biochemical changes
29. Physiology of fruit ripening- climacteric and non-climacteric fruits - factors affectingripening and manipulations
30. Drought - physiological changes - adaptation – compatible osmolytes - alleviation

31. High and low temperature stress – physiological changes - membrane properties -adaptation
32. Salt stress - physiological changes - adaptation – compartmentalization - alleviation
33. Flooding and UV radiation stresses – physiological changes - adaptation
34. Global warming – green house gases –-physiological effects on crop productivity- Carbon Sequestration

Practical schedule

1. Preparation of different types solutions
2. Measurement of plant water potential by different methods
3. Estimation of photosynthetic pigments- chlorophylls and Carotenoids
4. Determination of stomatal index and stomatal frequency
5. Measurement of leaf area by different methods
6. Physiological and Nutritional disorders in crops plants
7. Estimation of chlorophyll Stability Index
8. Estimation of Relative Water Content
9. Determination of photosynthetic efficiency in crop plants – soluble protein
10. Estimation of Nitrate Reductase activity
11. Growth Analysis - LAI, LAD, SLA, SLW, LAR, NAR, RGR, CGR and HI
12. Bioassay of Cytokinin
13. Bioassay of GA
14. Estimation of proline
15. Demonstration of Practical applications of PGRs.
16. Field visit for foliar diagnosis
17. **Final Practical examination**

Course Outcome

CO 1: Students will acquire basic knowledge on various functions and processes related tocrop productivity

CO 2: Will be able to identify the mineral nutrient deficiencies and their symptoms

CO 3: Know about the various plant growth regulators and environmental stresses.

CO 4: In addition, hands on exposure to preparation of solutions, analysis of pigmentcomposition, estimation of growth analytical parameters,

CO 5: Will be able to diagnose nutrient deficiencies in crops and ameliorate them and will be competent in enzyme assays and applications of plant growth regulators

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	-	-	-	-
CO 2	-	3	-	-	-
CO 3	-	2	-	-	2
CO 4	2	-	-	-	-
CO 5	-	-	-	-	-

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5. https://drive.google.com/file/d/1QTqWSdYkJ37PGSVLQyXA3PsOlEdeGn-r/view

23HOR 101 FUNDAMENTALS OF HORTICULTURE (1+1)

Learning objectives

- To impart knowledge on fundamentals of horticulture
- To learn about the importance, branches, layout of an orchard, special horticulture techniques for horticultural crops.
- To learn about the sexual and asexual Propagation techniques.
- Learn about the different tools and their use in propagation of horticultural crops and identification of horticultural crops.

Theory

Unit I: Basic concepts of Horticulture: Horticulture - Its definition and branches, importanceand scope. Horticultural and botanical classification. Climate and soil for horticultural crops. Horticulture zones of India and Tamil nadu.

Unit II: Propagation Methods and Structures: Plant propagation-methods and propagating structures. Seed dormancy, Seed germination, principles of orchard establishment.

Unit III: Training and Pruning: Principles and methods of training and pruning, juvenility and flower bud differentiation, unfruitfulness.

Unit IV: Pollination: Pollination, Pollinizers and Pollinators. Fertilization and Parthenocarpy.

Unit V: Growth regulators: Importance of plant bio-regulators in horticulture. Irrigation –methods, Fertilizer application in horticultural crops.

Practicals

Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/nursery bed. Practice of sexual and asexual methods of propagation including micro-propagation. Layout and planting of orchard. Training and pruning of fruit trees. Preparation ofpotting mixture. Fertilizer application in different crops. Visits to commercial nurseries/orchard. **Lesson plan**

Theory Schedule

1. Horticulture - Its definition.
2. Branches of Horticulture.
3. Importance and Scope of horticulture.
4. Horticultural and botanical classification.
5. Climate and soil for horticultural crops.
6. Plant propagation-methods and propagating structures.
7. Seed dormancy, Seed germination.
8. Principles of orchard establishment.
9. **Mid – Semester Examination**
10. Principles and methods of training.
11. Principles and methods of pruning.
12. Juvenility and flower bud differentiation, Unfruitfulness.
13. Pollination, Pollinizers and Pollinators
14. Fertilization and Parthenocarpy.
15. Importance of plant bio-regulators in horticulture.
16. Irrigation – methods.
17. Fertilizer application in horticultural crops.

Practical Schedule

1. Identification of horticultural crops.

2. Acquiring knowledge about Layout and planting of an orchard
3. Acquiring knowledge and identification of garden tools.
4. Practicing Preparation of seed bed/ nursery bed
5. Practicing preparation of potting mixture.
6. Practicing sexual methods of propagation.
7. Acquiring knowledge about uses of plant parts used in Vegetative propagation.
8. Practicing asexual propagation by different methods of Cutting and Layering.
9. Practicing asexual propagation by different methods of Budding and Grafting.
10. Learning about the micropropagation techniques.
11. Practicing training and pruning of fruit trees.
12. Fertilizer application in different crops.
13. Visits to commercial nurseries/orchard.
14. End semester practical examination.

Course outcome

CO 1: The student will gain knowledge on branches of horticulture and the climaticrequirements of horticulture Crops

CO 2: The student will acquire skill on different propagation methods of horticulture crops

CO 3: The student will acquire knowledge on establishment and management of orchardcrops

CO 4: The students will gain skills on training, pruning and crop regulations of horticulturecrops

CO5: The students will acquire knowledge on bearing habits and factors influencing onfruitfulness

CO-PO MAPPING MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	1	0	1	2	0
CO 2	3	2	0	0	1	0
CO 3	2	1	0	3	1	0
CO 4	2	2	1	2	1	0
CO 5	3	2	0	2	2	0

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5. http://www.fao.org/

23EXT - 101 RURAL SOCIOLOGY AND EDUCATIONAL PSYCHOLOGY (2+0)

Learning Objectives

- To acquire knowledge on basic concepts of rural sociology and educational psychology
- To understand the social structure and social stratification and social groups: their typesand characteristics
- To gain knowledge on the concepts of migration and its impact on society

- To understand the concepts of social control and social change
- To gain knowledge on teaching–learning process and basic principles of human behaviourand personality

Theory

UNIT I: Introduction to Sociology, Social groups, Culture and Social Values

Sociology and rural sociology – definitions; society – rural and urban, characteristics, differences and relationships, important characteristics of Indian rural society; social groups – definition, classification, role of social groups in extension; culture – concept, cultural traits, characteristics, functions; ethnocentrism, acculturation, cultural lag, cultural diffusion, marginal man, ethos; social values – definition, values and norms, characteristics of values and its functions

UNIT II: Social Structure, Social Stratification and Migration

Structure of rural society – patterns of rural settlement, social institutions, social organizations,ecological entities (region, community, neighbourhood, family); social stratification – concept, functions, types, differences between class and caste system; migration – concept, factors influencing migration.

UNIT III: Social Control, Social Customs

Social control – definition; customs – conventions, folkways, mores, rituals, taboos; social interaction process – definition, basic social processes; social change – concept, factors influencing social change, indicators of social change; leader and leadership, definitions,types, functions, characteristics of a good leader, methods of selecting leaders

UNIT IV: Introduction to Educational Psychology, Intelligence, Teaching-LearningProcess

Education – psychology – educational psychology – social psychology – definitions, importance in extension; basic principles of human behaviour – sensation, attention, perception – meaning, characteristics; cognitive, affective, psychomotor domains; intelligence – concept, types, measurement, factors affecting intelligence; personality – concept, types, measurement, factors influencing personality; teaching–learning process – teaching – definition, meaning, principles of teaching, steps in extension teaching; learning – definition, meaning, principles, types of learning, learning situation.

UNIT V: Motivation, Attitude

Motivation – concept, Maslow's hierarchy of needs, intrinsic and extrinsic motivation, techniques of motivation, importance in extension; attitude – concept, factors influencing the development of attitudes and current stream of thoughts.

Lesson Plan

Theory Schedule

1. Sociology and rural sociology – definitions, importance of rural sociology in extension education
2. Society – rural and urban, characteristics, differences and relationship, important characteristics of Indian rural society
2. Social groups – definitions, classification, role of social groups in extension
3. Culture – concept, cultural traits, characteristics, functions
4. Ethnocentrism, acculturation, cultural lag, cultural diffusion, marginal man, ethos
5. Social values – definition, values and norms, characteristics of values and its functions
6. Structure of rural society – patterns of rural settlement
7. Social institutions,
8. Social organizations
9. Ecological entities - region, community, neighbourhood and family
10. Social stratification – concept, functions, types, differences between class and castesystem
11. Migration – concept, factors influencing migration
12. Social control – definition; customs – conventions, folkways, mores, rituals, taboos
13. Social interaction process – definition, basic social processes

14. Social change – concept, theories, factors and indicators of social change

16. Leader and leadership - definitions, types, functions

17.Mid-semesterExamination

18. Characteristics of a good leader and methods of selecting leaders

19. Education – psychology – educational psychology –definitions, importance in extension

20. Social psychology – definitions, importance in extension21.

Basic principles of human behaviour

22.Sensation, attention, perception – meaning, characteristics

23.Cognitive, affective, psychomotor domains

24. Intelligence – concept, types, measurement, factors affecting intelligence25.

Personality – concept, types

26.Personality measurement- factors influencing personality

27.Teaching–learning Process

28.Teaching – definition, meaning, principles of teaching29.

Steps in extension teaching

30. Learning – definition, meaning, principles

31. Types of learning, learning situation

32.Motivation – concept, Maslow's hierarchy of needs , intrinsic and extrinsic motivation

33.Techniques of motivation, importance of motivation in extension

34. Attitude – concept, factors influencing the development of attitudes and current stream ofthoughts.

Course Outcome

At the end of the course students will be able to

CO 1: Understand basics concepts related to rural sociology and educational psychology.**CO 2:** Gain expertise on practical applications of sociological and psychological concepts.**CO 3:** Gain expertise on application of various psychological tests.

CO 4: Develop leadership skills

CO 5: Know the hierarchy of needs and techniques of motivation

Co-Po Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1	0	0	3
CO2	0	2	0	0	3	0
CO3	0	0	2	0	0	0
CO4	0	1	0	3	0	0
CO5	1	0	0	0	0	3

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23ENG - 101 COMPREHENSION AND COMMUNICATION SKILLS IN ENGLISH 2 (2+0)

Learning objectives

- To impart basic language skills such as listening, speaking, reading and writing in order to communicate with speakers of English Language
- To develop the linguistic competence necessarily required in various life situations
- To improve English pronunciation and enhance proficiency in English

Theory

Unit I: Comprehension

Reading Comprehension –Synonyms—Antonyms--Verbal Ability, A list of Words often confused and misused

Unit II: Vocabulary

Vocabulary --Homonyms --Homophones

Unit III: Grammar

Functional Grammar--Tenses --Active voice and Passive voice--Degrees of Comparison -- Types of Sentences--Direct and Indirect Speech --Agreement of Verb with Subject—Articles—Prepositions--Parts of Speech

Unit IV: Composition

Business Correspondence--Principles of Letter Writing--Structure and Layout of Letters -- Quotations and Orders --Tenders--Job Application Letters --Social Correspondence—CV-- Professional Writing--Precis Writing

Unit V: Interview

The Screening Interview--The informational Interview --The Stress Interview--The Behavioural Interview--The Audition --Body Language and Interview

Lesson plan

Theory Schedule

1. A Lesson: “The Sporting Spirit” --Answering the questions related to the text -- Comprehension pertaining to the Textual Grammar i.e., Fill in the blanks, Matching and vocabulary
2. Comprehension and answering the questions related to the Text
3. Synonyms, List of synonyms, Choose the correct synonyms, exercises – Practice and Implementation Antonyms, fill in the blanks, choose the correct Antonyms, exercisesPractice and Implementation
4. Verbal Ability, A list of Words often confused and misused – Practice and Implementation
5. Comprehension pertaining to the Textual Grammar i.e., Fill in the blanks, Matching, Vocabulary and Reading Comprehension
6. Reading Comprehension and answering the Questions
7. Homonyms -- Homonyms are distinct words with quite different meanings --Use the following words in two ways, more words at a glance and exercises related to GRE & TOEFL
8. Homophones, A list of homophones, Fill in the blanks, Underline the correct word and exercises related to GRE & TOEFL
9. A Lesson: “Spoken English and Broken English” by G.B. Shaw. Answering the questionsrelated to the Text. Fill in the blanks, Matching, Vocabulary and Reading Comprehension
10. Functional Grammar, Tenses, Active voice and Passive voice, Degrees of Comparisonand types of sentences
11. Direct and Indirect speech and Agreement of verb with subject

12. Functional Grammar, Articles, Prepositions, Parts of Speech and Agreement of Verb with Subject
13. Business Correspondence, Principles of Letter writing, Courtesy and Consideration, Directness and Conciseness, Avoid Verbosity and participial Endings, Clarity and Precision, Structure and layout of letters, Planning a letter, Quotations, Orders, Tenders, Sales letters, Claim and Adjustment Letters, Job application letters, Social correspondencePersonal Correspondence and CV
14. The Style**,** Importance of Professional Writing, Choice of words and Phrases, Clichés, Jargons, Foreign words and phrases
15. Precis Writing, Summarizing, The essential features of a good précis, Important points while making a précis, Make a précis of the following paragraph and suggest suitable title. Figurative language
16. Interview, The Screening Interview, The informational Interview, The Directive Style, The Meandering Style, The Stress Interview, The Behavioural Interview, The Audition, The Tag-Team Interview, The Mealtime Interview, The Follow-up Interview, Fermi Interview, Preparing for the Interview, Body Language and Interview, Types of Interviews Questions. Idiomatic language
17. **Mid Semester Examination**
18. Effective Listening – Developing Listening Skills – Honing Listening skills
19. Listening to Short talks and Lectures from the cassettes of EFLUniversity
20. Spoken English, Vowels, consonants, monophthongs, diphthongs, triphthongs
21. Stress, intonation, phonetic transcription
22. Seminars, Conferences, preparation and demonstration
23. Oral Presentation by students, Articulation and delivery – Evaluation sheet for oralpresentation
24. Communication skills – Verbal communication, Written Communication
25. Telephonic Conversation
26. Reading Skills, Skimming, Scanning, Extensive reading, Intensive reading examples
27. Meeting, purpose, procedure, participation, physical arrangements
28. Presentation of reports by using power point & L.C.D
29. Interviews – Mock interviews
30. Debate and Group discussion
31. Using a dictionary effectively
32. Vocabulary
33. Pronunciation Practice
34. **Final practical examination**

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23EXT 101* AGRICULTURAL HERITAGE (1+0)

Learning objectives

To enable the student to

- Understand the importance of Agricultural heritage
- Know about the value of Indigenous knowledge in agriculture
- Familiarize the students about current scenario of Indian Agriculture

Learning outcomes

- The students have gained the basic knowledge about agricultural history of India.
- They have been familiarized with the indigenous knowledge and present scenario of Indian agriculture.

Theory

Unit I:

Agricultural heritage - Introduction, definition of agricultural heritage- Need and importance of Agricultural heritage- Historical facts- Relevance of heritage to present day Agriculture

Unit II:

Development of human culture – stone age, bronze age and iron age periods; Ancientagricultural practices - Indus civilization, Vedic civilization- Agriculture and Kaudilya's Artha sasthra- Agriculture in Sangam literature, Agriculture in Tamil dynasties Chera, Chola, Pandyaans Pallavas

Unit III:

Journey of Indian agriculture and its development from past to modern era- Development of agriculture in World and India- Green revolution in India - Role of International/NationalInstitutions for Agricultural research

Unit IV:

Indigenous Traditional Knowledge (ITK): Plant production and Plant protection through Indigenous traditional knowledge- Crop voyage in India - Branches of Agriculture- Agricultural resources available in India.

Unit V:

Classifications of crops- Major crops of India and Tamil Nadu- National Agriculture setup in India- Current scenario of Indian agriculture- Indian Agricultural concerns and future prospects**Lesson plan**

Theory Schedule

1. Agricultural heritage; Definition, Indian agricultural heritage; Introduction
2. Need and importance of studying Agricultural heritage
3. Historical facts of agricultural heritage, relevance of heritage to present day Agriculture
4. Development of human culture – stone age, bronze age and iron age periods
5. Agriculture and allied activities in ancient India and Tamil Nadu- Indus civilization
6. Agriculture in Vedic civilization and Kaudilya's Artha sasthra
7. Agriculture in Sangam literature
8. Agriculture in Tamil dynasties Chera, Chola, Pandya and Pallavas
9. **Mid Semester Examination**
10. Journey of Indian agriculture and its development from past to modern era
11. Development of agriculture in World and India- Green revolution in India
12. Role of International/National Institutions for Agricultural research
13. Indigenous Traditional Knowledge (ITK): Plant production and Plant protection through Indigenous traditional knowledge
14. Crop voyage in India - Branches of Agriculture- Agricultural resources available in India
15. Classifications of crops- Major crops of India and Tamil Nadu
16. National Agriculture setup in India- Current scenario of Indian agriculture

17. Indian Agricultural concerns and future prospects

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1. A text book on Agricultural heritage of India by D. Kumari M. Veeral
2. Ancient Indian heritage by Varahamihira'S 2nd volume.
3. History of Agriculture in India up to C 1200 a.d
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23NSS 111*/NCC 111* (0+1)

NSS 111 National service scheme*

Course aims at evoking social consciousness among students through various activities viz., working together, constructive and creative social work, to be skilful in executing democratic leadership, developing skill in programme development to be able for self employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.

All the activities related to the National Service Scheme course is distributed under four different courses viz., National Service Scheme I, National Service Scheme II, National Service Scheme III and National Service Scheme IV each having one credit load. The entire four courses should be offered continuously for two years. A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than fiveregular one day camp in a year and one special camp for duration of 7 days at any semester break period in the two year. Different activities will include orientation lectures and practical works. Activities directed by the Central and State Government have to be performed by allthe volunteers of NSS as per direction.

Theory

Semester I

Course Title: National Service Scheme I

Introduction and basic components of NSS:

Orientation: history, objectives, principles, symbol, badge; regular programmes under NSS, organizational structure of NSS, code of conduct for NSS volunteers, points to be considered by NSS volunteers awareness about health

NSS programmes and activities

Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analysing guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary

Understanding youth

Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change

Community mobilisation

Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilisation involving youth-adult partnership **Social harmonyand national integration** Indian history and culture, role of youth in nation building, conflictresolution and peacebuilding

Volunteerism and shramdan Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism **Citizenship, constitution and human rights** Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information

Family and society

Concept of family, community (PRIs and other community based organisations) and society

Semester II

Course Title: National Service Scheme II

Importance and role of youth leadership

Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership

Life competencies

Definition and importance of life competencies, problem-solving and decision-making, inter personal communication

Youth development programmes

Development of youth programmes and policy at the national level, state level and voluntary sector; youth-focused and youth-led organisations

Health, hygiene and sanitation

Definition needs and scope of health education; role of food, nutrition, safe drinking water, water born diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programmes and reproductive health.

Youth health, lifestyle, HIV AIDS and first aid

Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid

Youth and yoga

History, philosophy, concept, myths and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method

Semester III

Course Title: National Service Scheme III

Vocational skill development

To enhance the employment potential and to set up small business enterprises skills of volunteers, a list of 12 to 15 vocational skills will be drawn up based on the local conditionsand opportunities. Each volunteer will have the option to select two skill-areas out of this list **Issues related environment**

Environmental conservation, enrichment and sustainability, climatic change, natural resource management (rain water harvesting, energy conservation, forestation, waste land development and soil conservations) and waste management

Disaster management

Introduction and classification of disaster, rehabilitation and management after disaster; role ofNSS volunteers in disaster management.

Entrepreneurship development

Definition, meaning and quality of entrepreneur; steps in opening of an enterprise and role offinancial and support service institution.

Formulation of production oriented project

Planning, implementation, management and impact assessment of project

Documentation and data reporting

Collection and analysis of data, documentation and dissemination of project reports

Semester IV

Course Title: National Service Scheme IV

Youth and crime

Sociological and psychological factors influencing youth crime, cyber crime, pear mentoring in preventing crime and awareness for juvenile justice

Civil/self defence

Civil defence services, aims and objectives of civil defence; needs and training of self defence

Resource mobilisation

Writing a project proposal of self fund units (SFUs) and its establishment

Additional life skills

Positive thinking, self confidence and esteem, setting life goals and working to achieve them, management of stress including time management.

Schedule

1. Introduction and basic components of NSS: Orientation
2. NSS programmes and activities
3. Understanding youth
4. Community mobilisation
5. Social harmony and national integration
6. Volunteerism and shramdan
7. Citizenship, constitution and human rights
8. Family and society
9. Importance and role of youth leadership
10. Life competencies
11. Youth development programmes
12. Health, hygiene and sanitation
13. Youth health, lifestyle, HIV AIDS and first aid
14. Youth and yoga
15. Vocational skill development
16. Issues related environment
17. Disaster management
18. Entrepreneurship development
19. Formulation of production oriented project
20. Documentation and data reporting
21. Resource mobilization
22. Additional life skills
23. Activities directed by the Central and State Government

23NCC 111 National Cadet Corps* (0+1)

Schedule

Semester I: National Cadet Corps

1. Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
2. Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
3. Sizing, numbering, forming in three ranks, open and close order march and dressing.
4. Saluting at the halt, getting on parade, dismissing and falling out.
5. Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, paceforward and to the rear.
6. Turning on the march and wheeling. Saluting on the march.
7. Marking time, forward march and halt.
8. Changing step, formation of squad and squad drill.
9. Command and control, organization, badges of rank, honours and awards
10. Nation Building- cultural heritage, religions, traditions and customs of India. National integration.

Semester II: National Cadet Corps

11. Values and ethics, perception, communication, motivation, decision making, discipline andduties of good citizen.
12. Leadership traits, types of leadership. Character/personality development.
13. Civil defense organization, types of emergencies, fire fighting, protection,
14. Maintenance of essential services, disaster management, aid during developmentprojects.
15. Basics of social service, weaker sections of society and their needs, NGO's and their contribution, contribution of youth towards social welfare and family planning.
16. Structure and function of human body, diet and exercise, hygiene and sanitation.
17. Preventable diseases including AIDS, safe blood donation, first aid, physical and mentalhealth.
18. Adventure activities
19. Basic principles of ecology, environmental conservation, pollution and its control.
20. Precaution and general behaviour of girl cadets, prevention of untoward incidents,vulnerable parts of the body, self defense.

Semester III: National Cadet Corps

1. Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and fallingout. Ground/take up arms, examine arms.
2. Shoulder from the order and vice-versa, present from the order and vice-versa.
3. Saluting at the shoulder at the halt and on the march. Short/long trail from the order andvice versa.
4. Guard mounting, guard of honour, Platoon/Coy Drill.
5. Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning and sight setting.
6. Loading, cocking and unloading. The lying position and holding.
7. Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight.
8. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing.
9. Characteristics of Carbine and LMG.
10. Introduction to map, scales and conventional signs. Topographical forms and technicalterms.

Semester IV: National Cadet Corps

11. The grid system. Relief, contours and gradients. Cardinal points and finding north. Typesof bearings and use of service protractor.
12. Prismatic compass and its use. Setting a map, finding north and own position. Map toground and ground to map.
13. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
14. Field defenses obstacles, mines and mine lying. Bridging, waterman ship
15. Field water supplies, tracks and their construction.
16. Nuclear, Chemical and Biological Warfare (NCBW)
17. Judging distance. Description of ground and indication of landmarks.
18. Recognition and description of target. Observation and concealment. Field signals.Section formations.
19. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill.
20. Types of communication, media, latest trends and developments.

23PEY 111 Physical Education and Yoga Practices* 1(0+1)

Semester I: Physical Education and Yoga Practices

1. Teaching – Meaning, Scope and importance of Physical Education
2. Teaching – Definition, Type of Tournaments
3. Teaching – Physical Fitness and Health Education
4. Teaching of skills of Football/ Basket ball – demonstration, practice of the skills,correction, involvement in game situation (For girls teaching of Tennikoit)
5. Teaching of advance skills of Football/ Basket ball – involvement of all the skills in game situation with teaching of rules of the game
6. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
7. Teaching of skills of Ball Badminton/ Table Tennis – demonstration, practice of the skills, correction of skills, involvement in game situation
8. Mid Semester
9. Teaching of skills of Ball Badminton/ Table Tennis – involvement of all the skills in game situation with teaching of rule of the game
10. Teaching of some of Asanas – demonstration, practice, correction and practice
11. Teaching of some of Asanas – demonstration, practice, correction and practice
12. Teaching of some of Asanas – demonstration, practice, correction and practice
13. Teaching of some more of Asanas – demonstration, practice, correction and practice
14. Teaching of some of Asanas – demonstration, practice, correction and practice
15. Teaching of some of Asanas – demonstration, practice, correction and practice
16. Construction and laying out of the track and field (*The girls will have Tennikoit and ThrowBall).

Semester II: Physical Education and Yoga Practices

17. Teaching of different asanas – demonstration practice and correction.
18. Teaching of different asanas – demonstration practice and correction.
19. Teaching of different asanas – demonstration practice and correction.
20. Teaching of different asanas – demonstration practice and correction.
21. Teaching of weight training – demonstration practice and correction.
22. Teaching of circuit training – demonstration practice and correction.
23. Teaching of calisthenics – demonstration practice and correction
24. Mid Semester
25. Teaching of skills of Hockey – demonstration practice of the skills and correction.
26. Teaching of skills of Kho-Kho – demonstration practice of the skills and correction.
27. Teaching of different track events – demonstration practice of the skills and correction.
28. Teaching of different track events – demonstration practice of the skills and correction.
29. Teaching of different track events – demonstration practice of the skills and correctionwith
30. competition among them.
31. Teaching of different field events – demonstration practice of the skills and correction.
32. Teaching of different field events – demonstration practice of the skills and correction.
33. Teaching of different field events – demonstration practice of the skills and correction with competition among them.

Note: 1) Compulsory Uniform: Half pants, Tee Shirts, Shoes and socks all white (Girls will have white Tee Shirt and Track pants) 2) The games mentioned in the practical may be inter changed depending on the season and facilities.

23MAT 101 ELEMENTARY MATHEMATICS** 2 (1+1)

Learning Objectives

To impart knowledge to the students on elementary mathematics topics required and useful inthe study of agricultural courses. By the end of the course, the students will be able to

- Understand concepts of geometry of straight lines, circles.
- Understand concepts on calculus and matrices and their applications.

Theory

Unit I: Straight Lines (7 hours)

Distance formula, section formula – Equation of co- ordinate axes, Equation of lines parallel to axes - Problems on distance between the lines, Change of axes - Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line - Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines- Angles between two st. lines, Parallel lines, Perpendicular lines..

Circles - Introduction to Circle, Equation of circle with centre and radius, General equation of acircle, Equation of circle passing through three given points and tangent of the circle - Simple problems.

Unit II: Differential Calculus (7 hours)

Definition of function, limit and continuity - Differentiation of x^n, e^x, sin x & cos x from first principle - Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions - Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method - Differentiation of Inverse Trigonometric functions .

Unit III: Partial Differentiation (6 hours)

Partial differentiation, homogeneous functions - Examples and problems on partial differentiation- Euler‘s theorem and its application.

Unit IV: Integral Calculus (6 hours)

Integration of simple functions - Integration of Product of two functions, Integration bysubstitution method - Simple problems.

Unit V: Matrices and Determinants (6 hours)

Definition of Matrices, Addition, Subtraction and Determinants of Matrices - Multiplication, Transpose of matrices - Properties of determinants up to 3rd order and their Evaluation - Simple problems.

Lesson plan

Theory Schedule

1. Straight lines: Distance formula, section formula (internal and external division).
2. Change of axes (only origin changed), Equation of co- ordinate axes, Equation of linesparallel to axes.
3. Problems on distance between the lines, Change of axes.
4. Slope-intercept form of equation of line, Slope-point form of equation of line, Two pointform of equation of line.
5. Intercept form of equation of line, Normal form of equation of line.
6. General form of equation of line, Point of intersection of two straight lines.
7. Angles between two straight lines, Parallel lines, Perpendicular lines.
8. Problems on Angles between two straight lines, Parallel lines, Perpendicular line.
9. Introduction to – Circle, Equation of circle with centre and radius, General equation of acircle, Equation of circle passing through three given points and tangent of the circle.
10. Differential Calculus: Definition of function, limit and continuity.
11. Problems on limits and continuity.
12. Simple problems on continuity, Differentiation of x^n, e^x, sin x & cos x from first principle.
13. Derivatives of sum, difference, product and quotient of two functions.
14. Differentiation of functions of functions.

15. Simple problems based on Derivatives of sum, difference, product and quotient of two functions.
16. Simple problems based on Differentiation of functions of functions.
17. Logarithmic differentiation, Differentiation by substitution method.
18. Simple problems based on Logarithmic differentiation and differentiation by substitution method.
19. Differentiation of Inverse Trigonometric functions.
20. Simple problems based on Differentiation of Inverse Trigonometric functions.
21. Partial differentiation, homogeneous functions.
22. Examples and problems on partial differentiation.
23. Euler's theorem and its application.
24. Integral Calculus: Integration of simple functions.
25. Integration of Product of two functions, Integration by substitution method.
26. Problems on Integration of Product of two functions.
27. Problems on Integration by substitution method.
28. Matrices and Determinants: Definition of Matrices, Addition, Subtraction.
29. Problems on Addition, Subtraction and Determinants of Matrices.
30. Multiplication, Transpose of matrices.
31. Problems on Multiplication, Transpose of matrices.
32. Properties of determinants up to 3rd order and their evaluation.

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3. Mathematical Foundations – P. R. Vittal, Margham Publications, Chennai, 2000.
4. Text Book of Matrix, A. K. Sharma, Discovery Publishing House 2004.
5. Essential Engineering Mathematics, Michael Batte, Ventus Publishing ApS (e-book).

23GPB 102 INTRODUCTORY BIOLOGY** (1+1)

Learning objectives

To expose the students to the basic features of crop plants and its classification, botanical description, economic parts and economic importance of different field and horticultural crops. **Theory**

Unit I: Systems of classification and general morphological description

Introduction to the living world, diversity and Characteristics of life, Origin of life, Evolution and Eugenics. Bentham and Hooker's classification of plant kingdom - Nomenclature and it guidelines - Agricultural classification of crops; General morphology: Life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leaf shape, venation and phyllotaxy; Modification of roots and leaf; Floral morphology: Kinds of bracts, inflorescence; Structure of flower, androecium, gynoecium, placentation, types of fruits.

Unit II: Botanical description and economic uses of Poaceae

List of cultivated crops, economic parts, chromosome number and family description ofPoaceae: Key botanical features of Rice, Wheat, sorghum, Maize, Pearl millet, Finger millet, list of small millets, Guinea grass, Napier grass, Cenchrus and Sugarcane.

Unit III: Botanical description and economic uses of Papilionaceae

List of cultivated crops, economic parts, chromosome number and family description of Papilionaceae: Key botanical features of Red gram, Bengal gram, Soybean, Black gram,

Green gram, Cowpea, Lablab, Horse gram, Groundnut, Lucerne, *Stylosanthes*, Clitoria, Agathi and Sunhemp.

Unit IV: Botanical description and economic uses of Pedaliaceae, BrassicaceaeandMalvaceae

List of cultivated crops, economic parts, chromosome number and family description of the following families and Key botanical features of the crops given against them: Brassicaceae - Rapeseed, Mustard and Cabbage, Cauliflower; Malvaceae: Cotton, Mesta and Bhendi.

Unit V: Botanical description and economic uses of following Horticultural crops

List of cultivated crops, economic parts, chromosome number and key botanical features ofthe crops and family description of the following families, Tiliaceae, Piperaceae, Chenopodiaceae, Solanaceae, Mimosae, Moraceae, Cucurbitaceae, Alliaceae, Musaceae,Rubiaceae, Theaceae, Medicinal Plants them.

Practicals

Family features - observation and description of habit, morphology of root, stem, leaves, inflorescence, flowers, floral diagram, floral formula and economic parts of Poaceae, Fabaceae, Brassicaceae. Cell, tissues & cell division. Internal structure of root, stem and leaf. Study of specimens and slides.

Lesson plan

Theory Schedule

1. Introduction to the living world, diversity and Characteristics of life, Origin of life, Evolution and Eugenics.
2. Bentham and Hooker's classification of plant kingdom - - International code of nomenclature and its major guidelines - author citation - Agricultural classification ofcrops.
3. General morphology: Life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leafshape, venation and phyllotaxy; Modification of roots and leaf.
4. Floral morphology: Kinds of bracts, inflorescence; Structure of flower, androecium, gynoecium, placentation, types of fruits.
5. List of cultivated crops, economic parts, chromosome number and family description of Poaceae; Key botanical features of Rice and Wheat.
6. Key botanical features of sorghum, maize, pearl millet and finger millet. List of small millets.
7. Key botanical features of Guinea grass, Napier grass, Cenchrus and sugarcane
8. List of cultivated crops, economic parts, chromosome number and family description of (Papilionaceae) Key botanical features of Red gram, Bengal gram and Soybean.
9. **Mid Semester Examination.**
10. Key botanical features of Black gram, Green gram, Cowpea, Lab lab, Horse gram and Groundnut.
11. Key botanical features of Lucerne, Stylosanthes, Clitoria, Agathi, and Sunnhemp.
12. List of cultivated crops, economic parts, chromosome number and family description of Brassicaceae Key botanical features of Rapeseed and Mustard, Cabbage, Cauliflower.
13. List of cultivated crops, economic parts, chromosome number and family description of Malvaceae; Key botanical features of Cotton, Mesta and Bhendi.
14. List of cultivated crops, economic parts, chromosome number and family description of Solanaceae, Mimosae and Moraceae.
15. Key botanical features of Tobacco, Potato, Chilli, Tomato and Brinjal, Desmanthes,Subabul and Mulberry.

16. List of cultivated crops, economic parts, chromosome number and family description of Cucurbitaceae and Alliaceae; Cucurbitaceae: Key botanical features of Cucumber, Pumpkin and Ashgourd; Alliaceae: Onion and Garlic.
17. List of cultivated crops, economic parts, chromosome number and family description of Musaceae, Rubiaceae and Theaceae; Key botanical features of Banana, Coffee and Tea.

Practical schedule

1. Observing general morphology of roots, stems and leaves.
2. Observing general morphology of inflorescence - flowers, stamens and pistils.
3. Family characters, Botany, Economic parts, floral diagram and floral formula of thefollowing crop plants: - Poaceae: Rice and Wheat.
4. Poaceae: Sorghum, Maize, Pearl millet and Finger millet.
5. Poaceae: Guinea grass, Napier grass, Cenchrus and Sugarcane.
6. Papilionaceae: Redgram, Bengal gram and Soybean.
7. Papilionaceae: Blackgram, Greengram, Cowpea, Lab - lab, Horse gram and Groundnut.
8. Papilionaceae: Lucerne, Stylosanthes, Clitoria, Agathi, Sunnhemp, and Sesbania.
9. Brassicaceae: Rapeseed and Mustard, Cabbage and Cauliflower.
10. Malvaceae: Cotton, Mesta and Bhendi.
11. Tiliaceae: Jute; Piperaceae: Betelvine; Chenopodiaceae: Sugar beet.
12. Solanaceae: Tobacco. Potato, Chilli, Tomato and Brinjal; Mimosae: Desmanthes andSubabul, Moraceae: Mulberry.
13. Cucurbitaceae: Cucumber, Pumpkin, Ashgourd; Alliaceae: Onion and Garlic.
14. Musaceae: Banana; Rubiaceae: Coffee; Theaceae: Tea.
15. Cell, tissues & cell division.
16. Internal structure of root, stem and leaf.
17. Study of specimens and slides.

IISemester

23AGR 102 INTRODUCTORY AGROMETEOROLOGY AND CLIMATE CHANGE (1+1)

Learning objectives

- To know the basic concepts of agricultural meteorology and recording various weather elements in observatory.
- To understand about solar radiation, temperature and relative humidity on cropproduction
- To be familiar with cyclones, El Nino and La -Nina
- To study of clouds, precipitation, drought, flood and evapotranspiration.
- To study about different Agro climatic zones of India and Tamil Nadu, importance of weather forecasting.

Theory

Unit -I: Introduction to Meteorology and Agrometerology

Introduction to meteorology – branches, importance in crop production, scope of atmosphere -lower and upper- composition and its characters. Agro climatic zones of India and Tamilnadu **Unit -II: Solar radiation, light and temperature**

Importance of solar radiation - sun and its thermal properties, different types of solar radiation and its effect on crop growth, lights and its influence on crop productivity, bandwidth, temperature, air and soil. Crop response to different conditions - factors affecting solar radiations, light and temperature.

Unit- III: Atmospheric pressure and wind

Atmospheric pressure - variation in atmospheric pressure, causes of variation, pressure and wind system of the world, wind, daily and seasonal variation of wind speed, cyclone, anti

cyclone. Effect of wind on crops - movement of air mountain and valley winds- land and sea breezes.

Unit -IV: Atmospheric humidity, precipitation and clouds

Atmospheric humidity-effect of humidity on crops- concept of saturation, vapour pressure and process of condensation, evaporation, evapotranspiration, PET, different forms of precipitationand condensation, cloud seeding (artificial rain making). Clouds- clouds formation, WMO classification and characteristics. Rainfall- importance of rainfall on crops, types of rain fall. Monsoon- definition, origin and distribution of South West Monsoon and North West Monsoon,mechanism and importance in Indian agriculture.

Unit -V: Climate change and weather forecasting

Various types of weather hazards influencing crop growth - modification of micro climate, climatic normal, livestock, and crops. Global warming- impact of El-nina. Weather forecasting -principles and types. Current stream of thoughts.

Practicals

Agromet observatory - site selection and layout. Acquiring skill in the use of different instruments and recording data on rainfall / precipitation temperature, pressure, humidity, winddirection and velocity, solar radiation, sunshine hours, evaporation, evapotranspiration, automatic weather station, preparation of synoptic charts and crop weather calendars, mapping of agro climatic zones.

Lesson plan

Theory Schedule

1. Introduction to meteorology – branches- definitions of meteorology, climatology andagricultural meteorology – scope and practical utility of agricultural meteorology.
2. Weather and climate- Factors affecting weather and climate-earth atmosphere- itscomposition, extent and structure
3. Atmospheric weather variable- agro climatic zones of India and Tamil Nadu
4. Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, long wave and thermal, terrestrial, net radiation and albedo.
5. Physiological responses of different bands of incident radiation – function of light, factors affecting distribution of solar radiation within the plant canopy, heat units.
6. Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, cardinal temperature- importance of air temperature- energy balance of earth.
7. Low and high air temperature plant injury- soil temperature- importance of soil temperature.
8. Atmospheric pressure – variation in atmospheric pressure- causes of variation- pressure and wind system of the world
9. **Mid-Semester Examination**
10. Wind, daily and seasonal variation of wind speed, cyclone, anti cyclone, effect of wind oncrops- movement of air and valley winds- land and seas breezes.
11. Atmospheric humidity, concept of saturation, vapor pressure, effect of humidity on crops.,concept of saturation, vapour pressure and process of condensation- evaporation –Evapotranspiration-PET
12. Precipitation and condensation – definition- different forms of precipitation andcondensation – cloud seeding (artificial rain making).
13. Clouds- clouds formation – WMO classification and characteristics.
14. Rainfall- importance of rainfall on crops- types of rain fall-monsoon definition – origin and distribution of South West Monsoon and North West Monsoon-mechanism and importancein Indian agriculture.

15. Weather hazards- drought , floods, frost, tropical cyclones , heat wave, cold wave, storms, hail storms, thunder storms, dust storms and tornadoes
16. Agricultural and weather relations, modifications of crop micro climate, climatic normal for crop and livestock production.
17. Weather forecasting, types of weather forecast and their uses-climate change, climatic variability, El-Nino and La-Nina, global warming, causes of climate change and its impact on national and global agriculture and Current stream of thoughts.

Practical Schedule

1. Visit to PRIST University Agrometeorology observatory and understanding varioustypes of agromet observatories.
2. Site selection & layout for observatory
3. Measurement of sunshine duration and light intensity
4. Measurement of maximum and minimum air temperature, its tabulation, trend andvariation analysis
5. Measurement of soil temperature
6. Determination of vapor pressure, relative humidity and dew point temperature readings, hygrometric table.
7. Measurement of atmospheric pressure with various equipments.
8. Measurement of wind speed, direction and preparation of wind rose.
9. Measurement of rainfall and its tabulation
10. Rainfall analysis
11. Measurement of evaporation and evapotranspiration
12. Measurement of dew - dew gauge
13. Weather forecasting, types and its importance in agriculture
14. Use of synoptic chart and weather reports
15. Climatic variability and analysis of its impact on agriculture
16. Mapping of agro climatic zones of India and Tamil Nadu and its characterization.
17. **Final practical examination**

Course Outcome

CO 1: To gain knowledge about role of weather elements in crop growth andhow to recordvarious weather elements

CO 2: To construct information about effect of solar radiation, temperature and relativehumidity on crop production

CO 3: To comprehend knowledge with cyclones, El Nina and La Nina

CO 4: To create awareness on cloud types, precipitation, drought, flood and evapotranspiration.

CO 5: To formulate cropping pattern for different Agro climatic zones of India and Tamil Nadu, importance of weather forecasting.

Co-Po Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	1	1	2
CO2	-	2	-	-	-	2
CO3	-	1	-	-	-	-
CO4	-	2	-	-	-	-
CO5	-	2	1	-	-	1

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2. Laxmi Lal. 2021. Introduction to Agrometeorology. Agrotech Publishing Academy. Udaipur.

3. Lenka D.2006. Climate Weather and Crops in India, Kalyani Publishers, Ludhiana.
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23AGR 103 IRRIGATION MANAGEMENT (1+1)

Learning objectives

- The students will study the basic principles and practices of irrigation.
- The students will gain clear scientific knowledge on soil water plant relationship
- The student will acquire knowledge about the water requirement for various field crops.
- The students will learn about various methods of irrigation and improve irrigation efficiency.
- The students will study and understand how to use poor quality water for irrigation and importance of drainage.

Theory

Unit I: Importance, history and role of irrigation water

Role of water in plants - importance of irrigation - water resources and irrigation potential of India and Tamil Nadu. History and development of irrigation in India – Irrigation systems of India and Tamil Nadu - Important major irrigation projects - Command area development and water management and water budgeting.

Unit II: Soil water availability and its measurement

Soil plant atmospheric continuum- physical properties of soil and classification of soil water- kinds of water in soil – soil moisture constants - effective root zone depth – moisture-extractionpattern – soil water movement - theories of soil water availability – measurement of soil moisture by direct and indirect methods – relative merits and demerits.

Unit III: Irrigation requirement and CWR

Potential evapotranspiration, reference crop evapotranspiration and consumptive use– Factors influencing water requirement - Crop co-efficient – crop co-efficient curve - Water requirement of crops – irrigation period and interval - critical stages of irrigation - water requirement and management of major field crops.

Unit IV: Irrigation scheduling, its methods and WUE

Scheduling of irrigation – different approaches -– IW/CPE ratio method –critical growth stages,Methods of irrigation –Surface and sub- surface irrigation - Water use efficiency (WUE) – factors influencing WUE - micro irrigation - sprinkler, drip irrigation method –Fertigation - advantages and disadvantages. fertigation scheduling in drip irrigation method.Recommended water soluble fertilizers.

Unit V: Irrigation water quality, its management and drainage

Irrigation management under limited water supply - quality of irrigation water – management practices for using poor quality water – saline, effluent and sewage water- SAR- Sodium adsorption ratio, sodicity hazard, residual sodium carbonate and boron toxicity - agricultural

drainage – surface and sub-surface drainage systems – relative merits and suitability to different soils-conjunctive use of surface and ground water and Current stream of thoughts.

Practicals

Estimation of soil moisture- Measurement of irrigation water through water measuring devices (flumes, weirs and water meter) - Measurement of field capacity, bulk density and infiltration rate. Calculation on irrigation Agronomy- Acquiring skill in land shaping for different surface irrigation methods - Operation and economics of drip and sprinkler irrigation systems - Estimation of crop water requirement - Scheduling of irrigation based on different approaches - Irrigation efficiency – Quality analysis of Irrigation water quality - On-farm irrigation structures - Visit to irrigation command area (Reservoirs and tanks) and water management institutes.

Lesson Plan

Theory Schedule

1. Irrigation–importance, definition and objectives. Water resources of India and Tamil Nadu–surface and ground water resources–Irrigation development–Important major irrigation projects.
2. Role of water in plant growth, command area development, water budget and management
3. Soil plant atmospheric continuum and soil-water relations-physical properties of soil – effective root zone depth–m o i s t u r e extraction pattern– moisture sensitive periods of important crops
4. Water retention in soil – adhesion and cohesion – soil moisture tension - pF - Soilmoisture characteristic curves -water movement in soils–infiltration–percolation–hydraulic conductivity–saturated and unsaturated waterflow
5. Kinds of water in soil–gravitational water-capillary water- hygroscopic water. soil moisture constants- saturation capacity - field capacity – permanent wilting point –available soil moisture – hygroscopic coefficient – theories of soil water availability –moisture retentive capacity viz., FC, PWP and ASM.
6. Measurement of soil moisture–Direct methods: gravimetric and volumetric method,i nfra - red moisture balance method, spirit burning method-Indirect methods: soil moisture probe, tensiometer, resistance blocks, pressure plate and pressure membrane apparatus– relative merits and demerits.
7. **Mid Semester Examination**
8. Evaporation, transpiration, ET and ET_o–factors influencing Evapotranspiration-daily, seasonal and peak period consumptive use.
9. Crop co-efficient–crop co-efficient curve-water requirement–irrigation requirement–net and gross irrigation requirement–irrigation interval–irrigation periods seasonal water requirement of important crops. critical stages of irrigation water requirements of major field crops
10. Scheduling of irrigation–different criteria- soil water regime approach-feel and appearance method, soil moisture tension and depletion of available soil moisture method - climatological approach, IW/CPE.
11. Plant indices approach–visual plant symptoms, soil-cum-sand mini plot technique, growthrate, relative water content, plant water potential, canopy temperature, indicator plants and critical growth stages
12. Surface irrigation methods–flooding, check basin, ring basin, border strip, furrow and corrugations–advantages and disadvantages.
13. Micro irrigation-sprinkler, drip irrigation method–definition-advantages and disadvantages-fertigation, scheduling in drip irrigation method –recommended water soluble fertilizers
14. Study of various weirs and flumes – water use efficiency (WUE)–crop water use and fieldwater use efficiency–factors influencing WUE.
15. Quality of water salinity hazard, SAR – Sodium adsorption ratio, sodicity hazard, residual sodium carbonate and boron toxicity-criteria and threshold limits– management practicesfor using poor quality water
16. Agricultural drainage–surface and sub-surface drainage systems–relative merits andsuitability to different soils.
17. Irrigation management under limited water supply and conjunctive use of surface and ground water. Current stream of thoughts.

Practical Schedule

1. Determination of bulk density
2. Determination of soil moisture content by gravimetric and volumetric methods
3. Installation and working of tensiometer in a cropped field
4. Installation and working of resistant block in a cropped field
5. Determination of field capacity by field method
6. Determination of permanent wilting point by field method
7. Measurement of irrigation water through flumes, weirs and water meters.
8. Scheduling of irrigation by IW/CPE ratio method
9. Measurement of plant water status using Pressure bomb apparatus/ porometer
10. Calculation of irrigation water needs (problems)
11. Determination of infiltration rate
12. Demonstration of surface methods of irrigation (basin, check basin and furrow)
13. Demonstration of drip irrigation system (filter cleaning, flushing of laterals) and calculation of crop water requirement.
14. Component, operation and maintenance of sprinkler irrigation system
15. Fertigation scheduling in important crops
16. Visit to farmer's field and Cost estimation of drip and sprinkler irrigation system
17. **Practical examination**

Course Outcome

CO 1: To understand basic principles and practices of irrigation. CO 2: To formulate ideas pertaining to soil water plant relationship.CO 3: To evaluate water requirement for various field crops.

CO 4: To gain skill development on layout of different methods of irrigation and ways toimprove irrigation efficiency.

CO 5: To analyses the quality of water for irrigation and formulate differentdrainage methods.

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	-	-	2
CO2	3	2	-	-	-	
CO3	3	1	2	-	-	2
CO4	2	2	1	-	2	-
CO5	2	1	-	-	-	-

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3. https://imp.center/agri/amp/devices-used-for-measuring-ittigation-water/
4. http://nsdl.niscair.res.in/123456789/552-IRRIGATIONMETHODS - formatted.pdf
5. http://nsdl.niscair.res.in/123456789/495-correctedwatermanagement.pdf
6. http://nsdl.niscair.res.in/123456789/549IrrigationWaterResources-Formatted.pdf.

23ENT101 Fundamentals of Entomology (2+1)

Learning Objectives:

- To study about the relative position of insects in animal kingdom
- To explore the external morphology of insects
- To observe the anatomy, physiology and behaviour of insects
- To understand the classification of insects and to identify different groups of insects
- To study different methods of collection and preservation of insects

Theory

Unit–I: History and Importance

Entomology as a science – branches of Entomology – History of Entomology in India – Scope of Entomology. Origin of insects – Position of insects in the animal kingdom – Classification and Characters of Phylum Arthropoda. Relationship of Class Insecta with other Classes of Arthropoda. Reasons for insect dominance.

Unit–II: Morphology and Behaviour

Body segmentation, Structure and functions of insect cuticle – cuticular appendages and moulting. Basic Structures of head, thorax, abdomen and their appendages. Modifications of insect antennae, mouth parts, legs, wings, wing venation, wing coupling apparatus and abdomen and its appendages; Metamorphosis and their types; Insect behaviour – tropisms, biocommunication, rhythm, diapause, migration, defense and offence.

Unit–III: Anatomy and Physiology

Anatomy and functions of digestive, excretory, respiratory, circulatory, nervous andreproductive systems in insects. Types of reproduction and mating. Functions of exocrine and endocrine glands. Sensory organs and their functions.

Unit–IV: Taxonomy of Entognatha and Ectognatha (Insecta) (Apterygota and Pterygota)

Taxonomy, systematics and nomenclature – Classification of insects – Orders and examples. Distinguishing characters of agriculturally important non insect orders – Collembola, Proturaand Diplura and Insect orders Archaeognatha and Zygentoma. Paleoptera – Ephemeropteraand Odonata. Neoptera – Polyneoptera – Plecoptera, Dermaptera, Embioptera, Zoraptera,Orthoptera, Phasmatodea, Grylloblattodea and Mantophasmatodea, Mantodea, Blattodea(Cockroach), Blattodea (Termites), Paraneoptera – Psocodea (free living), Psocodea(parasitic), Thysanoptera and Hemiptera (Tingidae, Reduviidae, Miridae, Pentatomidae,Coreidae, Pyrrhocoridae, Lygaeidae, Nepidae, Belostomatidae, Gerridae, Cimicidae, Cicadidae, Cicadellidae, Delphacidae, Aphididae, Cercopidae, Membracidae, Aleyrodidae,Coccidae, Diaspididae, Pseudococcidae, Kerridae, Lophopidae and Psyllidae).

Unit V: Taxonomy of Endopterygota

Distinguishing characters of agriculturally important orders of Endopterygota - Neuroptera (Chrysopidae, Myrmeleontidae, Mantispidae, Ascalaphidae), Megaloptera, Rhaphidioptera,Coleoptera (Cicindellidae, Carabidae, Dytiscidae, Curculionidae, Apionidae, Staphylinidae, Coccinellidae, Lampyriidae, Hydrophilidae, Scarabaeidae, Dynastidae, Cerambycidae, Melolonthidae, Anobiidae, Tenebrionidae, Bruchidae, Meloidae, Cetonidae, Buprestidae, Elateridae and Bostrychidae), Strepsiptera, Diptera (Cecidomyiidae, Agromyzidae, Tephritidae, Asilidae, Tabanidae, Tachinidae, Pipunculidae, Hippoboscidae, Culicidae, Syrphidae and Muscidae, Drosophilidae), Mecoptera, Siphonaptera, Trichoptera, Lepidoptera (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Crambidae, Pyraustidae, Noctuidae, Arctiidae, Bombycidae, Cochlidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae, Metarbelidae and Hesperiidae) and Hymenoptera (Tenthredinidae,Apidae, Xylocopidae, Megachilidae, Bombidae, Sphecidae, Vespidae, Formicidae, Ichneumonidae, Braconidae, Platygastridae, Bethylidae, Evaniidae, Chalcididae, Encyrtidae, Eulophidae and Trichogrammatidae). Current stream of development in Morphology,Physiology and Taxonomy

Practical

Observations on segmentation and external features of Grasshopper/Cockroach/Blisterbeetle. Methods of collection and preservation of insects including immature stages.Observations on structure and various types of insect head orientation, antennae, mouthparts,legs, wings, wing venation, wing coupling apparatus and abdominal appendages. Studies onmetamorphosis in insects and their immature stages. Demonstration and observation ofdigestive system and male and female reproductive systems in grasshopper/ cockroach.Observing the characters of agriculturally important orders and their families – Paleoptera -Ephemeroptera and Odonata. Neoptera – Polyneoptera – Plecoptera, Dermaptera,Embioptera, Orthoptera, Phasmatodea, Mantodea, Blattodea (Cockroach), Blatttodea (Termites) Paraneoptera – Psocodea (free living), Psocodea (parasitic), Thysanoptera and Hemiptera. Endopterygotes – Neuroptera, Megaloptera, Rhaphidioptera, Coleoptera, Strepsiptera, Diptera, Mecoptera, Siphonaptera, Trichoptera, Lepidoptera and Hymenoptera.

Assignment: Each student has to submit 25 insects covering at least ten orders

Lesson Plan

Theory Schedule

1. Entomology- definition & Branches - Scope of Entomology - History of Entomology in India – Arthropoda – mention of insects in scripts – contributions of Fabricius, Caroleus Linnaeus, Rothney, L De Niceville, H.M Lefroy, T.B.Fletcher, T.V. Ramakrishna Ayyar, B.V.David, Ronald Ross, H.S. Pruthi, M.R.G.K. Nair and S.Pradhan; Locations and year of establishment of Zoological Survey of India (ZSI), Directorate of Plant Protection, Quarantine and Storage (DPPQS), Indian Institute of Natural Resins and Gums (IINRG), National Bureau of Agricultural Insect Resources (NBAIR), National Institute of PlantHealth Management (NIPHM), National Centre for Integrated Pest Management (NCIPM) and Forest Research Institute (FRI).
2. Origin of insects – Position of insects in the animal kingdom. Classification and Characters of Phylum Arthropoda – different Classes of Arthropoda and comparison of characters of Class Insecta with Arachnida, Crustacea, Symphyla, Chilopoda, Diplopoda and Onychophora
3. Major points related to dominance of Insects in Animal kingdom
4. Morphology - Structure and functions of body wall – different layers, chemical composition, functions
5. Cuticular appendages – cuticular processes and cuticular invaginations – chaetotaxy – moulting – apolysis, ecdysis and sclerotization
6. Body segmentation – Structure of head – procephalon and gnathocephalon, types of head, sclerites and sutures of insect head; Thorax and abdomen segments and appendages, Epimorphic and anamorphic development in insects
7. Structure of typical insect antenna and its modifications
8. Mouth parts - biting and chewing type, sucking type-piercing and sucking, rasping and sucking, chewing and lapping, sponging and siphoning, mask and degenerate types with examples
9. Structure of a typical insect leg, wing and its modifications – Structure of a typical insect wing and its modifications,Wing venationand wing coupling
10. Structure of insect abdomen and its modifications – Abdominal appendages, Structure of male and female genitalia.
11. Metamorphosis- No metamorphosis, hemi- and holo metamorphosis, intermediate and hyper metamorphosis and diapause – obligate and facultative diapause in insects.
12. Types of eggs, larvae and pupae
13. Insect behaviour – tropisms, biocommunication, rhythm, diapause, migration, defense andoffence.
14. Structure and functions of Digestive system – alimentary canal – structure of foregut, midgut and hindgut – histology, functions, filter chamber and peritrophic membrane – process of digestion
15. Excretory system – structure, functions and modifications of malpighian tubules – structure and functions of other organs of excretion
16. Respiratory system – tracheal system – structure of spiracle and trachea – classification based on

functional spiracles and other means of respiration

17. Circulatory system – open and closed types – organs of circulatory system – dorsal blood vessel (diaphragms, sinuses and accessory pulsatile organs) – process of circulation – properties and functions of haemolymph
18. **Mid Semester Examination**
19. Nervous system – neuron and its types (based on structure and function) – synapse, ganglia, central nervous system, sympathetic nervous system and peripheral nervous system
20. Reproductive system – structure of male and female reproductive systems – structure andtypes of ovarioles and structure of follicle, Types of reproduction in insects
21. Endocrine and Exocrine systems – their structure and functions
22. Sense organs – compound eyes – structure of ommatidium – ocelli – dorsal ocelli and lateral ocelli – types of images and auditory organs (tympanum and Jhonston‘s organ)
23. Taxonomy and systematics – importance - history – Binomial nomenclature –definitions ofbiotype, holotype, allotype and paratype – suffixes of tribes, subfamily, family and superfamily – law of priority – synonyms and homonyms - Species - subspecies – genus -family and order
24. Characters of Class Insecta – Ectognata and entognatha- orders under each group with characters
25. Classification of insects – Apterygota, Pterygota, Endopterygota with examples
26. Distinguishing characters of orders Collembola, Protura, Diplura, Archaeognatha andZygentoma
27. Distinguishing characters of Paleoptera orders– Ephemeroptera and Odonata.
28. Distinguishing characters of Neoptera orders – Polyneoptera – Plecoptera, Dermaptera, Embioptera, Zoraptera, Orthoptera
29. Distinguishing characters of orders Phasmatodea, Grylloblattodea and Mantophasmatodea, (Mantodea, Blattodea (Cockroach), Blattodea (Termites)
30. Distinguishing characters of Paraneoptera orders – Psocodea (free living), Psocodea (parasitic), Thysanoptera and Hemiptera
31. Distinguishing characters of order Endopterygotes – Neuroptera, Megaloptera, Rhaphidioptera, Coleoptera and families of agricultural importance
32. Distinguishing characters of order Strepsiptera, Mecoptera, Siphonaptera, Trichopteraand Diptera and their families of agricultural importance
33. Distinguishing characters of order Lepidoptera and families of agricultural importance
34. Distinguishing characters of order Hymenoptera and families of agricultural importance

Practical Schedule

1. Observations on segmentation and external features of grasshopper/ cockroach/blisterbeetle
2. Practicing the methods of collection, killing, pinning, labelling, display and preservation ofinsects including immature stages. Preparation of riker mount.
3. Observations on various types of insect head orientation and antennae
4. Demonstration of mouth parts of cockroach and plant bug and study of mouth parts offemale mosquito, honeybee, thrips, antlion grub, house fly and butterfly
5. Observations on the modifications in legs and wings (wing venation, regions, angles andwing coupling)
6. Observations on various types of abdominal appendages
7. Studies on the types of metamorphosis. Observations on immature stages of insects – Eggs, larvae and pupae and their types
8. Demonstration of digestive system and male and female reproductive systems (grasshopper/cockroach)
9. Observation on distinguishing characters of Ephemeroptera and Odonata. Plecoptera, Dermaptera, Embioptera and Orthoptera (Acrididae, Tettiigonidae, Gryllidae and Gryllotalpidae)
10. Observation on distinguishing characters of Phasmatodea, Mantodea, Blattodea (Cockroach), Blattodea (Termites) Psocodea – free living, Psocodea (parasitic) and Thysanoptera
11. Observation on distinguishing characters of Hemiptera (Families: Reduviidae, Pentatomidae,

Miridae, Coreidae, Pyrrhocoridae, Lygaeidae, Nepidae, Belastomatidae, Gerridae, Cimicidae, Tingidae, Cicadidae, Cicadellidae, Delphacidae, Aphididae, Cercopidae, Membracidae, Aleyrodidae, Coccidae, Diaspididae, Pseudococcidae, Kerridae, Lophopidae and Psyllidae)

12. Observation on distinguishing characters of Neuroptera, Megaloptera and Rhaphidioptera
13. Observation on distinguishing characters of Coleoptera (Families: Cicindellidae, Carabidae, Dytiscidae, Curculionidae, Apionidae, Staphylinidae, Coccinellidae, Gyrinidae, Lampyriidae, Hydrophilidae, ScarabaeidaeDynastidae, Cerambycidae, Melolonthidae, Anobiidae, Tenebrionidae, Bruchidae, Meloidae, Cetonidae, Buprestidae, Elateridae and Bostrychidae)
14. Observation on distinguishing characters of Strepsiptera, Mecoptera, Siphonaptera, Trichoptera, Diptera (Families: Cecidomyiidae, Agromyzidae, Tephritidae, Asilidae, Tabanidae, Tachinidae, Pipunculidae, Drosophilidae, Hippoboscidae, Culicidae, Syrphidae and Muscidae)
15. Observation on distinguishing characters of Lepidoptera (Families: Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Crambidae, Pyraustidae, Noctuidae, Arctiidae,Bombycidae, Cochlidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae, Metarbelidae and Hesperiidae)
16. Observation on distinguishing characters of Hymenoptera (Families: Tenthredinidae, Apidae, Xylocopidae, Megachilidae, Bombidae, Sphecidae, Vespidae, Formicidae, Ichneumonidae, Braconidae, Platygastridae, Bethylidae, Evaniidae, Chalcididae, Encyrtidae, Eulophidae and Trichogrammatidae)
17. Orientation for final practical examination

Course Outcome:

CO1: Describe characters of Arthropoda and Insecta, and their relationship and reasons forinsect dominance

CO2: Explain morphology of insects, their appendages, their modifications, growth and development (metamorphosis) and behavior

CO3: Describe anatomy and physiology of various systems of insects

CO4: Identify different orders of insects based on their diagnostic characters up to familylevel

CO5: Demonstrate different collection and preservation techniques of insects

CO-PO Mapping Matrix:

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	0	0	1	0
CO2	1	2	0	0	1	0
CO3	3	3	0	0	1	0
CO4	2	3	0	0	1	0
CO5	3	3	0	0	1	0

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e-Resources

1. http://www.itis.usda.gov/it is/
2. www.zin.ru/animalia

3. https://courses.cit.cornell.edu/ent201/content/*anatomy*2.pdf
4. www.*insects*explained.com/03*external*.htm
5. www.earthlife.net/*insects*/anatomy.html

23BIO - 101 FUNDAMENTALS OF PLANT BIOCHEMISTRY AND BIOTECHNOLOGY (1+1)

Learning objectives

- To understand the concepts of biochemistry and biotechnology
- To understand the biochemical reactions occurring in living cells
- To differentiate between qualitative identification and quantitative estimations
- To understand the separation of biomolecules using various biochemical techniques
- To understand the basic techniques of biotechnology

Theory

Unit I: Carbohydrates, lipids and proteins

Introduction – pH and Buffer – Phosphate and carbonate-bicarbonate buffer, Carbohydrate: Importance and classification. Structures of Monosaccharides, Structure of Disaccharides and Polysaccharides, Lipid: classification, Proteins: – amino acids – classification essential and non-essential amino acids, classification based on their hydrophobicity of R(side chain) groups.

Unit II: Nucleic acids

Nucleic acids – structure of nitrogen bases – nucleosides and nucleotides – Adenosinetriphosphate (ATP), Guanosine triphosphate (GTP), Cytidine triphosphate (CTP), Thymidine triphosphate (TTP) and Uridine triphosphate (UTP), Types of DNA -A, B & Z DNA. Types of RNA

Unit III: Enzymes and metabolism

Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Glycolysis and Tricarboxylic Acid (TCA) cycle- metabolic energy generation in the above cycles. Oxidative phosphorylation and substrate level phosphorylation – electron transport chain in mitochondria

Unit IV: Plant Biotechnology-I

Concepts and applications of plant biotechnology: Organ culture, embryo culture, cell suspension culture, callus culture, anther culture and pollen culture and their applications, Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance, cryo-preservation.

Unit V: Plant Biotechnology-II

Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and *Agrobacterium* mediated gene transfer methods, DNA fingerprinting. Biotechnology regulations

Lesson plan

Theory Schedule

1. Introduction – pH and Buffer – Phosphate and carbonate-bicarbonate buffer
2. Carbohydrate: Classification. Structures of Monosaccharides, Structure of Disaccharidesand Polysaccharides
3. Lipid: Classification
4. Proteins: – amino acids – classification essential and non essential amino acids – classification based on their hydrophobicity of R (side chain) groups.
5. Nucleic acids –Structure of nitrogen bases – nucleosides and nucleotides – Adenosine triphosphate (ATP), Guanosine triphosphate (GTP), Cytidine triphosphate (CTP),Thymidine triphosphate (TTP) and Uridine triphosphate (UTP)
6. Types of DNA -A, B & Z DNA. Types of RNA
7. Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes.
8. Glycolysis and Tricarboxylic Acid (TCA) cycle- metabolic energy generation in the above cycles
9. **Mid Semester Examination**
10. Oxidative phosphorylation and substrate level phosphorylation – electron transport chainin mitochondria
11. Concepts and applications of plant biotechnology: Organ culture, embryo culture, cell

suspension culture.

12. Callus culture, anther culture and pollen culture and their applications
13. Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds andtheir significance
14. Cryo-preservation
15. Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods,
16. DNA fingerprinting
17. Biotechnology regulations

Practical schedule

1. Preparation of solution
2. Preparation of buffers and pH
3. Qualitative tests of amino acids
4. Quantitative estimation of glucose
5. Quantitative estimation of proteins
6. Titration methods for estimation of amino acids
7. Titration methods for estimation of lipids
8. Effect of pH on enzyme activity
9. Effect of temperature on enzyme activity
10. Substrate concentration on enzyme activity
11. Separation of amino acids and by Paper chromatography
12. Agarose gel electrophoresis-demonstration
13. Sterilization techniques. Composition of various tissue culture media
14. Preparation of stock solutions for MS nutrient medium.
15. Demonstration on isolation of DNA
16. Demonstration of paper electrophoresis techniques
17. **Practical Examination**

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2. Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.H. 1995. Outlines of Biochemistry. John Wiley and Sons Inc., Singapore.
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23 GPB 102 FUNDAMENTALS OF GENETICS (2+1)

Learning objectives

- To inculcate knowledge on the fundamental concepts of inheritance and variation
- To make the students to understand the Structure of chromosomes and their functions
- To explore linkage and crossing over techniques for drawing gene maps
- To understand the sex determination process and inheritance of quantitative traits.
- To decipher the genetic code for the determination of protein product.

Theory

Unit I; Mendal's work and non-mendalian inheritance

Pre-Mendelian ideas about heredity – Vapor and fluid theory, Magnetic power theory, Preformation theory, Lamarck's theory, Darwin's theory, Germplasm theory and Mutationtheory. Post mendalian

concepts- Probability and Chi-square- Mendel's experiments and laws of inheritance. Allelic interactions – Dominance vs. recessive, complete dominance, codominance, incomplete dominance, over dominance. Deviation from Mendelian inheritance
– Non allelic interaction without modification in Mendelian ratio – Bateson and Punnett's experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio –i.) Dominant epistasis (12:3:1) ii.) Recessive epistasis (9:3:4) iii.) Duplicate and additiveepistasis (9:6:1) iv.) Duplicate dominant epistasis (15:1) v) Duplicate recessive epistasis (9:7) vi.) Dominant and recessive epistasis (13:3); Lethal genes, Pleiotropy, penetrance and expressivity, phenocopy: Multiple alleles, blood group in humans, coat colour in rabbits, self incompatibility in plants; pseudo alleles, isoalleles.

Unit II; Study of chromosomes and chromosomal theory of inheritance

Structure and function of cell and cell organelles - Chromosome structure, chemical composition, nucleosome, centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram –Types of chromosomes based on position of centromere, based on structure and function: based on the role in sex determination, normal and special chromosomes - polytene, lamp brush, other types of chromosomes - B, ring and isochromosomes. Cell division – mitosis, meiosis and their significance, cell cycle-Chromosomal theory of inheritance.

Unit III; Recombination genetics and chromosomal aberrations

Linkage - coupling and repulsion; Experiment on Bateson and Punnet Chromosomal theory of linkage of Morgan – Complete and incomplete linkage, Linkage group. Crossing over –significance of crossing over; cytological proof for crossing over - Stern's experiment; Factors controlling crossing over. Strength of linkage and recombination; Two point and three-pointtest cross. Double cross over, interference and coincidence; genetic map. Chromosomalaberration: Variation in chromosome structure – deletion, duplication, inversion andtranslocation – genetic and cytological implications; Chromosomal aberration: Variation in chromosome number – euploid, aneuploid, types of aneuploids and their origin; Uses of Di haploids and Doubled haploids in Genetics-Nondisjunction - Klinefelter syndrome and Turner syndrome; Polyploid - auto and allopolyploids, their characters; evolution of wheat, Triticale, cotton, tobacco, Brassicas.

Unit IV; Sex chromosomes and extra chromosomal inheritance

Sexual reproduction- Sporogenesis and Gametogenesis- Sex determination: Autosomes and sex chromosomes - chromosomal theory of sex determination - different types –Genic balancetheory of Bridges, Sex linked inheritance – criss cross inheritance – reciprocal difference; holandric genes; sex influenced and sex-limited inheritance. Cytoplasmic inheritance andmaternal effects – features of cytoplasmic inheritance, chloroplast, mitochondrial - plastid colour in *Mirabilis jalapa* - iojap gene of maize, cytoplasmic male sterility in rice, kappaparticles of paramecium - plasmid and episomic inheritance. Quantitative inheritance – Multiple factor hypothesis – Nilsson Ehle experiment on wheat kernel colour. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers; Types of gene action controlling quantitative traits. Mutation – characteristics of mutation – Classification of Mutation- micro and macro mutation – ClB technique - molecular basis of mutation- Transition and transversion; major physical and chemical mutagens.

Unit V DNA-Models, Replication , Genetic code and Protein Synthesis

Nature of Genetic material- DNA as genetic material – Griffith's experiment, experiment of Avery, McCleod and McCarthy – confirmation by Hershey and Chase; RNA as genetic material
– Frankel, Conrat and Singer experiment. Structure of DNA – Watson and Crick model –Central dogma of life. Proof for semi conservative method of DNA replication; Models of DNA replication; RNA types - mRNA, tRNA, rRNA; Genetic code, protein synthesis; Gene function-Regulation of gene expression – operon model of Jacob and Monad; Gene concept- Cistron,muton and recon; Complementation test; exons, introns – split genes –Functional genomics,Metagenomics, Transcriptomics, Proteomics, Metabolomics and Phenomics.

Practicals

Study of microscope- Study of cell structure- Study of cell organelles- Experiments on monohybrid- Experiments on Dihybrid - Experiments on trihybrid- Test cross, backcross, experiments on gene interactions (monohybrid)- Experiments on Study of cell geneinteractions (Di hybrid)- Experiments on epistatic gene interactions- Experiments on epistatic gene interactions- Experiments on probability- Experiments on chi-square test –Gene interactions- Determination of linkage and cross over analysis through two point test cross data- Determination of linkage and cross over analysis through three point test cross data-Sex linked inheritance in *Drosophilla*- Study of models on DNA and RNA structure

Lesson plan

Theory lecture schedule

1. Pre Mendelian concepts and Post Mendelian concepts of heredity
2. Mendelian principles of heredity. Law of segregation and Law of independent assortment
3. Exceptions to Mendel ‘s 1st law. Dominance relationships
4. Exceptions to Mendel ‘s 2nd law. (Law of incomplete dominance and interaction of factors)
5. Epistatic gene interactions (3 interactions with examples)
6. Epistatic gene interactions
7. Cell organelles
8. Chromosome –structure, types
9. Special chromosomes
10. Chromosomal theory of Inheritance
11. Cell division, cell cycle, mitosis
12. Meiosis
13. Probability and chi-square
14. Multiple alleles examples
15. Blood group genetics, pleiotropism and pseudo alleles
16. Sex determination mechanisms
17. **Mid semester examination**
18. Sexual reproduction-sporogenesis and Gametogenesis
19. Sex determination mechanisms
20. Sex linkage, sex limited and sex influenced traits
21. Linkage – its estimation, two-point test cross
22. Crossing over mechanisms, Three-point test cross, chromosome mapping
23. Structural changes in chromosomes Deletions, Duplications and inversions
24. Translocations, examples of all structural alternations
25. Mutations and classifications
26. Mutagenic agents, methods of inducing mutations, CLB techniques
27. Qualitative and quantitative traits
28. Polygenes, continuous variations, multiple factor hypothesis
29. Cytoplasmic inheritance
30. Nature and structure of DNA, RNA
31. Replication of genetic material, DNA and RNA
32. Protein synthesis, transcription
33. Translational mechanisms of genetic material gene concept, gene structure
34. Gene function and regulation. Lac operon and top operator Genetic disorders

Practical schedule

1. Study of microscope. Study of cell structure
2. Study of cell organelles
3. Experiments on monohybrid

4. Experiments on Dihybrid
5. Experiments on trihybrid
6. Test cross, backcross, experiments on gene interactions (monohybrid)
7. Experiments on Study of cell gene interactions (Di hybrid)
8. Experiments on epistatic gene interactions
9. Experiments on epistatic gene interactions 1
10. Experiments on probability
11. Experiments on chi-square test
12. Experiments on chi-square test –Gene interactions
13. Determination of linkage and cross over analysis through two-point test cross data
14. Determination of linkage and cross over analysis through three-point test cross data
15. Sex linked inheritance in *Drosophilla*
16. Study of models on DNA and RNA structure
17. **Final practical examination**

Course Outcome

CO 1: Students will understand the molecular structure of DNA and the central dogma oflife.
CO 2: Importance of studying Linkage and recombination mapping will be well understood bythe students.
CO 3: Students will able to figure out the Fine structure of gene and gene mappingtechniques.
CO 4: The necessity of studying Gene regulation and function will be well elucidated
CO 5: To explore the students in understanding various Genetic disorders and have a betteridea on consanguineous mating

CO-PO Mapping Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	**3**				
CO2		**1**	**2**		
CO3				**2**	
CO4					**4**
CO5					

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23SOL 102 MANURES, FERTILIZERS AND SOIL FERTILITY MANAGEMENT (2+1)

Learning objectives

- To gain knowledge on plant nutrients and basic principles of soil fertility.
- To important knowledge on soil fertility evaluation

- To learn about types of commercial fertilizers and its effect on soil and crop
- To understand the importance of organic manures for sustainable agriculture.
- To gain the knowledge about problem soils and their reclamation as well as analytical knowledge on soil available nutrients.

Theory

Unit I-Soil fertility and Plant nutrition

Introduction to soil fertility and productivity- factors affecting. Essential plant nutrient elements- functions, deficiency systems, Plant nutrient toxicity symptoms and remedies measures.

Unit II- Fertilizers and Manures

Fertilizers – Definition - classification –Manufacturing process of nitrogen, phosphorus, potassium, secondary and micronutrient. Manures – definition- classification – effect on soils and plants. Fertilizer control order.

Unit III- Nutrient transformation

Fate of applied major, secondary and micronutrients in soils and its effect on soil properties

Unit IV- Problem soils and Soil organic matter

Acid, calcareous and salt affected soils – characteristics and management. Soil organicmatter, Role of microorganisms in organic matter- decomposition – humus formation. Importance of C: N ratio and pH in plant nutrition, soil buffering capacity.

Unit V- Soil fertility evaluation and Fertilizer use efficiency

Soil fertility evaluation and methods, critical limits of plant nutrient elements and hunger signs. Luxury consumption, nutrient interactions. Soil test crop response and targeted yield concept. Integrated plant nutrient management. Methods of fertilizer application. Bio fertilizer. Fertilizer use efficiency and management. Effect of potential toxic elements in soil productivity. Current streams of thoughts

Lesson plan

Theory lecture schedule

Soil fertility and productivity –definition- types- factors influencing soil fertility and crop productivity.

1. Nutrient elements - essential nutrients- criteria of essentiality – beneficial and functional nutrients- N, P and K nutrients -functions, deficiency and toxicity symptoms.
2. Secondary and micronutrients- functions, deficiency and toxicity symptoms.
3. Concepts and approaches of soil fertility evaluation - Liebig's Law, Mitscherlich's law andray's nutrient mobility concept.
4. Approaches - Deficiency symptoms, tissue analysis, biological tests and chemical tests.
5. Fertilizers - Definition, classification of N,P and K fertilizers
6. N fertilizers- Urea, ammonium sulphate, ammonium nitrate, CAN properties and their reactions in soil- Manufacture of urea and ammonium sulphate
7. P fertilizers- Rock phosphate, bone meal, basic slag, single super phosphate,diammonium phosphate, triple super phosphate, properties and their reactions in soil
8. Manufacturing of SSP and DAP
9. K fertilizers- MOP and SOP- properties and reactions in soil
10. Syntheses of MOP and SOP
11. Complex fertilizers- definition, manufacture of ammonium phosphate, nitrophosphate andN, P, K complexes
12. Mixed fertilizers-definition, preparation and compatibility

13. Preparation and characteristics and compatibility - Specialty/ Customized fertilizers, Watersoluble fertilizers, liquid fertilizers, Micro nutrient mixtures and chelated micronutrients
14. Fertilizer Control Order
15. Organic manures- Definition, and difference between manures and fertilizers-classification of manures with suitable examples- importance of manures in soil fertility management.
16. Composting techniques- Aerobic and anaerobic (Bangalore and Coimbatore method)enriched FYM and vermicompost. Composting of organic waste-Sugarcane trash andcoir waste.
17. **Mid Semester Examination**
18. Nutrients transformations in soil- ionic forms of plant nutrients in soil-mass flow, diffusion, root interception and contact exchange.
19. Sources, forms, mobility, transformation, fixation, losses and availability of nitrogen in soil
20. Sources, forms, mobility, transformation, fixation, losses and availability of phosphorus in soil
21. Sources, forms, mobility, transformation, fixation, losses and availability of potassium and in soil
22. Sources, forms, mobility, transformation, fixation, losses and availability of calcium magnesium and sulphur in soil
23. Sources, forms, mobility, transformation, fixation, losses and availability of micronutrients in soil
24. Problem soils- definition- classification-acid, salt affected soils (saline, alkali/sodic and saline alkali/sodic)-field diagnosis-characteristics-formation nutrient availability in these soils.
25. Reclamation measures of acid soil-lime requirement and saline, sodic and saline sodic- gypsum requirement a calcareous soil.
26. Humus formation-importance of C:N ratio and pH in plant nutrition, soil buffering capacity.
27. SOM maintenance - Role of SOM in sustaining soil health
28. Concepts and approaches of soil fertility-Liebig's Law, Mitcherlich Law and Bray's nutrientmobility concept.
29. Techniques/ methods of soil fertility evaluation - Inductive, deductive, 'A' value technique, crop logging, critical level,Luxury consumption, hidden hunger, DRIS, indicator plants and agronomic approach
30. Methods of fertilizer application for different soil types - Fertigation - Definition water Soluble fertilizers
31. Bio-fertilizers – definition – classification with suitable examples- importance ofimportance of manures in soil fertility management.
32. Nutrient management concepts - INM, STCR, IPNS, SSNM and RTNM.
33. Nitrogen use efficiency - Slow release N fertilizers - Significance and enhancementTechniques.
34. Nutrient use efficiency of P, K and micronutrients and their enhancement techniques

Practicals

1. Estimation of available nitrogen in soils
2. Estimation of available phosphorus in soils
3. Estimation of Potassium and calcium and magnesium in soils
4. Estimation of available sulfur and micronutrient in soil
5. Estimation of soil organic carbon
6. Determination of boron and chlorine content in soils
7. Estimation of gypsum requirement in sodic soil
8. Estimation of lime requirement in acid soils
9. Sampling of organic manure and fertilizer for chemical analysis
10. Physical properties of organic manure and fertilizers.
11. Estimation of Total nitrogen in urea and farmyard manure.
12. Estimation of ammonical nitrogen and nitrate nitrogen in ammonical fertilizer.
13. Estimation of water soluble P_2O_5, Ca and S in SSP, Lime and Gypsum.
14. Estimation of Potassium in MOP/SOP and

15. Estimation of Zinc in zinc sulphate.
16. Visiting of fertilizer testing laboratory.
17. Practical Examination.

Course Outcome

CO1: The students get knowledge on various kinds of problematic soilsCO2: The students will learn how to maintain the soil health.
CO3: The students acquire practical knowledge of nutrient analysis soil.
CO4: The students gain knowledge on nutrients essential for crop growth and developmentCO5: The knowledge gained useful in making decisions on nutrient dose, choice of fertilizers/manures and method of application etc

CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	1	-	-	1
CO2	1	2	1	1	-	-
CO3	1	1	1	-	-	-
CO4	-	2	-	1	-	1
CO5	1	2	1	1	1	-

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23 HOR 102 PRODUCTION TECHNOLOGY FOR FRUITS AND PLANTATION CROPS (2+1)

Learning objectives

- To impart knowledge on cultural management of Tropical fruit crops.
- To impart knowledge on cultural management of Subtropical fruit crops.
- To impart knowledge on cultural management of Temperate fruit crops.
- To impart knowledge on cultural management of Arid and Semi-Arid zone fruit crops.
- To impart knowledge on cultural management of Plantation crops.

Theory

Unit I: Introduction and Major fruit crops:
Importance and Scope of fruit and plantation crop industry in India. Importance of rootstocks. Production technology of major fruits-Mango, Banana, Citrus.

Unit II: Tropical and Subtropical fruit crops:

Production technology of Guava, Sapota, Grape, Pineapple, Papaya, Fig and Iitchi

Unit III: Temperate fruit crops:
Production technology of Apple, Pear, Peach, Plum strawberry

Unit IV: Arid and Semi-Arid zone fruit crops:
Production technology of Minor fruits -Aonla, Jamun, Date palm, Ber, Pomegranate andJackfruit.

Unit V: Plantation crops:
Production technology of Coconut, Arecanut, Cashew, Tea, Coffee, Rubber, Oil palm and

Palmyrah and current stream of thoughts

Practicals

Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops. Description and identification of fruit. Training and Pruning in Fruit andPlantation crops preparation of plant bio regulators and their uses, Important pests, diseases and physiological disorders of above fruit and plantation crops. Visit to commercial orchards and plantations and current stream of thoughts.

Lesson plan

Theory Schedule

1. Importance and scope of fruit and plantation crop industry in India. Importance ofrootstocks.
2.& 3. Production technology of Mango.
4.& 5. Production technology of Banana.
6.& 7. Production technology of Citrus.
8. Production technology of Guava.
9. Production technology of Sapota.
10. Production technology of Grapes.
11. Production technology of Pine apple.
12. Production technology of Papaya.
13. Production technology of Fig.
14. Production technology of Litchi
15.& 16. Production technology of Apple.
17. Mid Semester Examination
18. Production technology of Pear and Peach.
19. Production technology of Plum
20. Production technology Strawberry.
21.Production technology of Aonla and Jamun.
22. Production technology of Date palm and Ber.
23. Production technology of Pomegranate and Jackfruit.24.&
25. Production technology of Coconut.
26. Production technology of Arecanut and Cashew.
27.&28. Production technology of Tea.
29.&30. Production technology of Coffee.
31.&32.Production technology of Rubber.
33. Production technology of Oil Palm.
34. Production technology of Palmyra.

Practical Schedule

1. Seed propagation.
2. Scarification and stratification of seeds.
3. Propagation methods for fruits and plantation crops.
4. Description and identification of fruits.
5. Bearing habits in Fruit crops.
6. Practicing Training and Pruning in Fruit crops.
7. Practicing calculation and application of manures and fertilizers.
8. Preparation of plant bio regulators and their applications.
9. Important pests and diseases of fruit crops.
10. Practicing training and pruning methods followed in Tea and Coffee
11. Physiological disorders of Fruit and Plantation crops.
12. Practicing harvesting and postharvest handling of Fruit crops.
13. Visit to state Rubber farm.

14. Visit to papain extraction unit.
15. Visit to commercial orchards.
16. Visit to commercial plantations.
17. Final Practical examination

Course outcomes

CO 1: The students will be able to practice the production technology aspects of Tropical, Subtropical, Temperate and Arid zone fruits.
CO 2: The students can demonstrate Sexual and Asexual method of propagation in Fruitcrops.
CO 3: The students can demonstrate important production techniques and diagnose problemsin cultivation of tropical and arid zone fruits.
CO 4: The students will be able to practice the production technology aspects of Plantationcrops.
CO 5: The students can demonstrate important production techniques and diagnose problemsin cultivation of Plantation crops.

CO-PO Mapping matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	1	2	0
CO 2	3	2	1	2	1	0
CO 3	3	3	1	1	2	0
CO 4	3	3	1	1	2	0
CO 5	3	2	1	1	2	0

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23 EXT 102 FUNDAMENTALS OF AGRICULTURAL EXTENSION EDUCATION (2+1)

Learning objectives

- To improve the knowledge level of the students on concepts, Principles of Extension Education, various extension teaching methods and information sources.
- To acquaint the students with Agricultural journalism, Innovation Decision Process and capacity building of various stake holders.
- To identify and understand various information sources for effective transfer oftechnology.
- To understand the scope and importance of agricultural journalism and state the sourcesof news and types.
- To gain knowledge on capacity building among the target groups.

Theory

Unit I: Extension Education, Programme planning and Administration

Extension Education - Meaning, definition, scope & process, Objectives & principles of extension education, Extension programme planning: meaning & principles, Steps in programme planning, Extension administration: Meaning, concept, functions & principles. Monitoring & Evaluation – concept, definition & types, Differences between monitoring & evaluation & importance of evaluation in agricultural extension.

Unit II: Communication Methods and Techniques

Communication - Meaning, definition, elements & characteristics. Models: Aristotle, Shannon& weaver, Schramm, Paul Leagans, Westley, Macclean & Litterer, Concepts to related to Communication- Empathy, redundancy, fidelity, frame of reference, entropy. Barriers to communication, Extension teaching methods - Definition, functions & classification, Media mix, selection & combination of extension teaching methods, Agricultural journalism: Meaning,Scope, importance & characteristics.

Unit III: Diffusion and adoption of innovation

Factors determining news value, types and sources of news, Diffusion and adoption - Meaning& Definition steps in adoption process: 5 stage & 7 stage models. Concepts of Innovation, attributes of innovation, over adoption & rate of adoption. Adopter categories- characteristics& classification, Innovation decision process: Meaning, definition & stages, Factors influencingrate of adoption.

Unit IV: Transfer of technology, Reforms & New trends in agricultural extension

Transfer of technology: Concept & models with examples, Reforms in Agricultural Extension - ATMA, SREP, Gap Analysis, New trends in agricultural extension - Privatization of extension, meaning, factors influencing privatization, Privatization - merits & demerits and strategies with examples. Cyber extension meaning, features, successful models, Kisan call centers, farmers call centers: Meaning. Objectives, operational mechanism, Market led extension: Meaning, enhanced roles of agriculture extension personnel in light of market led extension, Difference between TOT & market led extension. Indigenous Technical Knowledge

- Meaning, Definition, Methods of Documentation, Farmers led extension- Meaning, Examples.Expert system in agriculture - Meaning, components, examples

Unit V: Capacity building of extension personnel and farmers:

Training meaning, concept & types of training - pre service, in-service, orientation, induction, refresher training, Training to farmers & farm women: time, duration & venue, short term, midterm & long term. FTC, KVK, DAATC: mandate & objectives PRA: Meaning, techniques and importance in Agricultural Extension and current stream of thoughts

Practicals

Understanding university extension system and KVK centers of Agricultural University - Group discussion and practicing brainstorming -Preparation and use of audio-visual aids, extension literature- Leaflets, folders - Preparation and Presentation of power point - Preparation of training schedule - Assess training needs - Understanding the problems being encountered bythe villagers through PRA exercise - Organization and functioning of DRDA and other development departments at district level - NGOs in rural development - Understanding PRA

techniques and their application in village development - Exposure to mass media centers - community radio and television studio for understanding the process of programme production

- Planning and writing of scripts for radio print media and electronic media - Adoption of agricultural technologies

Lesson plan

Theory Schedule

1. Extension education: Meaning, definition, scope & process
2. Objectives & principles of extension education
3. Extension programme planning: meaning & principles
4. Steps in programme planning
5. Extension administration: Meaning, concept, functions & principles.
6. Monitoring & Evaluation – concept, definition & types
7. Differences between monitoring &evaluation & importance of evaluation in agricultural

extension.

8. Communication - Meaning, definition, elements & characteristics. .
9. Models: Aristotle, Shannon & weaver, Schramm, Paul Leagans, Westley, Macclean &Litterer
10. Concepts to related to Communication- Empathy, redundancy, fidelity, frame of reference, entropy. Barriers to communication
11. Extension teaching methods - Definition, functions & classification
12. Media mix, selection & combination of extension teaching methods
13. Agricultural journalism: Meaning, Scope, importance & characteristics
14. Factors determining news value, types and sources of news
15. Diffusion and adoption - Meaning & Definition steps in adoption process: 5 stage & 7 stagemodels.
16. Concepts of Innovation, attributes of innovation, over adoption & rate of adoption
17. **Mid Semester Examination**
18. Adopter categories-characteristics & classification, Innovation decision process: Meaning, definition & stages
19. Factors influencing rate of adoption
20. Transfer of technology: Concept & models with examples
21. Reforms in Agricultural Extension - ATMA, SREP
22. Gap Analysis
23. Privatization of extension, meaning, factors influencing privatization
24. Privatization - merits & demerits and strategies with examples.
25. Cyber extension meaning, features, successful models
26. Kisan call centers, farmers call centers: Meaning. Objectives, operational mechanism
27. Market led extension: Meaning, enhanced roles of agriculture extension personnel in lightof marketled extension
28. Difference between TOT & market led extension.
29. Indigenous Technical Knowledge - Meaning, Definition, Methods of Documentation
30. Farmers led extension- Meaning, Examples.
31. Expert system in agriculture - Meaning, components, examples
32. Training meaning, concept & types of training - pre service, in-service, orientation,induction, refresher training
33. Training to farmers &farm women: time, duration & venue, short term, midterm &long term. FTC, KVK, DAATC: mandate & objectives
34. PRA: Meaning, techniques and importance in Agricultural Extension and currentstream of thoughts

Practical schedule

1. Visit to the KVK center of Agricultural University
2. Group discussion and practicing brainstorming
3. Preparation and use of audio-visual aids
4. Preparation of extension literature-Leaflets, folders
5. Preparation of power point presentation
6. Presentation of power point slides
7. Preparation of training schedule
8. Visit to a village to conduct survey to assess training needs
9. Visit to a village to conduct resource inventory through PRA exercise
10. Visit to DRDA, to study the organizational setup and antipoverty programmes at districtlevel
11. Visit to an NGO and learning from their experience in rural development.
12. Understanding PRA techniques and their application in village development planning.
13. Visit to community radio/television studio for understanding the process of

programme production.

14. Planning and writing of scripts for radio.
15. Planning and writing of scripts for print media and Electronic media
16. Survey on adoption of agricultural technologies.
17. Final Practical Examinations

Course Outcome

At the end of the course students will be able to

CO 1: Understand fundamentals of extension education.
CO 2: know the concepts related to communication
CO 3: Gain expertise to conduct PRA exercise
CO 4: Expose on Extension activities of different organizations.
CO 5: Gain knowledge about to TOT and capacity building

Co-Po Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	0	2	0	3	3
CO2	1	1	0	3	0	3
CO3	0	2	2	0	3	0
CO4	2	0	1	0	0	3
CO 5	0	0	-	0	0	3

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23 AEC - 101FUNDAMENTALS OF AGRICULTURAL ECONOMICS(1+1)

Learning objectives

- To provide knowledge to students about basic concepts of economics
- To explain its relevance and importance in agricultural science
- To understand the theory of production
- To know the theory of exchange and distribution
- To provide knowledge to national income and inflation

Theory

Unit I: Nature and Scope of Economics

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macroeconomics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Economic systems: Concepts of economy and its functions, Important features

of capitalistic, socialistic and mixed economies. Agricultural economics: meaning,definition, characteristics of agriculture.

Unit II: Theory of Consumption

Utility theory; law of diminishing marginal utility, equi-marginal utility principle. Indifference curve analysis and properties, budget line - Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Demand: meaning, law of demand, schedule and demand curve, determinants, Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity.

Unit III: Theory of Production

Production: process, creation of utility, factors of production, input output relationship-Production function- Supply: Stock v/s supply, law of supply, schedule, supply curve, determinants of supply, elasticity of supply. Producer's surplus.

Unit IV: Exchange and Theory of Distribution

Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit.

Unit V: Macroeconomic concepts

Public finance -National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification ofmoney, supply, general price index, inflation and deflation. Budget-public revenue and public expenditure. Tax: meaning, direct and indirect taxes, agricultural taxation, VAT/GST.

Economic Planning-its importance, elements of Agricultural Economics- importance and its role in economic development. Agricultural planning and development in the country. Current stream of thought.

Practicals

Basic Concepts -Law of Diminishing Marginal Utility-Law of Equi Marginal Utility-Indifference Curve Analysis-Demand and Supply- Equilibrium Analysis-.Consumer's and Producer's surplus-Elasticity of Demand and Supply-Short and Long run Equilibrium in Perfect Market-National Income Measurement Approaches-.Demographic and Socio-economic Indicators-Consumer Price Index-Human Development Index-Budget Discussion-Taxes-Direct & Indirect Taxes Discussion-Economic Planning & NITI Ayog- Discussion-SDG – Discussion

Lesson Plan

Theory Schedule

1. Economics: Meaning, scope and subject matter, definitions – Wealth, welfare, scarcity and growth definitions. approaches to economic analysis; micro and macroeconomics, positive and normative analysis – deductive and inductive methods.
2. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behaviour – Economic systems: Concepts of economy and its functions, Important features of capitalistic, socialistic and mixed economies.

3. Basic concepts: Goods and services – classification and characteristics. Want – meaning and characteristics, demand, utility, cost and price, wealth, capital, income and welfare.
4. Agricultural economics: meaning, definition, subject matter of agricultural economics, importance and its role in economic development.
5. Utility theory - cardinal and ordinal utility; law of diminishing marginal utility, equimarginal utility principle: definition, assumptions – limitations and applications.
6. Indifference curve analysis and properties – budget line – definition, assumptions, limitations and applications – Consumer's equilibrium and derivation of demand curve.
7. Engel's Law of Family Expenditure – Consumers surplus: definition and importance.
8. Demand: meaning, kinds of demand, law of demand, demand schedule and demand curve, determinants of demand, Demand function-Extension and contraction Vs Increaseand decrease in demand. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity – Factors influencing elasticity of demand – Importance of elasticity of demand
9. **Mid Semester Examination**
10. Production: process, creation of utility, factors of production, definition and characteristics - Input Output Relationship. Production function
11. Supply: Stock versus supply, law of supply, supply schedule, supply curve, Supply and its determinants of supply, supply function, elasticity of supply.
12. Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition;
13. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of Rent and Ricardian theory of rent - Quasi rent - Wages: Real wage and money wage. Interest: Pure interest and gross interest –Profit: Meaning of economic profit.
14. National income: Meaning and importance, circular flow, Concepts of national income - accounting and approaches to measurement, difficulties in measurement.
15. Population: Importance, Malthusian and Optimum population theories Natural and socio-economic determinants, current policies and programmes on population control.
16. Money: Barter system of exchange and its problems, evolution, meaning and functions of money. Classification of money, money supply, general price index, inflation and deflation, inflation – meaning, definition, types of inflation
17. Welfare economics – meaning – Pareto optimality-Consumer Banking: Role in modern economy Public revenue and public expenditure. Tax: meaning, direct and indirect taxes, Cannons of taxation - agricultural taxation, VAT and GST.

Practical schedule

1.Basic Concepts
2.Law of Diminishing Marginal Utility
3.Law of Equi Marginal Utility
4.Indifference Curve Analysis
5.Demand and Supply- Equilibrium Analysis
6.Consumer's and Producer's surplus
7.Elasticity of Demand and Supply
8.Short and Long run Equilibrium in Perfect Market
9.National Income Measurement Approaches
10.Demographic and Socio-economic Indicators

11.Concumer Price Index
12.Human Development Index
13Budget Discussion
14.Taxes- Direct & Indirect Taxes Discussion
15.Economic Planning & NITI Ayog Discussion
16.SDG -Discussion
17. Final Practical Examination

Course Outcome
At the end of the course students will be able to
CO 1: To understand the important concepts on micro and macro economics.
CO 2: To know the principles of economics and its application
CO 3: To acquire the practical exposure on application of economic principles related to agriculture.
CO 4: To work out the measurement of Human Development Index, welfare indicators.
CO 5: To understand the concepts like GDP, GNP and Inflation.

CO-POMapping matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	-	-	-	-
CO2	2	-	-	2	-	2
CO3	-	-	2	2	-	1
CO4	1	-	1	-	-	-
CO5		2			2	

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23 EXT 112 HUMAN VALUES AND ETHICS* (1+0) (NON-GRADIAL)

Learning objectives

- To understand the concepts of human values and ethics
- To gain knowledge about virtues and goals in life
- To develop interpersonal skills and ethical decision making
- To know the professional ethics in agricultural research
- To enhance gender sensitivity and emotional intelligence

Theory

Unit I: Human Values

Human values – definition – concepts – culture and values – socialization – evaluation of human values – types of values. Ethics – introduction – origin of ethics – meaning – types of ethics – ethical issues – ethical conflict – national differences in ethics – ethical behaviours, ethics vs. morals and values.

Unit II: Virtues & Goals

Virtues – civic virtues – civic knowledge – self restraint – self assertion – self reliance – respect for others – living peacefully – caring, sharing, honesty, courage, valuing time,cooperation, commitment, empathy, self confidence. Goals in life – steps in goal setting – SMART Goals, mission for life – linking mission to goal setting – vision of life – driving one self to success – self esteem and self confidence. Art of self improvement – self exploration – self awareness – putting capabilities to use – SWOT analysis.

Unit III: Personality Development

Personality development – definition – elements and stages of personality development. Attitudes of attachment and detachment. Interpersonal skills – delegation, humour, trust, expectations, values, status, compatibility and their role in building team work – resolving conflicts. Ethical decision making – role of moral philosophies in decision making – difficulties in decision making – ethical reasoning – levels of decision making. Ethics in media and technology – impact on youth, cyber ethics and etiquette, mobile phones, social networking – correct and judicious use.

Unit IV: Spirituality and Positive Thinking

Positive spirit – anatomy of the self – the mind – the intellect – the sub conscious mind –consciousness - the cyclic process within the self – states of awareness – innate andacquired qualities of the self – power to act. Spirituality – concepts, nature and identity of god –form or image – attributes – relationship – purpose and benefits – power and acts – meditation – transmitter and receiver – morality and religion. Positive thinking – assertiveness – coping with life stresses – peer pressure – suicidal tendencies – addiction – substance abuse.

Unit V: Professional ethics

Professional ethics – code of professional ethics in agricultural research – organizational ethics – violation of code of ethics – causes and consequences – whistle blowing. Gender issues and gender sensitivity at work place – legal provisions. Managing emotions – anger, frustration, helplessness etc, emotional intelligence – meaning and role in leading a balanced life. Case study on ethics & values and current stream of thoughts.

Lecture Plan

Theory schedule

1. Human values – definition – concepts – culture and values – socialization – evaluation of human values – types of values.
2. Ethics – introduction – origin of ethics – meaning – types of ethics – ethical issues – ethical conflict – national differences in ethics – ethical behaviour, ethics vs. morals and values.
3. Virtues – civic virtues – civic knowledge – self restraint – self assertion – self reliance – respect for others – living peacefully – caring, sharing, honesty, courage, valuing time, cooperation,

commitment, empathy, self confidence.

4. Goals in life – steps in goal setting – SMART Goals, mission for life – linking mission to goal setting – vision of life – driving one self to success – self esteem and self confidence.
5. Art of self improvement – self exploration – self awareness – putting capabilities to use – SWOT analysis.
6. Personality development – definition – elements and stages of personality development.Attitudes of attachment and detachment.
7. Interpersonal skills – delegation, humour, trust, expectations, values, status, compatibilityand their role in building team work – resolving conflicts.
8. Ethical decision making – role of moral philosophies in decision making – difficulties in decisionmaking – ethical reasoning – levels of decision making.
9. **Mid Semester Examination**
10. Ethics in media and technology – impact on youth, cyber ethics and etiquette, mobile phones, social networking – correct and judicious use.
11. Positive spirit – anatomy of the self – the mind – the intellect – the sub conscious mind – consciousness - the cyclic process within the self – states of awareness – innate and acquired qualities of the self – power to act.
12. Spirituality – concepts, nature and identity of od – form or image – attributes – relationship – purpose and benefits – power and acts – meditation – transmitter and receiver – morality and religion.
13. Positive thinking – assertiveness – coping with life stresses – peer pressure – suicidal tendencies – addiction – substance abuse.
14. Professional ethics – code of professional ethics in agricultural research – organizational ethics – violation of code of ethics – causes and consequences – whistle blowing.
15. Gender issues and gender sensitivity at work place – legal provisions.
16. Managing emotions – anger, frustration, helplessness etc, emotional intelligence – meaning and role in leading a balanced life.
17. Case study on ethics, values and current stream of thoughts.

Course Outcome

At the end of the course students will be able to

CO 1: Understand the concepts of human values and ethicsCO 2:

Gain knowledge about virtues and goals in life

CO 3: Develop interpersonal skills and ethical decision making

CO 4: Know the professional ethics in agricultural research CO 5:

Enhance gender sensitivity and emotional intelligence

Co-Po Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	0	3	1	0	2
CO2	0	1	3	2	1	3
CO3	0	2	2	0	1	3
CO4	0	1	3	0	1	2
CO 5	1	1	3	1	1	3

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IISemester

AGR 201 WEED MANAGEMENT (1+1)

Learning objectives

- To develop the mastery of weed identification.
- To understand different methods of weed management including herbicides, their mode ofaction and selectivity and resistance for the effective weed control.
- To understand and develop technical knowledge on different herbicides and their usage, computation of herbicide doses.
- To acquire skills on herbicide application for better herbicidal effects and weedmanagement.

Theory

Unit I: Weed biology and ecology

Introduction to weeds- definitions, characteristics of weeds, their harmful and beneficial effectson the ecosystem. Classification, reproduction and dissemination of weeds. Weed seed dormancy – crop weed competition, allelopathy and its application for weed management.

Unit II: Principles of weed management

Concepts of weed prevention, control and eradication. Methods of weed management- cultural, mechanical, chemical, biological and biotechnological methods. Integration of herbicides with non-chemical methods of weed management and IWM.

Unit III: Herbicides

Herbicides- definition, advantages and limitation of herbicide usage in India. New developments in herbicides- classification, formulations and methods of application. Conceptof adjuvants, surfactant and their use.

Unit IV: Behaviour of herbicides and herbicide resistance

Introduction to mode of action of herbicides and selectivity. Herbicide absorption and translocation. Compatibility of herbicides with other agro-chemicals. Herbicide residue management- persistence, degradation and herbicide resistance.

Unit V: Weed management

Weed management in field crops. Aquatic, problematic, invasive alien weeds and their management. Sustainable weed management concepts for climate change. Current stream of thoughts.

Practicals

Identification of weeds; Survey of weeds in crop fields and other habitats; Preparation of herbarium of weeds; weed seed bank; Biology of problematic weeds; Acquiring skill in mechanical and cultural methods of weed management, use of tools and implements; Calculations on weed indices; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipments and calibration; Methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Economics of weed management practices. Designing integrated weed management practices for various crops.

Lesson plan

Theory Schedule

1. Weeds – Definition, classification and characteristics, harmful and beneficial effect ofweeds.
2. Classification and characteristics of weeds of different agro ecosystems – lowland weeds,irrigated upland and rainfed land weeds.
3. Classification and characteristics of weeds – Aquatic, parasitic and obnoxious weeds.
4. Life cycle of weeds, weed migration, weed seed distribution.
5. Weed dormancy, germination, establishment and perennation of weeds in different ecosystems.
6. Crop weed interactions – Critical crop weed competition, competitive and allelopathiceffects of weeds and crops.
7. Principles and methods of weed management: Preventive, cultural, mechanical.
8. Principles and methods of weed management: chemical, biological and alternate methods.
9. **Mid Semester Examination.**
10. Classification and characteristics of herbicides, methods of herbicide application and herbicide formulations – History and Development.
11. Herbicide use efficiency – Adjuvants, herbicide protectants and antidotes – Herbicide and herbicide mixtures in India – Interaction with moisture, fertilizer and other agrochemicals.
12. Herbicides absorption and translocation – Mechanism of action of herbicides and their selectivity.
13. Herbicide persistence and degradation in plants and soils – Herbicide residue and their management.
14. Herbicide resistant weeds and their impact on weed management.
15. Success of herbicide resistant crops (HRC) in Indian and World agriculture.
16. IWM in crops and cropping systems – Agricultural crops.
17. Aquatic , problematic, invasive alien weeds and their management and sustainable weed management concept for climate change- Current stream of thoughts.

Practical Schedule

1. Identification, classification and characterization of wet land and garden land weeds.
2. Identification, classification and characterization of dry land and aquatic weeds.
3. Identification, classification and characterization of problematic and parasitic weeds.
4. Biology and survey of weeds in cropped area and other habitats.
5. Techniques of weed preservation - Herbarium preparation.
6. Estimation of soil weed seed bank and seed production potential of problematic weeds.
7. Phytosociological survey of weeds
8. Calculations on weed indices(WCE and WI)
9. Study of commonly available herbicides in the market, their nomenclature and labelinformation.
10. Study of herbicide formulations and mixture of herbicides.
11. Computation of herbicide doses.
12. Study of herbicide application equipment and calibration.
13. Herbicide application methods and precautionary measures.
14. Herbicide phytotoxicity scoring under field conditions and its compatibility with agrochemicals.
15. Field study of weed control in cropped and non-cropped areas.
16. Herbicide residue analysis.
17. **Practical examination.**

Course Outcome

CO 1: To create knowledge on facts and information from different sources, pertaining toweed biology and management and be able to explain how they are interrelated; demonstrated

through successful completion of assignments.

CO 2: To critically assess different weed management strategies

CO 3: To synthesis idea about various herbicides, formulations and adjuvants

CO 4: To understand about mechanism and action of herbicides, persistence of herbicides.

CO 5: To construct information regarding management of weeds of field crops, aquatic and problematic weeds.

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	1	1	-
CO2	3	2	2	-	-	-
CO3	-	-	2	-	2	-
CO4	-	-	-	-	2	-
CO5	2	1	2	1	2	2

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23AGR 202 INTRODUCTORY TO FORESTRY (1+1)

Learning objectives

- To acquire knowledge on the basic aspect of Forestry.
- To conceptualize the importance of forests and Agro forestry system.
- To impart knowledge on Agroforestry systems as an essential eco-friendly mechanism in productivity of agro-ecosystems.
- To learn about artificial regeneration and manmade forestry
- To learn about techniques of tree planting and its management.

Theory

Unit I: Forest and its importance

Forest- definitions of basic terms. Role and functions of forests. Forest classification- Social forestry, farm forestry, agro forestry, community forestry, industrial forestry and urban forestry,forest Influences. Scope of forestry- types of forest in World, India and Tamil Nadu. Salient features of national forest policies.

Unit II: Forest regeneration

Forest regeneration- objectives- natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers. Artificial regeneration-Man made plantations. Factors determining regeneration. Nursery technique. Forest plantation. Tending operations – weeding, cleaning, thinning – mechanical,

ordinary, crown and advance thinning.

Unit III: Forest mensuration

Forest mensuration- objectives, diameter measurement, instruments used in diameter measurement. Non instrumental methods of height measurement - shadow and single pole method. Instrumental methods of height measurement - geometric and trigonometric principles. Instruments used in height measurement. Measurement of tree diameter, tree height, age and growth rate and tree stand.

Unit IV: Agroforestry

Agroforestry- concept, definitions, importance, benefits, limitations. Criteria of selection oftrees in Agroforestry. Classification of different agro forestry systems prevalent in the country- Shifting cultivation, taungya, alley cropping, wind breaks, shelter belts and home gardens. Criteria for selection of AF Trees.

Unit V: Silviculture

Silviculture- definition, objectives. Plant classification – Crown, stem, roots locality, Plantsuccession- Cultivation practices for importance trees. Silviculture practices for important fast growing tree species of the region. TBO's, MPTS and NFTS- Ailanthus, Neem, Pungam, Prosopis, Casuarina, Silk cotton, Bamboo and Acacias and Current stream of thoughts.

Practicals

Identification of trees-Seeds and seedlings of important agroforestry species-Seed treatments - Forest nursery-types-Layout-bed preparation-Nursery technology of important tree species- Forest mensuration- Visit and study of different agroforestry systems- Biomass estimation in Energy plantations- Economics- Forest plantations and their management- Visit to foresttraining college- Visits of nearby forest based industries.

Lesson plan

Theory Schedule

1. Introduction- Introduction to Indian forest, target area, productivity - Definitions of basicterms related to forestry – Role, functions and scope of forestry.
2. Classification of forest- Social forestry, Community forestry, Extension forestry, Farm forestry, Industrial forestry and urban forestry.
3. Types of forest in India and Tamil Nadu.
4. National Forest Policies including Agro forestry policies.
5. Forest regeneration- Natural and Artificial Regeneration methods- seed and vegetativeparts.
6. Artificial regeneration- man made plantations -coppicing, pollarding, root suckers choice between natural, essential preliminary considerations.
7. Nursery management practices in forestry.
8. Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning.
9. Mid – semester examination.
10. Forest mensuration- Objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method- Instrumental methods of height measurement.
11. Geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees.
12. Agroforestry-concept - definitions, importance, benefits, limitations -criteria of selection of trees in Agroforestry
13. Planning for agroforestry – constraints, diagnosis and design methodology.
14. Selection of tree crop species for agroforestry
15. Classification of different agro forestry systems prevalent in the country, shifting cultivation, Taungya, Alley cropping, Home gardens, multitier cropping, Wind breaks and Shelter belts.

16. Silviculture- definition- objectives- cultivation practices for important trees TBO's, MPTS and NFTS.
17. Silvicultural practices for Ailanthus, Neem, Pungam, Prosopis, Casuarina, Silk cotton, Bamboo and Acacias and Current stream of thoughts.

Practical Schedule

1. Identification of tree species suitable for Timber, Fuel wood and Fodder
2. Identification of tree species suitable for Roadside plantation, Field bunds, Windbreaksand for Wastelands
3. Identification of Minor forest tree species, trees for Beautification purpose and Nitrogenfixing tree species and other species suitable for Agroforestry
4. Identification of seeds of important tree species
5. Collection, Extraction and Storage of tree seeds
6. Collection, Extraction and Storage of tree seeds
7. Application of Pre-sowing Seed Treatment to tree seeds
8. Nursery, types, importance of nursery and criteria for nursery site selection.
9. Nursery methods for important silviculture tree species – Mother bed – raised bed andsunken bed
10. Biomass estimation in Energy plantations.
11. Cost of cultivation of Commercial trees.
12. Diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees
13. Height measurement of standing trees by Shadow method, Single pole method and Hypsometer.
14. Volume measurement of logs using various formulae.
15. Forest plantations and their management.
16. Visits of nearby forest based industries.
17. **Practical examination**.

Course Outcome

CO 1: Students can learn about the basic aspects of Forestry.
CO 2: Students can understand the importance of forests and Agro forestry system.CO 3: Students acquire knowledge about the minor forest products.
CO 4: Students can learn about the aging of tree species.
CO 5: Students learn about techniques of tree planting and its management.

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	3	2	1
CO2	2	2	3	-	3	-
CO3	2	3	3	-	2	2
CO4	2	1	3	-	1	2
CO5	3	3	2	3	2	2

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23 AGR 203 CROP PRODUCTION TECHNOLOGY-I (KHARIF CROPS) (1+1)

LEARNING OBJECTIVES

- To impart updated technology and skills in performing different operations in raising of the crops.
- To understand crop statistics and study the constraints for low productivity in India and Tamil Nadu.
- The students will gain knowledge about the Kharif crops and their cultivationtechniques.
- To know cropping systems in India and post-harvest operations for different crops.
- To Learn about seed production, Farm Mechanization and resource conservationtechnology.

THEORY

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield, post-harvest management practices. Value addition and by-products utilization of *Kharif* crops.

Unit I: Cereals and Millets

Cereals – Rice, Maize, Millets – Sorghum, Pearl millet, Finger millet. Minor millets – Foxtail millet, Kodo millet, Common millet, little millet and barnyard millet.

Unit II: Pulses and oil seeds

Pulses – Pigeon pea, Black gram, Green gram, Horse gram and cluster bean.Oil seeds

– Sesame, Soybean, Castor and Jatropha.

Unit III: Fiber crops.

Cotton, jute and mesta

Unit IV: Fodder and Forage crops

Fodder sorghum, fodder maize, cowpea, horse gram, and cluster bean. Forage crops –Stylosanthus, elephant grass and Napier hybrid grass.

Unit V : Green manures and green leaf manures

Green manures – Daincha, Sunnhemp, sesbania, kolingi. Green leaf manures – Glyricida, subabul, pungam, poovarasu, and neem. Insitu incorporation ofgreen manures and green leaf manures. Current stream of thoughts

PRACTICAL

Nursery preparation and transplanting of rice, pearl millet and finger millet. Sowing of maize, soybean, pigeon pea, mungbean, sesame and cotton. Effect of seed size on germination and seedling vigour in the kharif season. The effect of sowing depth on kharif cropgermination, identification of weeds in *Kharif* season crops, Topdressing and foliar feeding of nutrients, a study of yield-contributing characteristics and yield calculation of kharif season crops, a study of crop varieties, and important agronomic experiments at an experimentalfarm. Study of forage experimentation, morphological description of *kharif* season crops. Visit research centers for related crops.

Theory

Lesson Plan

1. Importance, area, production and productivity of cereals and millets in world, India and Tamil nadu. Rice - origin - geographic distribution - economic importance – soil and climatic requirement. Important varieties and hybrids, Transgenic Rice. Rice - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
2. System of Rice Intensification (SRI) – byproduct utilization, quality parameters - post harvesting technology.
3. Maize and sorghum - Origin, geographical distribution, economic importance, soil andclimatic requirements, varieties, cultural practices and yield. Post harvest handling, processing, value addition and by product utilization.
4. Pearl millet and finger millet - origin, geographic distribution, economic importance,soil and climatic requirement, varieties, cultural practices and yield - Post harvest management
5. Minor millets - foxtail millet, little millet, kodo millet, common millet and barnyard millet - Origin, geographic distribution, economic importance, soil and climaticrequirement, varieties, cultural practices and yield. Post harvest management.Importance, area, production and productivity of pulses in world, India and Tamilnadu. Reasons for low productivity of pulses in India and Techniques to improve productivity.
6. Pigeonpea, blackgram and greengram - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield -Post harvest handling, processing, value addition and by product utilization. Agronomy of rice fallow pulses.
7. Importance, area, production and productivity of oilseeds in world, India and Tamilnadu. Reasons for low productivity of oilseeds in India and Techniques toimprove productivity. Sesame - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield -Post harvest management
8. **Mid semester examination**
9. Soybean, Jatropha and castor - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield -Post harvest management
10. Cotton - Origin, geographical distribution, economic importance, soil and climatic requirements - Season and varieties. Cultural practices and yield. Post harvest management and quality parameters. Rainfed cotton - Rice fallow cotton and transgenic cotton. Post harvest management.

11. Jute and Mesta - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
12. Importance of forage crops in Indian agriculture. Fodder maize and fodder sorghum - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield
13. Horse gram, clusterbean and cowpea - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
14. Stylosanthus, Elephant grass and Napier hybrid grass - Origin - geographical distribution - economic importance - soil and climatic requirements – varieties - Cultural practices: Field preparation – Season - Sowing – Water management – Weed management – Nutrient management – Harvesting – Yield. Forage crops. Preservationof fodders - Silage and hay making.
15. Green manures – Daincha, Sunhemp and *S.rostrata*and Kolingi - Importance - Soil and climatic requirement - Cultural practices and yield.
16. Glyricidia, subabul, pongam and neem - Soil and climatic requirement - Cultural practices and yield. *Insitu* incorporation of green manures. Current stream of thoughts

Practical Schedule:

1. Identification of seeds of *kharif* crops
2. Acquiring skill in different seed treatment techniques for *kharif* crops.
3. Practicing various nursery types and main field preparation for rice.
4. Layout and raising of crop cafeteria
5. Acquiring skill in nursery preparation and sowing of important millets.
6. Acquiring skill in main field preparation, manuring and sowing/ transplanting or kharif
7. Study of yield parameters and yield estimation in *kharif* crops.
8. Acquiring skill in harvesting of *kharif* crops
9. Working out cost and returns of *kharif* crops.
10. Study of crop varieties and important agronomic experiments at experimental farm
11. Visit to farmers field / experimental farm to acquire skill in mechanisation.
12. Visit to nearby Forage farm/ Agricultural Research Station / Farmer's field.
13. **Practical examination**.

COURSE OUTCOMES:

CO1: To understand the importance of food grain requirement and cultivationof major cereal crops

CO 2: To gain knowledge about importance of minor millets and its cultivation practices

CO3: To formulate legume based cropping system and production technologies for various pulse crops

CO4: To construct idea regarding knowledge on growing of legume andperennial fodders and its preservation

CO5: To create awareness about role of green manures in soil fertility

CO-PO MAPPINGMATRIX

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	-	-	-	2
CO2	2	-	-	-	-	2
CO3	2	2	2	-	-	2
CO4	2	2	2	-	-	2
CO5	2	-	-	-	-	-

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- *https://drive.google.com/file/d/1rACrrSvqJOIwWZScsNmNcR-RZYhUQtSi/view*

23 SOL 201 PROBLEMATIC SOILS AND THEIR MANAGEMENT 2 (1 +1)

Learning Objectives

- To know about the soil and different problem occur during cultivation.
- How to identify the problem and what are the reclamation method requires improving thesoil health.
- Students learn practically about the identification of problem soil and learn different methodto improve soil fertility, that necessary to improve the yield.
- To gain knowledge on the assessment irrigation water quality
- To learn about modern tools to asses the extent of types of problematic soils

Theory

Unit 1 Soil health and Soil quality and Wastelands

Soil degradation: Concept, types, factors and processes. Soil quality and soil health: definition and concept, soil quality indicators. Characteristics of healthy soils. Distribution of Waste land and problem soils in India. Their categorization based on properties

Unit 11- Soil constraints- Chemical

Saline soils, alkali Soils, saline-alkali soils, degraded alkali soils, coastal saline soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Acid and acidsulphate soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Calcareous Soil: definition, formation, characteristics, effect on plant growth, reclamation and management.

Unit III- Soil constraints- Physical and polluted soil

Slow permeable, excessively permeable, surface crusting, sub surface hard pan and fluffy paddy soils. Eroded soils and compacted soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Submerged soils and flooded soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Polluted soils: definition, sources and their remediation. Water pollution: definition, sources and their remediation.

Unit IV- Irrigation Water Quality and Use

Quality of irrigation water – Criteria used for assessing the quality of irrigation water – Water quality appraisal – Effect of poor quality water on soil and crop growth – Management of poor quality irrigation water.

Unit V- Assessment and bioremediation

Remote sensing and GIS in diagnosis and management of problem soils. Land capability and classification, land suitability classification. Problem soils under different agro ecosystems. Bioremediation of problem soils through multipurpose tress (MPTs**).** Current stream of thoughts

Lesson plan

Theory Lecture Schedule

1. Soil quality-Physical, Chemical and Biological indicators and major factors affecting thesoil quality
2. Soil health and Soil health card, its importance to farmer and crop productivity
3. Distribution of Waste land and problem soils in different agro-ecosystem of India
4. Properties and categorization of saline and sodic soils
5. Reclamation and management of Saline and Sodic soils
6. Properties and categorization of acid and acid sulphate soils based on properties
7. Reclamation and management of acid and acid sulphate soils
8. Slow permeable, excessively permeable, surface crusting, sub surface hard pan and fluffypaddy soils. Eroded soils and compacted soils: definition, formation, characteristics, effecton plant growth, reclamation and management
9. **Mid Semester examination**
10. Submerged soils and flooded soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Polluted soils: definition, sources and their remediation. Water pollution: definition, sources and their remediation.
11. Introduction to water quality and its effective usage for irrigation
12. Criteria, classification and standards of irrigation water –an appraisal
13. Management and utilization of saline water for irrigation
14. Remote sensing and GIS in diagnosis of problem soils
15. Remote sensing and GIS utility on management of problem soils
16. Land capability and land suitability classification
17. Bio remediation of soils through multipurpose trees (MPTs), and current stream of thoughts

Practicals

1. Identification of physical problems of soils
2. Determination of soil pH
3. Determination of EC of soils
4. Determination of lime requirement of acid soils (Shoemaker et al.)
5. Determination of gypsum requirement of alkali soils (Schoonover 1952)

6. Determination of calcium carbonate content in calcareous soils
7. Determination of infiltration rates of soils.
8. Estimation of CEC in problem soil
9. Estimation of exchangeable calcium and magnesium
10. Estimation of exchangeable K and Na and ESP
11. Water quality assessment (pH, EC, alkalinity)
12. Determination of Carbonate and Bicarbonate in irrigation water (Richards, 1954)
13. Determination the amount of Chloride in irrigation water.
14. Determination of Ca and Mg content in irrigation water
15. Determination of Na and K content in irrigation water
16. Computation of quality index of irrigation water
17. **Practical examination**

Course outcome

CO1: The students get knowledge about different kind of problem soil in India and their characteristics

CO2: Students gain knowledge in methods of reclamation of problem soils

CO3: The students gain practical knowledge of laboratory to test the problem soil.

CO4 : Identify processes resulting in deterioration of soil physical and chemical properties

CO5: Students gains knowledge on importance of quality irrigation water for soil and crops

CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	-	-	1
CO2	2	1	1	-	-	-
CO3	-	1	1	-	-	-
CO4	1	1	-	-	-	-
CO5	1	1	-	-	1	1

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2. Das, D.K 2013 Introductory Soil Science. Kalyani Publishers, New Delhi
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23 GPB 201 FUNDAMENTALS OF PLANT BREEDING (2+1)

Learning objectives:

- To expose the students to basic and applied principles of plant breeding.
- To impart knowledge on emasculation and pollination techniques of various crops
- To impart knowledge on breeding methods of self, cross and clonally propagated crops
- To impart knowledge on application of various genetic principles in crop improvement
- To familiarize recent strides in molecular markers.

Theory

Unit I: Reproductive systems in plant breeding

Plant Breeding – definition, concept, Nature, Aims & Objectives and Role. Major Achievements and future Prospects of Plant Breeding. History and Development of Plant Breeding – Genetics in relation to Plant Breeding – Modes of reproduction – Asexual reproduction (Vegetative reproduction and apomixes)

and sexual reproduction – their classification and significance in plant breeding – Modes of pollination – classification of crop species on the basis of mode of pollination – self-pollination – Mechanisms promoting self and cross pollination. Self-incompatibility – classification – utilization in crop improvement. Male sterility – different types – genetic, cytoplasmic and cytoplasmic genetic male sterility –inheritance and maintenance – Utilization of male sterile lines in hybrid seed production – their limitations, advantages and disadvantages.

Unit II: Breeding methods of self-pollinated crops

Genetic consequences of self-pollination, cross pollination and often cross-pollinated crops - Plant introduction – Types, history, purpose, procedure, merits and demerits – plant introduction agencies in India – NBPGR and its activities – germplasm collections, genetic erosion, gene sanctuaries – centers of origin / diversity. Biometrical genetics – definition, qualitative and quantitative characters, role of environment on quantitative characters – biometrical techniques used in plant breeding – Selection – natural and artificial selection – basic principles of selection – selection intensity – selection differential – heritability – genetic advance. Johannsen's pure line theory and its concepts and significance – progeny test. Genetic basis and breeding methods in self-pollinated crops – Mass selection – procedure by mass selection – merits, demerits and achievements. Genetic basis of pure line selection – general procedure for evolving a variety by pure line selection – merits, demerits and achievements – comparison between mass and pure line selection – Hybridization – types of hybridization – pre-requisites of hybridization – procedure / steps involved in hybridization. – Pedigree, bulk method – procedure – merits, demerits and achievements – comparisonbetween pedigree and bulk method – single seed descent method. Back cross method – applications, procedure for transfer of single dominant gene, recessive gene – merits, demerits and achievements, comparison between pedigree and back cross methods – Multiline variety – definition, characteristics, development of multiline varieties and achievements.

Unit III: Breeding methods of cross pollinated crops and clonally propagated crops Population genetics – concepts, Hardy Weinberg law, factors affecting equilibrium frequenciesin random mating populations. Heterosis breeding and Inbreeding depression –Composites and Synthetics – steps in development of synthetics and composites Population improvement – selection without progeny testing – selection with progeny testing – progeny selection – merits and demerits of progeny selection – line breeding – achievements –Recurrent selection – different types – detailed procedure of simple recurrent selection and brief description of other recurrent selection methods – conclusion of the efficiency of different selection schemes. Methods of breeding for vegetatively propagated crops – clone – characteristics of asexually propagated crops – characteristics of clones – importance of a clone – sources of clonal selection – procedure – advantages and disadvantages – problems in breeding asexually propagated crops - genetic variation within a clone – clonal degeneration – achievements – comparison among clones, pure lines and inbreds.

Unit IV: Special breeding methods

Wide hybridization – history – objectives – barriers to the production of distant hybrids – techniques for production of distant hybrids – applications of wide hybridization in crop improvement – sterility in distant hybrids – Polyploidy breeding – classification - applications in crop improvement and limitations. Mutation breeding – spontaneous and induced mutations – characteristic features of mutations – procedure of mutation breeding – applications –advantages, limitations and achievements. Breeding for resistance to biotic stresses – diseaseresistance – mechanisms of disease resistance in plants – Insect resistance – mechanism of insect resistance in plants – nature of insect resistance – genetics of insect resistance – horizontal and vertical – genetics of resistance – sources of insect resistance – breeding methods for insect resistance – problems in breeding for insect resistance – achievements. Breeding for resistance to abiotic stresses – drought resistance – mechanisms of drought resistance – features associated with drought resistance – sources – breeding methods – limitations – achievements ; breeding for resistance to water logging – effects of water logging mechanism of toleance – ideotype for flooded areas – breeding methods – breeding for salt tolerance – response of plants to

salinity – symptoms – mechanisms – breading methods – problems – achievements; cold tolerance – chilling resistance – effects of chilling stress of plants – mechanism – sources – selection criteria – freezing resistance – effects of freezing – mechanism if freezing resistance – genetic resources freezing tolerance – selection criteria – problems in breeding for freezing tolerance.

Unit V: Molecular markers and plant breeders rights

Molecular markers – Definition – Brief description of different types of molecular markers, RFLP, AFLP, RAPD and SSR markers – Importance, procedure and applications. DNA finger printing – procedure, application – QTL mapping and MAS and its applications in crop improvement. Pre breeding – Definition, Concept, need, methods and factors affecting pre breeding. Participatory Plant Breeding – Concept Relevance, activities and goals of PPB,

kinds of PPB, perspectives and prospects, advantages, disadvantages and limitations. Intellectual Property Rights (IRP) and Patents – Types, protection of IPR, trade secret, copy rights, Plant Variety Protection and Geographical Indications, Plant Breeders' Rights – Benefits and disadvantages. Protection of Plant Varieties and Farmers' Rights Act – Introduction, types f varieties, NDUS, salient features, National Gene Fund, Award and Recognitions.

Practicals

Plant Breeder's kit for hybridization, study of germplasm of various crops. Study of megasporogenesis and Microsporogenesis, fertilization and life cycle of an angiospermicplant. – Study of floral structure of self pollinated crops – floral biology, antheis, pollination, selfing and crossing techniques in rice. – Study of floral structure of cross pollinated crops – Floral biology, anthesis, pollination, selfing and crossing techniques in millets – Maize, sorghum and pearl millet. – Floral biology, anthesis, pollination, selfing and crossing techniques in oilseeds and pulses – sunflower and redgram. – Types of male sterility –genetic, Cytoplasmic and cytoplasmic Genetic male sterility, transfer of male sterile cytoplasm and restorer gene to a normal strain. – types of self incompatibility, gametophytic and sporophytic incompatibility. – Terminology in backcross method, transfer of a dominant gene and recessive gene for disease rust resistance through the backcross methods in self pollinated crops. – Handling of segregating populations – Pedigree, bulk and Single seed decent methods. – consequences of inbreeding on genetic structure of resulting populations – Types of recurrent selection, simple RS, RS for GCA & SCA and reciprocal recurrent selection. – Field layout of experiments – Designs used in plant breeding experiments – analysis of Randomized Block Design (RBD) – field trails – maintenance of records and registers. – Basic statistics, commonly used in plant breeding – Mean, range, variance,Phenotypic coefficient of Variation (PCV), Genotypic Coefficient of Variation (GCV),Heritability and Genetic advance. – Estimation of Heterosis, Heterobeltiosis and Standard heterosis – Prediction of performance of double cross hybrids.- Estimation of general combining ability, specific combining ability, variances and effects. – visit to RARS / Local / ICAR stations to acquaint about the mode of pollination in a given crop and extent of natural out crossing. – Visit to RARS / Local / ICAR Institute to acquaint about the handling of segregating generations – Pedigree, bulk and back cross methods – Preliminary Yield Trail, Advanced Varietal Trail and other methods.

Lesson plan

Theory lecture schedule

1. Plant Breeding – definition, concept, Nature, Aims & Objectives and Role. Major Achievements and future Prospects of Plant Breeding.
2. History and Development of Plant Breeding – Scientific contributions of eminent scientists – landmarks in Plant Breeding.
3. Genetics in relation to Plant Breeding – Modes of reproduction – Asexual reproduction (Vegetative reproduction and apomixes) and sexual reproduction – their classification andsignificance in plant breeding – Modes of pollination – classification of crop species on thebasis of mode of pollination – self pollination – Mechanisms promoting self and cross pollination.
4. Self incompatibility – classification – heteromorphic, homomorphic, gametophytic and

sporophytic systems of incompatibility – mechanisms of self incompatibility – Relevanceof self incompatibility – methods of overcome self incompatibility – advantages anddisadvantages – utilization in crop improvement.

5. Male sterility – different types – genetic, cytoplasmic and cytoplasmic genetic male sterility – inheritance and maintenance – Utilization of male sterile lines in hybrid seed production – their limitations, advantages and disadvantages.
6. Genetic consequences of self pollination, cross pollination and often cross pollinated crops. Cultivar options – method of plant breeding – classification of plant breedingmethods – methods of breeding for self pollinated, cross pollinated and asexually propagated species – brief account of breeding methods.
7. Plant introduction – Types, history, purpose, procedure, merits and demerits – plantintroduction agencies in India – NBPGR and its activities – germplasm collections, genetic erosion, gene sanctuaries – centers of origin / diversity.
8. Biometrical genetics – definition, qualitative and quantitative characters, role ofenvironment on quantitative characters – biometrical techniques used in plant breeding – components of genetic variation – additive, dominance and epistatic variance – differences between additive and dominance variance.
9. Selection – natural and artificial selection – basic principles of selection – basic characteristies and requirements of selection – selection intensity – selection differential –heritability – genetic advance.
10. Genetic basis and breeding methods in self pollinated crops – Mass selection – procedurefor evolving a variety by mass selection – modification of mass selection – merits, demerits and achievements.
11. Genetic basis of pure line selection – general procedure for evolving a variety by pure lineselection – merits, demerits and achievements – comparison between mass and pure line selection – Johannsen's pure line theory and its concepts and significance – origin of ariation in pure lines – characters of pure lines – progeny test.
12. Hybridization – aims and objectives – types of hybridization – pre-requisites of hybridization – procedure / steps involved in hybridization.
13. Handling of segregating generation – pedigree method – procedure – modifications of pedigree method – merits, demerits and achievements.
14. Handling of segregating generations - - bulk method – procedure – merits, demerits and achievements of bulk methods – comparison between pedigree and bulk methods bulk method – procedure – merits, demerits and achievements of bulk method – comparison between pedigree and bulk method – single seed descent method.
15. Back cross method – requirements and applications, procedure for transfer of single dominant gene, recessive gene – transfer of two or more characters.
16. Back cross method – merits, demerits and achievements, comparison between pedigree and back cross methods – Multiline variety – definition, characteristics, development of multiline varieties and achievements.
17. **Mid semester examination**
18. Population genetics – concepts, Hardy Weinberg law, factors affecting equilibrium frequencies in random mating populations.
19. Heterosis – heterosis and hybrid vigour, luxuriance, brief history in self and cross pollinated crops, types, manifestations of heterosis, genetic basis – dominance, over dominance and epistasis hypotheses.
20. Heterosis – comparison between dominance and over dominance hypothesis – physiological bases of heterosis – commercial utilization of heterosis in different crops.
21. Inbreeding depression – brief history, effects of inbreeding depression, degrees of inbreeding depression – procedure for development of inbred lines and their evaluation Composites and Synthetics – production procedures, merits and demerits, achievements,

factors determining the performance of synthetics, comparison between synthetics and composites.

22. Population improvement – selection without progeny testing – selection with progeny testing – progeny selection – merits and demerits of progeny selection – line breeding – achievements – Recurrent selection – different types – detailed procedure of simple recurrent selection and brief description of other recurrent selection methods – conclusionof the efficiency of different selection schemes.
23. Methods of breeding for vegetatively propagated crops – clone – characteristics of asexually propagated crops – characteristics of clones – importance of a clone – sources of clonal selection – procedure – advantages and disadvantages – problems in breeding asexually propatated crops - genetic variation within a clone – clonal degeneration – achievements – comparison among clones, purelines and inbreds.
24. Wide hybridization – history – objectives – barriers to the production of distant hybrids – techniques for production of distant hybrids – applications of wide hybridization in crop improvement – sterility in distant hybrids – cytogenetic, genetic and cytoplasmic bases of sterility – limitations and achievements.
25. Polyploidy – autopolyploids – origin and production – morphological and cytological features of autopolyploids – applications of autopolyploidy in crop improvement – limitations of autopolyploidy – segregating in autotetraploids – allopolyploidy – morphological and cytological features of allopolyploids – applications of allopolyploidy in crop improvement – limitations of allopolyploidy.
26. Mutation breeding – spontaneous and induced mutations – characteristic features of mutations – procedure of mutation breeding – applications – advantages, limitations and achievements.
27. Breeding for resistance to biotic stresses – disease resistance – mechanisms of disease resistance in plants disease escape, tolerance, resistance, immunity and hypersensitivity)
– causes of disease resistance – genetic basis of disease resistance – sources of diseaseresistance – breeding methods for disease resistance – achievements – Insect resistance
– mechanism of insect resistance in plants (non preference, antibiosis, tolerance and avoidance) – nature of insect resistance – genetics of insect resistance – horizontal and vertical – genetics of resistance – sources of insect resistance – breeding methods for insect resistance – problems in breeding for insect resistance – achievements.
28. Breeding for resistance to abiotic stresses – drought resistance – mechanisms of drought resistance (drought escape, avoidance, tolerance, and resistance) – features associated with drought resistance – sources – breeding methods – limitations – achievements; breeding for resistance to water logging – effects of water logging mechanism of tolerance
– ideotype for flooded areas – breeding methods – breeding for salt tolerance – response of plants to salinity – symptoms – mechanisms – breeding methods – problems – achievements; cold tolerance – chilling resistance – effects of chilling stress of plants – mechanism – sources – selection criteria – freezing resistance – effects of freezing – mechanism of freezing resistance – genetic resources for freezing tolerance – selection criteria – problems in breeding for freezing tolerance.
29. Molecular markers – Definition – Brief description of different types of molecular markers, RFLP, AFLP, RAPD and SSR markers – Importance, procedure and applications.
30. DNA finger printing – procedure, application – QTL mapping and MAS and its applicationsin crop improvement.
31. Pre breeding – Definition, Concept, need, methods and factors affecting pre breeding. Participatory Plant Breeding – Concept Relevance, activities and goals of PPB, kinds of PPB, perspectives and prospects, advantages, disadvantages and limitations.
32. Intellectual Property Rights (IRP) and Patents – Types, protection of IPR, trade secret,copy rights,
33. Plant Variety Protection and Geographical Indications
34. Plant Breeders' Rights – Benefits and disadvantages.

Practical schedule

1. Plant Breeder's kit for hybridization, study of germplasm of various crops.
2. Study of megasporogenesis and Microsporogenesis, fertilization and life cycle of anangiospermic plant.
3. Study of floral structure of self pollinated crops – floral biology, antheis, pollination, selfingand crossing techniques in rice.
4. Study of floral structure of cross pollinated crops - Floral biology, anthesis, pollination,selfing and crossing techniques in millets – Maize, sorghum and pearl millet.
5. Floral biology, anthesis, pollination, selfing and crossing techniques in oilseeds andpulses – sunflower and redgram.
6. Types of male sterility – genetic, Cytoplasmic and cytoplasmic Genetic male sterility, transfer of male sterile cytoplasm and restorer gene to a normal strain.
7. Types of self incompatibility, gametophytic and sporophytic incompatibility.
8. Terminology in backcross method, transfer of a dominant gene and recessive gene fordisease rust resistance through the backcross methods in self pollinated crops.
9. Handling of segregating populations – Pedigree, bulk and Single seed decent methods.
10. Consequences of inbreeding on genetic structure of resulting populations – Types of recurrent selection, simple RS, RS for GCA & SCA and reciprocal recurrent selection.
11. Field layout of experiments – Designs used in plant breeding experiments – analysis of Randomized Block Design (RBD) – field trails – maintenance of records and registers.
12. Basic statistics, commonly used in plant breeding – Mean, range, variance, Phenotypic coefficient of Variation (PCV), Genotypic Coefficient of Variation (GCV), Heritability and Genetic advance.
13. Estimation of Heterosis, Heterobeltiosis and Standard heterosis – Prediction ofperformance of double cross hybrids.
14. Estimation of general combining ability, specific combining ability, variances and effects.
15. Visit to RARS / Local / ICAR stations to acquaint about the mode of pollination in a given crop and extent of natural out crossing.
16. Visit to RARS / Local / ICAR Institute to acquaint about the handling of segregating generations – Pedigree, bulk and back cross methods – Preliminary Yield Trail, AdvancedVarietal Trail and other methods.
17. **Final practical examination**

Course outcome:

CO 1: The student will have the gist of the various self and cross pollinated crops.
CO 2: Will be able to develop expertise in the various crossing and emasculation techniquesin various crops
CO 3: Students will develop the capacity to carry out independent plant breeding experiments
CO 4: The students will be able to multiply and modify the vegetatively propagated crops.
CO 5: The students will be able to develop in the various biotic and abiotic resistance sourcein various crops.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5
CO1	3			3	
CO2	3				3
CO3					3
CO4					3
CO5		3			2

References

1. Singh, B.D. 2006. Plant breeding - Principles and methods. Kalyani Publishers, NewDelhi.
2. Allard, R. 1960. Principles of Plant breeding. John Wiley and Sons, New York.
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23 AGM 201 PRINCIPLES OF FOOD SCIENCE AND NUTRITION (1+1)

Learning objectives:

- The impart knowledge on microbes and their diversity, sources of contamination in food.
- To make the students to know the principle underlying food preparation and preservation technologies.
- To have a knowledge on the fermentation technologies of producing value-added foodsby microbes and their spoilage.
- To impart knowledge on nutritive value on foods, spoilage and develop skills andtechniques on pasteurization and preservation methods.
- To learn advanced techniques on food production, processing, packing and qualitycontrol.

Theory

Unit I: Introduction to Food and Microflora

Food in relation to health – food groups – incidence and behavior of microorganism in food – source of contamination in food.

Unit II: Nutritive Value and Preservation

Composition and nutritive value – rice, wheat, bajra, ragi, raw rice, groundnut, black gram – breakfast cereal – idly - chapathi and cakes. Principles and method of food preservation – physical method – high temperature, low temperature, drying, osmotic pressure, irradiation, chemical method – class I and class II chemical, other adulterants.

Unit III: Fermented Food and Spoilage

Fermentation of pickles, sauerkraut, bread, vinegar, idly. Single cell proteins – microbialspoilage of different types of food – cereals, fruits and vegetables, meat and sea foods.

Unit IV: Milk, Egg, Fats and Oils

Milk – composition – nutritive value, spoilage, pasteurization. Egg – structures, composition, nutritive value, spoilage. Fats and oils – composition, emulsion, rancidity, smoking point, roleof fat/oil in cookery.

Unit V: Novel Food Production, Processing, Packing and Quality Control

Mushroom, spirulina, leaf protein concentrates (LPC), packaging material, package forms, andtechniques Aseptic packaging, referable containers, modified and control atmosphere packaging, microwaveable containers, other package forms. Food manufacturing practice, quality control, Food safety Laws and standards.

Lesson plan

Theory schedule

1. Food in relation to health – food groups.
2. Incidence and behaviors of microorganisms in food and Sources of microorganisms infood.
3. Intrinsic and extrinsic parameters of food affecting microbial growth.
4. Composition and nutrient value of rice, wheat, bajra, raw rice, ragi, peanut and blackgram.
5. Breakfast cereal – idly, chapathi, cake.
6. Food preservation techniques adulterants.
7. Fermentation of pickles, sauerkraut, bread, vinegar, idly.
8. **Mid semester examination**
9. Single cell protein production techniques.
10. Microbial spoilage of cereals fruits and vegetables.
11. Spoilage of fresh foods.
12. Nutritive value of milk, spoilage and pasteurization technique.
13. Structure, composition, nutritive value of egg.
14. Fats and oils – composition, emulsion, rancidity, smoking point.
15. Novel food production and processing of mushroom, spirulina and leaf proteinconcentration.
16. Types of packaging materials
17. Food manufacturing practices, quality control, Food safety Laws and standards.

Practical schedule

1. Microbiological examination of fruits.
2. Microbiological examination of vegetables.
3. Microbiological examination of cereals.
4. Spoilage of bakery foods.
5. Microbiological examination of seafoods.
6. Microbiological examination of egg.
7. Direct microscopic counting bacteria in liquid foods.
8. Examination of canned foods for sterility and quality.
9. Production of fermented foods – Sauerkraut.
10. Isolation and enumeration of yeast from rice batter.
11. Isolation of lactic acid bacteria from curd.
12. Methylene blue reduction test.
13. Resazurin test.
14. Production of single cell protein
15. Production of leaf protein concentrates.
16. Microbiological spoilage of pulses.
17. **Practical examination**

Course outcome

CO 1 - The students would thoroughly understand about the nutritional properties.
CO 2 - The students exposed to food microbes and awareness in wellbeing.
CO 3 - To have a knowledge on the fermentation technologies of producing value-addedfoods by microbes and their spoilage.
CO 4 - The students would expose to the principles involving the food preservation.
CO 5 - The students will gain knowledge on the role of microorganism in food and processing techniques.

CO – PO MAPPING MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	-	-	-	-	-
CO 2	-	2	-	-	-	-
CO 3	-	2	-	-	-	-

CO 4	-	-	-	-	2	-
CO 5	-	-	-	-	-	3

Current stream of thoughts

1. Basic knowledge on nutritive value of foods
2. Knowledge on microbes and their contamination in foods
3. Microbial spoilage of various foods
4. Gain knowledge on Preservation techniques
5. To know the food production, processing, packing and quality control

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2. Vijaya khader. 2001. Text book of Food Science and Technoology. Directorate ofinformation and publications of agriculture, ICAR, New Delhi.
3. Bibek Ray. 2004. Fundamentals of Food Microbiology. CRC Press, New York
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5. https://www.nature.com/subjects/food-microbiology

23 HOR 201 PRODUCTION TECHNOLOGY FOR VEGETABLES, SPICES AND PROTECTEDCULTIVATION (2+1)

Learning objectives

- To learn about the nursery practices, planting methods of vegetable crops.
- To learn about the cultivation techniques, maturity indices, harvesting techniques ofvegetable crops.
- To learn about the nursery practices, propagation methods of spice crops.
- To learn about the cultivation techniques, harvesting techniques of spice crops.
- To provide knowledge on protected cultivation of vegetable crops.

Theory

Unit I: Importance of vegetables, spices and cultivation details of solaneous vegetables Importance of vegetables in human nutrition and role of spices in national economy - origin, area, climate, soil, improved varieties and cultivation practices viz., time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of following crops:

Tomato, brinjal, chilli, potato and onion.

Unit II: Cucurbits, legumes, perennial and leafy vegetables

Cucumber, watermelons, pumpkin, ash gourd, snake gourd, bitter gourd, bottle gourd, ridge gourd, garden bean, cluster bean, french bean, peas, annual moringa, chow chow andamaranthus

Unit III: Cole crops, roots, tubers and yam

Cabbage, cauliflower, knol-khol, carrot, beetroot, radish, tapioca, sweet potato, elephant foot yam.

Unit IV: Major spice crops

Pepper, cardamom, clove, turmeric, and ginger.

Unit V: Protected cultivation

Green house technology –scope and importance - types of greenhouses - Plant response to Greenhouse environment- structural components of a greenhouse-protected cultivation ofcapsicum and cucumber.

Current stream of thoughts.

Practical

Identification of vegetables & spice crops and their seeds. Nursery raising. Direct seed sowing and transplanting. Study of morphological characters of different vegetables & spices. Fertilizers applications. Harvesting & preparation for market.

Economics of vegetables and spices cultivation- Study on different modes of protected cultivation-Study on structural components of a greenhouse

Lesson plan

Theory Schedule

1. Importance of vegetables in human nutrition
2. Role of spices in national economy
3. Production technology of Tomato
4. Production technology of Brinjal
5. Production technology of Chilli
6. Production technology of Potato
7. Production technology of Onion
8. Production technology of Cucumber and Watermelons.
9. Production technology of Pumpkin and Ash gourd.
10. Production technology of Snake gourd and Bitter gourd,
11. Production technology of Bottle gourd and Ridge gourd
12. Production technology of Garden bean and Cluster bean.
13. Production technology of French bean and Peas
14. Production technology of Annual moringa
15. Production technology of Chow chow
16. Production technology of Amaranthus
17. **Mid-Semester Examinations**
18. Production technology of Cabbage
19. Production technology of Cauliflower
20. Production technology of Knol-khol
21. Production technology of Carrot
22. Production technology of Beetroot and Radish
23. Production technology of Tapioca
24. Production technology of Sweet potato and Elephant foot yam
25. Production technology of Pepper
26. Production technology of Cardamom
27. Production technology of Clove
28. Production technology of Ginger
29. Production technology of Turmeric
30. Scope and importance of protected cultivation
31. Types of greenhouses
32. Plant response to Greenhouse environment
33. Production technology of Capsicum under protected condition
34. Production technology of Cucumber under protected condition

Practical Schedule

1. Identification of vegetables & spice crops.
2. Identification and study on seed viability of different vegetable crops.
3. Calculation of seed requirement for important vegetable crops.
4. Raising vegetable seedlings in nursery bed and protrays.
5. Transplanting methods of vegetable crops.

6. Study of morphological characters of different vegetables & spices.
7. Study on water management techniques for vegetable crops.
8. Study on fertilizers applications in vegetable crops.
9. Study on maturity indices of vegetable crops.
10. Study on physiological disorders of vegetable crops
11. Study about grading and packaging of vegetable crops.
12. Calculating cost of production of important vegetable crops
13. Harvesting methods for spice crops
14. Processing methods of spice crops
15. Study on different modes of protected cultivation.
16. Study on structural components of a greenhouse.
17. **Final Practical examination.**

Course outcome

CO 1: The students will be able to practice the nursery techniques and planting methods ofvegetable crops

CO 2: The students will be able to understand the cultivation techniques of vegetable crops.CO3: The students will be to diagnose problems in cultivation of vegetable crops.

CO4: The students will be able to practice the protected cultivation of vegetable cropsCO5: The students will be able to practice production techniques of spice crops

CO-PO Mapping matrix

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**
CO 1	3	3	1	3	2	0
CO 2	3	3	2	3	3	0
CO 3	3	3	1	3	3	0
CO 4	3	3	3	3	1	0
CO 5	3	3	2	3	3	0

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2. Singh, S.P. 1989. Production Technology of Vegetable Crops. Universal Publicationcentre, Karnal.
3. Veeraraghavathatham, D., M. Jawaharlal and SeemanthiniRamadas. 1996. A Guideon Vegetable Culture. A.E. Publications, Coimbatore
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23 AEC 201 FARM MANAGEMENT, PRODUCTION AND RESOURCE ECONOMICS(1+1)

Learning objectives

- To provide knowledge to the students about the principles of farm management
- To help the students in using different methods and tools for decision making in farm management
- To explain ways for profit maximization through optimizing resource use
- To know the risk and uncertainty in production
- To understand the common property resources

Theory

Unit I: Production Economics and Farm Management - Nature and Scope

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factors determining types and size of farms. Types of farming: Specialized, Diversified, and Mixed farming – Systems of farming: Peasant Farming, State Farming, Capitalistic, Collective and Co – operative Farming.

Unit II: Factor – Product, Factor – Factor and Product – Product Relationships

Principles of farm management: concept of production function and its characteristics and its type, use of production function in decision-making on a farm. Factor-Product relationship. meaning, Definition – Laws of Returns. Meaning and concept of cost, types of costs, cost curves - and their inter-relationship - shut down and break-even points, importanceof cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income. Economies of Scale – Economies of Size -Determination of Optimum Input and Output – Physical and Economic Optimum. Factor –Factor relationship: Least Cost Combination of inputs; Product – Product relationship: Optimum Combination of Products – Principle of Equi – Marginal Returns – Principle of Opportunity Cost and Minimum Loss Principle. Law of Comparative Advantage.

Unit III: Farm Planning and Budgeting

Farm business analysis: meaning and concept of farm income and profitability, technical andeconomic efficiency measures in crop and livestock enterprises. Importance of farm recordsand accounts in managing a farm, various types of farm records needed to maintain on farm,farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farmplanning and budgeting, partial and complete budgeting, steps in farm planning and budgeting -linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.

Unit IV: Risk and Uncertainty in Agriculture Production

Concept of risk and uncertainty occurrences in agriculture production, nature and sources of risks and their management strategies**,** Crop / livestock / machinery insurance. Weather based crop insurance - Features and determinants of compensations.

Unit V: Resource Economics

Resource Economics: Concepts, Classification, differences between Natural Resource Economics (NRE) and agricultural economics, unique properties of natural resources. Natural Resources - Issues – Scarcity of resources – Factors mitigating scarcity – PropertyRights: Common Property Resources (CPRs): meaning and characteristics of CPRs – Externalities:meaning and types - positive and negative externalities in agriculture, Inefficiency

and welfare loss, solutions; Important issues in economics and management of common property resources of land, water, pasture and forest resources.

Practicals

Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Application of equi-marginal returns / opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use ina farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crops – Estimation of costs and returns of livestock products. Preparation of farm plan and budget, farm records and accounts and profit and loss accounts. Break – even analysis- Graphical solution to Linear Programming problem. Collection and analysis of data on various resources in India.

Lesson plan

Theory Schedule

1. Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factors determining types and size of farms – Objectives of farm management – Production Economics Vs FarmManagement.
2. Types of farming: Specialized, Diversified, and Mixed farming – Systems of farming: Peasant
Farming, State Farming, Capitalistic, Collective and Co – operative Farming.
3. Principles of farm management: Factor – Product relationship: Meaning, Definition – Laws of Returns: Concept of production function, Classical production function and three stages of production and its characteristics – types of production function and use of production function in decision making.
4. Meaning and concept of cost, types of costs, cost curves - and their inter-relationship -shut down and break even points, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labour income and farm business income.
5. Economies of Scale – Economies of Size - Determination of Optimum Input and Output – Physical and Economic Optimum.
6. Factor – Factor relationship: Meaning – Isoquant – definition and types – isoquant map – MRTS – Isocost line - Least Cost Combination of inputs – expansion path – isocline – ridge line – Elasticity of Factor Substitution.
7. Product – Product relationship: Meaning – Production Possibility Curve – MRPT – Enterprise
relationship: Joint products, complementary, supplementary and competitive products – Iso revenue line - Optimum Combination of Products.
8. Principle of Equi –Marginal Returns – Principle of Opportunity Cost and Minimum Loss Principle. Law of Comparative Advantage.
9. Mid Semester Examination.
10. Farm business analysis: meaning and concept of farm income and profitability, technical and
economic efficiency measures in crop and livestock enterprises.
11. Importance of farm records and accounts in managing a farm, various types of farm records

needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts.
12. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting – Concept of risk and uncertainty in agriculture production, nature and sources of risks and its management strategies.
13. Linear programming, appraisal of farm resources, selection of crop and livestock enterprises.
14. Crop / livestock / machinery insurance. Weather based crop insurance - Features and determinants of compensations.
15. Resource Economics: Concepts, Classification, differences between Natural Resource Economics (NRE) and agricultural economics, unique properties of natural resources.
16. Natural Resources Issues – Scarcity of resources – Factors mitigating scarcity – Property Rights – Common Property Resources (CPRs): meaning and characteristics of CPRs –Externalities: meaning and types - positive and negative externalities in agriculture –Inefficiency and welfare loss, solutions.
17. Important issues in economics and management of common property resources of land, water, pasture and forest resources.

Practical schedule

1. Preparation of farm layout. Determination of cost of fencing of a farm.
2. Computation of depreciation of farm assets. Cost of farm assets: Valuation of assets by different methods.
3. Application of equi - marginal returns / opportunity cost principle in allocation of farm resources.
4. Determination of most profitable level of inputs use in a farm production process.
5. Determination of least cost combination of inputs.
6. Selection of most profitable enterprise combination.
7. Application of cost principles including CACP concepts in the estimation of cost of cultivationand cost of production of agricultural crops.
8. Estimation of cost of cultivation and cost of production of perennial crops / horticultural crops.
9. Estimation of cost of returns of livestock products.
10. Preparation of farm plan and budget.
11. Farm records and accounts: Usefulness, types of farm records: farm production records and farm financial records.
12. Preparation of Cash flow statement
13. Preparation and Analysis of Net worth Statement and Profit and Loss statement
14. Estimation of Break – even analysis.
15. Graphical solution to Linear Programming problem.
16. Collection and analysis of data on various resources in India.- Land use pattern, Agro climatic zones etc

17. Final Practical Examination.

Course outcome

CO1: Understand the concepts, nature and Scope of farm management
CO2: Know the importance of farm planning and budgeting.
CO3: Work out the cost of cultivation for different crops

CO4: Importance of farm records and accounts and farm business analysis
CO5: Understand the natural resources issues and CPR

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	-	-	-	-
CO2	3	-	-	-	-	-
CO3	-	2	3	-	-	-
CO4	-	-	-	-	-	2
CO5	1	-	2	-	-	-

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23 AHS 201 LIVESTOCK MANAGEMENT (1+1)

Learning Objectives

- The course aims to impart knowledge and adequate understanding of the importance ofthe Dairy Industry in the National economy and in different career Opportunities
- To familiarize with different livestock breeds in relation to various agro climatic zones, enabling to choose appropriate breeds for their utility

- To provide hands-on and field oriented training in dairy cattle management techniquesthat will assist students to develop entrepreneurial skills.
- To disseminate information on scientific feeding using locally available feed componentsin order to save the farming expenditure
- To signify the importance of clean milk production and different milking methods

Theory

Unit I: Introduction to Livestock Management

Introduction - Significance of Livestock in Indian economy- census - common nomenclatures used in white and black cattle - various systems of livestock rearing - Extensive, intensive, semi-intensive and integrated

Unit II: General Cattle Management

Breeds - classification of breeds - Breeds of white and Black cattle - Jersey, HF, Gir, Sindhi, Sahiwal, Kangeyam, Murrah, Surti and Toda - Care and management of new born calf,heifers, pregnant and lactating animals - wallowing – culling

Unit III: Reproductive and Housing Management of Dairy cattle

Breeding - Estrous cycle - Signs of estrum - Silent heat - Artificial insemination - Housing - selection of site - systems - loose housing - conventional barns - single row and double row - floor space requirement

Unit IV: Feeding and General Health Management of Dairy cattle

Nutrition - Ration - balanced ration - concentrate - roughage - classification of feed and fodder - Distribution of total dry matter requirement - Green fodder and its importance - General disease control measures - signs of health - Deworming and Vaccination

Unit V: Milk and Milk Processing

Milk - Composition - Milking methods - Clean milk production - Pasteurization of Milk and Current stream of thoughts.

Practicals

Study of external parts of cattle-Identification methods - Restraining -Disbudding -Deworming -Ageing - Design of cattle shed-Selection of Dairy cow - Specific gravity of milk- Fat percentageof milk- Artificial Insemination- Weight of cattle-Cream separation-Feeds and fodder-Milking methods.

Lesson Plan

Theory Schedule

1. Introduction to Livestock and its significance in Indian economy
2. Common nomenclatures used in dairy cattle
3. Systems of dairy cattle rearing practices
4. Classification of different breeds of white and black cattle with examples
5. Care and Management of new born cattle
6. Care and Management of heifers, pregnant and lactating animals - wallowing- culling
7. Estrous cycle- signs of estrum - silent heat
8. AI - merits, demerits and procedure
9. **Mid-Semester Examination**
10. Housing management- selection of site- floor space requirement
11. Systems of housing
12. Nutrition- Classification of feeds and fodder - Ration and balanced ration
13. Importance of green fodder
14. General health Management- Deworming and Vaccination
15. Milk - Composition- Milking Methods
16. Clean milk production
17. Pasteurization of milk and Current stream of thoughts.

Practical Schedule

1. Study of external parts of cattle
2. Identification methods of Cattle and Buffalo
3. Common methods of restraining in cattle and Buffalo
4. Disbudding in calves
5. Deworming in cattle and Buffalo
6. Ageing in cattle
7. Design of cattle shed
8. Selection of Dairy cow by unified score card method
9. Determination of specific gravity in milk
10. Determination of fat percentage in milk
11. Demonstration of AI
12. Determination of weight in cattle
13. Demonstration of cream separation
14. Identification of feeds and fodder
15. Demonstration of milking methods
16. Visit to Dairy farm
17. **Practical Examination**

Course Outcome

CO 1: The students gain knowledge in basic concepts of scientific rearing of cattle.

CO 2: Further, they would enrich on cattle management practices including feeding, breeding and housing.

CO 3: Students would be able to analyse and solve different problems arising in cattle andgoat rearing.

CO 4: This course encompasses all relevant information and serve as source of knowledge to understand the modern techniques used in animal husbandry sector.

CO 5: It enlightens the importance of livestock products and clean milk production.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	-	2	1	3	-
CO 2	3	-	2	-	3	1
CO 3	3	-	3	1	1	1
CO 4	3	-	3	-	2	2
CO 5	2	-	1	2	2	1

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23 AEG - 201 INTRODUCTORY SOIL AND WATER CONSERVATION ENGINEERING 2(1+1)

Learning objectives

To impart the basics of soil and water conservation engineering to the undergraduate students.

Theory

Unit I: Surveying and Levelling

Surveying and levelling – Chain, compass and plane table survey – levelling – land measurement and computation of area – Simpson's rule and Trapezoidal rule. Height of instrument, Bench mark, Contour survey-definition, characteristics

Unit II: Irrigation and drainage

Irrigation – measurement of flow in open channels – velocity area method – rectangular weir – Cippoletti weir – V notch – orifices – Parshall flume – duty of water – irrigation efficiencies – conveyance of irrigation water – canal lining – underground pipeline system – surface irrigation methods – borders, furrows and check basins – drip and sprinkler irrigation –agricultural drainage – surface irrigation systems – sub-surface drainage systems – drainage coefficient - design of open ditches.

Unit III: Wells and Pumps

Groundwater occurrence – aquifers – types of wells and sizes – pump types – reciprocating pumps – centrifugal pumps – turbine pumps – submersible pumps – jet pumps – airlift pumps – selection of pumps – operation and their maintenance. Current Streams of thought.

Unit IV: Soil conservation and watershed management

Erosion control measures for agricultural lands – biological measures – contour cultivation – Strip cropping - cropping systems – vegetative barriers – wind breaks and shelterbelts – shifting cultivation – mechanical measures – contour bund – graded bund – broad beds and furrows – basin listing – random tie ridging – mechanical measures for hill slopes – contour trench – bench terrace – contour stone wall – Rain water harvesting – insitu soil moisture conservation – Runoff Computation – runoff water harvesting – Farm ponds and percolation ponds – storage and its use for domestic and ground water recharge. Gully control structures – Check dams – Temporary and permanent. Watershed concept – Integrated approach and management.

Unit V: Soil erosion

Soil Erosion – causes and evil effects of soil erosion – geologic and accelerated erosion – water erosion – causes – erosivity and erodibility – mechanics of water erosion – splash, sheet, rill and gully erosion – ravines – land slides – wind erosion – factors influencing wind erosion – mechanics of wind erosion – suspension, saltation, surface creep. Water harvesting techniques

Practicals

Study of survey instruments – chains and cross staff surveying – linear measurement –plotting and finding areas. Compass survey – observation of bearings – computation of angles – radiation, intersection. Levelling – fly levels – determination of difference in elevation – Computation of area and volume – Contouring, Design of contour bund graded bund. Drip systems and Sprinkler irrigation systems. Problems on water measurement. Problems on duty of water, irrigation efficiencies. Problems on water requirement – agricultural drainage. Study of different types of wells and its selection. Study of pumps and its selection.

Lesson plan

Theory Schedule

1. Surveying – definition and objectives of survey, primary divisions of surveying, definitionof geodetic and plane surveys, linear measurements (MKS), measurement of distances.
2. Levelling-definition, description of dumpy level and Levelling staff, terminology connectedwith

Levelling. Height of instrument, Bench mark and its types, change point.

3. Contour survey-definition, characteristics and uses of contours.
4. Irrigation-definition, classification of irrigation projects based on CCA and expenditure, benefits of irrigation, ill effects of irrigation, flow irrigation and lift irrigation.
5. Earthern channels-Advantages and disadvantages of earthern channels, channel lining materials, Advantages of lining the channels. Underground pipeline over earthern channels, disadvantages.
6. Measurement of irrigation water-importance, methods of measuring water-volumetric and area-velocity method.
7. Direct discharge methods-water meter, weirs, and orifices, parshall flume-Installation of these devices, conditions for weir installation.
8. Water lifting devices-classification of pumps, centrifugal pump, principle of operation, Installation procedure.
9. **Mid Semester examination**
10. Deep well pump- submersible pumps, Installation and working principle of pump – Troubles and remedies.
11. Water conveyance systems-open channel, definitions of wetted perimeter, hydraulic radius, hydraulic slope, area of cross section and free board. Manning‘s formula.
12. Soil and water conservation-definition and scope, soil erosion-definition, types, Geologicaland accelerated soil erosion, causes and ill effects of soil erosion.
13. Accelerated soil erosion-water and wind erosion definitions, rain drop (splash) erosion, sheet erosion, rill erosion, Gully erosion, stream bank erosion and their stage of occurrence.
14. Study on soil estimation methods : USLE, MUSLE, EI and Cosecton wheel method
15. Erosion control measures-Engineering measure. Study of engineering measures likecontour bunds, graded bunds, broad based terracing and bench terracing.
16. Wind erosion definition, mechanics of wind erosion and types of soil movement.Principles of wind erosion and its controls methods
17. Water harvesting techniques: Definition and types

Practical schedule

1. Acquaintance with survey equipment
2. Acquaintance with leveling instruments and levelling procedure
3. Contour field survey
4. Preparation of contour maps using contour field survey data
5. Study of components of centrifugal pump
6. Power estimation on centrifugal pump
7. Capacity calculation of open channel
8. Discharge calculation of different water measuring devices
9. Identification of different forms of water erosion
10. Estimation of soil loss by USLE method
11. Exercise on soil erosion control by contour and graded bunds
12. Exercise on broad base and bench terracing
13. Exercise on shelterbelts and wind breaks.
14. Study on onfarm water harvesting methods
15. Visit to water harvesting structures like farm pond
16. Visit to nearby watershed to study soil conservation structures
17. **Practical Examination**

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IIISemester

23 AGR 204 PRACTICAL CROP PRODUCTION - I (*Kharif* Crops) (0+1)

Learning objectives

Crop planning, raising field crops in multiple cropping systems. Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management. Management of insect- pests diseases of crops. Harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect- pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

- Each student will be allotted a minimum land area of 100/200 m2. He / she will do all field operations in the allotted land from field preparation to harvest and processing.
- Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying,winnowing, storage and marketing of produce.
- Rice (Transplanted or direct sown)

Transplanted rice:

- Rice ecosystems - Climate and Weather - Seasons and varieties of India and Tamil Nadu.
- Preparation of nursery - Application of manures to nursery - seed treatment - Forming nursery beds and sowing seeds – Weed and water management and plant protection to nursery.
- Preparation of main field - Application of organic manures - Green manuring - Bio-fertilizers - Pulling out seedlings and transplanting - Rajarajan 1000 (SRI) - Application of herbicides - Water management - Nutrient management - Plant protection measures - Mechanization in rice cultivation
  - Recording growth, yield attributes and yield.
- Harvesting, threshing, drying and cleaning the produce - Working out cost of cultivation and economics.

Practical

1. Study of rice ecosystems, climate, weather, seasons and varieties of Tamil Nadu.
2. Acquiring skills in selection of nursery area, preparation of nursery, application of manures and fertilizer to nursery.
3. Study and practice of green manuring and bio-fertilizer application in rice and acquiring skills in seed treatment, seed soaking and incubation, nursery sowing and management.
4. Study and practice of main field preparation and puddling operations
5. Practicing of field preparatory operations – sectioning of field bunds and plastering, leveling and basal application of fertilizers.
6. Practicing transplanting techniques in lowland rice/ exposure to mechanized

transplanting.

7. Estimation of plant population and acquiring skill in thinning and gap filling
8. Study of weeds and weed management in rice/ exposure to mechanized weeding
9. **Mid-semester examination**
10. Acquiring skill in nutrient management and practicing top dressing techniques
11. Study of water management practices for lowland rice
12. Observation of insect pests and diseases and their management
13. Recording growth and other related characters of rice
14. Estimation of yield and yield parameters in rice
15. Harvesting, threshing and cleaning of the produce/exposure to mechanized harvesting& threshing.
16. Preparation of balance sheet including cost of cultivation and net returns perstudent
17. **Practical examination**

Note: According to the season, the crops in practical crop production – I & IIcan be interchanged

Course Outcome

CO 1: To acquire skill in various agronomic practices that can bring improvedcropyield.
CO 2: To gain hands on experience on cultivation of crops individually.
CO 3: To understand the different sowing methods for garden land crops
CO 4: To apply different seed treatment techniques
CO 5: To evaluate different harvesting methods and processing

CO-PO Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	-	1	3
CO2	1	2	3	-	2	-
CO3	2	1	-	-	-	-
CO4	1	-	-	-	2	-
CO5	2	-	-	3	-	1

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23 AGR 205 CROP PRODUCTION TECHNOLOGY-II (*Rabi* CROPS) (1+1)

Learning objectives

- To impart updated technology and skills in performing different operationsin raising the crop.
- To understand the effect of climate, soil, varieties, affordable and clean energy.
- To understand the concepts of integrated weed control, integratednutrient management and conjunctive use of water.
- To know cropping systems in India and Tamil Nadu, post-harvestoperations in different crops.
- To learn about farm mechanization and resource conservation technologyfor sustainable development for the communities.

Theory

Origin, geographical distribution, Area and production, classification, nutrition quality component, economic importance, soil and climatic requirements, seasons and improved varieties. Cultural practices and yield. Post-harvest management practices. Value addition and by-products utilization of *Rabi* crops.

Unit I: Cereals

Cereals- Wheat, barley, Oats, Quinoa, Rye and Triticale.

Unit II: Pulses

Pulses- Chickpea, *Rabi* Red gram, lentil, Peas, Rajmah.

Unit III: Oilseeds

Oil seeds- Groundnut, Sunflower, Rapeseed and mustard, Safflower, Linseed.

Unit IV: Sugar and Fibre Crops

Sugar crops- Sugarcane, Sugar beet. Fibre crop- Agave.

Unit V: Tuber, Fodder and Forage crops, Narcotics crops

Tuber crops- Potato, and Sweet Potato. Fodder and forage crops- Berseem, LucerneFodder preservation techniques. Narcotics- Tobacco. Current stream of thoughts.

Practicals

Sowing methods of wheat and sugarcane, identification of weeds in *rabi* season crops. Study of morphological characteristics of *rabi* crops. Study of yield contributingcharacters of *rabi* season crops. Yield and juice quality analysis of sugarcane. Study of important agronomic experiments of *rabi* crops at experimental farms. Study of *rabi* forage experiments. Oil extraction from oil seed crops. Visit to research stations of related crops.

Lesson Plan (Theory)	
1.	Wheat-Introduction–Origin and distribution–Area, production and productivity in World, India, and Tamil Nadu-Wheat growing zones of India-classificationof Indian wheat, varietal Improvement. Soil and climate requirements –land preparation, Seasons and Varieties–seeds and sowing– seed rate-spacing- manures and fertilizer. Water management-critical stages of irrigation- methods of irrigation and weed management-harvesting-threshing-yield attributes and yield. By-Product utilization quality parameters-Post harvesting technology-wheat based cropping systems.

2.	Barley, Oat -Introduction-economic importance–origin and distribution, area, production and productivity in the World- India and Tamil Nadu- Classificationof barley- climate, soils, land preparation, seasons and varieties – seeds and sowing - nutrient management-water and weed management- harvesting- threshing-yield attributes & yield -major cropping systems under rainfed and irrigated conditions - Post harvest management.
3.	Quinoa, Rye, and Triticale - Introduction-Economic importance-Origin and distribution, area, production, productivity in the World, India and Tamil Nadu, -climate and soil requirements-field preparation –seasons and varieties-seeds-seed rate and seed treatment- sowing manures and fertilizers-water and weedmanagement – harvesting, threshing-yield and yield attributes-cropping systems – Post-harvest management.
4.	Chickpea - Introduction-economic importance-origin and distribution-area requirement - Production and Productivity in the World, India and TamilNadu-Climate and soils-land preparation-seasons and seed rate, varieties, different types-desi, and Kabuli types- spacing-manures and fertilizers Irrigation and weed control, harvesting– threshing-yield attributes and yield- cropping systems - Post harvest handling, processing, value addition and by product utilization.
5.	*Rabi* Red gram, Lentil - origin and distribution, Reasons for increasing *rabi*red gram area – regions suitable for *rabi* red gram, area–production and productivity in– India–Tamil Nadu-suitable *rabi* varieties, soils - Climate – seasons – seeds and sowing – manures and fertilizers - irrigation – water requirement - critical stages - weed control - harvesting threshing – yield attributes and yield, cropping systems - Post harvest management.
6.	Pea, Rajma -Introduction-Economic importance-origin and distribution, area, production, productivity in the World, India and Tamil Nadu - climate and soils -land preparation season-seed rate and seed treatment – varieties- different types – field pea and garden pea- sowing time and method of sowing-spacing- manures and fertilizers-irrigation, weed control-harvesting- Threshing-yield attributes and yield-cropping systems - Post harvest management.
7.	Rape seed & Mustard --Introduction–area, production and productivity inWorld and India, Tamil Nadu, Origin and distribution–soils and climatic requirements -seasons-seeds and sowing- manures and fertilizers-irrigation– Weed control–harvesting– threshing-yield attributes and yield, cropping systems – Post-harvest management.

8.	Groundnut.-Introduction-economic importance-origin and distribution, area, production, productivity in the World, India and Tamil Nadu-habitat groups- varieties-classification - climate and soil requirements-field preparation- seasons-seed rate and treatment-sowing time and method- spacing, manuresand fertilizers- bio-fertilizer – Rhizobium – Gypsum application - irrigation, weed control- Mturity Symptoms harvesting – yield and yield attributes – Quality Parameters- Aflatoxin contamination - cropping systems - Post harvest management.
9.	**Mid – semester examination**
10.	Sunflower-Introduction-economic importance-origin and distribution-area, production, productivity in the World, India, and Tamil Nadu-climate and soil requirements-field preparation seasons and varieties-seeds and sowing , nutrient, inter cultivation-weed control- harvesting-threshing-yield and yield attributes–cultivation problems–poor seed set–reasons and remedies-Postharvest management.
11.	Safflower and Linseed -Introduction-economic importance-origin and distribution, area, production Productivity in the World, India, and Tamil Nadu-
	climate and soil requirements-field preparation seasons–varieties/hybrids- seed rate and treatment-sowing time and method- spacing-manures and fertilizers- water management -weed control-harvesting-threshing- yieldattributes and yield-cropping systems - Post harvest management.
12.	Sugarcane-Introduction-Economic importance-Origin and distribution, Area, Production Productivity in the World, India, and Tamil Nadu- Latest varieties for different situations. Climate and soils-planting seasons-different planting material-setts-short crop/nursery crop, split cane, bud chip seed/sett rate–setttreatment-spacing-planting methods. Manures and fertilizers, time and method of application, bio-fertilizers water management scheduling, methods and time of irrigation – after cultivation – parasitic weed control- ripening, judging ripening - factors affecting ripening-harvesting, yieldattributes and yield-byproducts–crop logging-special operations-blind hoeing- trash mulching. Ratoon management-varieties suitable for ratiooning-stubble shaving-weed management, Fertilizers-irrigation-special operations –mechanization in sugarcane, post-harvest handling, processing jaggery making – Value addition and by product utilization.
13.	Sugar beet-Introduction-economic importance-origin and distribution, area, production, productivity in the World, India, and Tamil Nadu- climate and soil requirements - field preparation-seasons - varieties - seed rate and treatment - sowing time and method- spacing- manures and fertilizers- irrigation-weed control-harvesting- yield attributes and yield-cropping systems- Post harvest management.

14.	Potato and Sweet Potato.-Introduction-economic importance-origin anddistribution, area, production, productivity in the World, India and Tamil Nadu-soil and climatic requirements-field preparation–seasons–seeds/seed material-seed rate and seed treatment- sowing time and methods– manures and fertilizers – irrigation – weed control – cropping systems – harvesting– yield attributes and yield - Post harvest management.
15.	Tobacco-Introduction-economic importance-origin and distribution, area, production, Productivity in the World, India and Tamil Nadu-varieties–latest –different types of tobacco. Climate and soil requirements-field preparation- nursery management-season–seeds and varieties-sowing-manures and fertilizers- -water management. Weed control-harvesting-special operations- quality characters-physical and chemical. Properties of tobacco - principle of flue-curing of Virginia tobacco – cropping systems – Post-harvest management.
16.	Agave - Importance – origin – area – production, productivity in World-India and Tamil Nadu-soil and climatic requirements- seasons – seeds - seedtreatment- sowing nursery raising- manures and fertilizers-water and weed management-harvesting-poling–reasons and strategies for poling- yield attributes and yield - Post-harvest management.
17.	Berseem, Lucerne –Introduction-economic importance-origin and distribution,Area, production, productivity in the World, India and Tamil Nadu – soils and
	climatic requirement seed bed preparation seasons and varieties –seeds and sowing time and method–spacing-manures and fertilizer requirement irrigation-time and method of harvesting–yield. Hay and Silage – FodderPreservation. Post – harvest management practices and current stream of thoughts.

Practical Schedule

1. Identification of *Rabi* crops *viz*, cereals, pulses, oilseeds, sugar, fibre, tuber and narcotics.
2. Acquiring skills in field preparation and sowing techniques in *Rabi* crops underpure andintercropping situations.
3. Acquiring skills in different seed treatment techniques for *rabi* crops.
4. Estimation of plant population and seed rate per unit area for *rabi* crops.
5. Identification of weeds and weedicide calculation.
6. Nursery preparation and management for sugarcane and tobacco.
7. Planting techniques for Sugarcane.
8. Topdressing and foliar feeding of nutrients.
9. Fertilizer management and fertilizer requirement of *rabi* crop.
10. Recording bio-metric observations of the standing *rabi* crops.
11. Acquiring skills in after-cultivation practices of *rabi* crops.
12. Study on yield parameters and estimation of yield in *rabi* crops
13. Preparation of balance sheet including the cost of cultivation
14. Visit ongoing agronomic experiments and forage production farm.

15. Visit units of mechanization and resource conservation technology.
16. Visit research stations of related crops.
17. **Practical Examination**

Course Outcomes

CO1: To understand the importance of oil seed production and cultivation of majoroilseed crops

CO2: To gain knowledge about importance of sugar crops and its Cultivation practicesCO3: To formulate different cropping systemand production technologies for various fibre crops

CO4: To construct idea regarding knowledge on growing of tuber cropsCO5: To create awareness about narcoticscrops and its production Technologies

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	-	-	1	-
CO2	3	3	-	-	1	-
CO3	3	2	3	-	3	2
CO4	3	2	-	-	3	-
CO5	3	2	-	-	1	-

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23 PAT 201 DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIRMANAGEMENT-I (2+1)

Learning objectives

- To acquire knowledge on etiology, symptoms, epidemiology and management of diseasesof cereals and millets.
- To acquire knowledge on etiology, symptoms, epidemiology and management of diseasesof pulses and oilseed crops.
- To learn about the etiology, symptoms, epidemiology and management of diseases ofcash

crops.

- To learn about the etiology, symptoms, epidemiology and management of diseases ofFruit crops and vegetable crops.
- To learn about the etiology, symptoms, epidemiology and management of diseases ofspices and plantation crops.

Theory

Unit I - Diseases of cereals and millets

Etiology, symptoms, epidemiology and management of major diseases of rice, maize, sorghum, bajra, finger millet and minor millets.

Unit II: Diseases of pulses, oilseeds and cash crops

Etiology, symptoms, epidemiology and management of major diseases of blackgram, greengram, soybean, pigeonpea, groundnut, sesame, castor, sugarbeet, tobacco and mulberry.

Unit III: Diseases of fruits

Etiology, symptoms, epidemiology and management of major diseases of banana, papaya, guava, pomegranate, sapota and jack.

Unit IV: Diseases of vegetables

Etiology, symptoms, epidemiology and management of major diseases of brinjal, tomato, okra,carrot and cruciferous crops

Unit V: Diseases of spices and plantation crops

Etiology, symptoms, epidemiology and management of major diseases of ginger, cardamom, garlic, coconut, tea and coffee

Practicals

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium

Lesson plan

Theory schedule

1. Introduction to field crop diseases and their significance
2. Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of diseases of rice
3. Diseases of maize
4. Diseases of sorghum
5. Diseases of bajra
6. Diseases of finger millet
7. Diseases of minor millets
8. Diseases of black gram
9. Diseases of green gram
10. Diseases of soybean
11. Diseases of pigeon pea
12. Diseases of groundnut
13. Diseases of sesame
14. Diseases of castor
15. Diseases of sugarbeet
16. Diseases of tobacco
17. Mid-semester Examination
18. Diseases of mulberry
19. Diseases of banana
20. Diseases of guava
21. Diseases of papaya

22. Diseases of pomegranate
23. Diseases of sapota and jack
24. Diseases of brinjal
25. Diseases of tomato
26. Diseases of okra
27. Diseases of carrot
28. Diseases of cruciferous
29. Diseases of ginger
30. Diseases of cardamom and garlic
31. Diseases of coconut
32. Diseases of tea
33. Diseases of coffee
34. Post harvest diseases of vegetables and fruits

Practical schedule

Study of symptoms, host-parasite relationship and management of

1. Diseases of rice
2. Diseases of maize and sorghum
3. Diseases of bajra and finger millet
4. Diseases of blackgram and greengram
5. Diseases of soyabean and pigeon pea
6. Diseases of groundnut and sesame
7. Diseases of castor and sugarbeet
8. Diseases of tobacco and mulberry
9. Diseases of banana
10. Diseases of guava and sapota
11. Field visit
12. Diseases of papaya, pomegranate and jack
13. Diseases of brinjal, tomato and okra
14. Diseases of carrot and cruciferous vegetables
15. Diseases of ginger, cardamom and garlic
16. Diseases of coconut, tea and coffee
17. Record certification

Assignment: Students should submit 50 well-pressed diseased specimens.

Course Outcome

CO 1: Acquired knowledge of etiology, epidemiology, identifying and managing diseases ofcereals and millets

CO 2: Acquired knowledge of etiology, epidemiology, identifying and managing diseases inpulses, oil seeds and cash crops

CO 3: Acquainted with the etiology, epidemiology, identifying and managing diseases in fruits

CO 4: Acquainted with etiology, epidemiology, identifying and managing diseases invegetables

CO 5: Acquainted with etiology, epidemiology, identifying and managing diseases in plantationcrops

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	2	3	-	1	1	-
CO2	2	3	-	1	1	-
CO3	2	3	-	1	1	-
CO4	2	3	-	1	1	-
CO5	2	3	-	1	1	-

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23 GPB 202 PRINCIPLES OF SEED TECHNOLOGY (2+1)

Learning objectives

- To make the students to understand the importance of quality seed
- To impart the students about the genetic and agronomic of principles involved in qualityseed production
- To impart the knowledge about the techniques of seed production
- To create awareness about the seed laws pretending to the quality seeds
- To impart knowledge to the students about the seed testing methods for assessing thequality of the seeds.

Theory

Unit I: Introduction to seed quality concept

Introduction to seed technology – definitions – concept, role and goals of seed technology – differences between scientifically produced seed and grain used as seed. Deterioration of cropvarieties – Factors responsible for loss of genetic purity – Maintenance of genetic purity duringseed production – Safeguards for maintenance of genetic purity- Definition – Characters of good quality seed – factors affecting seed quality – classes ofseed – Nucleus seed, Beeder seed, foundation and certified seeds.

Unit II: Seed production techniques of various agricultural crops

Foundation and certified seed production of important cereal crops – Rice, Maize and Sorghum Foundation and certified seed production of important pulse crops – Red gram, Black gram and green gram. Foundation and certified seed production of important oilseed crops – Sesame, Sun flower and Groundnut. Foundation and certified seed production ofFiber crop – Cotton - Foundation and certified seed production of important vegetables – Tomato, Brinjal and Bhendi.

Unit III: Post harvesting seed handling techniques and seed certification.

Seed drying – Methods of seed drying – Sun drying – Forced air drying – Principle of forcedair drying – Seed drying – heated air drying system – management of seed drying operations -seed treatment its importance. Seed Processing – principles – equipments Seed certification –Phases of seed certification – Procedure for seed certification – Field inspection.

Unit IV: Seed storage techniques and seed marketing

Method of application and seed packing- Seed storage – General principles – Stages, factors affecting Seed longevity during storage – Measures for pest and disease control during storage. Seed marketing- Structure and organization – Sales generation activities, Promotional media – Factors affecting seed marketing – Role of WTO and OECD in seed marketing.

Unit V: Seed quality testing, legislation and marketing

Varietal identification through Grow Out Test (GOT) and Electrophoresis - MolecularBiochemical test – Detection of genetically modified crops – Transgene contamination innon-GM crops – GM crops and organic seed production - Seed Act 1966 – Main features of the Seed Act, 1966 – Seed Act Enforcement- Duties and powers of seed inspectors,- Offences and penalties- Seed Control Order 1983.

Practicals

Seed structure of Monocot and Dicot - Internal and External seed structure of various crops - Seed Certification and its role in seed quality - Field Inspection pattern, Methods and its importance - Seed sampling and testing – Principles and procedures - Physical Purity analysisof field crops and vegetable crops - Germination analysis of field crops and vegetable crops

Seed viability test of field crops and vegetable crops - Moisture tests of field crops and vegetable corps - Seed and seedling vigour tests of field crops and vegetable crops - Genetic purity test – Grow out test and electrophoresis - Seed blending - Visit to seed production farms
- Visit to seed testing laboratory - Visit to seed processing plant - Planning for seed production
- Cost of cultivation of seed production.

Lesson plan

Theory lecture schedule

1. Introduction to seed technology – definitions – concept, role and goals of seedtechnology – differences between scientifically produced seed and grain used as seed.
2. Seed development and maturation – Embryo development – Endosperm development –food reserves accumulation.
3. Seed dormancy –types – breaking methods – factors affecting seed dormancy
4. Seed germination – types – phases of seed germination – factors affecting seed germination
5. Definition – Characters of good quality seed – Factors affecting seed quality – Classes ofseed – Nucleus, breeder, foundation and certified seeds.
6. Deterioration of crop varieties – factors responsible for loss of genetic purity – Maintenance of genetic purity during seed production – Safeguards for maintenance of genetic purity
7. State and Central varietal release and notification – Generation system of seed multiplication
8. Foundation and certified seed production of important cereal crops – Rice and Maize
9. Foundation and certified seed production of important cereal crops – Pearl millet and Sorghum
10. Foundation and certified seed production of important pulse crops – Red gram and Blackgram
11. Foundation and certified seed production of important pulse crops – Green gram andCowpea
12. Foundation and certified seed production of important oilseed crops – Sesame and Sunflower.
13. Foundation and certified seed production of important oilseed crops – Groundnut andCastor
14. Foundation and certified seed production of fiber crop – Cotton and Jute
15. Foundation and certified seed production of important vegetables – Tomato, Brinjal andChilli
16. Foundation and certified seed production of important vegetables – Bhendi and Onion
17. **Mid semester examination**
18. Seed production techniques in Cucurbits – Ridge gourd, Bottle gourd, Cucumber,Muskmelon and Watermelon
19. Seed production techniques in Cole crops – Cauliflower, Cabbage, Radish, carrot andKnol-khol
20. Seed certification – Phases of seed certification – Procedure for seed certification
21. Field inspection – importance, procedure and various travel patterns
22. Seed extraction methods of agricultural and horticultural crops
23. Seed processing- principles and equipments – Air screen cleaner cum grader and other processing equipment - types and working principle

24. Seed drying – methods – sun drying – forced air drying – principle of forced air drying –Seed drying – heated air drying system – management of seed drying operations
25. Seed treatment its importance – Method of application and seed packing
26. Seed Testing – sampling – mixing and dividing – Seed quality estimation
27. Seed vigour test and viablity testing
28. Seed storage – general principles – Stages and factors affecting – Seed longevity during storage – Measures for pest and disease control during storage
29. Seed marketing – Structure and organization – Sales generation activities, promotionalmedia – Factors affecting seed marketing – Role of WTO and OECD in Seed Marketing
30. Varietal identification through Grow Out Test (GOT) and electrophoresis
31. Seed blending – Concept, principle and procedure
32. Seed Act 1966 – and Seed Rules 1968– main features
33. Seed Control Order 1983 – New Seed Policy, 1988 – PPV & FRA 2001.
34. Seed Village concept – Organic Seed Certification

Practical lecture schedule

1. Seed structure of monocot and dicot
2. Internal and External seed structure of various crops
3. Seed Certification and its role in seed quality
4. Field Inspection pattern, Methods and its importance
5. Seed sampling and testing – Principles and procedures
6. Physical Purity analysis of field and vegetable crops
7. Germination analysis of field and vegetable crops
8. Seed viability test of field and vegetable crops
9. Moisture tests of field and vegetable corps
10. Seed and seedling vigour tests of field and vegetable crops
11. Genetic purity test – Grow out test and electrophoresis
12. Seed Blending
13. Planning for seed production
14. Cost of cultivation of seed production
15. Visit to seed production farms and seed processing plant
16. Visit to seed testing laboratory
17. **Final practical examination**

Course outcome:

CO 1: Acquire knowledge on seed quality characteristics, varietal deterioration and various principles of seed production

CO 2: Understand the Foundation and Certified Seed production techniques and post harvestprocesses of various Agricultural crops.

CO 3: Understand the Foundation and Certified Seed production techniques and post harvestprocesses of Important Horticultural crops.

CO 4: Import knowledge about seed certification, Legislation, Storage and Marketing

CO 5: Acquire knowledge on various seed quality testing procedure, Molecular varietalidentification techniques and seed production cost analysis.

CO-PO Mapping Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	-	-	-	3
CO2	2	2	1	2	2
CO3	3	-	-	-	-
CO4	-	-	-	2	-
CO5	-	-	-	-	-

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23 HOR 202 PRODUCTION TECHNOLOGY FOR ORNAMENTAL CROPS, MAP ANDLANDSCAPING (2+1)

Learning objectives

- To impart knowledge on basic principles, components and practices of landscape gardening.
- To highlight the different styles of gardens and special features in a garden.
- To enable them in designing gardens using various tools and techniques
- To impart knowledge on the production technology of Cut and Loose flower crops.
- To impart comprehensive knowledge about the production technology of Medicinal and Aromatic crops

Theory

Unit I: Introductory Floriculture:

Importance, Scope, Potential of Floriculture, Flower Trading, Flowers and foliage's, Productionand constraints, Famous gardens of India.

Unit II: Protected cultivation – Cut flowers:

Production technology of important cut flowers like Rose, Gerbera, Carnation, Lilium, Orchids and Anthurium under protected conditions.

Unit III: Production technology of Cut flowers and Loose flowers:

Production technology of Gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like Rose, Jasmine, Marigold, Crossandra and Nerium under open conditions.

Unit IV: Production technology of Medicinal plants and Aromatic plants:

Ashwagandha, Asparagus, Aloe, Costus, Cinnamomum, Periwinkle, Isabgol, Mint, Lemongrass, Citronella, Palmarosa, Ocimum, Rose, geranium, Vetiver. Processing and value addition.

Unit V: Landscaping:

History, Styles, Soft and Hardscape Components, Principles of landscaping, Landscape designing-drawing-manual and CAD, Practising Garden designing for Residential, Community living, Institutional, Industrial gardens and Theme parks, Horticultural crafts and current streamof thoughts.

Practicals

Identification of flower crops and ornamental plants. Identification of Medicinal and Aromatic

Plants. Propagation and planting methods, Training and pruning of Ornamental plants. Planning and layout of garden, Landscape designing-drawing-manual and CAD, Bed preparation, planting and cultural aspects of MAP. Protected structures – care and maintenance. Intercultural operations in flowers.

Harvesting and postharvest handling of cut and loose flowers. Processing of MAP. Visit to commercial flower/MAP unit.

Lesson plan

Theory Schedule

1. Importance and scope of floriculture crops, Flower trade and constraints
2. Institutes and agencies involving in flower trade
3. Famous gardens in India
4. Production technology of important Cut flowers like Roseunder protected conditions
5. Production technology of Gerbera under protected conditions.
6. Production technology of Carnationunder protected conditions
7. Production technology of Lilium under protected conditions.
8. Production technology of Orchids and Anthurium under protected conditions
9. Production technology of Gladiolus and Tuberose.
10. Production technology of Chrysanthemum under open conditions.
11. Package of practices for Rose
12. Package of practices for Marigold
13. Package of practices for Jasmine.
14. Package of practices for Crossandra
15. Package of practices for Nerium
16. Processing and Value addition of flower crops
17. **Mid-Semester examinations**
18. Production technology of important medicinal plants like Ashwagandha, Asparagus.
19. Production technology of Aloe, Costus and Cinnamum.
20. Production technology of Periwinkle and Isabgol.
21. Production technology of Aromatic plants like Mint, Lemongrass and Citronella.
22. Production technology of Palmarosa and Ocimum.
23. Production technology of Geranium and Vetiver.
24. Processing and value addition in MAPs.
25. History of Gardening
26. Various styles of gardens
27. Soft and Hardscape components in gardens
28. Principles of garden designing
29. Drafting techniques-Manual and CAD
30. Designing garden for Residence and community living
31. Designing garden for Institute and Industry
32. Designing garden for Public park and theme park
33. Flower arrangement-Ikebana, Moribana
34. Bonsai, Terrarium, Bouquet making and dry flowers

Practical Schedule

1. Identification of flowers and ornamental plants.
2. Protected structures – care and maintenance
3. Crop management for Rose and Gerbera
4. Crop management for carnation and Lilium
5. Crop management for Orchids and Anthurium
6. Crop management for Gladiolus and tuberose
7. Crop management for Chrysanthemum
8. Crop management for Jasmine, Marigold and crossandra
9. Identification of Medicinal plants and Aromatic Plants.
10. Crop management for Ashwagandha, Asparagus, Aloe, Costus, Cinnamomum and

Periwinkle.

11. Crop management for Isabgol, Mint, Lemongrass, Citronella, Palmarosa, Ocimum,Rose, geranium, Vetiver
12. Essential oil extraction and Value addition in MAP
13. Identification of Living and non living garden components
14. Practicing in lawn making and maintenance
15. Designing and Drafting of various gardens-Residential, Community living, Institutional, Industrial gardens and Theme parks
16. Horticultural crafts-Bonsai, terrarium, Flower arrangements, Bouquet etc
17. Final Practical Examination

Course outcome

CO 1: The students will be able to practice the nursery techniques and planting methods ofcut and loose flower crops

CO 2: The students will beable to understand the cultivation techniques of medicinal and aromatic plants.

CO3: The students will be to diagnose problems in cultivation of flower crops under protected cultivation.

CO4: The students will be able to practice the landscape designing for various places

CO5: The students will be able to practice horticultural crafts

CO-PO Mapping matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	3	2	0
CO 2	3	3	2	3	3	0
CO 3	3	3	1	3	3	0
CO 4	1	0	3	3	2	0
CO 5	1	0	2	3	1	0

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23 AEC- 202 AGRICULTURAL MARKETING, TRADE AND PRICES (1+1)

Learning objectives

- To give exposure to the Under Graduate students on market concepts
- To understand domestic and export trade
- To study risking agricultural marketing, marketing institutions involved, price dynamics and the role

of government in regulation of markets
- To know the impact of WTO in agriculture
- To study the price stabilization measures

Theory

Unit I: Agricultural Marketing – Nature and Scope

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, , classification and characteristics of agricultural markets. - Producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities. Approaches to the study of marketing - Market forces - Nature and determinants of demand and supply of farm products. Marketing of agricultural versus manufactured goods. Modern marketing systems versus traditional agricultural marketing systems

Unit II: Marketing Functions and Marketing efficiency

Marketing process and functions: Marketing process - concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transportand processing; facilitating functions – packaging, branding, grading, quality control and labeling (AGMARK); Standardization, Finance, Storage and Warehousing, Processing, Value Addition and Risk Taking -Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products;Market integration-over space, time and form: Meaning, definition and types Marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing, reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; - Market Structure, Conduct and Performance paradigm (SCP) – Marketing mix and market segmentation - Market Structure: Meaning, Components, Dynamics of Conduct and Performance – Price determination under perfect and imperfect competition.

Unit III: Pricing, Promotion Strategies and Marketing Institutions

Product Life Cycle (PLC) and competitive strategies: Meaning and stages in PLC; Pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits and demerits, characteristics of PLC; strategies in different stages of PLC; Role of Government in agricultural marketing - Public sector institutions - CWC, SWC, FCI and DMI – their objectives and functions; cooperative marketing in India; New EXIM policy of India – Advantages of AEZs, ITPO, Export Promotion Councils, APEDA, MPEDA, and Commodity Boards.

Unit IV: Trade in Agricultural Products

International Trade: Concept of International Trade and its need - Free trade, Autarky and its needs -Theories of Trade: Absolute and comparative advantage; Present status and prospects of Agricultural exports / imports from India and their share - Barriers to Trade: Tariff and non-tariff barriers - Trade policy instruments – Terms of Trade - Role of institutions like UNCTAD and GATT - WTO in promoting trade in agricultural products - Free Trade Agreements – AoA and its implications on Indian agriculture: Sanitary and Phyto-sanitary issues, Market Access, Domestic Support and Export Subsidies - IPR.

Unit V: Agricultural Prices and Risk Analysis

Agricultural Prices and Policy: Meaning and functions of price; administered prices; need for agricultural price policy; Objectives of Price Policy and Price Stabilization – Role of CACP –

Concept of MSP, FRP (SMP) and SAP – Price Parity - Procurement of food grains and buffer stock,FCI- Risk in marketing: Meaning and Importance - Types of risk in marketing: Speculation and Hedging - Forward and Futures trading; an overview of futures trading; – Roleof Contract Farming in risk mitigation.

Practicals

Computation of marketable and marketed surplus of important commodities; Study ofprice behavior over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by differentagencies,identification of marketing channels for selected commodity, collection of data regardingmarketing costs, margins and price spread and presentation of report in the class;Visit tomarket institutions – NAFED, SWC, CWC, Cooperative marketing society, etc to study theirorganization and functioning; Application of principles of comparative advantage ofinternational trade.

Lesson plan

Theory Schedule

1. Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing. Classification and characteristics of agricultural markets.

2Approaches to the study of marketing: Market forces. Demand and supply of agri-commodities: meaning, nature and determinants of demand and supply of farm products.

3. Marketing of agricultural versus manufactured goods.Modern marketing systems versus raditional agricultural marketing systems Producer's surplus – meaning and itstypes, marketable and marketed surplus, factors affecting marketable surplus of Agri commodities.

4. Marketing process and functions: Marketing process - concentration, dispersion and equalization. Exchange functions – buying and selling; physical functions – storage, transport and processing.

5. Facilitating functions – packaging, branding, grading, quality control and labeling (AGMARK).Standardization, Finance, Storage and Warehousing, Processing, Value Addition and Risk Taking.

6.Market functionaries and marketing channels: Marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing reasons for higher marketingcosts of farm commodities; ways of reducing marketing costs.

7. Market Structure, Conduct and Performance paradigm (SCP) – Market Structure: Meaning, Components, Dynamics of Conduct and Performance. Market structure and Price determination under perfect and imperfect competition.

8. Marketing mix and market segmentation. Market Integration overspace, time and form: Meaning, definition and types of market integration..

9.Mid-Semester Examination

10.Product Life Cycle (PLC) and competitive strategies: Meaning and stages in PLC;characteristics of PLC; strategies in different stages of PLC.

11. Pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing. Market promotion – advertising, personal selling, sales promotionand publicity – their meaning and merits and demerits.

12. Role of Government in agricultural marketing - Modern marketing systems versus traditional agricultural marketing systems.-Public sector institutions- CWC, SWC, FCI, and

DMI – their objectives and functions. Co-operative marketing in India. Advantages of AEZs, ITPO, Export Promotion Councils, APEDA, MPEDA, and Commodity Boards.
13. International Trade: Concept of International Trade and its need - Free trade, Autarky and it needs. Theories of Trade: Absolute and comparative advantage;
14. Present status and prospects of Agricultural exports / imports from India and their share.. Barriers to Trade: Tariff and non-tariff barriers - Trade policy instruments.
15. Terms of Trade - Role of institutions like UNCTAD and GATT - WTO in promoting trade in agricultural products - Free Trade Agreements. AoA and its implications on Indian agriculture: Sanitary and Phyto-sanitary issues, Market Access, Domestic Support and Export Subsidies - IPR.
16. Agricultural Prices: Meaning and functions of price; administered prices; need for agricultural price policy; Objectives of Price Policy and Price Stabilization – Role of CACP –Concept of MSP, FRP (SMP) and SAP. Price Parity - Procurement of food grains and buffer stock.
17. Risk in marketing: Meaning and Importance - Types of risk in marketing. Role of Contract Farming in risk mitigation. Speculation and Hedging and Forward and Futures trading: an overview of futures trading.

Practical Schedule

1. Preparation of Market survey schedule
2. Visit to a farm to collect information on marketing practices of agricultural commodities and marketing problems.
3. Computation of marketable and marketed surplus of important commodities.
4. Visit to a local market / weekly *shandy* / farmers' market to study various marketing Functions performed by different agencies.
5. Identification of marketing channels for selected commodity.-. Types and importance of agencies involved in agricultural marketing; marketing channels for different farm products.
6. Marketing costs, margins; price spread estimation for major agricultural and allied agricultural products.
7. Estimation of marketing efficiency and market integration.
8. Visit to market committee and regulated market to study their organization and functioning.
9. Visit to co-operative marketing society to study its organization and functioning.
10. Visit to Food Corporation of India (FCI)
11. Visit to market institutions – SWC / CWC to study their organization and functioning.
12. Visit to AGMARK Laboratory / Grading institutions.
13. Visit to NAFED
14. Visit to Commodity Boards / AEZ / Export oriented units.
15. Construction of Index Numbers and their uses.
16. Application of principles of comparative advantage of international trade.
17. Practical Examination.

Course Outcome

CO1: To understand the marketing channels of different commodities.
CO2: To gain the practical knowledge of price spread and its implications.
CO3: To know the role of marketing institutions and trade in agricultural products like WTO

and APEDA.
CO4: Gain practical knowledge on FCI, CWC and regulated market activities.
CO5: Role of CACP for price fixation, and price stabilization measures.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	2	-	-	-
CO2	-	-	2	-	-	2
CO3	-	-	-	1	-	-
CO4	-	-	-	2	-	-
CO5	1	-	-	-	-	1

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23 AHS 202 POULTRY AND FISHERIES MANAGEMENT (1+1)

Learning Objectives

- To educate students about the current status of the poultry industry and the issues confronted by the poultry producers.
- To provide practical information on broiler and layer management in order to increase production levels.
- To impart sufficient knowledge on the construction of poultry houses using high-quality

materials in order to comply with safety regulations and to prevent disease transmission.

- To familiarize with different types of inland fish and their importance in human nutrition.
- To provide field-oriented skills in fish and poultry production as part of an integrated farmmodel.

Theory

Unit I : Introduction to Poultry Management

Introduction - Significance of poultry industry in Indian economy – Census - common nomenclatures used in poultry husbandry practices - systems of farming - Extensive, semi intensive, Intensive system and integrated farming system - class – breeds – variety -strains with examples

Unit II : Broiler Management

Broilers - commercial strains of broiler - Housing - site selection - floor space requirement of different age groups / systems - Cage Vs deep litter - Brooding management - Litter management - Feeding Management - Feed Conversion Ratio (FCR)

Unit III : Layer Management - I

Layers - Commercial Strains of Layers - Housing Management - deep litter - cage system - Slat cum Deep litter system - floor space requirements for different age groups / systems - Brooder, grower and layer management

Unit IV: Layer Management - II

Lighting management - feeding management - Deworming and Vaccination Schedule - Feed Conversion Ratio (FCR) - Hen Housed Egg production (HHEP) - Hen Day Egg production (HDEP)

Unit V : Fisheries Management

Types of common fresh water fishes - Integrated Fish farming- Fish preservation – Fishmeal - Production, processing, importance in poultry feeding and current stream of thoughts.

Practicals

External parts of chicken-Deworming-Vaccination schedule -Parts of egg-Poultry farm equipments-Feed and feed ingredients-Grading of egg- Slaughtering of chicken -Economic traits- Preservation of egg and meat -Brooding-Debeaking -Processing of Fish meal.

Lesson Plan

Theory schedule

1. Introduction, significance, scope and census of chicken
2. Common Nomenclatures in chicken- systems of farming- Extensive, intensive, Semi-Intensive and Integrated farming system
3. Class, breeds, Variety and Strains of chicken with examples
4. Introduction to Broilers - Housing Management - Selection of site
5. Cage Vs Deep litter system - merits and demerits
6. Floor space requirement of different age group birds / systems - Brooding Management
7. Litter Management - Qualities of Litter and its maintenance
8. Feeding Management of broilers - Feed Conversion Ratio (FCR)
9. **Mid-Semester Examination**
10. Introduction to layer - housing Management- Deep litter system - cage system- slat cumDeep litter system
11. Floor space requirement of different age groups / Systems - Brooder Management
12. Grower and Layer management
13. Lighting Management – HHEP - HDEP
14. Feeding Management
15. Bio security - Fumigation and disease prevention
16. Introduction to common fresh water fishes- integrated fish farming
17. Fish preservation- Fish meal, its processing & importance in poultry feeding and currentstream of thoughts.

Practical Schedule

1. Study of external parts of chicken
2. Deworming in layers
3. Vaccination schedule in Broilers & layers
4. Parts of egg
5. Identification of poultry farm equipments
6. Identification of feed and feed ingredients
7. Grading of egg
8. Slaughtering of chicken and dressing percentage.
9. Important economic traits of broiler & layers- FCR/ HDEP/HHEP
10. Preservation of egg
11. Preservation of chicken meat
12. Brooder Management
13. Debeaking in poultry
14. Processing of Fish meal and its inclusion level in poultry feed
15. Visit to poultry farm
16. Visit to fish farm
17. **Practical Examination**

Course Outcome

CO 1: The students gain knowledge in basic concepts of scientific rearing of poultry.

CO 2: Further, they would enrich on poultry management practices including feeding, housing and lightning management.

CO 3: Students would be able to analyse and solve different problems arising in broilerand layer management.

CO 4: This course encompasses all relevant information and serve as source of knowledge to understand the modern techniques used in animal husbandrysector.

CO 5: To understand about the basics of fish farming and fresh water fishes.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	-	2	2	3	1
CO 2	2	-	2	2	2	1
CO 3	2	-	2	3	2	-
CO 4	2	-	3	3	3	1
CO 5	3	-	1	2	1	-

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23 ECENT 202 URBAN ENTOMOLOGY (2+1)

COURSE SCHEDULE: Lecture and title

1 Introduction part I: Urban pests: their importance and habitats
2 Introduction part II: Principles of urban pest management
3 Urban Pesticides part I: Classification, risks, and non-synthetic insecticides
4 Urban Pesticides part II: Synthetic insecticides, insecticide resistance
5 Cockroaches part I: Identification, biology of important species
6 Cockroaches part II: Cockroach management Lab experiment I. Efficacy of selected insecticides against the German cockroach
7 North America Termite taxonomy, general biology, and economic importance
8 Termite management and other wood destroying insects
9 Ant diversity, biology, and economic importance
9 Important ant pests and their management
10 Stinging wasps and their management
11 Stinging bees and their management
12 Diversity and importance of stored product pests
13 1 Management of stored product pests Mid-term exam
14 Ectoparasites I: fleas, lice, ticks
15 Ectoparasites II: Mites, kissing bugs, bed bugs, delusory parasites
16 Occasional invaders I: Arthropods other than Insects
17 Occasional invaders II: The Insects
18 Fabric insects: clothes moths, carpet beetles
19 Flies part I: Importance of flies, fly biology, important filth flies
20 Flies part II: Small flies, biting flies, midges, management of flies Lab experiment II. Behavior of bed bugs
21 Mosquito morphology, biology, and mosquito transmitted diseases
22 Important mosquito species in urban environment and their management
23 Rodents
24 Pesticide legislation and integrated pest management

23 ECAEC-203 PROJECT MANAGEMENT (2+1)

Learning objectives

To provide knowledge to the students on project selection, formulation, financial feasibility analysis, monitoring and evaluation techniques with reference to agricultural sector.

- To study the human resource in project management
- To know the project management techniques
- To understand indicators for monitoring
- To know the types of evaluation system

Theory

Unit I:Introduction to ProjectManagement

Introduction-Project definition-Project characteristics-Project performance dimensionsProject cycle -Project classification-Agricultural Project- Project management -Benefits of Project

Management Approach. Project identification–Formulation-Economic and market analysisPre-feasibility Studies / Opportunity Studies-Feasibility Study -Environmental impact study-Financial analysisUndiscounted Cash Flow Analysis -Pay-back period- Return on Investment(ROI)Discounted Cash Flow Analysis: NPV, BCR and IRR- Risk and uncertainty-Project appraisal-Detailed project report.

UnitII: Human Resource in Project Management

Project organization design Human resource management-Role management-Team building Communication-Motivation-Decision making leadership Appraisal -Social Cost Benefit Analysis (SCBA).

Unit III:Project Management Techniques

Project management techniques-Bar Charts -Gantt Chart-Milestone Chart -Networks - Programme Evaluation and Review Technique (PERT)-Network diagram-Computation of EST&LST-Steps for Network Analysis. CPM -Network Revision -Project Crashing-Time-Cost Relationship of an Activity -Normal and crash situations-Project Crashing - Project Control-Redrawing Network- Progress Report.

Unit IV: Monitoring

Monitoring– Introduction, basic elements, importance -Monitoring and progress reporting-Monitoring techniques-Indicators for monitoring-Types of monitoring- Monitoring risk and uncertainties.

UnitV:Evaluation

Evaluation–Definition, introduction, features, importance-comparison of appraisal, monitoring and evaluation-Types of evaluation-Designing monitoring and evaluation system- Salient aspects of evaluation-Quantitative and qualitative approaches – Participatory monitoring and evaluation-Social audit-Evaluation report. Current Streams of thought.

Practicals

Developing skills in identification of projects - Formulation of projects -Measuring of cost and benefit of projects - Appraisal of project using undiscounted and discounted techniques - Use of sensitivity analysis - Selection methods among mutually exclusive projects - Preparation of case studies - Social cost benefit analysis – Developing network techniques for project management -PERT, CPM - Time cost relationship of and activity - Use of management tools in project monitoring - Analyzing risk in projects -Environmental Impact Assessment.

Lesson plan

Theory Schedule

1. Introduction-Project definition-Project characteristics-Project performance dimensions
2. Project cycle -conceptualization, planning, execution phases
3. Project classification-Differences between Industrial projects and Developmental projects-Agricultural Project
4. Project management -Benefits of Project Management Approach
5. Project identification–Formulation-Economic and market analysis

6. Pre-feasibility Studies / Opportunity Studies-Feasibility Study
7. Environmental impact study-Financial analysis
8. Undiscounted Cash Flow Analysis -Pay-back period- Return on Investment(ROI)
9. Discounted Cash Flow Analysis: Net Present Value (NPV)- Profitability Index(PI)/BenefitCost Ratio- Internal Rate of Return (IRR)
10. Risk and uncertainty-Economic benefit–Management aspects
11. Project appraisal–Market, Technical, Economic appraisal
12. Time Frame for Project Implementation -Feasibility Report
13. Detailed project report -Project organization design
14. Human resource management-Role management-Teambuilding
15. Communication-Motivation-Decision making leadership
16. Appraisal -Social Cost Benefit Analysis (SCBA)
17. Mid Semester Examination
18. Project management techniques-Bar Charts -Gantt Chart-Milestone Chart
19. Networks - Activity-on-Arrow (AOA)- Activity-on-Node (AON)- Programme Evaluation and Review Technique (PERT)
20. Dummy Activity-Critical Activity-Event-Expected Time-Slack-Steps for Network Analysis
21. Network diagram- Computation of EST&LST-Steps for Network Analysis
22. Rules for Drawing the Network-Event Numbering-Floats and their relationship-
23. CPM-Critical Path and Project Management-Examples
24. Network Revision -Reviewing the duration of activities -Final network
25. Activity Scheduling -Resource Analysis and scheduling
26. Project Crashing-Time-Cost Relationship of an Activity
27. Normal and crash situations-Project Crashing Examples- Normal and Crash parameters
28. Project Control-Steps in Project Control-Redrawing Network- Progress Report-
29. Monitoring– Introduction, basic elements, importance -Monitoringand progressreporting-Monitoring techniques
30. Indicatorsformonitoring-Typesofmonitoring-Monitoringriskanduncertainties
31. Evaluation–Definition, introduction, features, importance Comparison of appraisal, monitoring and evaluation
32. Types of evaluation-Designing monitoring and evaluation system
33. Salient aspects of evaluation-Quantitative and qualitative approaches
34. Participatorymonitoringandevaluation-Socialaudit-Evaluationreport

Practical schedule

1. Developmentskillsinidentificationofprojects
2. Formulation of projects
3. Measuring of cost and benefit of projects
4. Appraisal of project using undiscounted techniques
5. Appraisal of project using discounted techniques
6. Use of sensitivity analysis
7. Selection methods among mutually exclusive projects
8. Preparation of case studies

9. Preparation of case studies
10. Social cost benefit analysis
11. Networks-PERT-Network diagram
12. PERT-CPM analysis
13. Time cost relationships of and activity
14. Developing network techniques for project management
15. Use of management tools in project monitoring
16. Analyzing risk in projects and environmental impact assessment
17. Practical Examination

Course outcome

CO1: Understand nature and scope of financial management in agribusiness.
CO2: Identify the tools for credit, repayment and downpayments.
CO3: Do the appraisal of projects by measurement of costs, benefits and sensitivity analysis.
CO 4: Understand the monitoring and progress of the report
CO 5: Know the salient aspects of evaluation

CO-POMappingMatrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	3	-	-	-
CO2	-	3	-	-	-	-
CO3	2	2	-	-	-	2
CO4	-		-		2	-
CO5	-	2		2	-	

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23 ECSAC 202 AGROCHEMICALS (2+1)

Learning Objectives:

- The students are expected to gain both theoretical as well as practical knowledge on

agrochemicals-their type and role in agriculture,

- The student learn the effect on environment, soil, human and animal health; managementof agrochemicals for sustainable agriculture
- Understand how more efficient use of agrochemicals can build and improve the health ofthe soil
- Understand that reducing use of agrochemicals does not reduce productivity
- Identify the characteristics of a sustainable farm with regards to agrochemical use

Theory

Unit 1: Agrochemicals- overview

An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil,human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture

Unit II:- Herbicides and bio pesticides

Herbicides-Major classes, properties and important herbicides. Fate of herbicides. Plant bio- pesticides for ecological agriculture, Bio-insect repellent.

Unit III: Fungicides

Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxychloride. Organic fungicides- Mode of action-Dithiocarbamates-characteristics, preparation and use of Zineb and maneb. Systemic fungicides-Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use.

Unit IV: Insecticides

Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids,Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use,Fate of insecticides in soil & plant. IGRs Bio pesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses.

Unit V: Fertilizers

Fertilizers and their importance. Nitrogenous fertilizers: Feedstock's and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate.

Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitro phosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing. Current stream of thoughts

Lesson Plan

Lecture Schedule

1. Introduction to agrochemicals
2. Types and role of agrochemicals in agriculture.
3. Effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture.
4. Herbicides –Classification of herbicides based on chemical nature with examples.
5. Selectivity of herbicides brief note on mode of action of herbicides (Respiration,mitochondrial activity, photosynthesis, protein and nucleic acid metabolism.
6. Structure, properties and uses of 2, 4 D, Atrazine, Batchelor, Glyphosate and Benthiocarb Fate of herbicides.
7. Plant bio-pesticides for ecological agriculture and Bio-insect repellent.
8. Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use ofsulphur
9. Characteristics, preparation and use of copper, Mode of action-Bordeaux mixture andcopper

oxychloride.

10. Organic fungicides- Mode of action- Dithiocarbamates-characteristics, preparation anduse of Zineb and maneb.
11. Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim,
12. Characteristics and use. . Introduction and classification of insecticides.
13. Inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates,
14. Synthetic pyrethroids Neonicotinoids, Biorationals,
15. Insecticide Act and rules, Insecticides banned, withdrawn and restricted use,
16. Fate of insecticides in soil & plant.
17. **Mid Semester Exam**
18. IGRs Bio pesticides and Reduced risk insecticides.
19. Botanicals, plant and animal systemic insecticides their characteristics and uses.
20. Fertilizers and their importance.
21. Classification with examples –Nitrogenous fertilizers- Manufacturing process and
22. properties of major nitrogenous fertilizers viz., Ammonia
23. Nitrogenous fertilizers: Feedstock's and Manufacturing of ammonium sulphate, Ammonium nitrate, ammonium chloride, urea.
24. Slow release N-fertilizers.
25. Classification of Phosphatic fertilizers: feedstock and manufacturing of single superphosphate.
26. Preparation of bone meal and basic slag.
27. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride,
28. potassium sulphate and potassium nitrate.
29. Mixed fertilizer
30. Complex fertilizers:
31. Sources and compatibility–preparation of major, secondary and micronutrient mixtures.
32. Complex fertilizers: Manufacturing of ammonium phosphates, nitro phosphates and
33. Manufacturing of NPK complexes.
34. Fertilizer control order.
35. Fertilizer logistics and marketing. Current stream of thoughts

Practicals

1. Sampling of fertilizers and pesticides.
2. Pesticides application technology to study about various pesticides appliances.
3. Quick tests for identification of common fertilizers.
4. Identification of anions in fertilizers
5. Identification of cations in fertilizers.
6. Calculation of doses of insecticides to be used.
7. To study and identify various formulations of insecticide available in market.
8. Estimation of nitrogen in Urea.
9. Estimation of water soluble P_2O_5 and
10. Estimation of citrate soluble P_2O_5 in single super phosphate.
11. Estimation of potassium in Muriate of Potash/ Sulphate of Potash by flame photometer.
12. Determination of copper content in copper oxychloride.
13. Determination of sulphur content in sulphur fungicide.
14. Determination of thiram.
15. Determination of ziram content.
16. Calculation of fertilizer requirement in preparation of mixed fertilizer
17. Practical Examination

Course Outcome:

CO1: Students will gain knowledge on chemical composition and proper understanding ofChemistry of pesticides.
CO2: Students will acquire the skills on quality monitoring of crops and pesticides throughpractices.
CO3: Students will acquire knowledge on manufacture, nutrient content and use of variousfertilizers, slow-release fertilizers and fertilizer control order etc.
CO4: Students gain practical skills in analysis of pesticides and fertilizers
CO5: Students gain knowledge in act and rules pertaining to fertilizers and pesticides usage

Co-Po Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	-	-	1	-
CO2	-	1	-	-	-	-
CO3	1	2	1	-	1	-
CO4	-	1	-	-	-	1
CO5	1	1	-	1	-	-

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23 AGR 211 EDUCATIONAL TOUR I (0+1)

VSemester

23 AGR 301 PRACTICAL CROP PRODUCTION – II (RABI CROPS) (0+1)

Practicals

Crop planning, raising field crops in multiple cropping systems. Field preparation, seed,treatment, nursery raising, sowing, nutrient, water and weed management. Management of insect-pests diseases of crops. Harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease managementtechnologies. Preparation of balance sheet including cost of cultivation, net returns per studentas well as per team of 8-10 students.

- Each student will be allotted a minimum land area of 100/200 m^2 and he/she will do all field operations in the allotted land from field preparation to harvest and processing.
- Field preparation, seed, treatment, nursery raising, sowing, nutrient, water, weed management and management of insect-pests & diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce.
- Any irrigated upland crop (maize / sorghum / pearl millet / finger millet / cotton / groundnut / sunflower / sesame/ green gram / black gram etc.).

Practical Schedule for Irrigated upland crop (e.g. Maize/ Cotton):

- Ecosystem - Climate and weather - Seasons and varieties of India.
- Selection of field - Main field preparation - seed treatment - Application of manures and fertilizers - Sowing - Weed management and practicing pre- emergence application of herbicides - Thinning and gap filling - Estimation of plant population - Top dressing - Weed management - Water

management - Pest management - Observation on nutrientand weeds - Recording growth, yield attributes and yield

- Harvesting, threshing and cleaning the produce - Cost of cultivation and economics.

Practical Schedule

- Selection of field for ID crop cultivation
- Acquiring skill in seed treatment practices
- Study and practice of main field preparation for ID crop
- Practicing of application of manures and fertilizers for ID crop
- Practicing sowing of ID crop/ exposure to mechanized sowing
- Acquiring skill in pre-emergence application of herbicides
- Estimation of plant population and acquiring skill in gap filling and thinning
- Observation on nutritional deficiency symptoms and corrective measures
- **Mid-semester examination**
- Study of weeds and weed management in ID crop/ exposure to mechanized weeder
- Recording growth parameters and assessing dry matter production
- Study of water management practices for ID crop
- Observation of insect pests and diseases and their management
- Estimation of yield and yield parameters in ID crop
- Harvesting, threshing and cleaning of the produce/ exposure to mechanized harvestingand threshing.
- Preparation of balance sheet including cost of cultivation and net returns per student
- **Practical examination**

Note: According to the season, the crops in practical crop production – I & II can be interchanged

Course Outcome

CO 1: To gain knowledge about cultivation aspects of maize
CO 2: To demonstrate various seed treatment methods for maizeCO 3:
To evaluate different methods of planting techniques
CO 4: To acquire knowledge on mechanized farming practices

CO 5: To construct methodologies in harvesting, processing and value addition

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	-	3	-
CO2	2	-	-	-	3	-
CO3	2	-	-	3	3	-
CO4	2	-	1	1	1	-
CO5	1	-	-	-	2	1

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23 AGR 302 RAINFED AGRICULTURE, WATERSHED MANAGEMENT AND SECONDARYAGRICULTURE (2+1)

Learning objectives

- To teach the students about the basic aspects and concepts of rain fed agriculture
- To learn about soil and water conservation techniques
- To enrich knowledge about drought management in different crops
- To acquire knowledge on water harvesting and contingent crop planning
- To enrich knowledge on watershed management

Theory

Unit I: Rain fed agriculture

Rain fed agriculture - introduction, types- history of rain fed agriculture in India - Problems and prospects of rainfed agriculture in India, characteristic features. Importance and need for development

Unit II: Soil and moisture conservation

Soil moisture conservation, climatic constraints, soil moisture constraints, cultivation practices and socio-economic constraints. Soil and water conservation techniques- In-situ soil moisture conservation- Fertilizer use in dry lands – use of organic manures – introduction of legumes in crop rotation – organic recycling and bio-fertilizer use in dry land.

Unit III: Drought and contingent crop planning

Drought - definition, classification of drought, types. Effect of moisture stress on physio-morphological characteristics drought. Efficient utilization of water through soil and crop management practices, Contingent crop planning for aberrant weather conditions. Management of crops in rain fed areas.

Unit IV: Watershed management

Water harvesting, importance and its techniques. Watershed management - Definition, concept, objectives, need and advantages, principles and components of watershed management. Action plan and organizational requirement of watershed. Current stream of thoughts.

Unit V: Secondary agriculture

Post-harvest technology- introduction- physical properties of cereals, pulses and oilseed- PHTequipment design and operation- Drying and dehydration, moisture measurement, EMC,drying, various drying method- commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators- principle, working and selection.

Practicals

Climate classification- rainfall pattern in rain fed areas of the country and pattern of onset and withdrawal of monsoons- cropping pattern of different rain fed areas in the country anddemarcation of rain fed area on map of India. Interpretation of meteorological data andscheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation - cultural practices for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil and moisture conservation measures. Field demonstration on construction of water harvesting structures. Determination of physical properties of grains Determination of moisture content of various grains. Visit to rain fed research station/watershed.

Lesson plan

Theory Schedule

1. Rain fed Agriculture: Introduction, types - Dry farming, dry land farming and rain fed farming
2. History of rain fed agriculture in India – CRIDA, objectives and activities.
3. Characteristics and prospects of rain fed agriculture in India
4. Significance of crop production in rain fed agriculture.
5. Importance and need for development in rain fed agriculture in India.
6. Soil moisture conservation and their need in dry land agriculture.
7. Problems of crop production in dry lands.
8. Climatic parameters- Rainfall- Variability- Temperature and other constraints.
9. Soil characteristics and their problems - Other problems (weed, socio economic,infrastructure and policy constraints).
10. Fertilizer use in dry lands – use of organic manures – introduction of legumes in crop rotation.
11. Organic recycling and bio-fertilizer use in dry land agriculture
12. Drought-Classification of drought and types of drought.
13. Effect of water deficit on physio-morphological characteristics of the plants.
14. Efficient utilization of water through soil and crop management practices
15. Mechanism of crop adaptation under moisture deficit condition- drought escaping-tolerance and resistance.
16. Measures to reduce evaporation, transpiration and ET losses, crop substitution.
17. **Mid semester examination**
18. Contingent crop planning for aberrant weather conditions – Late onset, dry spell and early withdrawal of monsoon in India and in Tamil Nadu
19. Management of crops in rain fed areas.
20. Water harvesting, importance and its techniques- In-situ and Ex-situ water harvesting inarid and semiarid areas.
21. Efficient utilization of water through soil and crop management practices-
22. Efficient utilization of water -Agronomic, mechanical and agrostological measures.
23. Management of crops and cropping systems in rain fed areas – Intercropping, sequence cropping and crop rotation- Choice of crops and cropping systems based on length ofcrop growing season – Potential cropping systems.
24. Concepts, objectives and principles of watershed management- Application of remote sensing and GIS in delineation of watershed
25. Components of watershed management- Natural resource management in arable andnon arable lands- Soil and water conservation
26. Alternate land use systems- different types of ALUS based on land capability classification.
27. Factors affecting watershed management- Technical, social, economic and policy constraints and Current stream of thoughts.
28. History of watershed concepts in India – guidelines for integrated watershed management programme.
29. Engineering properties such as physical, thermal and aero and hydrodynamic propertiesof cereals, pulses and oilseed-
30. Threshers for different crops, types of screens and separators.
31. Working principles of maize Sheller, hand and power operated decorticator
32. Drying and dehydration, moisture measurement, EMC.
33. Various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer).

34. Material handling equipment; conveyer and elevators- principle and working.

Practical Schedule

1. Study on climate classification
2. Study of rainfall pattern in rain fed areas of the country and in Tamil Nadu
3. Study of pattern of onset ,withdrawal of monsoons and length of crop growing season
4. Studies on cropping pattern of different dry land areas in the country and demarcation ofdry land area on map of India.
5. Interpretation of meteorological data and scheduling of supplemental irrigation on the basisof evapo-transpiration demand of crops
6. Drought, its significance and estimation of drought indices- MAI, AI
7. Critical analysis of rainfall and possible drought period in the country,
8. Effective rainfall and its calculation.
9. Studies on cultural practices viz; mulching and anti transpirants for mitigating moisturestress.
10. Studies on cultural practices viz; plant density, depth of sowing, thinning and leaf removalfor mitigating moisture stress.
11. Characterization and delineation of model watershed.
12. Field demonstration on soil & moisture conservation measures
13. Visit to watershed.
14. Alternate land use systems- different types of ALUS and visit to AICRP on Agroforestry
15. Determination of physical properties of grains
16. Determination of moisture content of various grains
17. **Practical examination**

Course Outcome

CO 1: The students acquire knowledge on basic aspects of rainfed agriculture and its management

CO 2: The students acquaints of the soil and water conservation techniques

CO 3: The students gain knowledge on various drought management techniques in differentcrops

CO 4: The students gets well-versed in contingent crop planning and water harvesting

CO 5: Understand technologies for threshing, shelling and drying of cereals, pulses and oilseeds.

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	-	2
CO2	3	2	-	-	2	
CO3	3	1	2	2	-	2
CO4	2	2	1	3	2	-
CO5	2	1	-	-	3	-

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23 ENT 301 PESTS OF CROPS AND STORED GRAIN AND THEIR MANAGEMENT (2+1)

Learning Objectives:

- To study the distribution, bionomics and symptoms of damage of pests of crops andstorage.
- To distinguish various symptoms of damage
- To identify different life stages of the major pests of crops and storage
- To discuss integrated pest management protocols for major crops and pests
- To perform rearing and collection of major pests for better understanding of their biologyand identification characters

Theory

Economic Classification of Insect Pests, Distribution, Bionomics, Symptoms of damage and Integrated management strategies for insects and non-insect pests such as mites, nematodes,rodents, birds and other vertebrates of the following crops.

Unit I: Pests of Cereals, Millets and Pulses

Rice, Wheat, Maize, Sorghum, Cumbu, Ragi, Tenai; Redgram, Greengram, Blackgram, Bengal gram, Cowpea and Soybean

Unit II: Pests of Oilseeds, Cotton, Sugarcane, Green manures, Forage crops andTobacco

Groundnut, Castor, Sesame, Sunflower, Safflower, Linseed, Jatropa, Mustard; Cotton; Sugarcane; Sunhemp, Sesbania, Daincha, Glyricidia; Lucerne, Subabul; Tobacco

Unit III: Pests of Vegetables, Tubers, Spices and Plantation crops

Brinjal, Tomato, Bhendi, Crucifers, Cucurbits, Moringa, Amaranthus, Potato, Sweet Potato, Tapioca, Yam; Chillies, Onion, Garlic, Ginger, Turmeric, Coriander, Curry leaf, Cardamom, Pepper and Betel vine; Coconut, Arecanut, Coffee, Tea, Rubber, Cocoa

Unit IV: Pests of Fruits and Forest trees

Mango, Sapota, Citrus, Cashew, Banana, Grapevine, Guava, Jack, Custard apple, Pomegranate, Pineapple, Papaya, Aonla, Ber, Tamarind, Apple; Neem, Teak, Sandalwood, Eucalyptus, Casuarina

Unit V: Pests of Flower crops, Ornamentals, Medicinal plants and Stored products Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers, Greenhouse crops andMushroom, Lawn and Turf; Gloriosa, Coleus, Phyllanthus, Periwinkle, Aswagantha, Senna;Stored grains, Dry fruits and Nuts; Locusts and their management. Current Streams ofThoughts in pest management.

Practical

Identification of symptom of damage and life stages of important insect, non-insect pests such as mites, nematodes and rodents, various crops and storage – cereals, millets, pulses,oilseeds, cotton, sugarcane, green manures, forage crops, fruits, forest trees, flower crops, plants, Ornamentals, Lawn Medicinal and Stored products.

Assignment

- Collection and submission of at least 50 insect pests of crops and storage.
- Rearing a minimum of 20 insect pests of crops and storage

Theory Lecture Schedule

Distribution, Bionomics, Symptoms of damage and Integrated management strategies forinsect, non-insect pests such as mites, nematodes, rodents, birds and other vertebrate pestsof

1. Rice – Leaf feeders and borers
2. Rice – Sap feeders
3. Wheat, Maize, Sorghum
4. Cumbu, Ragi, Tenai
5. Redgram, Greengram, Blackgram
6. Bengal gram, Cowpea and Soybean
7. Groundnut

8. Castor, Sesame
9. Sunflower, Safflower, Linseed, Jatropa, Mustard
10. Cotton
11. Sugarcane
12. Sunhemp, Sesbania, Daincha, Glyricidia; Lucerne, Subabul; and Tobacco
13. Brinjal, Tomato
14. Bhendi, Crucifers
15. Cucurbits, Moringa and Amaranthus
16. Potato, Sweet Potato, Tapioca, Yam
17. **Mid-semester examination**
18. Chillies, Onion, Garlic, Ginger, Turmeric, Coriander, Curry leaf
19. Cardamom, Pepper and Betel vine
20. Coconut, Arecanut
21. Coffee
22. Tea, Rubber, Cocoa
23. Mango, Sapota
24. Citrus, Cashew
25. Banana, Grapevine
26. Guava, Jack, Custard apple, Pomegranate, Pineapple
27. Papaya, Aonla, Ber, Tamarind, Apple
28. Neem, Teak, Sandalwood, Eucalyptus, Casuarina
29. Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers
30. Green house crops and Mushroom,
31. Lawn and Turf
32. Gloriosa, Coleus, Phyllanthus, Periwinkle, Aswagantha, Senna
33. Stored grains, Dry fruits and Nuts
34. Locusts and their management

Practical Schedule

Identification of symptoms of damage and life stages of insect, non-insect pests such asmites, nematodes, rodents, birds and other vertebrate pests of

1. Rice, Wheat, Maize, Sorghum, Cumbu, Ragi, Tenai
2. Redgram, Greengram, Blackgram, Bengal gram, Cowpea and Soybean
3. Groundnut, Castor, Sesame, Sunflower, Safflower, Linseed, Jatropa, Mustard
4. Cotton, Sugarcane
5. Sunhemp, Sesbania, Daincha, Glyricidia; Lucerne, Subabul; and Tobacco
6. Brinjal, Tomato, Bhendi, Crucifers, Cucurbits, Moringa and Amaranthus, Potato, SweetPotato, Tapioca, Yam
7. Chillies, Onion, Garlic, Ginger, Turmeric, Coriander, Curry leaf, Cardamom, Pepper andBetel vine
8. Coconut, Arecanut
9. Coffee, Tea, Rubber, Cocoa
10. Mango, Sapota, Citrus, Cashew, Banana, Grapevine
11. Guava, Jack, Custard apple, Pomegranate, Pineapple, Papaya, Aonla, Ber, Tamarind,Apple
12. Neem, Teak, Sandalwood, Eucalyptus, Casuarina, Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers
13. Green house crops and Mushroom, Lawn and Turf, Gloriosa, Coleus, Phyllanthus,Periwinkle, Aswagantha, Senna, Stored grains, Dry fruits and Nuts
14. Methods of grain sampling under storage conditions
15. Fumigation of grain store/godown.

16. Visit to nearest FCI godowns
17. Orientation for final practicalexamination

Course Outcome:

CO 1: Define bionomics, symptoms of damage and integrated management strategies forpests of cereals, millets and pulses

CO 2: Discuss bionomics, symptoms of damage and integrated managementstrategies forpests of Oilseeds, Cotton, Sugarcane, Green Manures, Forage Crops and Tobacco

CO 3: Explain bionomics, symptoms of damage and integrated managementstrategies forpests of Vegetables, Tubers, Spices and Plantations

CO 4: Define bionomics, symptoms of damage and integrated managementstrategies for pests of Fruits, Ornamentals and Medicinal Plants

CO 5: Discuss bionomics, symptoms of damage and integrated management strategies forpests of Tree, Lawn, Stored Products, Mushroom and greenhouse crops

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	3	3
CO2	3	3	3	2	3	3
CO3	3	3	3	2	3	3
CO4	3	3	3	2	3	3
CO5	3	3	3	2	3	3

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23 PAT 301 DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIRMANAGEMENT-II (2+1)

Learning objectives

- To acquaint with the symptoms, etiology, disease cycle and management of diseases ofwheat and pulse crops.
- To acquaint with the symptoms, etiology, disease cycle and management practices of important diseases of oilseeds and cash crops.
- To know about the symptoms, etiology, disease cycle and management practices ofimportant diseases of fruits and vegetables crops.
- To know about the symptoms, etiology, disease cycle and management practices ofimportant

diseases of spices and plantation crops.

- To know about the symptoms, etiology, disease cycle and management practices ofimportant diseases of flower crops.

Theory

Unit-I Diseases of cereals and pulses

Symptoms, etiology, disease cycle and management of wheat, cowpea and chickpea.

Unit-II Diseases of oilseeds and cash crops

Symptoms, etiology, disease cycle and management of sunflower, safflower, mustard,sugarcane, cotton and lentil.

Unit-III Diseases of fruits and vegetables

Symptoms, etiology, disease cycle and management of mango, citrus, grapevine, apple,peach, pineapple, strawberry, potato, cucurbits, sweet potato, cassava, colocasia

Unit-IV Diseases of spices and plantation

Symptoms, etiology, disease cycle and management of chillies, turmeric, pepper, betelvine, coriander, cocoa, rubber and arecanut

Unit-V Diseases of flower crops

Symptoms, etiology, disease cycle and management of rose, jasmine, crossandra,chrysanthemum and marigold

Practicals

Identification and histopathological studies of selected diseases of field andhorticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.

Lesson plan

Theory schedule

Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of

1. Diseases of wheat
2. Diseases of cowpea
3. Diseases of chickpea
4. Diseases of sunflower
5. Diseases of safflower
6. Diseases of mustard
7. Diseases of sugarcane
8. Diseases of cotton
9. Diseases of lentil
10. Diseases of mango
11. Diseases of citrus
12. Diseases of grapevine
13. Diseases of apple
14. Diseases of peach
15. Diseases of pineapple
16. Diseases of strawberry
17. Mid-semester examination
18. Diseases of potato
19. Diseases of cucurbits
20. Diseases of sweet potato
21. Diseases of cassava and colocasia
22. Diseases of chilli
23. Diseases of turmeric
24. Diseases of pepper

25. Diseases of betelvine
26. Diseases of coriander
27. Diseases of cocoa
28. Diseases of rubber
29. Diseases of arecanut
30. Diseases of rose
31. Diseases of jasmine
32. Diseases of crossandra
33. Diseases of chrysanthemum
34. Diseases of marigold

Practical Schedule

Study of symptoms and host-parasite relationship of:

1. Diseases of wheat
2. Diseases of cowpea and chickpea
3. Diseases of sunflower, safflower and mustard
4. Diseases of sugarcane, cotton and lentil
5. Diseases of mango and citrus
6. Diseases of grapevine and pineapple
7. Diseases of apple, peach and strawberry
8. Field visit
9. Diseases of potato and sweet potato
10. Diseases of cucurbits
11. Diseases of cassava and colocasia
12. Diseases of chilli, turmeric and pepper
13. Diseases of betelvine and coriander
14. Diseases of rubber, cocoa and arecanut
15. Diseases of rose and jasmine
16. Diseases of crossandra, chrysanthemum and marigold
17. Record certification

Assignment: Students should submit 50 well-pressed diseased specimens.

Course outcome

CO 1: Acquainted with identifying and managing diseases of cereals and pulses
CO 2: Acquainted with identifying and managing diseases in oilseeds and cash crops
CO 3: Having in depth knowledge in identifying and managing diseases in fruits and vegetables
CO 4: Having in depth knowledge in identifying and managing diseases in spices and plantation
CO 5: Having in depth knowledge in identifying and managing diseases in flower crops

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	2	3	-	1	1	-
CO2	2	3	-	1	1	-
CO3	2	3	-	1	1	-
CO4	2	3	-	1	1	-
CO5	2	3	-	1	1	-

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23 SOL 301 GEOINFORMATICS, NANO-TECHNOLOGY AND PRECISION FARMING (1+1)

Learning Objectives

- To introduce the basic concepts of precision farming
- To create awareness about various applications of remote sensing and GIS in precision agriculture
- To impart knowledge to the students on the nanotechnology in precision farming
- Evaluate the role of geoinformatics in agriculture
- To gain knowledge on crop simulation models

Theory

Unit 1: Precision farming

Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture.

Unit 11: Geo-informatics

Geo-informatics- definition, concepts, tool, and techniques; Remote sensing concepts and application in agriculture; Image processing and interpretation. Crop discrimination and yield monitoring, soil mapping. Fertilizer recommendation using geospatial technologies. Spatial data and their management in GIS. Global positioning system (GPS), components and its functions andtheir use in Precision Agriculture

Unit 111: Techniques to precision farming

Introduction to crop simulation models and their uses for optimization of agricultural inputs. STCR approach for precision agriculture

Unit IV: Basics Nanotechnology

Nanotechnology, definition, concepts and techniques, brief introduction about nano scaleeffects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors.

Unit V: Applications of nanotechnology

Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity. Current stream of thoughts

Lesson Plan

Lecture schedule

1. Precision agriculture- introduction, scope, concepts and techniques , componentsand its implications, issues ,role and concerns in Indian agriculture.

2. Geo informatics- definitions and terminology, concepts, techniques and tools ,theiruse in precision agriculture.
3. Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendationusing geospatial technologies.
4. GIS -components of GIS, Spatial data and their management,Graphic representation of data- Vector /Raster- models-digitization.Data- creation of data- storage of data- geo coding and geo referencing –data file management –input methods and analysis -overlay analysis- GIS data outputs- maps, graphical outputs.
5. Remote sensing- concepts – applications in agriculture images – sensor systems- satellites, types- NOAA satellites, GOES satellites, INSAT,IRS, SEASAT,OCEANSAT-1,IKONOS
6. Digital image processing and interpretation- transformations- DTM, Triangulated irregular network (TIN)-Applications of DTM. Application of modelling in agriculture- crop yield models- simulation models-growth models
7. Global positioning Systems (GPS)- components, functions and applications.
8. **Mid Term Examination**
9. Integration of Remote sensing and GIS -need for integration-applications
10. Soil fertility management- Soil Test crop response (STCR) studies , Crop Simulation Models and their uses for optimization of agricultural inputs.
11. Nanotechnology -introduction– history – terminologies – definitions-– basic concepts, nano scale, nano dimension effects.
12. Nanoparticles, nano materials, nano structures – their properties,
13. Synthesis of nano particles – concepts, up - down and bottom-up approaches, methods – attrition, pyrolysis ,chemical synthesis – soil gel process . principles, physical
14. Nano structured materials – fullerenes, nano tubes, nano filters, nano clays, nano balls, bulky balls etc.- properties and synthesis. Nano composites – polymers, nano crystals etc. – properties and synthesis
15. Nano technology in Agriculture and allied fields – nano farming , precision farming Nano technology in soil fertility management – nano fertilizers, nano pesticides,soil binders, nano sensors, smart delivery mechanism to targeted site for promoting nutrient availability.
16. Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity. Current stream of thoughts

Practical schedule

1. Precision agriculture
2. Geo-informatics in precision agriculture
3. Crop discrimination and spectral features for crop classification
4. Yield monitoring and soil mapping
5. Site specific nutrient management
6. Spatial data and its management
7. Godsey and its basic principles
8. Remote sensing and its application in agriculture
9. Image processing and interpretation
10. Global positioning system, components, and its function
11. Simulation and crop modelling
12. STCR approach for fertilizers recommendations
13. Nano technology and nano scale sensors
14. Ano pesticides, nano fertilizers, and nano sensors
15. Nano biosensors
16. Use of nano technology.
17. Practical examination

Course outcome

CO.1: Concepts and techniques of Precision agriculture

CO.2: Learn about tools and techniques of geoinformatics used in precision farming

CO.3: Precision agriculture can address both economic and environmental issues thatsurround production agriculture today.

CO.4: Learn about tools and techniques of nanotechnology in relation to agricultureCO.5: Application of crop simulation models.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	1	1	-
CO2	-	-	1	1	1	-
CO3	-	1	1	-	2	-
CO4	-	-	1	-	-	1
CO5	-	-	-	1	-	1

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23 GPB 301 CROP IMPROVEMENT - I (Kharif Crops) (1+1)

Learning objectives

- To impart knowledge about the origin, evolution and modes of reproduction for different Kharif crops.
- To impart knowledge about the floral biology, crossing techniques, objectives of breeding and wild species as donors for resistant traits.
- To impart knowledge about the Genetics and Genomic relationship of Yield and Quality characters for different Kharif crops.
- To impart knowledge about the Biotic and Abiotic stress resistance breeding for different Kharif crops.
- To provide insight into recent advances in improvement of cereals, millets, pulses, oil seeds, fibre crops, vegetables using conventional and modern biotechnological approaches.

Theory

Unit I: Mode of reproduction and pollination control in kharif crops

Introduction - definition, aim, objectives and scope of crop improvement - Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops - Centers of origin - Law of homologous series - types of centres of diversity
- gene sanctuaries - genetic erosion - main reasons of genetic erosion - extinction - introgression - gene

banks -Types of gene banks - distribution of crop species.

Unit II: Breeding methods for cereals, pulses, millets and oilseed crops

Centres of origin, distribution of species, wild relatives in different cereals, millets, pulses and oil seeds - **Cereals -** rice, maize - **Millets -** sorghum, pearl millet and ragi - **Pulses -** redgram, urdbean, mungbean, soybean - **Oilseeds -** groundnut, sesamum and castor.

Unit III: Breeding methods for fodder, fibre and cash crops

Centres of origin, distribution of species, wild relatives in different fodder crops, fibre crops andcash crops - **Fodder crops -** Napier grass and Para grass - **Fibre crops -** Cotton - **Cash crops -** Tobacco.

Unit IV: Breeding methods for vegetable and fruit crops

Centres of origin, distribution of species, wild relatives in different vegetable crops and horticultural crops - **Vegetable crops -** Tomato, brinjal, chilli, bhendi- **Horticultural crops -** Mango, banana, guava, papaya.

Unit V: Hybrid seed production for kharif crops

Study of genetics of qualitative and quantitative characters - Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops - Major breeding objectives and procedures including conventional and modern innovative approaches for development ofhybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (Physical, chemical, nutritional) - Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops - Hybrid seed production technology in maize, rice, sorghum, pearl millet and pigeon pea - Ideotype concept and climate resilient crop varieties for future - Breeding for drought , salinity, water logging, high temperature and low temperature tolerant varieties in different crops.

Practicals

Observation of floral biology - Anthesis and Pollination - Selfing and crossing techniques-study of wild species in the above crops.

Lesson plan

Theory lecture schedule

1. Introduction - definition, aim, objectives and scope of Crop Improvement.
2. Breeding objectives and important concepts of breeding self pollinated, cross pollinatedand vegetatively propagated crops.
3. Centres of origin - Law of homologous series-Types of centres of diversity.
4. Gene sanctuaries-Genetic erosion - main reasons-extinction-introgression.
5. Gene banks - types of gene banks- distribution of crop species.
6. Centres of origin, distribution of species, wild relatives of the cereal crops : Rice, Maize, Millets: Sorghum, Pearl millet and Ragi.
7. Centres of origin, distribution of species, wild relatives of Pulses: Redgram, Urdbean , Mungbean, Soybean
8. Centres of origin, distribution of species, wild relatives of Oil seeds: Groundnut, Sesamumand castor.
9. **Mid semester examination**.
10. Centres of origin, distribution of species, wild relatives of Fodder crops: Napier grass andPara grass, Fibre crops : Cotton
11. Centres of origin, distribution of species, wild relatives of Cash crops : Tobacco, Vegetablecrops : Tomato, Brinjal, Chilli, Bhendi.
12. Centres of origin, distribution of species, wild relatives of Horticultural crops : Mango, Banana, Guava and Papaya.
13. Study of genetics of qualitative and quantitative characters. Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops.
14. Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability,abiotic and biotic stress tolerance and quality (physical, chemical, nutritional).

15. Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops
16. Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeon pea. Ideotype concept and climate resilient crop varieties for future.
17. Breeding for drought, salinity, waterlogging, high temperature and low temperature tolerant varieties in different crops.

Practical schedule

1. Floral biology - Types of inflorescence, flower structure of mononcots and dicots, floral formula and diagram.
2. Emasculation and hybridization techniques in Rice and Maize.
3. Emasculation and hybridization techniques in Sorghum, Pearl millet, Ragi.
4. Emasculation and hybridization techniques in Pigeon pea, urdbean, mung bean andcowpea.
5. Emasculation and hybridization techniques in Soybean, Groundnut and Sesamum.
6. Emasculation and hybridization techniques in Castor, Cotton and Tobacco.
7. Maintenance breeding of different Kharif crops - Rice, Maize, Sorghum, Redgram, Groundnut.
8. Maintenance breeding of different Kharif crops - Castor, Cotton and Tobacco.
9. Handling of germplasm and segregating generations by different methods - Pedigree, Bulkand Single seed descent methods.
10. Study of field techniques for varietal seed production and hybrid seed production in Rice,Maize.
11. Study of field techniques for varietal seed production and hybrid seed production in Sorghum and Redgram.
12. Study of field techniques for varietal seed production and hybrid seed production inCastor and Cotton.
13. Estimation of heterosis, inbreeding depression and heritability.
14. Layout of field experiments.
15. Study of quality characters, donor parents for different traits in different kharif crops.
16. Visit to seed production plots - AICRP plots for different field crops.
17. **Final practical examination.**

Course outcome

CO 1: The course will acquaint the student with importance of floral biology, participatory plant breeding.
CO 2: Knowledge about the objectives of breeding in Kharif crops.
CO 3: Knowledge about various breeding methods of Kharif crops.
CO 4: Knowledge about different hybridization techniques for Kharif crops.
CO 5: Knowledge about hybrid seed production for Kharif crops.

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5
CO1	2				
CO2				3	
CO3		2			
CO4					2
CO5			3		

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23 AEC- 301Agribusiness Management (1+1)

Learning objectives

- To impart skill, training, proficiency in decision making
- To enhance ability, to direct, to coordinate and control the work at all level so management for the farm graduates
- To use the knowledge and skill gained for starting new agri business and managing the business
- To study the marketing management
- To know the preparation of bankable projects

Theory

Unit I: Agribusiness and Management

Agribusiness – Definition – Nature and Scope – Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Structure of Agribusiness (input, farm and product sectors) - Agribusiness Management - Distinctive features of Agribusiness - Importance of Agribusiness in Indian Economy and New Agricultural Policy – Agri-value chain: Understanding primary and support activities and their linkages. Business environment – PEST and SWOT analysis. Management – Definition and Importance – Management functions – Nature. Management - Skills, Levels and functional areas of management. Forms of Business Organisation – Sole Proprietorship – Partnership –Private and Public Limited - Cooperatives.

Unit II: Management Functions

Management functions: Roles and activities, organizational culture. Planning – Definition – Types of plans (Purpose or Mission, Goals or Objectives, Strategies, Policies, Procedures, Rules, Programmes, Budget). Steps in planning and implementation – Characteristics of Sound plan. Objectives – MBO.Organizing – Principles of Organizing – Concept of Departmentation- Delegation- Centralization – Decentralization. Staffing – Concept – Human Resource Planning – Process. Directing – Concept – Principles – Techniques, Supervision. Motivation – Concept - Maslow's Need Hierarchy Theory – Types – Techniques. Communication – Definition and Process – Models – Types – Barriers. Leadership – Definition – Styles – Difference between leadership and management. Controlling – Concept - Steps – Types – Importance – Process.

Unit III: Functional areas of management

Functional areas: Operations, Human Resources, Finance and Marketing – Meaning and scope. Operations management: meaning – physical facilities – implementing the plan. Inventory control: meaning – inventory model – EOQ.

Unit IV: Marketing management

Financial management of agribusiness: Financial statements and their importance – Balance

sheet, Network analysis and Cash flow analysis. Marketing management: meaning, definition – market segmentation, targeting and positioning – 4Ps of marketing mix and marketing strategies. Consumer behavior analysis Product Life Cycle (PLC). Sales and distribution management. Pricing policy, various pricing methods.

Unit V: Preparation of bankable project

Project management: Definition – classification of agricultural projects – Project cycle: Identification, Formulation, Appraisal, Implementation, Monitoring and Evaluation. Project appraisal and evaluation of bankable projects – Pay Back Period, BCR, NPW and IRR. Agro-based industries – importance and need – Types of agro-based industries – institutional arrangements. Procedure to set up agro-based industries, constraints in establishing agro-based industries- Laws and policies related to agri-business in India.

Practicals

Study of agri-input markets: Seed, fertilisers, pesticides. Study of output markets: grains, fruits, vegetables, flowers. Study of product markets, retail trade commodity trading, and value added products. Study of financing institutions – Cooperative, Commercial banks,RRBs, Agribusiness Finance Limited, NABARD. Preparation of projects and Feasibility reports for agribusiness entrepreneur. Appraisal/evaluation techniques of identifying viable project – Non discounting techniques. Case study of agro-based industries. Trend and growth rate ofprices of agricultural commodities. Net present worth technique for selection of viable project. Internal rate of return.

Lesson plan

Theory schedule

1. Agribusiness – Nature and scope – Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Agribusiness – definition - Structure ofAgribusiness (input, farm and product sectors).
2. Agribusiness Management - Distinctive features of Agribusiness - Importance ofAgribusiness in Indian Economy – New Agricultural Policy. Agri-supply chain management and agri-value chain management – Forward and Backward linkages.
3. Business environment – analyzing the demographic, economic, socio-cultural,natural, technological and political-legal environment. Business environment – PEST and SWOT analysis.
4. Management – Definition and Importance – Management functions. Management –Roles,

Skills, Levels, Activities and organizational culture. Forms of Business Organisation – Sole Proprietorship – Partnership –Private and Public Limited - Cooperatives.
5. Management functions: Planning – Definition – Types of plans (Purpose or Mission, Goals or Objectives, Strategies, Policies, Procedures, Rules, Programmes, Budget). Steps in planning – Characteristics of Sound plan. Objectives – MBO
6. Organizing – Principles of Organizing – Organisation structure – Formal and Informal Organisation. Concept of Departmentation- Span of control – Authority and Responsibility – Concept and Meaning. Delegation- Centralization – Decentralization
7. Staffing – Concept – Human Resource Planning – Process. Directing – Concept – Principles – Techniques -ordering, leading, supervision.
8. Motivation – Concept - Maslow's Need Hierarchy Theory – Types – Techniques. Communication – Definition and Process – Models – Types – Barriers. Leadership – Definition – Styles – Difference between leadership and management.
9. Mid-semester examination
10. Controlling – Concept - Steps – Types – Importance – Process. Scheduling the work – controlling production in terms of quantity and quality – ISO standards – HACCP – TQM.
11. Functional areas of management: Operations management: meaning – operating system – physical facilities – implementing the plan. Inventory – meaning – types – inventory costs – inventory management – EOQ.
12. Financial management – financial statements – importance and need – Balance sheet, Net worth analysis and cash flow analysis. Marketing management: meaning, definition – market segmentation, targeting and positioning – 4Ps of marketing mix and marketing strategies.
13. Consumer buying behavior – factors influencing buying behavior – Buying decision process.
Sales and distribution management. Pricing policy- pricing method – pricing at various stages of marketing.
14. Project – meaning, definition – classification of agricultural projects – project cycle – Identification, formulation, appraisal, implementation, monitoring and evaluation. Project appraisal and evaluation techniques – undiscounted and discounted measures.
15. Agro-based industries – importance and need – types of agro-based industries – institutional arrangements for financing agro-based industries. Procedure to set up agro-based industries – constraints in establishing agro-based industries.
16. Business plan – components of business plan. Preparation of project reports for variousactivities in agriculture and allied sectors.
17. Laws and policies related to agri-business in India.

Practical schedule
1. Study of agro-input markets: Seeds, fertilizers and pesticides.
2. Visit to output markets – Regulated market/Uzhavarsandhai.
3. Visit to output markets – Shandies/flower market.
4. Visit to agro-processing unit to study retail trade, commodity trading and value addition.
5. Visit to Cooperatives to know their role in agriculture development.
6. Visit to Lead Bank/RRBs.

7. Visit to NABARD district office.
8. A case study of agro-based industries – preparation and presentation of project report.
9. Exercise on project evaluation techniques – Undiscounted measures.
10. Exercise on project evaluation techniques – Discounted measures.
11. Preparation of bankable project – I.
12. Preparation of bankable project – II.
13. Group presentation of projects – I.
14. Group presentation of projects – II.
15. Trend and growth rate in prices of agro-inputs.
16. Trend and growth rate in prices of agricultural commodities.
17. Final Practical examination

Course Outcome

CO1: To understand the opportunities in agribusiness sectors

CO2: To understand the marketing mix, and supply chain management in agribusiness.

CO3: To know the management functions and how to prepare agribusiness project.

CO4: To understand the components of business plan

CO5: To know the importance of financial management

CO-POMappingMatrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	2	-	-	-
CO2	3	-	2	-	-	-
CO3	-	-	3	-	-	2
CO4	2		-		2	-
CO5	-	2	-	-		-

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23 AEC- 302 Intellectual Property Rights 1+0

OBJECTIVES:

1. To provide knowledge to students about basic concepts of Intellectual Property Rights
2. To explain its relevance and importance in WTO and Agriculture
3. To know the composition of IPR
4. To understand the protection of plant varieties and farmers rights
5. To study the biological diversity acts

Theory

Unit 1: Introduction IPR

Introduction and meaning of intellectual property, brief introduction to GATT, WTO,TRIPS and WIPO, Treaties for IPR protection: Madrid Protocol, Berne Convention, Budapest Treaty, etc.

Unit 2: Components of IPR

Types of IP and legislations covering IPR in India: Patents, copy rights, trademark, industrial design, geographical indication, integrated circuits and trade secrets.

Unit 3 : Acts of IPR

Patents Act 1970, Patent systems in India, patentability, process and product patent, filing of patent, patent specifications, patent claims, patent opposition and revocation, infringement, compulsory licensing, Patent Cooperation Treaty, patent search and patent database.

Unit 4 : **Protection of Plant varieties (PPV &FR)**

Origin, history including a brief introduction to UPOV for protection of plant varieties, protection of plant varieties under UPOV and PPV & FR Act of India, Plant Breedersrights, registration of plant varieties under PPV & FR Act 2001, breeders, researcher andfarmers rights. Traditional knowledge - meaning and rights of TK holders.

Unit 5: Convention of Biological Diversity

Convention on Biological Diversity, International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

Lecture Schedule

1. Meaning, concepts and historical developments of Intellectual Property Rights.
2. Introduction to GATT, WTO, TRIPS and WIPO - role and importance
3. Treaties for IPR protection: Madrid Protocol, Berne Convention, Budapest Treaty, etc.
4. Types of IP and legislations covering IPR in India.
5. Patents, copy rights, trademark, industrial design,
6. Geographical indication and its importance, integrated circuits, trade secrets.
7. Patents Act 1970, Patent systems in India, patentability, process and product patent,

filing of patent.
8. Patent specifications, patent claims, patent opposition and revocation, infringement.
9. **Mid semester Examination**.
10. Compulsory licensing, Patent Cooperation Treaty, patent search and patent data base.
11. Origin, history including a brief introduction to UPOV.
12. Protection of plant varieties under UPOV and PPV & FR Act of India.
13. Plant Breeders rights, registration of plant varieties under PPV & FR Act 2001, breeders, researcher and farmers rights.
14. Traditional knowledge - meaning and rights of TK holders and IPR.
15. Convention on Biological Diversity, International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA),
16. Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.
17. Research collaborations in agriculture and role of IPR in protecting public institute inventions.

COURSE OUTCOMES:
CO1: Understand the impact of WTO in Agriculture
CO2: Understand the IPR acts in India
CO3: Understand the patent systems in India.
CO4: Understand the Protection of plant varieties under UPOV and PPV & FR ActofIndia
CO5: Know the features of biological diversity and benefit sharing

CO-POMAPPINGMATRIX

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	-	-	3	-	-	-
CO2	-	3	-	-	-	-
CO3	2	2	-	-	-	2
CO 4	-	-	2	-	-	-
CO5	-	1		1	-	-

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23 EXT -301 COMMUNICATION SKILLS AND PERSONALITYDEVELOPMENT (1+1)

Learning Objectives

- To improve the knowledge level of the students on various communication skills
- To improve listening skills and develop presentation skills
- To gain knowledge on personality development and team building
- To enhance skill on various group techniques
- To facilitate the student on effective management of time and stress.

Theory

Unit I: Communication skills

Communication: Meaning & process of communication. Forms of communication: verbal & non-verbal -meaning. Communication skills: Meaning, hard & soft skills – over view, Verbal & non- verbal communication: Verbal: oral &written skills Non- verbal communication skills: Concept, meaning, forms & functions, importance of non- verbal communication incommunication.

Unit II: Listening & Presentation skills

Listening skill- meaning, concept, types of listening, barriers in listening & Note Taking, Oral presentation skills: impromptu presentation & extempore presentation, Effective Public Speaking.

Unit III: Group discussion & Techniques

Group discussion: Procedure, principles, purpose, advantages & disadvantages, Small groupdiscussion techniques: Panel. Symposium, buzz session, syndicate, conference, seminars, workshop, debate and lecture. Writing of technical articles, field diary & lab record, indexing, footnote &bibliographic procedures

Unit IV: Personality development & Team Building

Personality development: Meaning, definition & overview of personality traits, Questioning skills Attitude: Meaning, functions of attitude, developing positive attitude, Team building: working in team

Unit V: Time & Stress Management

Time management: Importance & role in personality development & time management Techniques, Conflict management: Meaning. Concept, causes of conflict & managing conflicts, Stress management: Meaning, definition, management of stress and current stream of thoughts.

Practicals

Simulation exercise to acquire various communication skills, Practical exercises - Group discussion, Panel discussion, Debate, Exercise on writing of technical articles, Identification ofpersonality types analysis of attitude & student feedback, Management games, Simulation exercise - time management, conflict management & Stress management. Creativity, acquisition of interview skills.

Lesson Plan

Theory Schedule

1. Communication: Meaning & process of communication. Forms of communication: verbal & non-verbal -meaning.
2. Communication skills: Meaning, hard & soft skills – over view
3. Verbal & non- verbal communication: Verbal: oral &written skills Non- verbal communicationskills: Concept, meaning, forms & functions, importance of non- verbal communication in communication
4. Listening skill- meaning, concept, types oflistening, barriers in listening & Note Taking
5. Oral presentation skills: impromptu presentation & extempore presentation

6. Effective Public Speaking
7. Group discussion: Procedure, principles, purpose, advantages & disadvantages
8. Small group discussion techniques: Panel. Symposium, buzz session, syndicate, conference, seminars, workshop, debate and lecture
9. **Mid Semester Examination**
10. Writing of technical articles, field diary & lab record, indexing, footnote & bibliographic procedures
11. Personality development: Meaning, definition & overview of personality traits
12. Questioning skills
13. Attitude: Meaning, functions of attitude, developing positive attitude
14. Team building: working in team
15. Time management: Importance & role in personality development & time management Techniques
16. Conflict management: Meaning. Concept, causes of conflict & managing conflicts
17. Stress management: Meaning, definition, management of stress and current stream of thoughts.

Practical Schedule

1. Simulation exercise for non- verbal communication& students feedback
2. Listening & note taking & student feed back
3. Exercise on reading & comprehension & students feedback
4. Group discussion – Practical exercises
5. Panel discussion – Practical exercises
6. Debate – Practical exercises
7. Exercise on writing of technical articles& students feedback
8. Identification of personality types- role play & psychological tests & students feedback
9. Identification of personality types- role play & psychological tests & students feedback
10. Attitude-Role play- analysis of attitude & student feedback
11. Working in learners- management games
12. Simulation exercise on time management
13. Simulation exercise on conflict management
14. Interview Skills – Mock interviews
15. Simulation exercise on creativity
16. Simulation exercise on physical and mental stress.
17. **Practical Examination**

Course Outcome

At the end of the course students will be able to
CO 1: Organize and conduct of various group techniques
CO 2: Students will be able to acquire various personality traits
CO 3: Develop hard and soft skills
CO 4: Gain knowledge on conflict management
CO 5: Acquire skill on public speaking

Co-Po Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	0	3	0	0	3
CO2	0	1	3	1	1	3
CO3	1	1	3	1	0	3
CO4	0	0	3	0	1	3
CO 5	1	1	3	0	0	3

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23 COM 301 AGRI INFORMATICS (1+1)

Learning objectives

- Give students an in-depth understanding of why computers are essential components in business, education and society.
- Introduce the fundamentals of computing devices and reinforce computer vocabulary, particularly with respect to personal use of computer hardware and software, the Internet, networking and mobile computing.
- Provide hands-on use of Microsoft Office applications Word, Excel, Access andPowerPoint. Completion of the assignments will result in MS Office applications knowledge and skills.
- To get familiar with basics of the Internet Programming.

Theory

Unit I: Introduction to Computers:

Introduction to Computers, Definition, Advantages & Limitations Anatomy of Computers – Components of Computers and its functions - Overview of Input devices of Computer Memory concepts, Units of memory - Operating System Definition and Types of operating systems.

Unit II: Microsoft Office:

MSWORD: Creating, Editing, Formatting a document and saving a document – Features ofFile, Edit and Format menus.

MSEXCEL: Data Presentation, Data presentation, interpretation and graph creation -Statistical analysis, mathematical expressions with MSEXCEL

MSACCESS: Database, concepts and types - Uses of DBMS in Agriculture; creatingdatabase.

Unit III: Internet& Programming Languages:

Internet - World Wide Web (WWW): Concepts and components - Programming Languages: Introduction to different computer programming languages - Programming Languages: Concepts and standard input/output operations.

Unit IV: E-Agriculture:

E-Agriculture, concepts and applications, Use of ICT in Agriculture - IT application: Computer-controlled devices (automated systems) for Agri-input management - Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc;

Unit V: Applications in Agriculture:

Decision support systems, concepts, components and applications in Agriculture, AgricultureExpert System, Soil Information Systems etc for supporting Farm decisions.

Lesson plan

Theory Schedule

1. Introduction to Computers, Anatomy of Computers.
2. Input and Output devices, Units of memory, Hardware, Software and Classification of Computers.
3. Memory concepts
4. Operating System, Types of operating system.
5. Booting sequence of operating system, DOS, Windows, Unix, VIRUS.

6. MS Office word, Creating, Editing, Formatting a document and Saving a document.
7. MS Excel Data Presentation, Data presentation, interpretation and graph creation.,
8. MS Access Concepts of Database, Creating Database.
9. Internet - World Wide Web (WWW)
10. **Mid Semester Examination**
11. Programming Languages, Computer programming languages.
12. e-Agriculture.
13. ICT in Agriculture.
14. IT application.
15. Smartphone Apps in Agriculture.
16. Applications in Agriculture.

Practical schedule

1. Study of Computer Components and accessories– Booting of Computer and its ShutDown.
2. Practice of some fundamental DOS commands – TIME, DATE, DIR, MD, CD, RD, DEL, TREE, COPY, VOL and LABEL.
3. Introduction of different operating systems such as windows, Unix, Linux.
4. Practicing WINDOWS Operating System – Use of Mouse, Title Bar, Minimise, Maximumand Close Buttons, Scroll Bars, Menus and Tool Bars, Creating Folders, COPY and PASTE functions and File Management.
5. MSWORD – creating, editing and presenting a scientific Document.
6. MS POWER POINT – creating, editing and presenting a scientific Document.
7. MSEXCEL: Creating a spreadsheet, writing expressions, Entering formula expressionthrough the formula tool bar and use of inbuilt statistical, mathematical functions.
8. MSEXCEL: creating graphs, analysis of scientific data-Data analysis-t-test, Regression, ANOVA.
9. MSACCESS: Creating Database, preparing queries and reports.
10. MSACCESS: Demonstration of Agri-information system.
11. Introduction to World Wide Web (WWW) and its components.
12. Introduction of programming languages.
13. HTML: Creation of scientific website.
14. Internet: Presentation and management agricultural information through web.
15. Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CropSyst/ Wofost.
16. Introduction of Geospatial Technology for generating valuable information for Agriculture.

Course Outcome

At the end of the course students will be able to

CO 1: Describe the usage of computers and why computers in society.
CO2: Analyse common business problems using appropriate
CO 3: Learn categories of programs.
CO 4: system software and applications.
CO 5: Information Technology applications and systems.

CO - PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	0	3	0	0	3
CO2	0	1	3	1	1	3
CO3	1	1	3	1	0	3
CO4	0	0	3	0	1	3
CO5	1	1	3	0	0	3

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23 ECPAT 302 ANTAGONISTIC FORMULATIONS (2+1)

Learning objectives

- To study about biological control and its significance.
- To study mechanisms of action of antagonistic organisms.
- To study about factors governing biological control
- To study aout commercial production of antagonistic formulations
- To study about the delivery systems of antagonists and management of soil borne andfoliar diseases.

Theory

Unit I

History and concepts of biological control, significance, merits and demerits of disease management with antagonists- antagonistic organisms- mycorrhizal associations, suppressiveand conductive soils – general and specific suppression.

Unit II

Mechanisms of actions of antagonistic organisms and its relevance in biological control competition, antibiosis, lysis, hyper parasitism and Induced Systemic Resistance - ISR-SAR - rhizosphere colonization, competitive saprophytic ability, hypovirulence.

Unit III

Factors governing biological management of crop diseases, role of physical environment, agroecosystem, and cultural practices in biological control of pathogens- Soil fungistasis, influence of root exudates on establishment of antagonists – Effect of agrochemicals and fertilizers on antagonists – comparative approaches to biological control of plant pathogens byresident and introduced antagonists.

Unit IV

Commercial production of antagonists. Antagonists available in market. Quality control system of biocontrol agents.

Unit V

Delivery systems of antagonists, special methods of delivery systems - Control of soil-borne and foliar diseases. Compatibility of bioagents with agrochemicals and other antagonistic microbes.

Lesson plan

Theory schedule

1. Introduction of biological control
2. Important milestones of biological disease management
3. Concepts of biological disease management using antagonists

4. Merits and demerits of biological control
5. Suppressive and conductive soils
6. Mode of action of fungal antagonists
7. Mode of action of bacterial antagonists
8. Factors affecting antagonistic organisms
9. Influence of soil moisture, temperature and soil pH on growth of antagonists
10. Isolation and identification of fungal antagonists
11. Isolation and identification of bacterial antagonists
12. Estimation of fungal antagonists potential in soil
13. Estimation of bacterial antagonists potential in soil
14. Competitive saprophytic ability
15. Soil fungistasis
16. Influence of root exudates on establishment of antagonists
17. **Mid semester examination**
18. Mass multiplication of fungal antagonists
19. Mass multiplication of bacterial antagonists
20. VAM Fungi
21. Identification of carrier materials for formulation for fungal antagonists
22. Identification of carrier materials for formulation for bacterial antagonists
23. Methodology for formulation of fungal antagonists
24. Methodology for formulation of bacterial antagonists
25. Assessment of shelf-life period of antagonists
26. Different methods of storage systems for antagonists
27. Assessment of quality control of antagonists
28. Delivery system of fungal antagonists
29. Delivery system of bacterial antagonists
30. Special methods of antagonists application
31. Commercial formulation of biocontrol agent
32. Commercial formulation of biocontrol agent
33. Antagonists formulations available in market
34. Compatibility of bioagents with agrochemicals and other antagonistic microbes.

Practicals

Rhizophere soil – isolation and assessment of antagonists – methods of testing in vitroantagonism – assay of competitive saprophytic ability, antibiotics production, siderophores production– isolation of mychorriza and establishing its biocontrol potentiality – compatibility of agrochemicals with bio inoculants

Practical schedule

1. Isolation of fungal antagonistic organisms from rhizosphere soil
2. Isolation of bacterial antagonistic organisms from rhizosphere soil
3. Purification of fungal antagonistic organisms
4. Purification of bacterial antagonistic organisms
5. Methods of testing in vitro antagonism
6. Methods of testing in vitro antagonism
7. Assay of competitive saprophytic ability
8. Mass multiplication of *Trichoderma*
9. Mass multiplication of *Pseudomonas*
10. Mass multiplication of *Bacillus*
11. Mass multiplication of VAM fungi
12. Preparation of different formulations of selected antagonistic organisms

13. Quality parameters of antagonistic organisms
14. Application of antagonists against pathogen in vitro and in vivo conditions
15. Delivery systems of antagonist
16. Compatibility of agrochemicals with bio inoculants
17. Record certification

Course outcome

CO 1: Gain knowledge on concepts of biological control and its significance.
CO 2: Gain knowledge on operational mechanisms and its relevance in biological control.
CO 3: Gain knowledge on factors governing biological control.
CO 4: Gain knowledge on formulations of antagonistic organisms against diseases.
CO 5: Gain knowledge on Commercial production of antagonists and their delivery systems

CO –PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	1	1	3	2	2	-
CO 2	1	1	3	2	2	-
CO 3	1	1	3	2	2	-
CO 4	1	1	3	2	3	-
CO 5	1	1	3	2	2	-

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23 ECAGM 301 BIOPESTICIDES AND BIOFERTILIZERS (2+1)

Learning Objectives

- To know the concepts and potential of biopesticides and biofertilizers
- To acquire the basic knowledge about the biofertilizers and biopesticides.
- To impart knowledge on theoretical and practical aspects of biopesticides and biofertilizers production and usage.
- To understand and develop skills about the production technology of biopesticides and biofertilizers
- To create awareness about the importance of biopesticides and biofertilizers in sustainablecrop production.

Theory

Unit 1: HISTORY AND DEVELOPMENT OF BIOPESTICIDES.

History and concept of biopesticides, importance-scope and potential of biopesticides, Definition, concept and classification of biopesticides viz., entomopathogens, Botanical pesticides. Botanicals and their uses.

Unit 2: MASS PRODUCTION OF BIOPESTICIDES.

Mass production technology of biopesticides-virulence-pathogenicity and symptoms of entomopathogens-biocontrol of nematodes- uses of biopesticides-method of application of biopesticides. Quality control and limitations in production

Unit 3: IMPORTANCE OF BIOFERTILIZERS

Biofertilizer-Introduction, scope, concept and development. Characteristic features of bacterial biofertilizers, *Azospirillum*, *Azotobacter*, *Pseudomonas*, *Rhizobium* and *Frankia* -Fungal biofertilizers-current scenario-list of cyanobacterial biofertilizers- Anabaena, Nostoc- AM mycorrhiza and ectomycorrhiza

Unit 4: MASS PRODUCTION OF BIOFERTILIZER.

Phosphate solubilizing biofertilizer. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology- strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers.

Unit 5: FORMULATIONS AND DELIVERY SYSTEM OF BIOFERTILIZERS

Formulation–types–carrier based and liquid inoculants. Equipment's–tangential flow filtration (TFF)-centrifugation-freeze drying. Application technologies- dosage, method and time of application of biofertilizers for different crops. FCO specifications and quality control of biofertilizers.

Practicals

Isolation and purification of important biopesticides. *Trichoderma, Pseudomonas Bacillus, Metarhizium* etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in near by area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities field condition. Quality control of biopesticides.

Isolation and purification of *Azospirillum, Azotobacter, Rhizobium*, P-Solubilizers andcyanobacteria. Mass multiplication and inoculums production of biofertilizers. Isolation of AM fungi wet sieving method and sucrose gradient method. Mass production of AM inoculants.

Lesson Plan

Theory Lecture Schedule

1. History and concept of biopesticides
2. Importance of biopesticides
3. Classification of biopesticides.
4. Botanical pesticides and their uses.
5. Mass production technology of biopesticides
6. Virulence and Pathogenicity of biopesticides
7. Symptoms of entomopathogens
8. Biocontrol of nematodes.
9. Microbial management of pests.
10. Mode of entry and mode of action biopesticides.Uses of biopesticides

11. Method of application of biopesticides.
12. Quality control of biopesticides
13. Limitations in biopesticides production.
14. Introduction to biofertilizer.
15. Scope and development of biofertilizers.
16. Bacterial biofertilizers.
17. **Mid semester Examination.**
18. Current scenario of biofertilizers
19. Algal biofertilizers.
20. Fungal biofertilizers
21. Phosphate solubilizing biofertilizers.
22. Potassium releasing biofertilizers and their mechanism
23. Production technology of biofertilizers.
24. Strain selection
25. Sterilization, growth media and fermentation.
26. Formulations in biofertilizers
27. Techniques in carrier and liquid based biofertilizers.
28. Equipment's in biofertilizer production.
29. Equipment'stangential flow filtration (TFF) centrifugation-freeze drying.
30. Method of application of biofertilizers.
31. Dosage and time of application of biofertilizers for different crops.
32. FCO specifications of biofertilizers
33. Quality control of biofertilizers.
34. Preparation of biofertilizers projects

Practical Schedule

1. Isolation and purification of *Trichoderma sp*.
2. Isolation and purification of *Pseudomonas* and *Bacillus sp*.
3. Isolation and purification of *Beauveria bassiana*.
4. Isolation and purification of Metarhizium
5. Identification of important botanicals.
6. Visit to biopesticide laboratory in nearby area.
7. Field visit to explore naturally infected cadavers.
8. Identification of entomopathogenic entities in field condition.
9. Quality control of biopesticides.
10. Isolation and purification of *Azospirillum*,
11. Isolation and purification of *Azotobacter*,
12. Isolation and purification of *Rhizobium*,
13. Isolation and purification of P-solubilizers.
14. Mass production of bacterial biofertilizers.
15. Isolation of AM fungi – wet sieving method.
16. Mass production of AM inoculants.
17. **Final practical Examination**.

Course outcome:

CO 1: They will understand about the fundamental aspects, history,concepts, importance-scope and potential of biopesticides.

CO 2: They will acquire basic knowledge in mass production technology and quality control of biopesticides

CO 3: Students will gain knowledge on individual characteristics features of bacterial andfungal biofertilizers.

CO 4: Students will study and have practical knowledge of mass production of biofertilizers.
CO 5: Students will study and understand the recent biofertilizer formulations and qualitycontrol of biofertilizers

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5
CO1	2	-	1	1	1
CO2	3	1	-	2	3
CO3	1	-	3	1	2
CO4	-	2	2	-	-
CO5	1	2	3	2	1

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23 ECGPB 302 - COMMERCIAL PLANT BREEDING (2+1)

Learning objectives

- To expose the students to learn basic and applied principles of plant breeding.
- To help the students to understand the quality seed production of hybrids.
- To learn post harvest seed handling techniques.
- To impart knowledge on seed quality testing and marketing.
- To know the importance of seed certification.

Theory

Unit I: Reproductive systems in crop plants

Objectives and role of plant breeding - modes of reproduction - sexual and asexual - self and cross pollination - significance of fertilization. Self incompatability – classifications - mechanisms - application – measures to overcome and limitations. Male sterility systems – Introduction and classification – GMS, CMS and CGMS – inheritance and application- TGMS, PGMS, Gametocides, Transgenic male sterility and applications - Alternative methods: production of haploids and Tissue culture techniques- Biotechnological tools.

Unit II: Hybrid Seed Production

Advances in hybrid seed production of self and cross pollinated crops - rice, maize, sorghum, pearl millet, red gram, sunflower, sesame, castor, brassica, cotton and vegetables.

Unit III: Post harvest seed handling techniques

Seed drying - seed processing - importance - seed cleaning and grading - seed quality enhancement – Seed packaging and storage.

Unit IV: Seed quality testing and marketing

Seed quality assessment – genetic purity test - molecular markers. Seed marketing-policies and demand.

Unit V: Seed legislation and certification

Importance of seed quality regulation-seed act and rules – seeds control order 1983 and New Seed Bill, 2004 and seed labelling-IPR issues in commercial plant breeding. DUS testing – registration of varieties under PPV & FR Act. Seed certification – varietal release and notification systems in India.

Practicals

Pollination and reproduction methods in crop plants - Emasculation and pollination techniques in self and cross pollinated crops – Hybrid seed production techniques in self and cross pollinated crops using A/B/R and two line systems – Hybrid seed production techniques in cereals, pulses, oilseeds, fibre and vegetable crops – Seed drying and storage structures in quality seed management – Seed quality assessment test – Seed quality enhancementtechniques – PPV & FR Act and IPR issues in commercial plant breeding.

Lesson Plan

Theory Lecture Schedule

1. Objectives of plant breeding – modes of plant reproduction.
2. Classification of crops based on pollination.
3. Self – incompatability – classification – mechanisms – applications.
4. Male sterility – classifications – CMS, GMS and CGMS systems in self and crosspollinated crops.
5. Two line breeding systems in self and cross pollinated crops.
6. Alternative strategies for the development of the line and cultivars: Haploid inducer andtissue culture techniques.
7. Alternative strategies for the development of the line and cultivars: Biotechnological tools.
8. Advances in hybrid seed production of rice.
9. Advances in hybrid seed production of maize.
10. Advances in hybrid seed production of sorghum.
11. Advances in hybrid seed production of pearl millet.
12. Advances in hybrid seed production of redgram.
13. Advances in hybrid seed production of sunflower.
14. Advances in hybrid seed production of sesame.
15. Advances in hybrid seed production of castor.
16. Advances in hybrid seed production of brassica.
17. **Mid semester examination**
18. Advances in hybrid seed production of cotton.
19. Advances in hybrid seed production of vegetables.
20. Seed drying, seed processing – importance.
21. Seed cleaning and grading.
22. Seed quality enhancement techniques.
23. Seed packaging and storage.
24. Seed quality assessment – genetic purity test and molecular markers.
25. Seed marketing – structure and organization.
26. Seed demand and forecasting.
27. Importance of seed quality regulation – seed act and rules.
28. Importance of seed quality regulation – seed rules
29. Seed certification and labelling.
30. Seed control order, 1983
31. New Seed Bill, 2004.

32. IPR issues in commercial plant breeding.
33. DUS testing and registration of varieties under PPV and FR Act.
34. Varietal release and notification systems in India.

Practical Schedule

1. Pollination and reproduction in crop plants.
2. Emasculation and pollination techniques in various crops.
3. Techniques of seed production in self and cross pollinated crops using A, B, R and twoline systems.
4. Hybrid seed production techniques in cereals.
5. Hybrid seed production techniques in pulses.
6. Hybrid seed production techniques in oilseeds.
7. Hybrid seed production techniques in fibre.
8. Hybrid seed production techniques in vegetables.
9. Seed drying structures in quality seed management.
10. Seed storage structures in quality seed management.
11. Genetic purity test.
12. Varietal identification using molecular markers.
13. Seed quality enhancement techniques.
14. PPV & FR Act and IPR issues in commercial plant breeding.
15. Visit to seed production plot.
16. Visit to seed production plot.
17. **Final practical examination.**

Course outcome

CO 1: To enrich different types of male sterility system
CO 2: To provide knowledge on reproductive system in field and horticultural crops.
CO 3: Will acquire knowledge on hybrid seed production technologies for commercial seed production.
CO 4: Help to assess the seed quality and analyse the seed marketing.
CO 5: will know about seed rules, act and certification procedures to empower them tobecome entrepreneur.

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	1
CO2	3	2	3	2	3
CO3	2	3	2	1	2
CO4	1	2	3	2	1
CO5	3	1	2	3	2

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23 ECHOR 301- HI-TECH. HORTICULTURE 3 (2+1)

Learning objectives

- To impart knowledge on Modern Nursery techniques of Horticulture crops.
- To impart knowledge on the protected cultivation of horticultural crops.
- To sensitize the students on crop management of horticultural crops.
- To impart knowledge in precision horticultural techniques.
- To gain knowledge on mechanization in horticultural crops

Theory

Unit I: Modern Nursery techniques

Introduction & importance; Modern Nursery techniques –media- micro grafting, micro propagation of horticultural crops - Field preparation and planting methods.

Unit II: Protected Cultivation

Importance and methods of Protected Cultivation-Advantages, Climate control – Temperature,Relative Humidity, transpiration, ventilation – heating and cooling systems – Co2 enrichment –light regulation etc., methods and techniques- Micro irrigation systems and its components

Unit III: Crop Management

High density planting, UHDP, meadow orcharding, Canopy management-pollarding, rejuvenation of senile orchards, high density orcharding –Fertilization - EC, pH-based fertilizer scheduling, Leaf Nutrient analysis, nutrient deficiency symptoms and its remedy, water solublefertilizers-automation- mulch films-weed mat- hydroponics – NFT – aeroponics.

Unit IV: Precision Horticulture

Concept of Precision Horticulture: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA), mobile mapping system and its application in precision farming – role of computers in developing comprehensive systems needed in site specific management (SSM) – IOT and AI Tools, geo referencing and photometric correction-Application in Horticultural crops.

Unit V: Mechanization in Horticulture

Mechanized seed sowing, grafting, transplanting- Mechanization in Pruning, tree pruners, Hedge trimmers, Brush cutters, Mowers, Mechanized sprayers - Drone sprayers, Aerial sprayers, Mechanization in harvesting – Fruit harvester, Tree shakers, washing units, Sizeand colour graders – Mechanization in Packaging, Corking, Bottling and Labelling and QR Coding and Bar coding and Mechanized supply chain management of produce etc. Current stream of Thoughts.

Practicals

Nursery techniques, Mat nursery, Protrays, Micro grafting, Micro propagation, planting systems, Types of protected chambers, poly house, shade house, mist chamber, low tunnel, climate control tools, Micro irrigation- Sprinklers, drippers, foggers etc., High density planting, UHDP, Pruning methods, Pollarding, Fertilization methods-water soluble forms, Leaf nutrient analysis, foliar vs soil application, hydroponics , remote sensing tools, GIS, DGPS, VRA and their application in Horticultural crops. Mechanized seed sowing, transplanting, pruning, spraying, harvesting, grading and labelling, QR and Bar coding etc.

Lesson Plan

Theory Schedule

1. Hi-tech culture- overview – global scenario of horticultural Crops.
2. Nursery technology poly-tunnels, types of benches and containers.
3. Different media for growing nursery.
4. Micro propagation of horticultural crops.
5. Modern field preparation and planting methods.

6. Protected Cultivation-Advantages of Protected cultivation, various chambers.
7. Climate control - methods and techniques.
8. Micro irrigation systems and its components.
9. HDP, UHDP, Meadow Orcharding.
10. EC & PH based fertilizer scheduling -Water soluble fertilizers.
11. Weed management and weed mat.
12. Hydroponics and Aeroponics
13. Mid semester Examination
14. Precision horticulture, Principles and concepts,
15. Remote sensing and Robotics
16. Geographical Information System (GIS) and its application.
17. Differential Geo-positioning System (DGPS).
18. Variable Rate applicator (VRA).
19. Role of IOT and AI in Horticulture crops
20. Precision equipment's, computers and robotics in precision farming.
21. Precision farming technology for Horticultural crops.
22. Mechanized seed sowing and grafting
23. Pruning equipment's, trimmers, brush cutters and mowers
24. Modern spraying methods-Drones, aerial sprayers.
25. Mechanization in harvesting -Fruit harvester, Tree shaker.
26. Computerized Graders-Size and colour sensors.
27. Mechanized packaging units.
28. Bottling and corking methods.
29. QR and Bar coding – Role, Importance and methods

Practical Schedule

1. Modern techniques of nursery production.
2. Media and Micro propagation methods.
3. Micro grafting methods and its advantages.
4. Different Types of Protected structures.
5. Climate control in Poly- house-Concepts and Techniques.
6. Micro Irrigation Methods-Design, layout and installation methods.
8. HDP and UHDP –Advantages and its Application in modern orchards.
9. Leaf Nutrient analysis, EC, PH based fertilizer scheduling.
10. Nutrient Deficiency symptoms –its cause and remedy
11. Weed management-weed mat
12. Remote sensing - Role of GIS, DGPS, VRA etc.
13. IOT and AI in horticultural crops
14. Mechanized seed sowing, grafting, transplanting
15. Mechanization in Pruning, tree pruners, Hedge trimmers, Brush cutters, Mowers
16. Mechanized sprayers, Harvesting and Packaging methods
17. Practical Examination.

Course Outcome:

CO 1: The students will acquire knowledge on the Modern Techniques in NurseryTechnologies.
CO 2: The students will be gaining knowledge on Protected cultivation of Horticultural crops.
CO 3: Students will be able to understand and acquire knowledge on Canopy managementand crop management techniques.
CO 4: Students will be able to gain knowledge on Precision Horticulture.CO 5:
The students will know about the Mechanization in Horticulture.

CO-PO Mapping matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	2	2	2	0
CO 2	3	3	2	2	2	2
CO 3	3	3	2	2	2	2
CO 4	3	3	2	2	2	2
CO 5	3	0	2	2	2	3

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23IKS201 INDIAN KNOWLEDGE SYSTEM 2(1+1)

Course Objectives:

The course design seeks to address the following issues:

• To introduce to the students the overall organization of IKS

• To develop an appreciation among the students the role and importance of Veda, Vedāṅgas, Upa Vedas and Purāṇas

• To show case the multi-dimensional nature of IKS and their importance in the contemporary society • To motivate the students to take up a detailed study of some of these topics and explore their application potential

Course Outcomes:

CO1: Explain the historicity of Indian Knowledge System and the broad classification of Indian philosophical systems

CO2: Explain the potential of Sanskrit in natural language processing

CO3: Explain the features of Indian numeral system and its role in science & technology advancement

CO4: Illustrate the basic elements of the Indian calendar and the components of Indian Panchanga

CO5: Outline the science, engineering & technology heritage of ancient and medieval India

Syllabus

Unit I: Introduction to Indian Knowledge System (IKS), Definition, Concept and Scope of IKS (4)

Definition, Concept and Scope of IKS
IKS based approaches on Knowledge Paradigms
IKS in ancient India and in modern India

Unit II: IKS and Indian Scholars, Indian Literature (8)

1. Philosophy and Literature (Maharishi Vyas, Manu, Kanad, Pingala, Parasar, Banabhatta, Nagarjuna and Panini)
2. Mathematics and Astronomy (Aryabhatta, Mahaviracharya, Bodhayan, Bhashkaracharya, Varahamihira and Brahmgupta)
3. Medicine and Yoga (Charak, Susruta, Maharishi Patanjali and Dhanwantri)
4. Sahitya (Vedas, Upvedas, Upavedas (Ayurveda, Dhanurveda, Gandharvaveda)
5. Puran and Upnishad) and shad darshan (Vedanta, Nyaya.Vaisheshik, Sankhya, Mimamsa, Yoga, Adhyatma and Meditation)
6. Shastra (Nyaya, vyakarana, Krishi, Shilp, Vastu, Natya and Sangeet)

Unit III: Indian Traditional/tribal/ethnic communities, their livelihood and local wisdom (6)

1. Geophysical aspects, Resources and Vulnerability
2. Resource availability, utilization pattern and limitations
3. Socio-Cultural linkages with Traditional Knowledge System
4. Tangible and intangible cultural heritage.

Unit IV: Unique Traditional Practices and Applied Traditional Knowledge (8)

1. Myths, Rituals, Spirituals, Taboos and Belief System, Folk Stories, Songs, Proverbs, Dance, Play, Acts and Traditional Narratives
2. Agriculture, animal husbandry, Forest, Sacred Groves, Water Mills, Sacred Water Bodies, Land, water and Soil Conservation and management Practices
3. Indigenous Bio-resource Conservation, Utilization Practices and Food Preservation Methods, Handicrafts, Wood Processing and Carving, -Fiber Extraction and Costumes
4. Vaidya (traditional health care system), Tantra-Mantra, Amchi Medicine System
5. Knowledge of dyeing, chemistry of dyes, pigments and chemicals

Unit V: Protection, preservation, conservation and Management of Indian Knowledge System (4)

1. Documentation and Preservation of IKS
2. Approaches for conservation and Management of nature and bio-resources
3. Approaches and strategies to protection and conservation of IKS

IV Semester

23 AGR 303 FARMING SYSTEMS AND ORGANIC FARMING FOR SUSTAINABLE AGRICULTURE (2+1)

Learning objectives

- Aims at incurring knowledge on various aspects of organic farming and its importance inpresent world scenario and its impact on environment and soil health
- To impart knowledge on varied farming enterprises and their integration for sustainable productivity
- Students will gain knowledge about organic inputs for sustainable agriculture
- To develop skills on managing farm resource and improving nutritional standards for betterment of health
- Students will get exposure on innovative organic farm products and certification

Theory

Unit I: Farming System

Farming System-scope, importance, and concept. Types and systems of farming system and factors affecting types of farming. Farming system components and their maintenance. Interaction between different enterprises with cropping – scope and advantages of integrated farming system – Integrated farming system models for different agro eco – systems. Indices for evaluation of farming systems.

Unit II: Cropping system

Cropping system – definition, principles, concepts, various types of cropping systems. Interactions between different cropping systems. Cropping scheme – determinants – principles. Efficient cropping system and their evaluation. Allied enterprises and their importance. Tools for determining production and efficiencies in cropping and farming system

Unit III: Resource Management

Sustainable agriculture-problems and its impact on agriculture - indicators of sustainability - adaptation and mitigation. Conservation agriculture strategies in agriculture - HEIA, LEIA and LEISA and its techniques for sustainability. Resource use efficiency and optimization techniques - Crop residue management, resource management under constraint situations. Resource cycling and flow of energy in different farming system and environment.

Unit IV: Organic farming for sustainable Agriculture

Organic farming- concepts, principles and its scope in India- organic ecosystem and their concepts. Organic nutrient resources and its fortification. Restrictions to nutrient use in organicfarming. Choice of crops and varieties in organic farming. Organic waste recycling methods. Indigenous Technical Knowledge (ITK) in organic agriculture. Fundamentals of insect, pest, disease and weed management under organic mode of production.

Unit V: Organic certification and Labelling

Operational structure of NPOP - Certification process and standards of organic farming.Processing – labelling – economic considerations and viability - marketing and export potential of organic products-Initiatives taken by Government (central/state) - NGOs and otherorganizations for promotion of organic agriculture. Current stream of thoughts.

Practicals

Visit of IFS model in different agro-climatic zones of nearby state university/ institutes and farmer's field. Visit of organic farms to study the various components and their utilization. Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis. Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management. Cost of organic production system. Post harvest management- Quality aspect, grading, packaging and handling.

Lesson plan

Theory Schedule

1. Modern agriculture- problems and its impact on agriculture and resources – Sustainable agriculture
2. Indicators of sustainability- adaptation and mitigation.
3. Farming System-scope, importance, and concept – related terminology.
4. Types and systems of farming system and factors affecting types of farming.
5. Farming system- components and their importance and maintenance.
6. Cropping systems and patterns-multiple cropping system- Efficient cropping system andtheir evaluation.
7. Cropping scheme, principles and factors influencing cropping scheme competitive and complementary interactions in different cropping system (Light, water, nutrient and weed)
8. Integrated farming system-historical background-objectives and characteristics.
9. Components of IFS and its advantages - Site specific development of IFS model fordifferent agro-climatic zones in rainfed, irrigated and irrigated dry conditions
10. Allied enterprises and their importance - complementary and competitive interactions -Dairy, Sheep and Goat rearing – Aquaculture
11. Allied enterprises and their importance- complementary and competitive interactions-Poultry, Apiculture, Sericulture and Mushroom cultivation.
12. Tools for determining production and efficiencies in cropping and farming system.
13. Conservation agriculture - strategies – soil degradation, water availability, climate changeand its effect on agriculture, adaptation and mitigation
14. Management of natural resources -HEIA, LEIA and LEISA and its techniques forsustainability.
15. Resource use efficiency and optimization techniques - Resource cycling and flow ofenergy indifferent farming system.
16. Farming system and environment- Conservation of natural resources and maintenance of biodiversity.
17. **Mid semester Examination**
18. Organic farming- Definition- principles and its status and scope in India. Milestones inorganic farming movement in the World and in India - its comparison with conventional system.
19. Organic ecosystem and their concepts - Soil and water management- soil organic matterand humus- their physical, chemical and biological properties.
20. Choice of crops and varieties in organic farming – Conversion of soil to organic farming.
21. Organic nutrient management-types of organic manures - biofertilizers- efficient use oforganic sources of nutrients.
22. Organic waste recycling methods and techniques and ITK technology of organicagriculture and its importance
23. Organic nutrient resources and its fortification- Constraints of nutrient use in organicfarming.
24. Weed management in organic farming – cultural- mechanical- biological – bio herbicides.
25. Pest management in organic farming- different components – parasites- predators,microbial pesticides (Bio) -resistant varieties and pheromones.
26. Disease management in organic farming – cultural, mechanical, biological- bio fungicides.
27. Organic production package of important field crops- Rice, sorghum, finger millet, cotton, groundnut and soybean.
28. Operational structure of NPOP- Accreditation agencies in the World and India- Role of APEDA and IFOAM
29. Accreditation- standards- procedure of accreditation
30. Certification-Agencies/Organizations. – standards- procedure for certification.
31. Post- harvest - processing - labelling and sanitation procedures in organic farming.

32. Marketing and export potential of organic products- Opportunities and Constraints
33. Impact of organic farming on food security, environment and health.
34. Initiatives taken by Government (Central/State) - NGOs and other organizations forpromotion of organic agriculture and current stream of thoughts.

Practical Schedule

1. Components of organic ecosystem – soil, water, environment and biodiversity
2. Organic recycling – compost, coirpith compost, sugarcane trash compost
3. Vermicompost and enriched vermicompost methods from crop residues and organicwastes, production techniques, Grading, packaging and post- harvest packaging
4. Biofertilizers production techniques and its application methods
5. Preparation of neem products and other botanicals and their use for pest and diseasecontrol.
6. Indigenous technology knowledge (ITK) for nutrient and weed management
7. Indigenous technology knowledge (ITK) for pest and disease management
8. Study of quality parameters of organic products.
9. Visit to organic farm and cost economics of organic production system
10. Visit to organic farmer field.
11. Grading, labelling and packaging of organic products.
12. Visit to organic outlet
13. Visit to Agroforestry unit.
14. Working out of indices for evaluation of the cropping systems, land use, yield advantages, economic and sustainable
15. Visit to IFS unit in different agro-climatic zones of nearby states University/ institutes and farmers field.
16. Visit to Dairy unit/ Mulberry unit/ Poultry unit/ Mushroom unit
17. **Practical examination**

Course Outcome

CO 1: To gain the information and acquire practical knowledge on various types ofcropping systems.

CO 2: To understand interaction between different farm enterprises and to gain the information about the impact of organic farming and indigenous practices

CO 3: To understand the procedure followed for organic certification as per NPOP guidelines and to evaluate different resource management techniques in conservation agriculture.

CO 4: To know about : Low-cost input technologies for sustainable crop productionCO 5: To know about conservation agriculture strategies in agriculture

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	-	3	2	1
CO2	2	1	3	-	3	-
CO3	1	3	3	-	2	2
CO4	1	1	3	-	1	-
CO5	3	2	2	3	2	-

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23 ENT 302 INSECT ECOLOGY AND INTEGRATED PEST MANAGEMENT (2+1)

Learning Objectives:

- To understand the basic ecological concepts in relation to insects
- To evaluate influence of abiotic and biotic factors in insect population dynamics and its relevance in Integrated Pest Management (IPM)
- To illustrate various components of IPM and their importance
- To discuss ecological perspectives of insecticides
- To illustrate use of sampling and AESA in pest management decision making

Theory

Unit I: Insect Ecology

Insect Ecology–introduction and definition- anecology, synecology, biome, population,community, niche, ecosystem and agro-ecosystem. Balance of life in nature - trophic level, food chain, food web. Population dynamics-J-shaped growth form, S-Shaped growth form, natality, mortality, dispersal, biotic potential and life table. Environmental resistance on insect population - abiotic factors and biotic factors. Pests – definition, categories, biotypes, losses and causes for outbreaks. Symptoms and nature of damage. Pest surveillance - sampling techniques and forecasting. Concepts of ETL and EIL.

Unit II: Integrated Pest Management and its Components

IPM - Introduction, definition, importance, limitations of IPM. Components of IPM – Cultural, Mechanical, Physical and Legal methods – invasive insect pests, Host plant resistance in IPM,Biological methods in IPM - classical biological control, merits and limitations of biological control, Parasitoids, Predators and Pathogens, difference between predator and parasitoid Types of parasitoids and parasitism, Important families of predators and parasitoids, Microbial control - groups of microbial agents and their actions on insects, Mass multiplication and application techniques of important groups of parasitoids, predators, pathogens and entomophilic nematodes. Conservation, importation, augmentation and release of bio control agents. Role of birds in insect and rodent management.

Unit III: Bio rational Pest Management Strategies

Semiochemicals in IPM – Pheromones, Allomones, Kairomones and Synomones and theirrole in pest management- Traps - Insect growth regulators in IPM – Moult inhibitors and JH mimics - Push and Pull techniques - Botanical insecticides in IPM – antifeedants and repellents. Formulation techniques of botanicals. Traditional methods in IPM, Biotechnology, Sterile male technique and gamma radiation in IPM.

Unit IV: Chemical methods of Insect Pest Management

Chemical control – importance and history. Classification of pesticides. Toxicity ranges – $LD_{50,}$ $LC_{50,}$ etc. Basic and newer formulations of insecticides. Handling hazards of insecticides - Symptoms of poisoning, first aid and antidotes, Compatibility and phytotoxicity. Newer insecticides in pest management.

Unit V: Ecological Perspectives of chemical methods and IPM Strategies for crops Insecticide residues, Insecticide resistance, Insect resurgence, Insecticide contamination andpollution, Bio accumulation and Bio magnification, Acute Chronic toxicity, Insecticideresistance and residue

management. Integrated pest management strategies in different cropecosystems – Rice, cotton, sugarcane, coconut, Brinjal and Mango. Current Stream ofdevelopments in Insect Ecology and IPM.

Practical

Studies on terrestrial/pond ecosystems. Types and symptoms of insect damage. Sampling techniques for the estimation of insect population and damage. Pest surveillance through light traps, pheromone traps and estimating field incidence. Practices in Cultural, Mechanical and Physical methods. Studies on distinguishing characters of resistant varieties. Traps in pest management. Identification of parasitoids, predators and entomopathogens. Mass culturing techniques of *Trichogramma, Chrysopa*and Coccinellids. Mass production of NPV and Fungal pathogens. Models of bird perches, owl nesting and placement. Identification of plants of insecticidal value. Preparation of Botanical formulations. Practices in Traditional methods of pest management. Different groups of pesticide formulations and label information.Precautions in pesticide applications - first aid and antidotes in case of insecticide poisoning. Pesticide application equipments – types and uses. Preparations of spray fluids for field application. Calculation of dose/concentration of insecticides. Compatibility of pesticides and phytotoxicity of insecticides. Effective application of insecticides.

Assignment: Each student has to submit at least 20 numbers of insect damaged plantspecimens (Herbarium) and ten insecticide labels.

Theory Lecture Schedule

1. Definition and importance of Insect ecology. Terminologies related to Insect ecology - anecology, synecology, biosphere, habit, habitat, biome, population, community, niche, ecosystem and agro-ecosystem.
2. Balance of life in nature - Trophic level- producers and consumers, food chain, food web. Population dynamics - J shaped and S Shaped growth form, Natality, Mortality-r strategists and K strategists, dispersal, biotic potential and Life table.
3. Effect of abiotic factors on insect population – temperature, moisture, humidity, rainfall, light, atmospheric pressure, air currents etc.
4. Effect of biotic factors on insect population– intra specific, inter specific relations.
5. Definition and categories of pests, biotypes and causes for pest outbreak. Symptoms and losses of pest attack. Sampling techniques, Surveillance and pest forecasting. Conceptsof Economic Injury Level (EIL) and Economic Threshold Level (ETL).
6. Definition of IPM. Concepts, Scope and limitations of IPM.
7. Definition and examples of Cultural, Physical and Mechanical methods of pest management
8. Host plant resistance – Definition, Types of Resistance-Ecological Resistance - Host evasion - Induced Resistance – Escape. Genetic Resistance - Monogenic-Oligogenic- Polygenic - Major gene - Minor gene. Vertical and Horizontal resistance. Pureline and Multiline resistance. Cross and Multiple resistance. Sympatric and Allopatric resistance.
9. Mechanisms of Host plant resistance – Antixenosis - Antibiosis – Tolerance. Compatibilityof HPR in IPM. Advantages and Disadvantages of HPR. Examples of resistant varieties inmajor crops.
10. Legal methods of pest control - Important provisions, Plant Quarantine, Insecticides Act 1968 – Invasive insect pest.
11. Biological methods- classical biological control, merits and limitations, Parasitoids and Predators – definition - difference between a predator and a parasitoid - Types of parasitoids - Types of parasitism.
12. Important families of predators and parasitoids and their role in pest management.
13. Microbial control – definition, Important groups of microbial agents, Mode of action and symptoms of pathogenicity. Their role in pest management.
14. Mass multiplication and application techniques of important groups of Parasitoids and Predators.
15. Mass multiplication and application techniques of important Entomopathogenic Viruses,

Bacteria, Fungi and nematodes.

16. Conservation, importation, augmentation and release of natural enemies. Role of birds ininsect and rodent management.
17. **Mid Semester Examination**
18. Pheromones in IPM – Sex pheromones, Alarm pheromones, trail pheromones andaggregation pheromones
19. Allelochemicals in IPM -Allomones, Kairomones and Synomones. Insect growthregulators in IPM – Moult inhibitors and JH mimics.
20. Traps in management of crop and storage pests. Push and Pull techniques.
21. Biotechnology in IPM – genetic engineering – transgenic crops – Constraints in using transgenic crops. Sterile male technique and gamma radiation in IPM.
22. Botanical insecticides in IPM – Neem and other examples. Antifeedant, Repellant andInsect growth disturbance properties of botanicals.
23. Formulation techniques of Botanicals.
24. Traditional methods in IPM.
25. Chemical control – importance and history.
26. Classification of pesticides – different modes of classification.
27. Toxicity ranges. Basic and newer Formulations of insecticides.
28. Hazards of insecticides - Symptoms of poisoning, first aid and antidotes.
29. Insecticide residues, insecticide resistance, Insect resurgence
30. Insecticide contamination and pollution, bio accumulation and bio magnification.Compatibility and Phytotoxicity.
31. Newer insecticides in pest management. Insecticide resistance and residue management.
32. Integrated pest management strategies for Rice and cotton, sugarcane and coconut.
33. Integrated pest management strategies for Sugarcane and Coconut
34. Integrated pest management strategies for Brinjal and Mango.

Practical Schedule

1. Characterization of terrestrial /pond ecosystems and preparation of charts.
2. Observation on types of damage and major symptoms caused by insect pests.
3. Practicing various sampling techniques and assessment of insect population and theirdamage in field/horticultural crops.
4. Practicing Pest surveillance through light traps/ pheromone traps and forecasting of field incidence.
5. Practicing common Cultural, Mechanical and Physical methods in pest management.
6. Analysing distinguishing characters of few resistance varieties of important crops.
7. Observation on models of traps in pest management – Pheromone traps, light traps,sticky traps and other traps.
8. Identification of different types of parasitoids, predators and entomopathogens.
9. Practicing Mass culturing techniques of *Trichogramma.*
10. Practicing Mass culturing techniques of *Chrysopa* and Coccinellids
11. Practicing Mass production of NPV and Fungal pathogens.
12. Studies on models of bird perches, owl nesting and placement. Preparation of Botanical formulations. Practicing few Traditional methods of pest management.
13. Identification of different groups of pesticide formulations.
14. Recognizing label information, Precautions in pesticide applications, First aid and antidotes information. Identification of types of Pesticide application equipments andpracticing of application of insecticides.
15. Preparations of spray fluids for field application. Calculation of doses/concentrations of insecticides.
16. Observation on compatibility of pesticides and Phytotoxicity of insecticides. Effectiveapplication of

insecticides.

17. Orientation for final examination

Course Outcome:

CO 1: Depict basic ecological concepts; understand the impact of ecology on the insect population and concepts of IPM, ETL and EIL.To employ AESA and pest survey aspest management decision making tools.

CO 2: Explain role of biological pest suppression and mass production of various biocontrol agents.

CO 3: Describe non chemical methods of pest management viz., bio rationals and othernovel techniques like sterile insect method.

CO 4: Discuss classification and formulations of insecticides, their poisoning effects and antidotes.

CO 5: Describe ill effects of over use of insecticides and define various IPM modules for different crops.

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	2	3
CO2	3	2	3	3	2	3
CO3	3	3	3	2	3	2
CO4	3	2	3	2	3	3
CO5	2	2	3	2	3	3

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2. Jain, P.C. and M.C. Bhargava. 2007. *Entomology – Novel approaches*. New India Publishing agency, New Delhi. 533 p.
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23 PAT 303 PRINCIPLES OF INTEGRATED DISEASE MANAGEMENT (2+1)

Learning objectives

- To acquire knowledge on the history, economic importance and principles of IDM
- To learn the methods of detection, diagnosis and calculating economic injury level and economic threshold level of plant diseases
- To study the different principles of plant disease management with ecologicalmanagement of crop environment
- To acquire knowledge on plant disease survey, forecasting and development andvalidation of IDM module
- To acquaint with the safety issues in pesticide uses with political, social and legalimplication of

IDM.

Theory

Unit I

Categories of diseases, IDM: Introduction, history, importance, concepts, principles and toolsof IDM. Economic importance of diseases and pest risk analysis.

Unit II

Methods of detection and diagnosis of diseases. Calculation and dynamics of economic injury level and mportance of economic threshold level.

Unit III

Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the disease management.

Unit IV

Survey: surveillance and forecasting of diseases. Development and validation of IDM module. Implementation and impact of IDM and IDM module for disease.

Unit V

Safety issues in pesticide uses. Political, social and legal implication of IDM. Case histories of important IDM programmes.

Lesson plan

Theory schedule

1. Categories of plant diseases
2. Introduction of IDM
3. History of IDM
4. Importance of IDM
5. Concepts of IDM
6. Principles and tools of IDM
7. Economic importance of diseases and pest risk analysis
8. Methods of detection and diagnosis of diseases
9. Calculation and dynamics of economic injury level of plant diseases
10. Importance of economic threshold level of plant diseases
11. Introduction of principles of plant disease management
12. Host plant resistance
13. Cultural methods
14. Mechanical methods
15. Physical methods
16. Legislative methods
17. Mid semester examination
18. Biological methods
19. Mechanism of action of biocontrol agents
20. Chemical methods
21. Classification of fungicides
22. Mode of action and uses
23. Methods of application of fungicides
24. Ecological management of crop environment
25. Introduction to conventional pesticides for the disease management
26. Plant disease survey and surveillance
27. Plant disease forecasting
28. Development and validation of IDM module
29. Implementation and impact of IDM

30. IDM module for plant disease
31. Safety issues in pesticide uses
32. Political, social and legal implication of IDM
33. Case histories of important IDM programmes
34. Case histories of important IDM programmes.

Practical schedule

1. Diagnosis and detection of various plant diseases
2. Methods of plant disease measurement
3. Surveillance and forecasting of diseases
4. Assessment of crop yield losses calculations based on economics of IDM
5. Classification and grouping of fungicides
6. Preparation of Bordeaux mixture (1%) and Bordeaux paste (10%), Burgundy mixture, Chaubattia paste and Cheshunt compound.
7. Calculation of fungicides quantity and methods of application of fungicides – Seed (wetand dry) soil, foliar and post-harvest dipping.
8. Special methods of application: swabbing, acid delinting, pseudostem injection, capsule application
9. Identification of biocontrol agents
10. Mass multiplication of Trichoderma
11. Mass multiplication Pseudomonas
12. Mass multiplication Bacillus
13. Identification and nature of damage of important diseases and their management
14. Crop (agro-ecosystem) dynamics of a selected diseases
15. Plan & assess preventive strategies (IDM module) and decision making
16. Crop monitoring for attack by diseases
17. Record certification

Course outcome

CO1: Knowing the history, economic importance and principles of IDM

CO2: Having in depth knowledge in detection, diagnosis, economic injury level and economic threshold level of plant diseases

CO3: Being updated with the different principles of plant disease management with ecological management of crop environment

CO4: Having expertise in plant disease survey, forecasting and development and validation ofIDM module

CO5: Acquainted with the safety issues in pesticide uses with political, social and legal implication of IDM.

CO-PO Mapping matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	-	1	1	-
CO2	3	3	-	1	1	-
CO3	3	3	-	1	1	-
CO4	3	3	-	1	1	-
CO5	3	3	-	1	1	-

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3. https://www.apsnet.org/edcenter/disimpactmngmnt/casestudies/Pages/PlantDiseaseDiagnosis.aspx
4. https://www.apsnet.org/edcenter/disandpath/prokaryote/intro/Pages/Bacteria.aspx
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6. http://npic.orst.edu/health/safeuse.html

23 GPB 302 CROP IMPROVEMENT – II (Rabi Crops) (1+1)

Learning objectives

To impart knowledge about the origin, evolution and modes of reproduction for different Rabi Crops.

- To impart knowledge about the floral biology, crossing techniques, objectives of
- breeding and wild species as donors for resistant traits.
- To impart knowledge about the Biotic and Abiotic stress resistance breeding for different
- Rabi Crops.
- To impart knowledge about the Hybrid Seed Production Technologies for different Rabi
- Crops.
- To provide insight into recent advances in improvement of cereals, pulses, oil seeds
- fodder, Cash crop, Vegetables and Flowers using conventional and modern biotechnological approaches.

Theory

Unit I: Introduction to crop improvement

Introduction-definition, aim, objectives and scope of Crop Improvement - Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops- Centers of origin-Law of homologous series- types of centres of diversity- gene sanctuaries genetic erosion-main reasons of genetic erosion-extinction-introgression- gene banks-types of gene banks-distribution of crop species.

Unit II: Crop improvement for cereals and pulses

Centres of origin, distribution of species, wild relatives –Study of genetics of qualitative and quantitative characters for rabi crops- Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality parameters (physical, chemical, nutritional) in different rabicrops. **Cereals** – Wheat, Oat and Barley- **pulses**- Chickpea, Lentil, Field pea-

Unit III: Crop improvement for oilseeds, fodder and cash crops

Centres of origin, distribution of species, wild relatives –Study of genetics of qualitative and quantitative characters for rabi crops- Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality parameters (physical, chemical, nutritional) in different rabicrops**Oilseeds** – Rapeseed, Mustard and Sunflower-**fodder crops** – Berseem and Leucerne- C**ash** crop - Sugarcane .

Unit IV: Crop improvement for vegetables and flowers crops

Centres of origin, distribution of species, wild relatives –Study of genetics of qualitative and quantitative

characters for rabi crops- Important concepts of breeding self pollinated, cross

pollinated and vegetatively propagated crops Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality parameters (physical, chemical, nutritional) in different rabi crops. **Vegetables** –Bitter guard, Snake guard, Bottle guard, Pumpkin, Cucumber and Potato– **Flowers**- Rose, Chrysanthmum
, Marigold and Gerbera.

Unit V: Seed production and resistance breeding

Seed production technology in self pollinated, cross pollinated and vegetatively propagated rabi crops- Hybrid seed production technology in Wheat, Sunflower, Rapeseed, Mustard and Cucurbits - Ideotype concept and climate resilient crop varieties for future – Breeding for drought, salinity, water logging, high temperature and low temperature tolerant varieties in different rabi crops.

Practicals

Floral biology – Types of inflorescence, flower structure in different Rabi crops- Emasculation and hybridization techniques in Wheat, Oat and Barley Chickpea, Lentil, Field pea- Rapeseed and Mustard, Sunflower-Potato, Berseem and Sugacane -Maintenance breeding of different Rabi crops – Sunflower-Handling of germplasm and segregating generations by different methods – Pedigree, Bulk and Single Seed Descent methods -Study of field techniques for varietal seed production and hybrid seed production in Sunflower, Chickpea - Study of field techniques for varietal seed production and hybrid seed production in Rapeseed and Mustard, Potato and Sugarcane- Estimation of heterosis, inbreeding depression and heritability- Layout of field experiments-Study of quality characters, donor parents for different traits in different Rabi crops-Visit to Seed production plots -Visit to AICRP plots for different field crops

Lesson Plan

Theory Lecture Schedule

1. Introduction-definition, aim, objectives and scope of Crop Improvement - Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated rabi crops.
2. Centers of origin-Law of homologous series- types of centres of diversity-gene sanctuariesgenetic erosion-main reasons of genetic erosion-extinction-introgression-genebanks-types of gene banks-distribution of rabi crop species
3. Breeding of Wheat,
4. Breeding of Oat and Barley
5. Breeding of Chickpea,
6. Breeding of Lentil, Field pea
7. Breeding of Rapeseed and Mustard
8. Breeding of Sunflower
9. **Mid semester examination**
10. Breeding of Berseem and Leucerne
11. 11.Breeding of Sugarcane
12. Breeding of Bitter guard, Snake guard, Bottle guard, Pumpkin, Cucumber
13. 13.Breeding of Potato
14. Breeding of Rose, Chrysanthmum, Marigold and Gerbera
15. 15.Seed production technology in self pollinated, cross pollinated and vegetativelypropagated rabi crops
16. Hybrid seed production technology in Wheat, Sunflower, Rapeseed, Mustard and Cucurbits

17. Ideotype concept and climate resilient crop varieties for future – Breeding for drought, salinity, water logging, high temperature and low temperature tolerant varieties in differentrabi crops

Practical schedule

1. Floral biology – Types of inflorescence, flower structure in different Rabi crops Wheat,Oat, Barley, Chickpea, Lentil, Field bean, Rapeseed, Mustard, Sunflower, Berseem, Leucerne and Sugarcane
2. Floral biology – Types of inflorescence, flower structure in different Rabi crops- Cucurbits,Potato, Rose, Chrysanthmum, Marigold, and Gerbera.
3. Emasculation and hybridization techniques in Wheat, Oat and Barley
4. Emasculation and hybridization techniques in Chickpea, Lentil, Field pea
5. Emasculation and hybridization techniques in Rapeseed and Mustard, Sunflower
6. Emasculation and hybridization techniques in Potato, Berseem and Sugacane
7. Emasculation and hybridization techniques in Cucurbits
8. Maintenance breeding of different Rabi crops – Sunflower
9. Handling of germplasm and segregating generations by different methods – Pedigree,Bulk and Single Seed Descent methods
10. Study of field techniques for varietal seed production and hybrid seed production in Sunflower, Chickpea
11. 11.Study of field techniques for varietal seed production and hybrid seed production in Rapeseed and Mustard, Potato and Sugarcane
12. Estimation of heterosis, inbreeding depression and heritability
13. Layout of field experiments
14. Study of quality characters, donor parents for different traits in different Rabi crops
15. Visit to Seed production plots
16. Visit to AICRP plots for different field crops
17. Final **practical examination**

Course outcome

CO1 : Acquire knowledge on floral biology and selection of proper breeding method for majorRabi Crops

CO 2 : Cultivate skill in emasculation and pollination methods for major Rabi Crops

CO 3 : Gain expertise on hybrid seed production techniques for major Rabi Crops

CO 4 : Learn to use different selection procedures for selection of superior genotypes for majorRabi Crops.

CO 5: To get an overview about the breeding aspects about Rabi Crops

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	**1**				
CO 2			**3**		
CO 3					**2**
CO 4					
CO 5					

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23 HOR 302 POST-HARVEST MANAGEMENT AND VALUE ADDITION OF FRUITS ANDVEGETABLES (1+1)

Learning objectives

- To make the students learn the basics and principles of postharvest technology.
- To impart knowledge recent innovations in packaging of various horticultural crops.To make them familiarize with the storage and value addition of horticultural crops
- To make the students acquire knowledge on various postharvest management technologies on fruits and vegetables such as Jam, Jelly Candy, Squash and Picklepreparations.
- To familiarize the students to gain knowledge on conventional and modern packaging methods.

Theory

Unit I: Importance of post-harvest processing of fruits and vegetables, extent and possiblecauses of postharvest losses.

Unit II: Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening.

Unit III: Respiration and factors affecting respiration rate. Harvesting and field handling .Storage (ZECC, cold storage, CA, MA, and hypobaric).

Unit IV: Value addition concept, Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards, Fermentedand non-fermented beverages.

Unit V: Tomato products- Concepts and Standards; Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying. Canning – Concepts and Standards, packaging of products and current stream of thoughts.

Practicals

Applications of different types of packaging, containers for shelf life extension. Effect oftemperature on shelf life and quality of produce. Demonstration of chilling and freezing injuryin vegetables and fruits. Extraction and preservation of pulps and juices. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products, canned products. Quality evaluation of products -- physico-chemical and sensory. Visit to processing unit/ industry.

Lesson plan

Theory Schedule

1. Importance of post-harvest processing of fruits and Vegetables, extent and possiblecauses of postharvest losses.
2. Pre-harvest factors affecting postharvest quality, maturity, ripening Changes occurringduring ripening.
3. Respiration and factors affecting respiration rate.
4. Harvesting and field handling.

5. Storage -(ZECC-Zero energy cool chamber).
6. Principles of cold storage.
7. Controlled atmosphere storage, Modified atmosphere storage, and hypobaric.
8. Value addition concept.
9. Midsemester Examinations
10. Principles and methods of preservation.
11. Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards.
12. Fermented and non-fermented beverages.
13. Tomato products- Concepts and Standards.
14. Drying/ Dehydration of fruits and vegetables – Concept and methods,
15. Osmotic drying.
16. Canning - Concepts and Standards.
17. Packaging of products.

Practical Schedule

1. Applications of different types of packaging, containers for shelf-life extension.
2. Effect of temperature on shelf life and quality of produce.
3. Demonstration of chilling and freezing injury in vegetables and fruits.
4. Extraction and preservation of pulps and juices.
5. Preparation of jam.
6. Preparation of jelly
7. Preparation of RTS.
8. Preparation of nectar.
9. Preparation of squash & crush.
10. Preparation of osmotically dried products.
11. Preparation of fruit bar and candy and tomato products.
12. Preparation of canned products.
13. Preparation of pickles.
14. Preparation of Sauces.
15. Quality evaluation of products -- physico-chemical and sensory.
16. Visit to processing industry.
17. Practical Examination

Course Outcome:

CO 1: The students will learn the basics and principles of postharvest technology.
CO 2: The students will learn the recent innovations in packaging of various horticulturalcrops.
CO3: The students will get familiarised with the storage and value addition of horticulturalcrops
CO4: The students will acquire knowledge and Prepare various postharvest management technologies on fruits and vegetables such as Jam, Jelly Candy, Squash and Pickle preparations.
CO5: The students will gain knowledge on conventional and modern packaging methods.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	3	2	0
CO 2	3	3	2	2	3	0
CO 3	3	3	1	3	3	0
CO 4	3	3	2	3	2	0
CO 5	3	3	3	2	3	0

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23 EXT 302 ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS COMMUNICATION(1+1)

Learning objectives

- To familiarize the students to understand with key concepts and processes inentrepreneurship and business development.
- To introduce key debates around entrepreneurship and small businesses.
- To provide context to the processes in the form differences between small and large firmsand economic environment.
- To understand the function and types of entrepreneurship.
- To develop various managerial skills among the students.

Theory

Unit I: Entrepreneurship

Concept of Entrepreneur, Entrepreneurship, Agri- Entrepreneurship, concept, need, scope and opportunities of Rural and Agri Enterprises, Entrepreneurial Characteristics, Impactof economic reforms in agribusiness and agri enterprise and over view of Agri Business in the Country.

Unit II: Entrepreneurship Development Programmes

Entrepreneurship Development Programmes (EDPs)-objectives, phases, Government policies and programmes and schemes EDP Process-Stages, Developing organizational skills (controlling, supervision, monitoring and evaluation) Achievement Motivation, Problem solving skills

Unit III: Enterprise Management

Managing an enterprise, SWOT analysis, Time Management. for Entrepreneurship Development, Financing an Enterprise and Venture Capital Institutional Support to entrepreneurs.

Unit IV: Business communication

Business written communication skills and Negotiation Skills, Managerial skills (planning, budgeting, coordination, decision making), Business Leadership skills (communication, direction and motivation skills),

Unit V: Project Management

Project- meaning, importance, project formulation, project report components and management. Supply Chain Management- Meaning, definition, process, advantages and disadvantages, Total quality Management: Meaning, definition, process, advantages and current stream of thoughts.

Practicals

Practical exercise - problem solving skills, managerial skills, decision making, creativity and time management, Identification and selection of business ideas, Planning Preparation of business plan,proposal writing and presentation. Monitoring and supervision ofentrepreneurial activities, SWOT analysis of selected enterprise. Analysis of leadership and organizational skills. Study about Entrepreneurship development Institute, Business Communication and Negotiation Study about Successful Enterprise and characteristics of Successful Entrepreneurs

Lecture Plan

Theory schedule

1. Concept of Entrepreneur, Entrepreneurship, Agri- Entrepreneurship, concept, need,scope and opportunities of Rural and Agri Enterprises
2. Entrepreneurial Characteristics
3. Impact of economic reforms in agribusiness and agri enterprise and over view of Agri Business in the Country.
4. Entrepreneurship Development Programmes (EDPs)-objectives, phases, Government policies and programmes and schemes
5. EDP Process-Stages
6. Developing organizational skills (controlling, supervision, monitoring andevaluation)
7. Achievement Motivation, Problem solving skills
8. Managing an enterprise, SWOT analysis, Time Management.
9. Mid Semester Examination
10. Business written communication skills and Negotiation Skills
11. Managerial skills (planning, budgeting, coordination, decision making) for Entrepreneurship Development
12. Financing an Enterprise and Venture Capital
13. Institutional Support to entrepreneurs
14. Business Leadership Skills (communication, direction and motivation skills)
15. Project- meaning, importance, project formulation, project report components and management.
16. Supply Chain Management- Meaning, definition, process, advantages and disadvantages
17. Total quality Management: Meaning, definition, process and advantages and currentstream of thoughts.

Practical Schedule

1. Simulation exercise on assessing entrepreneurial traits
2. Practical exercise on problem solving skills
3. Practical exercise on managerial skills
4. Identification and selection of business ideas
5. Practical exercise on decision making
6. Planning, Preparation of business plan and proposal writing.
7. Monitoring and supervision of entrepreneurial activities
8. Practical exercise on Creativity
9. Presentation of business proposal
10. Practical exercises on time Management / time Audit
11. SWOT analysis of selected enterprise.
12. Analysis of Leadership Skills and organization skills
13. Visit to Entrepreneurship Development Institute
14. Business Communication and Negotiation
15. Field Visit to Successful Enterprise

16. Case Study of Successful Entrepreneurs
17. **Practical Examination**

Course Outcome

At the end of the course students will be able to

CO 1: Develop entrepreneurial competencies among the students
CO 2: Learn about principles to develop an enterprise or any business unit
CO 3: Gain expertise on SWOT analysis
CO 4: Exposure on entrepreneurial traits and culture
CO 5: To gain knowledge about enterprise and project management

Co-Po Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	0	2	0	3	3
CO2	1	0	0	2	0	3
CO3	2	2	0	0	3	3
CO4	2	0	1	0	0	3
CO 5	1	0	0	0	0	3

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23 AEC- 303Agricultural Finance and Co-operation (1+1)

OBJECTIVES

- To inculcate the knowledge on principles of finance and banking
- To understand the micro financial institutions
- To study the functions of various institutions involved farm financial analysis
- To provide the knowledge on co-operative credit structure
- To know the benefits of insurance schemes and different crop insurance products implemented in India.

Theory

Unit I: Agricultural Finance – Nature and Scope:

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Sources of credit -

advantages and disadvantages - Rural indebtedness- History and Development of rural credit in India.

Unit II: Financial Institutions:

Sources of agricultural finance: institutional and non-institutional sources and their roles, commercial banks - social control and nationalization of commercial banks – AD branches – Area approach – Priority sector lending. Micro financing including KCC, Micro finance – SHG Models, Lead Bank Scheme, RRBs, Scale of finance and unit cost. Cost of credit. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, World Bank, Insurance and Credit Guarantee Corporation of India. Recent development in agricultural credit: Rural credit policies of Government – Subsidized farm credit - Differential Interest Rate (DIR) Scheme – Loan relief measures

Unit III: Farm Financial Analysis:

Credit analysis: 3 R's,7 P's and 5 C's of credit. Preparation of bankable projects / Farm credit proposals – Feasibility; Appraisal - Time value of money: Compounding and Discounting - Undiscounted and Discounted measures. Preparation and analysis of financial statements Balance Sheet, Income Statement and Cash Flow Statement. Basic guidelines for preparation of project reports - Bank norms – SWOT analysis.

Unit IV: Co-operation:

Agricultural Cooperation in India–Meaning, brief history of cooperative development in India - Pre and Post - Independence periods and Co-operation in different plan periods, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Cooperative credit structure: short term and long term. Agricultural Cooperation - credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED. Strength and weakness of co-operative credit system, Policies for revitalizing cooperative credit.

Unit V: Banking and Insurance:

Negotiable Instruments: Meaning, Importance and Types - Central bank: RBI – functions- Credit control – Objectives and Methods: CRR, SLR and Repo rate - Credit rationing - Dearmoney and cheap money. monetary policies. Credit gap: Factors influencing credit gap. Non -Banking Financial Institutions (NBFI). NPA – Causes, consequences and mitigation. Crop Insurance: Schemes, Coverage, Advantages and Limitations in Implementation. Weather based crop insurance, features, determinants of compensation. Livestock Insurance Schemes - Agricultural Insurance Company of India Ltd (AIC): Objectivesand functions.

Practicals

Determination of most profitable level of capital use. Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank / cooperative society to acquire first- hand knowledge of their management, schemes and procedures. Visit to District Central Co-operative Bank (DCCB) to study its role, functions and procedures for availing loan – Fixation of Scale of Finance. Estimation of credit requirement of farm business – A case study. Preparation and analysis of Balance Sheet, and Cash Flow Statement – A case study. Exercise on Financial Ratio Analysis. Appraisal of farm credit proposals – A case study. Preparation and

analysis of income statement – A case study. Preparation of Bankable projects / Farm Credit Proposals and appraisal - Undiscounted methods and Discounted methods. Technoeconomic parameters for preparation of projects for various agricultural products and its value added products. Seminar on selected topics. Analysis of Different Crop Insurance Products / Visit to crop insurance implementing agency.

Lesson plan

Theory Schedule

1. Agricultural Finance - meaning, scope and significance, credit needs and its role in Indian agriculture. Rural indebtedness - History and Development of rural credit in India.

2.Agricultural credit: meaning, definition, need and classification. Sources of credit - advantages and disadvantages. Sources of agricultural finance: institutional and non- institutional sources - their roles. Commercial banks - social control and nationalization of commercial banks.

3. Micro financing including KCC, Micro finance – SHG Models, Lead bank scheme.8. RRBs, Scale of finance and unit cost. Cost of credit.

4. An introduction to higher financing institutions–RBI, NABARD, ADB, IMF and World Bank. Role of Insurance and Credit Guarantee Corporation of India.

5. Recent developments in agricultural credit. Rural credit policies of Government: Subsidized farm credit- Differential Interest Rate (DIR)Scheme– Loan relief measures

6. Credit analysis: 3 R's, 7 P's and 3C's of credit.

7. Preparation of bankable projects / Farm credit proposals – Feasibility. Appraisal: Time value of money: Compounding and Discounting - Undiscounted and Discounted measures.

8. Preparation and analysis of financial statements – Balance Sheet, Income Statement and CashFlow Statement.

9. Mid Semester Examination

10. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.

11. Agricultural Cooperation in India – Meaning, brief history of cooperative development in India. Pre and Post - Independence periods and Co-operation in different plan periods, objectives, principles of cooperation, significance of cooperatives in Indian agriculture.

12. Co-operating credit structure: short term and long term. Agricultural Cooperation - credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies,processing cooperatives, farming cooperatives, cooperative warehousing;

13. Role of ICA, NCUI, NCDC and NAFED. Strength and weakness of co-operative creditsystem, Policies for revitalizing co-operative credit.

14. Negotiable Instruments: Meaning, Importance and Types. Credit gap: Factors influencingcredit gap.

15. Central bank: RBI – functions, Credit control – Objectives and Methods: CRR, SLR and Repo rate. Credit rationing - Dear money and cheap money.

16. Financial Inclusion and Exclusion: credit widening and credit deepening monetary policies. Non - Banking Financial Institutions (NBFI). NPA – Causes, consequences and mitigation.

17. Crop Insurance and Livestock Insurance Schemes: Coverage, Advantages and Limitations in Implementation. Weather based crop insurance, features, determinants of compensation. Agricultural Insurance Company of India Ltd (AIC): Objectives and functions.

Practical Schedule

1. Determination of most profitable level of capital use.

2. Optimum allocation of limited amount of capital among different enterprises.

3. Analysis of progress and performance of cooperatives using published data.
4. Analysis of progress and performance of commercial banks and RRBs using published data.
5. Visit to a commercial bank, cooperative bank / cooperative society to acquire first - hand knowledge of their management, schemes and procedures.
6. Visit to District Central Co-operative Bank (DCCB) to study its role, functions and procedures
for availing loan – Fixation of Scale of Finance.
7. Guest lecture on Role and functions of Commercial Bank and Lead Bank / NABARD and itsRole and Functions.
8. Estimation of credit requirement of farm business – A case study.
9. Preparation and analysis of Balance Sheet and Cash Flow Statement – A case study.
10. Exercise on Financial Ratio Analysis. Appraisal of farm credit proposals – A case study.
11. Preparation and analysis of income statement – A case study.
12. Preparation of Bankable projects / Farm Credit Proposals and appraisal.
13. Undiscounted methods and Discounted methods.
14. Techno-economic parameters for preparation of projects for various agricultural products and its value added products.
15. Analysis of Different Crop Insurance Products / Visit to crop insurance implementing agency.
16. Seminar on selected topics.
17. Practical Examination.

Course Outcomes

CO1: To understand the functions of various institutions involved in farm financing.
CO2: To know the principles of credit,5c's,3R'sand time value of money.
CO3: To gain knowledge on microfinance, role of SHG's, NGO.
CO4:To understand risk mitigating measures like agricultural insurance schemes available for the benefits of famers.
CO5: To know the different crop insurance schemes in India

CO-POMapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	-	-	-	2
CO2	3	-	-	-	-	-
CO3	2	-	-	-	-	-
CO4	2	-	-	-	-	2
CO5	2	-	-	1	2	-

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23 STA 301 STATISTICAL METHODS (1+1)

Learning objectives

- To understand and apply fundamental concept of statistical applications in biology
- To acquire about theoretical concept of descriptive statistics, testing of hypothesis, correlation, regression and basic design of experiments.

Theory

Unit I: Diagrams and graphs

Introduction to Statistics, Definition, Advantages & Limitations, Quantitative and Qualitative data-Discrete and Continuous Variables. Diagrammatic representations Bar Graphs- PieGraphs - Graphical Representation – Frequency histogram, Frequency polygon, frequency curve and ogives.

Unit II: Measures of Central Tendency and Dispersion

Measures of Central Tendency: Definition, Different Measures, Characteristics of a Satisfactory Average. Definition and Calculation of Arithmetic Mean, Median and Mode -Merits and Demerits. Measures of Dispersion: Standard Deviation, Variance and Coefficient ofVariation

Unit III: Probability Distribution and Bivariate Analysis

Introduction to Probability—Events, Sample Space, Definition of Probability, Addition andMultiplication Theorem (without proof). Binomial Distribution, Poisson Distribution. NormalDistribution (Concepts only)

Introduction to Correlation: Definition, Scatter Diagram, Types of correlation, Properties - Karl Pearson's correlation coefficient. Regression – definition – fitting of two simple linear regression equation – properties of regression coefficient. Chi-square test

Unit IV: Tests of Significance

Definitions of Statistical Population, Sample, Random Sampling, Parameter, Statistic. Sampling distribution, Standard error - Test of Significance, Null Hypotheses, Types of Errors, Level of Significance and Degrees of freedom, Steps involved in Testing of a Hypotheses. Large sample tests: Test of single and difference of proportions - Test of single and difference of means.

Small sample tests: students t test for one and two samples. Paired T test and test for correlation coefficient. Chi-square test for attributes, F test for equality of variances.

Unit V: Design of Experiments

Analysis of Variance (ANOVA) – assumptions – one way and two way classifications. Basic principles of experimental designs – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD). **Current Streams of thought.**

Lesson plan

Theory Schedule

1. Introduction to Statistics, Definition, Advantages & Limitations, Applications in Agriculture, Data - Types of data – Quantitative and Qualitative Variables- Discrete and Continuous Variables
2. Simple bar diagram, Multiple Bar, percentage bar and Pie diagram—Histograms, Frequency polygon, frequency curve
3. Definition, Different Measures, Characteristics of a Satisfactory Average. Definition and Calculation of Arithmetic Mean, Median and Mode for Ungrouped data
4. Arithmetic Mean, Median and Mode for Grouped data. Merits and Demerits of AM, Median and Mode
5. Standard Deviation, Variance and Coefficient of Variation
6. Introduction to Probability—Events, Sample Space, Definition of Probability, Addition and Multiplication Theorem (without proof)
7. Binomial Distribution, Poisson Distribution. Normal Distribution
8. Correlation: Definition, Scatter Diagram, Types of correlation, Karl Pearson's correlation coefficient
9. **Mid Semester Examination**
10. Regression: Definition, Fitting of two lines Y on X and X on Y, Properties, inter relation between correlation and regression
11. Definitions of Population, Sample, Random Sampling, Parameter, Statistic. Sampling distribution, Standard Error, Null Hypotheses, alternate Hypotheses, Types of Errors, Levelof Significance and Degrees of freedom, Steps involved in Testing of a Hypotheses
12. Large sample tests - Test of single and difference of proportions - Test of single and difference of means, Null Hypotheses, Test Statistic Table values and Inference (Conclusion about Null Hypotheses)
13. Small sample tests: students t test for one and two samples. Paired T test and test for correlation coefficient
14. Chi-square test in 2x2 and r x c Contingency table. F-test for Two Population variancesand properties Assumptions
15. Analysis of Variance (ANOVA) – assumptions – one way and two way classifications.
16. Basic principles of experimental designs - Completely Randomized Design (CRD) –
17. Randomized Block Design (RBD) - Latin Square Design (LSD)

Practical schedule

1. Simple bar diagram. Multiple bar diagram, percentage bar diagram and pie diagram
2. Frequency histogram, Frequency polygon, frequency curve and ogives
3. Calculation of Arithmetic Mean, Median and Mode for ungrouped data
4. Calculation of Arithmetic Mean, Median and Mode for grouped data
5. Computation of Standard Deviation, Variance and Coefficient of Variation for ungroupeddata
6. Computation of Standard Deviation, Variance and Coefficient of Variation for grouped data
7. Computation of Karl Pearson's correlation coefficient
8. Computation of regression equations
9. Solving problems for long sample test for single proportion and difference of proportions
10. Large sample test – test for single mean and difference between two means
11. Small samples test – one sample t-test, two sample t test and paired t test
12. Chi-square test for 2x2 contingency table and r xc contingency table
13. F test for two population variances
14. Analysis of Completely Randomised Design (CRD)
15. Analysis of Randomised Block Design (RBD)
16. Analysis of Latin Square Design (LSD)
17. **Practical Examination**

Course Outcome

CO1: Understand fundamental concept of statistical applications in biology

CO2: Application of statistical concepts

CO3: Acquire theoretical concept of descriptive statistics, testing of hypothesis, correlation, regression and basic design of experiments.

CO4: Practical exposure to concept of descriptive statistics, testing of hypothesis, correlationand regression

CO5: Practical exposure to basic design of experiments

CO - PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	-	-	X	X
CO2	-	-	-	-	X	X
CO3	-	-	-	-	X	X
CO4	-	-	-	-	X	X
CO5	-	-	-	-	X	X

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23 AEG 301 FARM MACHINERY, POWER AND RENEWABLE ENERGY SOURCES (1+1)

Learning objectives

- To impart knowledge to the students on the significance, use and maintenance of farmpower and improved farm equipment through various media including demonstrations.
- To gain knowledge on the various types of IC engines, types and selection of tractors.
- To understand the construction and working of various farm implements like tillageimplements, seed drills, plant protection and harvesting equipments.
- To gain knowledge on the various renewable energy sources like solar, wind, biogas andbiomass energy.
- To understand the construction and working of various solar energy gadgets, windmill, biogas plants and production of bio diesel and ethanol from agricultural produce.

Theory

Unit I: Farm power sources, Mechanical Machinery and Tractors

Status of farm power in India-farm mechanization for enhancing productivity - sources of farm power – advantages and disadvantages-IC engines- Working principles, Two stroke and four stroke engines, IC engine terminology, modern agriculture diesel engine, Electronic fuel injection, dual fuel operation engine , Tractors- Types and Utilities.

Unit II: Tillage and Tillage Machinery, Sowing, Planting, Intercultural Equipment

Farm sources-Tillage – Ploughing Methods - Primary Tillage-Implements –Types of plough – Secondary

tillage implements –Cultivators, Harrows and rotavators – Wetland equipment - Puddlers, Tramplers and Cage Wheel. Sowing Methods - Seed Drills, Seed cum fertilizer drills - Paddy transplanters.

Unit III: Plant Protection Gadgets, Harvesting Machinery and Equipment for Land Development

Plant protection, Harvesting equipment - Combine harvesting machinery for groundnut, Tuber crops and Sugarcane - Tools for horticultural crops, Equipment for land development – Cost of operation of farm machinery, Implements for intercultural operations, Tools for horticulturalcrops.

Unit IV: Energy scenario and biomass energy conversion systems

Introduction – Energy crisis – Classification – Availability –Renewable energy sources – significance – Potential of Solar, Wind, Biogas, Biomass, and other Renewable Energy sourcesachievements in India- Methods of energy conversion - Thermo chemical conversion methods -Principles of combustion, Pyrolysis and gasification – Types of gasifiers –Producer gas andits utilization. Briquettes – Types of briquetting machines – Uses of briquettes – Shredders- biochemical conversion methods - Biogas and Ethanol Production – Applications. -Biogas technology – Feed stocks – Factor influences biogas yield–Biogas Plants Types – Construction and Working - Applications.

Unit V: Solar energy, Wind energy and bio – fuels and its applications

Solar energy– Solar energy applications – Solar collectors-Types – Solar energy gadgets –Solar air heaters – Solar cookers – Solar water heating systems –Solar grain dryers – Solar photo voltaic systems and application–Solar lights –Solar pumping systems – Solar refrigeration system – Solar ponds – Solar space heating and cooling systems. Wind energy –Types of wind mills – Constructional details and applications. Energy from agricultural wastes – Liquid Bio fuels – Bio diesel and ethanol from agricultural produce – Its production and Uses.

Lesson plan

Theory Schedule

1. Status of farm power in India - farm mechanization for enhancing productivity - sources offarm power – advantages and disadvantages.
2. Internal combustion (IC) engines – working principle – four stroke and two stroke cycle engines – difference between the two types- components of IC engine -Working principle of IC engines using diesel and petrol as fuels.
3. Familiarization with various systems of tractor – Power Transmission from engine to rear wheels – role of different units in speed reduction and transmission of power.
4. Tractors – classification – factors to be considered while purchasing a tractor. Costanalysis of owning and operating tractor and implements
5. Tillage – primary and secondary tillage- mould board plough- constructional features - components of MB plough and their functions – limitations of MB plough - Standard disc plough– constructional features and operational adjustments - determination of theoreticaland effective field capacities, field efficiency- numerical problems on drawbar power and field capacity in Metric and SI units.
6. Secondary tillage implements – harrows – different types – classification of disc harrows, cultivators – rigid tine and spring tine types- Methods of sowing-sowing implements-seed drills and planters-seed metering mechanism – calibration of seed drill and numerical problems on the subject.
7. Tractor - mounted equipment for land management – bund former, ridger and terraces blade - Equipment for manual and power harvesting- sickle and harvester combines - methods of harvesting fruits crops in hill areas.
8. Introduction – renewable energy sources – classification – advantages and disadvantages
9. **Mid Semester Examination**
10. Biomass – importance of biomass – classification of energy production – principles of combustion – pyrolysis and gasification - Biogas – principles of biogas production – advantages and

disadvantages – utilization

11. Biogas plants – classification – types of biogas plants – constructional details of biogas plants -Types of gasifiers – producer gas and its utilization - Briquettes – briquetting machinery – types and uses of briquettes – shredders
12. Solar energy – application of solar energy – methods of heat transfer – conduction, convection and radiation
13. Solar appliances – flat plate collectors – focusing plate collectors – solar air heater – solarcookers – solar water heating systems - Solar grain dryers – solar refrigeration system – solar ponds
14. Solar photovoltaic system – solar lantern – solar streetlights – solar fencing – solar water pumping system
15. Wind energy – constructional details of windmills – applications of windmills advantages – disadvantages – wind mills – types
16. Bio fuels – characteristics of various bio fuels – different parameters and calorific values- Bio diesel production – applications – extraction from *Jatropha*
17. Ethanol from agricultural produce (sugar cane and corn)

Practical schedule

1. Study of various components of IC engine and Study of two stroke and four stroke cycleengines.
2. Familiarization with air cleaning and fuel supply system
3. Familiarization with lubrication system and ignition system of tractor
4. Learning tractor driving
5. Familiarization with primary tillage implements – MB plough and disc plough – to studyMB plough and disc plough in operation.
6. Familiarization with secondary tillage implements study of harrows and cultivators
7. Familiarization with sowing implements - study of seed-cum-fertilizer drill- calibration ofseed drill.
8. Familiarization with various sprayers and dusters.
9. Familiarization with harvesting implements – study of mower.
10. Constructional details of different types biogas plants and gasifiers
11. To study the briquettes preparation from biomass
12. To study the performance of a solar still solar dryers and domestic solar water heater
13. To study the working of solar photovoltaic pumping system
14. To study the performance evaluation of solar lantern and solar street light
15. To study the performance of different types of wind mills
16. To study the processing of bio diesel production from Jatropha
17. **Practical Examination**

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23 ECAGR 305 SYSTEM SIMULATION AND AGRO-ADVISORY (AGR) (2+1)

LEARNING OBJECTIVES

- To acquire knowledge on the basic aspects of crop models
- To impart knowledge on the crop growth model and response to weather ailments
- To be familiar with soil water and nutrient balance
- To studying about weather forecasting
- To know about crop weather calendar

THEORY:

Unit I: System and Models

System Approach for representing soil-plant-atmospheric continuum, system boundaries. Crop models - concepts and techniques, types of crop models, data requirements, relational diagrams.

Unit II: Validation of models

Evaluation of crop responses to weather elements - Elementary crop growthmodels-calibration, validation, verification and sensitivity analysis.

Unit III: Modelling techniques

Potential and achievable crop production- concept and modelling techniques for their estimation. Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.

Unit IV: Weather forecasting and verification

Weather forecasting- types, methods, tools and techniques, forecast verification;Value added weather forecast. ITK for weather forecast and its validity

Unit V: Simulation and Agromet Advisory Bulletins

Crop-Weather Calendars- Preparation of agro-advisory bulletin based on weatherforecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination and current stream of thoughts.

PRACTICAL:

Preparation of crop weather calendars. Preparation of agro-advisories based onweather forecast using various approaches and synoptic charts. Working with statisticaland simulation models for crop growth. Potential and achievable production; yieldforecasting, insect and disease forecasting models. Simulation with limitations of water and nutrient management options. Sensitivity analysis of varying weather and crop

management practices. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast. Feedback from farmers about the agro advisory.

Theory

Lesson Plan

1. System-definition-scope

2. Models- definition - scope.
3. Soil-plant-atmospheric continuum
4. Model- System boundaries – inputs
5. Models limitations- constrains
6. Crop models, concepts and techniques
7. Types of crop models – Abstract models
8. Types of crop models – Simulation Models.
9. Input and output data requirements, relational diagrams.
10. Evaluation of crop responses to weather elements;
11. Elementary crop growth models
12. Calibration, validation, verification
13. Sensitivity analysis of models.
14. Potential and achievable crop production
15. Concept and modelling techniques for estimation of yields
16. Crop production in moisture and nutrients limited conditions;
17. Components of soil water and nutrients balance.
18. Mid semester exam
19. Weather forecasting- definitions- scope
20. Types of weather forecasting
21. Methods of weather forecasting and tools
22. Techniques of weather forecasting and forecast verification
23. Value added weather forecast.
24. Now casting and its application.
25. National Centre for Medium Range Weather Forecasting (NCMRWF) and Agro Meteorological Field Units (AMFU) and forecasting.
26. Gramin Krishi Mausam Sewa (GKMS) and District Agromet field Units (DAMU) - role in weather forecasting.
27. Long Range Weather Forecasting (LRF)
28. ITK for weather forecast and its validity
29. Preparation of agro-advisory bulletin based on weather forecast.
30. Use of crop simulation model for preparation of Agro-advisory
31. Dissemination of weather forecasting and its mode.
32. Crop-Weather Calendars
33. IMD and its role in weather forecasting.
34. Websites and information on weather forecasting and current stream of thoughts.

Practical Schedule

1. Visit to Agro meteorological Observatory.
2. Preparation of crop weather calendars.
3. Preparation of agro-advisories based on weather forecast using various approaches
4. Synoptic charts
5. Working with statistical and simulation models for crop growth
6. Potential and achievable production, yield forecasting
7. Insect and disease forecasting models.
8. Simulation with limitations of water and nutrient management options.
9. Sensitivity analysis of varying weather and crop management practices.
10. Use of statistical approaches in data analysis and

11. Preparation of historical, past and present meteorological data for mediumrange weather forecast.
12. Feedback from farmers about the agro advisory.
13. Visit to GKMS centre / AIR, Karaikal
14. Visit to IMD, DWRS, Karaikal
15. Visit to RMC, Chennai
16. Field visits
17. **Practical examination**

COURSE OUTCOMES

- **CO1:** Student can learn about the basic aspects of crop models concepts and techniques.
- **CO2:** Students can understand knowledge on crop growth model and response toweather elements**.**
- **CO3:** Student learn about soil water and nutrient balance.
- **CO4:** Student can study about concept and modelling techniques for estimation ofyields.
- **CO5:** Student can study about weather forecasting and crop weather calendar**.**

CO-PO MAPPING MATRIX

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	-	1	-	-
CO2	2	1	-	1	-	1
CO3	3	1	-	1	1	1
CO4	1	1	1	-	1	2
CO5	1	1	1	-	1	1

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23 ECEXT 303 AGRICULTURAL JOURNALISM (2+1)

Learning objectives

- To acquaint the students with the concepts of Journalism and how to write theagriculturalnews for print and electronic media for effective transfer of technology.
- To impart knowledge on Agricultural Journalism and its role in agricultural development.
- To inculcate skills in script writing for different media.
- To gain knowledge about the photo journalism
- To understand the role of social media in Farm journalism

Theory

Unit I: Introduction to Journalism

Journalism: Definition, meaning, functions & its role. Different types of Journalism with examples, Agricultural Journalism-Nature, scope, importance of Agricultural Journalism in TOT, Journalist-definition, roles, responsibilities, Characteristics, Agricultural Journalist – definition, roles, responsibilities, Characteristics of Farm Journalist, Distinguishing features of farm journalism- Different from other types of journalism

Unit II: News, Newspapers and magazines

News-Characteristics of News, Types of News, sources of News, Agricultural News, Characteristics, the types and sources of Agricultural News, Newspapers and magazines as a communication media, Characteristics, kinds and functions of newspapers and magazines, Characteristics of newspaper and magazine readers, Form, content, style and language of newspapers and magazines, Parts of newspapers and magazines

Unit III: News story and feature story

News story-Meaning, definition purpose, writing of news story, principles and parts, Agricultural story-Types- success story, feature story, news story, Feature story-Meaning, definition, purpose, writing of feature story, -principle-Parts, Writing news stories with differenttypes of leads,

Unit IV: Photo journalism, script writing for radio and TV

Photo journalism, meaning, role and its importance in transfer of technology, Use of art works, graphs, charts, maps in Agricultural Journalism, Writing attractive captions, Layout of Agricultural News, Readability, meaning, definition, concept and Measurement, Writing of radio script for delivering of radio talk, Writing of Story Board for Television and videoprogramme

Unit V: Social media and digital journalism

Role of social media in farm journalism, Editing of news story, Farm advertisement and role and its importance in Agricultural Journalism, Proof Reading, Digital Journalism- concept, definition, scope and significance, Concepts and principles, Photo journalism elements and techniques, Difference between traditional and e-journalism, E-journals and magazine in agriculture and current stream of thoughts.

Practical

Exercise on collection of Agricultural information through interview, coverage of agricultural events, Collecting information from agricultural research, writing of news stories & success stories, Selection for writing of Agricultural News story/Success Story, preparation of ArtWorks for writing of Agriculture NewsStory/Success Story, Measuring readability of the written News Story/Success Story, Writing of Radio Scripts, Planning and writing of Story Board, Visit to Print Media Office & Electronic Media office, Preparation of interview schedule to study the farmer preference towards mass media, Designing a programme on interview with farmer, Preparation of short film, Designing cover page for farm magazine

Lesson Plan

Theory Schedule

1. Journalism: Definition, meaning, functions & its role.
2. Different types of Journalism with examples
3. Agricultural Journalism-Nature, scope, importance of Agricultural Journalism in TOT

4. Journalist- definition, roles, responsibilities, Characteristics
5. Agricultural Journalist – definition, roles, responsibilities, Characteristics of FarmJournalist
6. Distinguishing features of farm journalism-Different from other types of journalism
7. News-Characteristics of News, Types of News, sources of News
8. Agricultural News, Characteristics, the types and sources of Agricultural News
9. Newspapers and magazines as a communication media
10. Characteristics, kinds and functions of newspapers and magazines
11. Characteristics of news paper and magazine readers
12. Form, content, style and language of newspapers and magazines
13. Parts of newspapers and magazines
14. News story-Meaning, definition purpose, writing of news story, principles and parts
15. Agricultural story-Types- success story, feature story, news story
16. Feature story-Meaning, definition, purpose, writing of feature story, -principle-Parts
17. **Mid Semester Examination**
18. Writing news stories with different types of leads
19. Photo journalism, meaning, role and its importance in transfer of technology
20. Use of art works, graphs, charts, maps in Agricultural Journalism
21. Writing attractive captions
22. Layout of Agricultural News
23. Readability, meaning, definition, concept and Measurement
24. Writing of radio script for delivering of radio talk
25. Writing of Story Board for Television and video programme
26. Role of social media in farm journalism
27. Editing of news story
28. Farm advertisement and role and its importance in Agricultural Journalism
29. Proof Reading
30. Digital Journalism- concept, definition, scope and significance
31. Digital Journalism - components and principles
32. Photo journalism elements and techniques
33. Difference between traditional and e-journalism
34. E-journals and magazine in agriculture and current stream of thoughts

Practical Schedule

1. Exercise on collection of Agricultural information through interview
2. Exercise on coverage of agricultural events
3. Exercise on collecting information from agricultural research
4. Exercise on writing of news stories
5. Exercise on writing of success stories
6. Selection for writing of Agricultural News story/Success Story
7. Exercise on Selection and preparation of Art Works for writing of Agriculture News Story/Success Story
8. Exercise on Editing of news story/Success story
9. Measuring readability of the written News Story/Success Story
10. Writing of Radio Scripts
11. Planning and writing of Story Board
12. Visit to Print Media/Electronic Media Office
13. Preparation of interview schedule to study the farmer preference towards mass media
14. Designing a programme on interview with farmer
15. Preparation of short film
16. Designing cover page for farm magazine

17. Final Practical Examinations

Course Outcome

CO 1: Describe the concepts of Journalism, agricultural journalism& characteristics ofagricultural news.

CO 2: Gain knowledge and skills in writing the Agricultural News stories and evaluation of them.

CO 3: Develop knowledge on print media and electronic media related toAgricultural Journalism.

CO 4: Develop skill in evaluation and measurement of readability of written News stories etc.CO 5: Develop skill in preparation of radio scripts and story boards.

Co-Po Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	2	2	3	1
CO2	-	-	1	1	-	-
CO3	1	1	-	1	2	1
CO4	-	-	2	-	-	1
CO 5	1	1	1	-	1	=

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23 ECAHS 301 CAPRINE AND OVINE MANAGEMENT (2+1)

Learning Objectives

- The course is designed to teach students about various sheep and goat rearingtechniques with a focus on effective breeding techniques.
- To disseminate information on scientific sheep and goat housing for optimal microclimateso as to improve the production.
- To educate about different types of grazing, feeding, and the importance of specialfeeding methods.
- To offer adequate knowledge of sheep and goat disease prevention including variousclinical signs and other prophylactic measures.
- To give a thorough understanding of goat milk production and to inculcate the importanceof goat milk.

Theory

Unit I: Introduction to Goat and Sheep Management

Introduction - Scope of Goat and Sheep farming - Common Terminologies – Breeds - Classification of

reeds based on milch, wool, meat and dual purpose in goats/sheep -Breeding management - Estrous cycle - Seasonally polyestrous animal- Types of mating - Artificial Insemination - Controlled breeding - Pregnancy diagnosis in Sheep and Goat

Unit II : Farming Practices

Sedentary farming - Nomadic farming – pastoralism – silvipasture - extensive, intensive, semi intensive - integrated farming system – Tethering - housing management - selection of site - floor space requirement of goat and sheep - systems of housing - pen, run, elevated slat system - care and management of Buck, Doe and Kids

Unit III: Nutrition

Nutrients requirements - Grazing - Scientific feeding of sheep and goat - feeds and fodders - flushing Vs steaming up

Unit IV: Disease Management

Introduction to caprine and ovine diseases - sign of health- deworming – dipping - vaccination - general control measures of diseases

Unit V: Products Technology

Caprine Milk and its importance - composition, yield and product preparation - meat- composition - Nutritive value – slaughtering methods- dressing percentage- processing and preservation- Current stream of thoughts.

Practicals

External parts of goat/sheep- Identification methods -Restraining methods -Castration and hoof trimming- Judging -Dentition -Type and design of goat house- oestrus detection- ArtificialInsemination- Recording physiological parameters – Endoparasites and Ectoparasites control-Feeds and fodders - Economic traits- farm records-Dressing Procedures.

Lesson Plan

Theory Schedule

1. Introduction to sheep/goat farming and its scope
2. Difference between sheep and goat-Common terminologies
3. Goat breeds and its classification
4. Sheep Breeds and its classification
5. Economic traits in Sheep and goat
6. Breeding management- oestrus cycle- seasonally polyestrous animal
7. Types of breeding- Natural and Artificial
8. Pregnancy diagnosis
9. Controlled breeding
10. Systems of rearing- extensive, intensive, semi intensive
11. Sedantry- nomadic- transhuman- pastoralism- silvipasture
12. Tethering and Integrated farming system
13. Housing management - Floor space requirements- selection of site
14. Pen, Run and Elevated slat system
15. Care and management of new born kids and lambs
16. Care and management of weanlings
17. **Mid -Semester Examination**
18. Care and management of pregnant and lactating ewes and does
19. Care and management of breeding buck and ram
20. Feeding management
21. Grazing behavior in sheep and Goat. Grazing Vs Browsing.
22. Role of silvipasture and Agro forestry in present scenario- tree lopping
23. Scientific feeding of sheep and goat
24. Flushing Vs steaming up- fattening

25. Signs of health
26. Disease- classification with examples
27. Pregnancy to xaemia and its prevention
28. Control of endo and ectoparasites
29. General control measures of diseases
30. Vaccination schedule
31. Caprine milk, composition and its importance
32. Mutton Vs Chevon- composition and nutritive value
33. Slaughtering methods-Dressing percentage and meat processing
34. Preservation of Meat and Current stream of thoughts.

Practical Schedule

1. External parts of goat/sheep
2. Identification methods in goat and sheep
3. Restraining methods in sheep / goat
4. Castration and hoof trimming
5. Judging of goats
6. Dentition in goats
7. Type and design of goat house
8. Identification of Does in oestrus
9. Demonstration of AI in Does/ Ewes
10. Recording physiological parameters in goat
11. Control of Endoparasites
12. Control of Ectoparasites
13. Identification of feeds and fodders
14. Economic traits of goat/ Sheep
15. Maintenance of goat farm records
16. Dressing of goat
17. **Practical Examination**

Course Outcome

CO 1: To gain knowledge in basic concepts of scientific rearing of caprines and ovines.

CO 2: To understand the basic ideas of goat and sheep management including feeding,breeding and housing

CO 3: Analyze and solve the different problems in goat and sheep management**CO 4:** This course encompasses all relevant information and serve as source of knowledge to understand the modern techniques used in goat and sheep farming.

CO 5: Demonstrate the importance of meat products and processing of meat.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	-	3	2	2	-
CO 2	3	-	3	2	-	1
CO 3	3	-	2	1	-	2
CO 4	2	-	2	2	3	-
CO 5	2	-	1	1	1	-

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V &VIII Semesters

Student READY (Rural and Entrepreneurship Awareness Development Yojana) toassure employability and to develop entrepreneurs

This will be undertaken by the students during the seventh and eighth semesters. Student READY shall be run for full year by making two groups and rotating activities of the final yearin two groups. To get the eligibility for registering for the Student READY programme, the students should have completed all the courses successfully up to Sixth semester. Nostudent should be allowed to take up the Student READY programme with backlog/repeat courses.

The students will be required to have registered for the three components listed below. The minimum attendance required for this programme is 85%. Any student in the event of recording shortage of attendance has to re-register the EL when offered next by paying the assigned fee.

1. Experiential Learning (EL)/Hands on Training (HOT) - 20 credits (24 weeks)
2. Rural Agricultural Work Experience (RAWE) 10 credits (10 weeks)
3. In Plant Training/Industrial attachment - 10 credits (10 weeks)

The Experiential Learning (EL) /Hands on Training (HOT)

Experiential Learning/Hands on Training (HOT) helps the student to develop competence, capability, capacity building, acquiring skills, expertise, and confidence to start their ownenterprise and turn job creators instead of job seekers. EL provides the students an excellent opportunity to develop analytical and entrepreneurial skills, and knowledge throughmeaningful hands on experience, confidence in their ability to design and execute projectwork.

The main objectives of EL are:

- To promote professional skills and knowledge through meaningful hands on experience
- To build confidence and to work in project mode
- To acquire enterprise management capabilities

The Experiential Learning (EL) shall be run for full year by making two groups and rotating activities of the final year in two groups.

The students will register for any of two modules, listed below, of 0+10 credit hours each. A separate certificate should be issued to the students after successful completion of EL.Allotment of EL amongst students to different modules should be done strictly on the basis of merit at the end of sixth semester.

1	23 ELAGR 401	Agriculture Waste Management	Agronomy	0+10
2	23 ELAGR 402	Organic Production Technology	Agronomy	0+10
3	23 ELGPB 401	Seed Production and Technology	Genetics and Plant Breeding	0+10
4	23 ELAGM 401	Production Technology for Bioagents and Biofertilizer	Agricultural Microbiology	0+10
5	23 ELPAT 401	Mushroom Cultivation Technology	Plant Pathology	0+10

6	23 ELSAC 401	Soil, Plant, Water and Seed Testing	Soil Science and Agricultural Chemistry	0+10
7	23 ELENT 401	Commercial Beekeeping	Entomology	0+10
8	23 ELENT 402	Commercial Sericulture	Entomology	0+10
9	23 ELAHS 401	Poultry Production Technology	Animal husbandry	0+10
10	23 ELHOR 401	Commercial Horticulture	Horticulture	0+10
11	23 ELHOR 402	Floriculture and Landscaping	Horticulture	0+10

Periodical evaluation of the above course will be done by the course teacher during different stages of work. Final evaluation of the above course will be done by the teacher in charge andanother staff member appointed as examiner by the Head of the Department. The finalexamination will be conducted by the University before the commencement of regular final semester examinations.

S.No.	Parameters	Max. Marks
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output delivery	10
6.	Entrepreneurship Skills	10
7.	Technical Skill Development/ Business networking skills	20
8.	Report Writing Skills	10
9.	Final Presentation	10
	Total	**100**

Rural Agricultural Work Experience (RAWE) and Industrial Attachment (IA) (Village/ Industrial Attachment Training Programme)

It shall be undertaken by the students during the seventh/eighth semesters for a total duration of 20 weeks with a weightage of 0+20 credit hours in two parts. The Rural Agricultural Work Experience (RAWE) helps the students primarily to understand the rural situations, status of agricultural technologies adopted by the farmers to prioritize the farmers problems and to develop skills & attitude of working with farm families for overall development in rural area.The timings for RAWE can be flexible for specific regions to coincide with the main cropping season.

It will consist of general orientation and on-campus training by different faculties followed by village attachment/unit attachment in university/college/KVK/estates or a research station. Thestudents would be attached with the horti-industries to get an experience of the industrial environment and working. Due weightage in terms of credit hours will be given dependingupon the duration of stay of students in villages/horti-industries. At the end of RHWE/IA, the students will be given one week for project report preparation, presentation and evaluation. The students would be required to record their observations in field and horti-industries on daily basis and will prepare their project report based on these observations.

23 RAWE & IA - Rural Agricultural Work Experience and Industrial Attachment

Activities	Department	No. of weeks	Credit Hours
General orientation & On campus training by different faculties	Agricultural Extension	1	9
Village attachment		8	

Unit attachment in Univ./College. KVK/ Estates/Research Station /Financial Inst.	Agricultural Economics	5	9
Agri clinic/Agri business center		4	
Agro-Industrial Attachment			
Project Report Preparation, Presentation and Evaluation	Agricultural Extension & Agricultural Economics	2	2
Total weeks for RAWE & AIA		**20**	**20**
23 EXT 411 Educational Tour II	Agricultural Extension		1(0+1)

Industrial Attachment:
The students would be attached with the Agro-Industries based industries for a period of 3 weeks to get an experience of the industrial environment and working.

RAWE Component-I

Village Attachment Training Programme

Sl. No.	Activity	Duration
1.	Orientation and Survey of Village	1 week
2.	Agronomical Interventions	1 week
3.	Plant Protection Interventions	1 week
4.	Soil Improvement Interventions (Soil sampling and testing)	1 week
5.	Fruit and Vegetable production interventions	1 week
6.	Food Processing and Storage interventions	1 week
7.	Animal Production Interventions	1 week
8.	Extension and Transfer of Technology activities	1 week

23 RAWE Component –II

Agri-Industrial Attachment

- Students shall be placed in Agro and Cottage industries and Commodities Boards for03 weeks.
- Industries include Seed/Sapling production, Pesticides-insecticides, Post harvest-processing value addition, Agri-finance institutions, etc

Activities and Tasks during Agro-Industrial Attachment Programme

- Acquaintance with industry and staff
- Study of structure, functioning, objective and mandates of the industry
- Study of various processing units and hands-on training under supervision of industrystaff
- Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business network including outlets of the industry
- Skill development in all crucial tasks of the industry
- Documentation of the activities and task performed by the students
- Performance evaluation, appraisal and ranking of students

The final examination will be conducted separately at the end of the semester by theUniversity. The marks will be awarded as detailed below.

Particulars	Max marks	Evaluation by
Observation Note book	20	By Teacher in-charge
Skills learned	20	
Final examination		
Commendable activities	10	By the Examiners
Detailed project report presentation and Record	30	
Viva Voce	20	
Total	**100**	

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

SCHOOL OF ARTS AND SCIENCE

B.SC., BIOCHEMISTRY

EMPLOYABILITY

SKILL DEVELOPMENT

ENTREPRENUERSHIP

2023-24

1.	**Employability**	
2.	**Skill development**	
3.	**Entreprenuership**	
4.	**Employability, Skill development and Entreprenuership**	

1. Preamble

Biochemistry is the cross over scientific discipline that integrates the living world and chemistry. It involves the study of the structure of biomolecules and explores the biological processes at molecular level in the living organisms. It is the laboratory science that has several domains like cell biology, molecular biology, clinical biology, enzymology, immunology, physiology, pharmacology etc., It has enlightened many aspects of health and diseases and paved the way for many interdisciplinary technological innovations like metabolomics, genomics and proteomics. There is a continuous demand for biochemists in public and private health care sectors, agriculture, medical and forensic departments. Almost all food, pharmaceuticals, health and beauty care etc required quality control and safety checks for which experts in the field of Biochemistry are always in need. The syllabi for the three-year B.Sc., degree programme in Biochemistry was framed in such a way that at the end of the course they could apply the knowledge and expertise in industries, diagnostic laboratories and various research fields

The programme endeavours to provide students a broad-based training in biochemistry with a solid background of basic concepts as well as exposing them to the exciting advancements in the field. In addition to theoretical knowledge, significant emphasis has been given to provide hands on experience to the students in the forefront areas of experimental biochemistry. A multidisciplinary approach has been employed to provide the best leverage to students to enable them to move into frontier areas of biological research in the future.

The course defines clearly the objectives and the learning outcomes, enabling students to choose the elective subjects for broadening their skills. The course also offers skills to pursue research in the field of Biological Chemistry and thus would produce best minds to meet the demands of society.

Biochemistry, today is considered as an application oriented integrated basic science. It's an interdisciplinary science that has emerged by the confluence of principles of Chemistry, Physics and Mathematics to Biology. Advances in Biochemistry have immense positive implications on the understanding of biochemical interactions, cellular communications, hormonal mechanisms and the cross talks between them. The research in Biochemistry has been translational and there is a shift from hypothesis driven research to data dependent research that promises translational, product oriented research. Much of the advancement in Biochemistry is in the advancement of Biotechnology, as a basic science discipline Biochemistry lead to Biotechnological advancement. Considering its pivotal role in biological sciences, it is imperative to strengthen the fundamental concepts of Biochemistry.

B.Sc., Graduate Attributes

- **Research, inquiry and analytical thinking abilities.**

- **Capability and motivation for intellectual development.**
- **Ethical, social and professional understanding.**
- **Communication in intra and inter disciplinary**
- **Teamwork, collaborative and management skills in scientific research**
- **Information literacy in respective discipline**

Programme Outcomes:

PO1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study

PO2: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.

PO3: Critical thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO4: Problem solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.

PO5: Analytical reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

PO6: Research-related skills: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation

PO7: Cooperation/Team work: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team

PO8: Scientific reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO9: Reflective thinking: Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.

PO10 Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO 11 Self-directed learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.

PO 12 Multicultural competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO 13: Moral and ethical awareness/reasoning: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.

PO 14: Leadership readiness/qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.

PO 15: Lifelong learning: Ability to acquire knowledge and skills, including „learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

Programme Specific Outcomes:

PSO1 – Placement:

To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, and beliefs and apply diverse frames of reference to decisions and actions.

PSO 2 - Entrepreneur:

To create effective entrepreneurs by enhancing their critical thinking, problem solving,

decision making and leadership skill that will facilitate startups and high potential organizations

PSO3 – Research and Development:

Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.

PSO4 – Contribution to Business World:

To produce employable, ethical and innovative professionals to sustain in the dynamic business world.

PSO 5 – Contribution to the Society:

To contribute to the development of the society by collaborating with stakeholders for mutual benefit

Eligibility for admission

Candidate for admission to the first year of B.Sc. Degree Course in Bio-Chemistry shall be required to have passed the Higher Secondary Examination with Chemistry and Biology or Chemistry, Botany and Zoology or Biochemistry and Chemistry.

3. Highlights of the Revamped Curriculum

- The curriculum is created to improve the relationship between business and academia
- Every semester, practicals based on the course taken that semester will aid students in applying what they have learned
- Students will benefit from the introduction of skill based elective courses including Bioinformatics, Nanobiotechnology, Therapeutic nutrition, and Medical Laboratory technology as they keep up with technological advancements in their fields of study
- The fourth semester internship will give students a chance to apply what they have learned in class to a real-world working experiment
- Skill enhancement courses help students venture new platforms in career.
- Equip students with employability skills, generate self-employment and small scale entrepreneurs.

Mapping of PEOs and PO

B.SC BIOCHEMISTRY

C1 - Nutritional Biochemistry

C2 - Chemistry - I

C3 - Nutritional Biochemistry Lab

C4 - Chemistry - I Lab

C5 - Cell Biology

C6 - Chemistry - II

C7 - Chemistry - II lab

C8 - Cell Biology lab

C9 - Medicinal Diet

C10 - Indian Constitution

C11 - Lifestyle Diseases (Non Major Elective)

C12 - First Aid

C13 - Communication Skills

C14 - Biomolecules

C15 - Microbiology-I

C16 - Biomolecules Lab

C17 - Microbiology-I lab

C18 - Basics of Forensic science

C19 - Medical Laboratory technology

C20 – Research Methodology

C21 - Biochemical Techniques

C22 - Microbiology-II

C23 - Biochemical Techniques Lab

C24 – Microbiology-II lab

C25- Participation in Bounded Research

C26 - Environmental Studies

C27 – Enzymes

C28 – Intermediary Metabolism

C29 – Clinical Biochemistry

C30- Clinical Biochemistry Lab

C31- Enzyme and Immunology Lab

C32- Professional Skills

C33- Value Education

C34- Molecular Biology

C35- Human Physiology

C36- Project

C37- Professional Competency Skill-

B. Sc., Curriculum Mapping

Programme Educational Objectives vs Programme Outcome

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PEO I	*	*		*		*	*		*		*	*		*	
PEO II	*		*	*		*		*	*		*		*	*	
PEO III			*	*	*			*	*	*			*	*	*
PEO IV		*	*	*			*	*	*			*	*	*	
PEO V	*			*	*	*			*	*	*			*	*

B. Sc., Curriculum Mapping

Programme Outcome vs Course Outcome

Programme Outcome-PO Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
C1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C5	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C6	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C7				*	*				*	*				*	*
C8	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

C9				*	*				*	*				*	*
C10	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C11			*	*	*			*	*	*			*	*	*
C12	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C13	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C14	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C16			*	*	*			*	*	*			*	*	*
C17	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C18	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C19			*	*	*			*	*	*			*	*	*
C20	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C21	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C22	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
C23		*		*	*		*		*	*		*		*	*
C24	*	*	*			*	*	*			*	*	*		
C25		*	*	*	*		*	*	*	*		*	*	*	*
C26	*	*	*	*		*	*	*	*		*	*	*	*	
C27		*		*	*		*		*	*		*		*	*
C28		*	*	*	*		*	*	*	*		*	*	*	*
C29		*		*	*		*		*	*		*		*	*
C30	*	*	*			*	*	*			*	*	*		

SCHOOL OF ARTS AND SCIENCE
B.Sc., BIOCHEMISTRY- REGULATION 2023
COURSE STRUCTURE

SEMESTER - I					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
23110AEC11/ 23111AEC11/ 23132AEC11/ 23135AEC11	Tami - I/Advanced English-I/Hindi-I/ French - I	3	1	0	3
23111AEC12	English-I	3	1	0	3
23115AEC13	Nutritional Biochemistry	4	1	0	3
23114GEC14	Chemistry - I	4	1	0	3
PRACTICAL					
23115SEC15L	Nutritional Biochemistry Lab	0	0	3	3
23114SEC16L	Chemistry Lab-I	0	0	3	3
Skill Enhancement Course					
23115SEC17	Medicinal Diet (Non-Major Elective)	2	0	0	2
23115SEC18	Foundation Course (FC)	2	0	0	2
Ability Enhancement Compulsory course (AECC1)					
2311AECCINC	Indian Constitution	2	0	0	2
AUDIT COURSE					
231LSCUV	Universal Human Values	-	-	-	1
	Total	**20**	**4**	**6**	**25**
SEMESTER – II					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
23110AEC21/ 23111AEC21/ 23132AEC21/ 23135AEC21	Tami - II/Advanced English-II/Hindi-II/ French - II	3	1	0	3
23111AEC22	English-II	3	1	0	3
23115AEC23	Cell Biology	4	1	0	3
23114AEC24	Chemistry - II	4	1	0	3
PRACTICAL					
23115SEC25L	Cell Biology Lab	0	0	3	3
23114GEC26L	Chemistry Lab - II	0	0	3	3
Skill Enhancement Course					
23115SEC27	Lifestyle Diseases (Non-Major Elective)	2	0	0	2
23115SEC28	First Aid	2	0	0	2
Ability Enhancement Compulsory course (AECC1)					
231AECCCMS	Communication Skills	2	0	0	2
AUDIT COURSE					
231SSCBE	Basic Behavioural Etiquette	-	-	-	1
	Total	**20**	**4**	**6**	**25**

SECOND YEAR					
SEMESTER – III					
23110AEC31/ 23132AEC31/ 23111AEC31/ 23135AEC31	Tamil - III/Hindi-III/Advanced English-III/ French - III	3	1	0	3
23111AEC32	English-III	3	1	0	3
23115AEC33	Biomolecules	4	1	0	3
23116GEC34	Microbiology-I	4	1	0	3
	PRACTICAL				
23115SEC35L	Biomolecules Lab	0	0	3	3
23116SEC36L	Microbiology Lab-I	0	0	3	3
Skill Enhancement Course					
23115SEC37	Basics of Forensic science	2	0	0	1
23115SEC38	Medical Laboratory technology	2	0	0	2
Ability Enhancement Compulsory course					
23115RMC39	Research Methodology	2	0	0	2
AUDIT COURSE					
231ACLSOAN	Office Automation	-	-	-	1
	Total	**20**	4	**6**	**24**
SEMESTER – IV					
23110AEC41/ 23111AEC41/ 23132AEC41/ 23135AEC41	Tamil-IV/Advanced English-IV /Hindi-IV/ French – IV	3	0	0	3
23111AEC42	English-IV	3	0	0	3
23115AEC43	Biochemical Techniques	4	1	0	3
23116GEC44	Microbiology II	4	1	0	3
PRACTICAL					
23115SEC45L	Biochemical Techniques Lab	0	0	3	3
23116SEC46L	Microbiology Lab-II	0	0	3	3
Skill Enhancement Course					
23115SEC47_	Biomedical Instrumentation Or Tissue Culture	2	0	0	2
23115SEC48_	Medical Coding Or Microbial techniques	2	0	0	2
Ability Enhancement Compulsory course					
23115BRC49	Participation in Bounded Research	2	0	0	2
231AECCEVS	Environmental Studies	2	0	0	2
AUDIT COURSE					
231LCSCLS	Leadership and Management Skills	0	0	0	1
	Total	**22**	**2**	**6**	**27**

SEMESTER – V					
23115AEC51	Enzymes	5	1	0	4
23115AEC52	Intermediary Metabolism	5	1	0	4
23115AEC53	Clinical Biochemistry	5	1	0	4
23115DSC54__	Discipline Specific Elective –I Immunology OR Biochemical Pharmacology OR Disaster Management	4	0	0	3
Skill Enhancement Course					
23115SEC55L	Clinical Biochemistry Lab	0	0	3	3
23115SEC56L	Enzyme and Immunology Lab	0	0	3	3
23115SEC57	Internship/Industrial Visit/Field Visit	**0**	**0**	**0**	**2**
AUDIT COURSE					
231ACLSPSL	Professional Skills	-	-	-	1
231AECCVED	Value Education	2	0	0	2
	Total	**21**	**3**	**6**	**26**
Third year					
SEMESTER – VI					
23115AEC61	Molecular Biology	5	0	0	4
23115AEC62	Human Physiology	5	0	0	4
23115DSC63__	Biotechnology Or Bioinformatics Or Bioentrepreneurship OR Plant Biochemistry and plant Therapeutics	5	0	0	3
23115PRW64	Project	0	0	13	4
23115SEC65	Professional Competency Skill- General awareness for competitive examination	2	0	0	2
231EXACT	Extension activity	-	-	-	1
AUDIT COURSE					
231ACSIKWS	Indian Knowledge System	-	-	-	2
	Total	**17**	**0**	**13**	**20**
Total Credits - Programme					**140**
Total Credits - Audit Courses					**08**
Total Credits					**148**

Discipline Specific Electives

Semester	Discipline Specific Elective Courses-I
V	a) 23115DSC54A – Immunology b) 23115DSC54B – Biochemical Pharmacology c) 23115DSC54C- Disaster Management
	Discipline Specific Elective Courses-II
VI	a) 23115DSC63A- Biotechnology b) 23115DSC63B - Bioinformatics c) 23115DSC63C - Bioentrepreneurship d) 23115DSC63D- Plant Biochemistry and plant Therapeutics

Credit Distribution

Sem	AEC	SEC	GEC	DSC	AECC	Research	Others	Total
I	9	10	3	-	2	-	-	24
II	9	10	3	-	2	-	-	24
III	9	9	3	-	-	2		23
IV	12	10	-	-	-	2	2	26
V	12	8	-	3	2	-	-	25
VI	8	2	-	3	-	4	1	18
Total	**59**	**49**	**9**	**6**	**6**	**8**	**3**	**140**

AUDIT COURSE CREDIT DISTRIBUTION

Semester	Audit
I	1
II	1
III	1
IV	1
V	1
VI	2
Total	**7**

SEMSTER I

Course Code	Course Name	L	T	P	C
23110AEC 11	இக்கால இலக்கியம்	3	1	0	3

இக்கால இலக்கியம்

23110AEC 11

முதல் பருவம்

பாடநோக்கங்கள்

1. இக்கால தமிழ் இலக்கிய வகைகளின் மாதிரிகளை கற்பித்தல்.
2. தமிழின் இனிமையை உணரச் செய்தல்
3. தமிழின் ஈடுபாட்டையும் சுவைக்கும் திறனையும் ஏற்படுத்துதல்.
4. கவிதை எழுதும் திறனை உருவாக்குதல்
5. படைப்பாளர்களாக உருவாக்கும் திறனை ஏற்படுத்துதல்.

பயன்கள்

- மொழி ஆளுமைத் திறன் பெறுதல்.
- சமூக சிந்தனையை வளர்த்துக் கொள்ளுதல்.
- படைப்பாளர்களாக உருவாகும் திறனைப் பெறுதல்.
- இலக்கியங்களின் அறிவை மேம்படுத்துதல்.
- கவிதை எழுதும் முறையை புரிந்துக்கொள்ளுதல்

அலகு **-1** மரபுக்கவிதை

1. பாரதியார்--விடுதலை, வந்தே மாதரம் ,காற்று

2.பாரதிதாசன் - அழகின் சிரிப்பு ,தமிழனுக்கு வீழ்ச்சி இல்லை

3.கவிமணி தேசியவிநாயகம் பிள்ளை-- தொழிலாளியின் முறையீடு

4.நாமக்கல் கவிஞர்-- தருணம் இதுவே ,

5.கண்ணதாசன்-- அனுபவம்

அலகு **-2** புதுக்கவிதைகள்

1.அப்துல் ரகுமான் -வெற்றி

2.அறிவுமதி-நட்புக் காலம்

3.வைரமுத்து- ருசி, சிற்பி- ஓடு ஓடு சங்கிலி

4.மு.மேத்தா- வெளிச்சம் வெளியே இல்லை

அலகு **-3** நாட்டுப்புறவியல்

1.பழமொழிகள்

2. விடுகதைகள்

3. தொழில் பாடல்

அலகு**- 4** சிறுகதை

1. தடயம்- மா. ஜெயபிரகாசம்

2. எதார்த்தம் - சு. தமிழ்ச்செல்வி

3.நீதி-- பூமணி

அலகு**- 5** இலக்கியவரலாறு

1. கவிதை

2. சிறுகதை

3. நாட்டுப்புறவியல்

பொதுக்கட்டுரை **–** மனித நேயம், வாழ்வியல் அறங்கள்

மனப்பாடப் பகுதி **:** பாரதியார் கவிதை- வேண்டும்,பாரதிதாசன் கவிதை-செந்தாமரை

பார்வை நூல்கள் **:**

1. பாரதியார் கவிதைகள் - மணிவாசகர் பதிப்பகம் சென்னை

2.பாரதிதாசன் கவிதைகள் **-** பாரி நிலையம்**,** சென்னை

3. தமிழ் இலக்கிய வரலாறு - மு வரதராஜன் சாகித்திய அகாதெமி,சென்னை

4. நாட்டுப்புறவியல் - முனைவர். ஆறு. ராமநாதன் ,மணிவாசகர் பதிப்பகம், சென்னை

5. தமிழ் சிறுகதையும் தோற்றம் வளர்ச்சி **-** தமிழ் புத்தக நிலையம்**,** சென்னை

இணையதளம் -www.tamilvu.org

www.noolulagam.com

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

English I

Course Code	Course Name	L	T	P	C
231114AEC12	**English I**	3	1	0	3

Learning Objectives

LO1: To enable learners to acquire the linguistic competence necessarily required in various life situations.

LO2: To help them understand the written text and able to use skimming, scanning skills

LO3: To assist them in creative thinking abilities

LO4: To enable them become better readers and writers

LO5: To assist them in developing correct reading habits, silently, extensively and intensively

Unit No.	Unit Title & Text	No. of Periods for the Unit
I	**Poetry** 1.1 A Patch of Land - Subramania Bharati 1.3 A Nation's Strength – Ralph Waldo Emerson 1.4 Love Cycle - Chinua Achebe	20
II	**Prose** 2.1 JRD - Harish Bhat 2.2 Us and Them - David Sedaris From Dress Your Family in Corduroy andDenim	20
III	**Short Stories** 3.1 The Faltering Pendulum- Bhabani Bhattacharya 3.2 How I Taught my Grandmother to Read- Sudha Murthy 3.3 The Gold Frame- R.K. Laxman	20
IV	**Language Competency** 4.1 Vocabulary: Synonyms, Antonyms, Word Formation 4.2 Appropriate use of Articles and Parts of Speech 4.3 Error correction	15
V	**English for Workplace** 5.1 Self - introduction, Greetings 5.2 Introducing others 5.3 Listening for General and Specific Information 5.4 Listening to and Giving Instructions / Directions	15

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Develop and integrate the use of the four language skills i.e. Reading, Listening,	PO1

	Speaking and Writing	
CO2	Understand the total content and underlying meaning in the context.	PO1,PO2
CO3	Form the habit of reading for pleasure and for information	PO4, PO6
CO4	Comprehend material other than the prescribed text	PO4, PO5, PO6
CO5	Develop the linguistic competence that enables them, in the future, to present the culture and civilization of their nation.	PO3, PO8

Text books (Latest Editions)

1. Steel Hawk and other stories by Bhattacharya, Bhabani, New Delhi: Sahitya Akademi, 1967
2. How I taught my Grandmother to Read and other Stories, Murthy, Sudha,Penguin Books, India, 2004

Reference Books

(Latest Editions, and the style given must be strictly adhered to)

1. English in use - A textbook for College Students (English, Paper back, - T.Vijay Kumar, K Durga Bhavani, YL Srinivas
2. Practical English Usage - 4th Edition By Michael Swan
3. The Art of Civilized Conversation: A Guide to Expressing Yourself with Style and Grace -Margaret Shepherd, Penny Carter, (Illustrator), Sharon Hogan, 2005.

Web Resources

1. A patch of land by Subramania Bharati translated by Usha Rajagoplan:

   https://books.google.co.in/books?id=iSHvOmXuvLMC&printsec=frontcover&dq=subramania+bharati+poems&hl=en&newbks=1&newbks_redir=0&source=gb_mobile_search&sa=X&redir_esc=y#v=onepage&q=subramania%20bharati%20poems&f=false
2. The Sparrow by Paul Laurence Dunbar https://poets.org/poem/sparrow-0
3. A Nation’s Strength by Emerson

   https://poets.org/poem/nations-strength

4. Love cycle by Chinua Achebe: https://www.best-poems.net/chinua-achebe/love-cycle.html
5. JRD by Harish Bhat

   https://www.tata.com/newsroom/heritage/coffee-tea-jrd-tata-stories
6. Us and Them by David Sedaris

   From Dress Your Family in Corduroy and Denim

   https://legacy.npr.org/programs/morning/features/2004/jun/sedaris/usandthem.html
7. Uncle Podger Hangs a Picture: http://rosyhunt.blogspot.com/2013/01/uncle-podger-hangs-picture.html
8. The Gold Frame: https://fybaenglish.blogspot.com/2018/12/the-gold-frame-r-k-laxman.html

Mapping with Programme outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

Mapping with Programme Specific Outcomes:

CO /PO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 - Strong, 2 – Medium, 1 – Low

NUTRITIONAL BIOCHEMISTRY

Course Code	Course Name	L	T	P	C
23115AEC13	**Nutritional Biochemistry**	4	1	0	

Course Oobjectives

The objectives of this course are to

- Create awareness about the role of nutrients in maintaining proper health
- Understand the nutritional significance of carbohydrates, lipids and proteins.
- Understand the importance of a balanced diet.
- Study the effect of additives, emulsifiers, flavour enhancing substances in food.
- Study the significance of nutraceuticals.

Unit I: Concepts of food and nutrition. 12 Hrs

Basic food groups-energy yielding, body building and functional foods. Modules of energy. Calorific and nutritive value of foods. Measurement of Calories by bomb calorimeter. Basal metabolic rate (BMR)- definition, determination of BMR and factors affecting BMR. Respiratory quotient (RQ) of nutrients and factors affecting the RQ. SDA-definition and determination- Anthropometric measurement and indices – Height, Weight, chest and waist circumference BMI.

Unit II: 12 Hrs

Physiological role and nutritional significance of carbohydrates, lipids and protein. Evaluation of proteins by nitrogen balance method- Biological value of proteins- Digestibility coefficient, Protein Energy Ratio and Net Protein Utilization. Protein energy malnutrition – Kwashiorkar and Marasmus, Obesity-Types and preventive measures.

Unit III: 12 Hrs

Balanced diet, example of low and high-cost balanced diet- for infants, children, adolescents, adults and elderly people. ICMR classification of five food groups and its significance food pyramid. Junk foods- definition and its adverse effects.

Unit IV: **Food additives:** 12 Hrs

Structure, chemistry, function and application of preservatives, emulsifying agents, buffering agents, stabilizing agents, natural and artificial sweeteners, bleaching, starch modifiers, antimicrobials, food emulsions, fat replacers, viscosity agents, gelling agents and maturing agents. Food colors, flavors, anti-caking agent, antioxidants. Safety assessment of food additives.

Unit V: **Nutraceuticals and Functional Foods:** 12 Hrs

Definition, properties and function of Nutraceuticals, food Supplements, dietary supplements prebiotics and probiotics, and functional Foods. Food as medicine. Natural pigments from plants– carotenoids, anthocyanins and its benefits.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Cognizance of basic food groups viz. Carbohydrates, proteins and lipids and their nutritional aspects as well as calorific value	PO1, PO5
CO2	Identify and explain nutrients in foods and the specific functions in maintaining health.	PO1
CO3	Classify the food groups and its significance	PO1, PO2
CO4	Understand the effect of food additives	PO1, PO2
CO5	Describe the importance of nutraceuticals and pigments	PO1, PO5, PO6

Text books

1. Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bredbenner. 2013. Wardlaw's Perspectives in Nutrition: A Functional Approach. McGraw-Hill, Inc., NY, USA.
2. M. Swaminadhan (1995) Principles of Nutrition and Dietics. Bappco.
3. Tom Brody (1998). Nutritional Biochemistry (2nd ed), Academic press, USA
4. Garrow, JS, James WPT and Ralph A (2000). Human nutrition and dietetics(10thed)
5. Churchill Livingstone.
6. Andreas M.Papas (1998). Antioxidant Status, Diet, Nutrition, and Health (1sted) CRC

Reference Books

1. Branen, A.L., Davidson PM &Salminen S. 2001. Food Additives.2nd Ed. Marcel Dekker.
2. Gerorge, A.B. 1996. Encyclopaedia of Food and Color Additives. Vol. III. CRC Press.
3. Advances in food biochemistry, Fatih Yildiz (Editor), CRC Press, Boca Raton, USA, 2010
4. Food biochemistry & food processing, Y.H. Hui (Editor), Blackwell Publishing, Oxford, UK, 2006.
5. Geoffrey Campbell-Platt. 2009. Food Science and Technology. Wiley-Blackwell, UK.

Web resources

1. http://old.noise.ac.in/SecHmscicour/english/LESSON O3.pdf
2. https://study.com/academy/lesson/energy-yielding-nutrients-carbohydratesfat-protein.html.
3. https://www.nhsinform.scot/healthy-living/food-and-nutrition/eatingwell/vitamins-and-minerals

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3				2		3	3	3	3
CO 2	3						3	3		3
CO 3	3	2					3	1		3
CO 4	3	2					3	3		3
CO5	3				2	2	3	3		3

S-Strong (3) **M-Medium (2)** **L-Low (1)**

CHEMISTRY 1

Course Code	Course Name	L	T	P	C
23114AEC12	Chemistry 1	4	1	0	3

Course Objectives:

- To understand the various theories of coordination chemistry.
- To study the various concepts of resonance and halogen compounds.
- To study the properties of aromatic compounds and organic reactions.
- To learn the concepts of solid-state chemistry.

Course Outcomes:

Upon successful completion of this course the students would be able:

- To describe structure and functions of biologically important coordination compounds.
- To apply eletromeric and resonance effect to predict reactivity and stability of organic compounds
- To classify the drugs based on their mode of actions.
- To predict conditions for spontaneous and non-spontaneous reactions.
- To calculate Gibb’s free energy, work function and entropy of a reaction

UNIT I: COORDINATION CHEMISTRY AND INDUSTRIAL CHEMISTRY:

1.1 Coordination Chemistry: Nomenclature-Werner's, sidgwick and Pauling's theories. Chelation-industrial importance of EDTA, Biological role of hemoglobin and Chlorophyll

1.2 Industrial Chemistry: Fuelgases – Watergas, producer gas, LPG gas, Gobar gas and natural gas. Fertilizers - NPK and mixed Fertilizers- soaps and detergents.

UNIT II: ELECTRON DISPLACEMENT EFFECTS AND HALOGEN COMPOUNDS:

2.1 Polar effects: Inductive effect - Relative Strength of Aliphatic monocarboxylic acid and aliphatic amines. Resonance - Condition for resonance. Consequences of resonance - resonance of energy. Basic property of aniline and acidic property of phenol. Hyper conjugation – Heat of hydrogenation – Bond length and dipole moment. Steric effect.

2.2 Halogen containing compounds: Important chloro-hydrocarbons use dissolvent. Pesticides–Dichloromethane, chloroform, carbon tetrachloride, DDT and BHC Types of solvents: -Polar, Non-polar.

UNIT – III AROMATIC COMPOUNDS AND ORGANIC REACTIONS:

3.1 Aromatic compounds: Structure, stability resonance and aromaticity of benzene. Substitution reaction: Nitration, Halogenations, Alkylation. Naphthalene – Isolation, properties and uses.

3.2 Organic reaction: Biuret, Decarboxylation, Benzoin, Perkin, Cannizaro, Claisen and Halo form reactions

3.3 Chemotherapy: Explanation with two examples each for analgesics, antibacterial, anti - inflammatory, antibiotics, antiseptic and disinfectant, anesthetics local and general (Structures not necessary).

UNIT – IV SOLIDSTATE, ENERGETICS AND PHASERULE:

4.1 Solidstate: Typical crystal lattices - unit cell, elements of symmetry, Bragg's equation, Weiss Indices, Miller indices, simple body centered and face centered lattices

4.2 Energetics: First law of thermodynamics – state and path function – need for the second law – carnotscycle and thermo- dynamic scale of temperature, spontaneous and Non–spontaneous processes–entropy – Gibbs free energy.

4.3 Phase rule: Phase, component, degree of Freedom, phase rule definitions – one component system–water system.

UNIT – V CHEMICALEQUILIBRIUMANDCHEMICALKINETICS:

5.1 Chemical equilibrium: Criteria of homo generous and heterogeneous equilibria, - decomposition of HI, N_2O_4, $CaCO_3$+Pd_5.

5.2 Chemical Kinetics: Order of reaction and their determinations-activation energy, effects of temperature on reaction rate.

REFERENCES:

1. Gopalan R, Text Book of Inorganic Chemistry, 2nd Edition, Hyderabad, Universities Press, (India), 2012.
2. Morrison R.T. and Boyd R.N., Bhattacharjee S.K. Organic Chemistry (7^{th} edition), Pearson India, (2011).
3. Puri B.R., Sharma L.R. and Pathania M.S. (2013), Principles of Physical Chemistry, (35^{th}edition), New Delhi: Shoban Lal Nagin Chandand Co.
4. https://gascnagercoil.in/wp-content/uploads/2020/12/allied-chemistry-book.pdf

NUTRITIONAL BIOCHEMISTRY LAB

Course Code	Course Name	L	T	P	C
23115AEC15L	**Nutritional Biochemistry Lab**	0	0	3	3

Course objectives

The objectives of this course are to

- Impart hands-on training in the estimation of various constituents by titrimetric method
- Prepare Biochemical preparations
- Determine the ash content and extraction of lipid

TITRIMETRY **20hrs**

1. Estimation of ascorbic acid in a citrus fruit.

2. Estimation of calcium in milk.

3. Estimation of glucose by Benedict's method in honey.

4. Estimation of phosphorous (Plant source)

BIOCHEMICAL PREPARATIONS **15 Hrs**

Preparation of the following substances and its qualitative tests

5. Lecithin from egg yolk.

6. Starch from potato.

7. Casein and Lactalbumin from milk.

GROUP EXPERIMENT **10Hrs**

8. Determination of ash content and moisture content in food sample

9. Extraction of lipid by Soxhlet's method.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Estimate the important biochemical constituents in the food samples.	PO1, PO3
CO2	Prepare the macronutrients from the rich sources.	PO1, PO3
CO3	Determine the ash and moisturecontent of the food samples	PO1, PO3
CO4	Extract oil from its sources	PO1, PO3, PO6

Text books

1. Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, NewAge International Publishers, 2011,
2. An Introduction to Practical Biochemistry, David T. Plummer, 3 rd edition, Tata McGraw-Hill Publishing Company Limited, 2001.

Reference books

1. Biochemical Methods, Sadasivam S and Manickam A, 4h edition, NewAge International Publishers, 2016
2. Essentials of Food and Nutrition, Vol. I & II, M.S. Swaminathan.
3. Bowman and Robert M. 2006. Present Knowledge in Nutrition.9th edition, International Life Sciences Publishers.
4. Indrani TK. 2003. Nursing Manual of Nutrition and Therapeutic Diet, 1st edition Jaypee Brothers medical publishers.
5. Martha H. and Marie A. 2012. Biochemical, Physiological, and Molecular Aspects of Human Nutrition.3rd edition. Chand Publishers.

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3		3				3	3	3	3
CO 2	3		3				3	3	3	3
CO 3	3		3				3	3	3	3
CO 4	3		3			3	3	3	3	3

S- Strong (3) M-Medium (2) L-Low (1)

ALLIED CHEMISTRY PRACTICAL - I

Course Code	Course Title	L	T	P	C
23114SEC16L	Allied Chemistry Practical - I	0	0	3	2

Course Objectives:

1. To learn the techniques of titrimetric analyses.
2. To know the estimation of several cations and anions.
3. To learn the techniques of qualitative analysis of organic compounds

Volumetric Analysis:

1. Acidimetry and alkalimetry:

(a) Strong acid VS strong base

(b) Weak acid VS strong base

(c) Determination of hardness of water.

2. Permanganometry:

(a) Estimation off ferrous sulphate

(b) Estimation of oxalic acid

3. Iodometry:

(a) Estimation of potassium dichromate

(b) Estimation of potassium permanganate

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

1. To understand the use of volumetric pipette, burette and analytical balance.
2. To explain the principles of volumetric analysis.

MEDICINAL DIET (NON-MAJOR ELECTIVE)

Course Code	Course Title	L	T	P	C
23115SEC17	Medicinal Diet (Non-Major Elective)	2	0	0	2

Learning Objectives

The main objectives of this course are to

- Provide basic knowledge about diet
- Understand of diet modification for GI diseases
- Plan a diet for liver diseases
- Prepare diet chart for Infectious diseases

- Plan a diet for Diabetes, Renal and Cardio-vascular diseases

Unit I: Principles of Therapeutic Diet: Definitions of Normal diet, Therapeutic diet, soft Diet and Liquid diet. Objectives of Diet Therapy. Advantages of using normal diet as the basis for Therapeutic diet. Normal Diet-therapeutic modification of normal diet. 6 Hrs

Unit II: Diet modification in Gastrointestinal diseases: Peptic ulcer, Diarrhea, Lactose intolerance, Constipation and Malabsorption syndrome 6 Hrs

Unit III: Diet Modification in liver and gall bladder in diseases: Etiology, symptoms and dietary treatment in jaundice, hepatitis, cirrhosis of liver and hepatic coma. 6 Hrs

Unit IV: Diet Modification in Infectious Diseases: Fevers, Typhoid, Tuberculosis and Viral Hepatitis. Dietary modifications in Tuberculosis. 6 Hrs

Unit V: Diet Modification in Diabetes, Renal and Cardio-vascular Diseases-Diabetes, acute & chronic glomerulonephritis, nephrosis, renal failure, kidney stone and Hypertension.6 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Possess basic knowledge about diet	PO1
CO2	Sketch diet plan for GI diseases	PO1, PO4, PO5, PO6
CO3	Sketch diet plan for liver diseases	PO1, PO4, PO5, PO6
CO4	Sketch a diet plan for Infectious diseases	PO1, PO4, PO5, PO6
CO5	Prepare diet chart for Diabetes Renal and Cardio-vascular diseases	PO1, PO4, PO5, PO6

Text Books

1. M. Raheena Begum, A Text Book of Foods, Nutrition and Dietetics, Sterling Publishers Pvt. Ltd.
2. M.V. Raja Gopal, Sumati. R., Mudambi, Fundamentals of foods and Nutrition, Wiley Eastern Limited, Year-1990.
3. William S.R Nutrition and Diet Therapy, 1985, 5thedition, Mosly Co. St. Louis.

Reference books

1. Rodwell Williams Nutrition and Diet Therapy, 1985, the C.V Mosly St. Louis.
2. M.V. Krause & M.A. Mohan, Food Nutrition and Diet Therapy, 1992 by W.B Saunders Company, Philadelphia, London.

3. Davidson and Passmore, Human Methods and Diabetics, 1976 the English Language Book Society and Churchill.

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2						3	3		3
CO 2	2			2	3	2	3	3		3
CO 3	2			2	3	2	3	3		3
CO 4	2			2	3	2	3	3		3
CO 5	2			2	3	2	3	3		3

S-Strong (3) M-Medium (2) L-Low (1)

INDIAN CONSTITUTION

Course Code	Course Title	L	T	P	C
231AECCICN	Indian Constitution	2	-	-	**2**

Aim:

The aim of the constitution is mentioned in the *preamble that is to constitute* India into a sovereign, socialist, democratic republic and it's the provision of the rights of citizens.it's primary objective is to provide economic, social & political justice.

Course Objectives:

- To make the students understand about the democratic rule and parliamentarian administration
- To appreciate the salient features of the Indian constitution
- To know the fundamental rights and constitutional remedies
- To make familiar with powers and positions of the union executive,union parliament and the supreme court
- To exercise the adult franchise of voting and appreciate the electoral system of Indian democracy.

Course outcome:

1. Democratic values and citizenship training are gained
2. Awareness on fundamental rights is established
3. The function of union government and state government are learnt
4. The power and functions of the judiciary are learnt thoroughly
5. Appreciation of democratic parliamentary rule is learnt

Unit I: The making of Indian constitution

The constitution assembly organization - character -work salient features of the constitution- written and detailed constitution -socialism - secularism-democracy and republic.

Unit II: Fundamental rights and fundamental duties of the citizens

Right of equality -right of freedom- right against exploitation -right to freedom of religion- cultural and educational rights -right to constitutional remedies -fundamental duties.

Unit III: Directive principles of state policy

Socialistic Principles-Gandhi a principles-liberal and general principles -differences between fundamental rights and directive principles

Unit IV: The union executive, union parliament and Supreme Court

Powers and positions of the president - qualification - method of election of president and vice president -prime minister -Rajya Sabah -Lok Sabah. The supreme court -high court - functions and position of supreme court and high court

Unit V: State council -election system and parliamentary democracy in India

State council of ministers -chief minister -election system in India-main features election commission-features of Indian democracy.

References:

1) Palekar. S.A. Indian constitution government and politics, ABD publications, India
2) Aiyer, Alladi Krishnaswami, Constitution and fundamental rights 1955.
3) Markandan. K.C. Directive Principles in the Indian constitution 1966.
4) Kashyap. Subash C, Our parliament, National book trust, New Delhi 1989

UNIVERSAL HUMAN VALUES

Course Code	Course Title	L	T	P	C
231LSCUV	**Universal Human Values**	-	-	-	1

Aim:

This course aims at making learners conscious about universal human values in an integral manner, without ignoring other aspects that are needed for learner's personality development.

Course Objectives:

- The present course deals with meaning, purpose and relevance of universal human values and how to inculcate and practice them consciously to be a good human being and realize one's potentials.

Course Outcomes:

By the end of the course the learners will be able to:

- Know about universal human values and understand the importance of values in individual, social circles, career path, and national life.
- Learn from case studies of lives of great and successful people who followed and practiced human values and achieved self-actualization.
- Become conscious practitioners of human values.
- Realize their potential as human beings and conduct themselves properly in the ways of the world.

Unit I: Introduction - What is love? Forms of love for self, parents, family, friend, spouse, community, nation, humanity and other beings, both for living and non-living Love and compassion and inter-relatedness Love, compassion, empathy, sympathy and non-violence Individuals who are remembered in history for practicing compassion and love. Narratives and anecdotes from history, literature including local folklore Practicing love and compassion: What will learners learn gain if they practice love and compassion? What will learners lose if they don't practice love and compassion? Sharing learner's individual and/or group experience(s). Simulated Situations. Case studies

Unit II: Introduction - What is truth? Universal truth, truth as value, truth as fact (veracity, sincerity, honesty among others). Individuals who are remembered in history for practicing this value. Narratives and anecdotes from history, literature including local folklore. Practicing Truth: What will learners learn/gain if they practice truth? What will learners lose if they don't practice it?. Learners' individual and/or group experience(s). Simulated situations Case studies

Unit III: Introduction - What is non-violence? Its need. Love, compassion, empathy, sympathy for others as pre-requisites for non-violence. Ahimsa as non-violence and non-killing. Individuals and organisations that are known for their commitment to non-violence. Narratives and anecdotes about non-violence from history, and literature including local folklore. Practicing non-violence: What will learners learn/gain if they practice non-violence? What will learners lose if they don't practice it? Sharing learner's individual and/or group experience(s) about non-violence. Simulated situations. Case studies

Unit IV: Introduction - What is righteousness? Righteousness and *dharma*, Righteousness and Propriety. Individuals who are remembered in history for practicing righteousness - Narratives and anecdotes from history, literature including local folklore. Practicing righteousness: What will learners learn/gain if they practice righteousness? What will learners lose if they don't practice it? Sharing learners' individual and/or group experience(s). Simulated situations. Case studies

Unit V: Introduction - What is peace? Its need, relation with harmony and balance.

Individuals and organisations that are known for their commitment to peace. Narratives and Anecdotes about peace from history, and literature including local folklore. Practicing peace: What will learners learn/gain if they practice peace? What will learners lose if they don't practice it? Sharing learner's individual and/or group experience(s) about peace. Simulated situations. Case studies

TAMIL – II

Course Code	Course Title	L	T	P	C
23110AEC21	Tami – II	3	1	0	3

பக்தி இலக்கியம் - 23110AEC21
இரண்டாம் பருவம்

பாடநோக்கங்கள்

- காலந்தோறும் பக்தி இலக்கியம் வளர்ந்துள்ள தன்மையைக் கற்பித்தல்.
- நாயன்மார்கள், ஆழ்வார்களின் பக்திச் சிறப்பை அறிய செய்தல்.
- ஆழ்வார்களின் பக்தி உணர்வை ஊட்டுதல்
- பாடல்களில் இசை இன்பம், ஓசை நயம் ஆகியவற்றை உணரச்செய்தல்
- குழந்தைப் பருவத்தின் தன்மையை உணர்த்துதல்

பயன்கள்

- நாயன்மார்கள் பக்திச் சிறப்பை அறிதல்.
- ஆழ்வார்களின் பக்தி நெறியை உணர்தல்.
- பக்தி இலக்கியம் காலம் தோறும் வளர்ந்ததை அறிதல்.
- பாடல்களில் இசை இன்பம், ஓசை நயம் அறிதல்.
- குழந்தைப் பருவத்தின் தன்மையை உணர்தல்.

அலகு- 1 பன்னிரு திருமுறைகள்
1. திருஞானசம்பந்தர்– திருத்தில்லைப் பதிகம்
2. திருநாவுக்கரசர் - திருநீற்றுப் பதிகம்
3. சுந்தரர் - திருவெண்ணைநல்லூர்
4. திருமூலர்- திருமந்திரம்(இளமை நிலையாமை)

அலகு- 2 பன்னிரு ஆழ்வார்கள்
1. ஆண்டாள் - திருப்பாவை
2. பெரியாழ்வார்- மூன்றாம் திருமுறை(பத்து பாடல்கள்)
3. மதுரகவியாழ்வார் - கண்ணின் நுண் சிறு தாம்பு

அலகு- 3 சிற்றிலக்கியங்கள்
1. மீனாட்சியம்மைப் பிள்ளைத்தமிழ்– செங்கீரை பருவம், அம்புலி பருவம்
2. நந்திக்கலம்பகம்
3. குற்றால குறவஞ்சி- குறத்தி நகர்வளம் கூறுதல்
4. காளமேகப்புலவர் பாடல்கள்

அலகு- 4 புதினம
1. நா .பார்த்தசாரதியின்- குறிஞ்சி மலர்

அலகு-5 தமிழ் இலக்கிய வரலாறு
1. பக்தி இலக்கியங்கள்
2. சைவமும் தமிழும்
3. வைணவ சமயம் போற்றி வளர்த்த தமிழ்
4. சிற்றிலக்கியங்கள்
5. நாவல் இலக்கியம்

பார்வை நூல்கள் :
1. தேவாரம் - மணிவாசகர் பதிப்பகம் சென்னை
2. நாலாயிர திவ்ய பிரபந்தம் - வர்த்தமான பதிப்பகம் சென்னை
3. தமிழ் இலக்கிய வரலாறு - முனைவர் ச சுபாஷ் சந்திர போஸ், இயல் வெளியீடு ,தஞ்சாவூர
4. தமிழ் நாவல் இலக்கியம் -கா கைலாசபதி- தமிழ் புத்தக,நிலையம், சென்னை

இணையதளம் -www.tamilvu.org , www.noolulagam.com

Mapping with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

ENGLISH-II

Course Code	Course Title	L	T	P	C
23111AEC22	English-II	3	1	0	3

Learning Objectives		
LO1	To introduce learners to the essential skills of communication in English	
LO2	To enable them use these skills effectively in academic and non-academic contexts	
LO3	To help them identify and eliminate common mistakes in writing and speaking	
LO4	To enable them use various business communication strategies and to use advanced vocabulary	
LO5	To familiarize them in writing descriptive essays and respond to arguments orally and in writing	
Unit No.	**Unit Title & Text**	**No. of Periods for the Unit**
I	**Poetry** 1.1Very Indian Poem in Indian English - Nissim Ezekiel 1.2 Still I Rise - Maya Angelou 1.3 On Killing a Tree - Gieven Patel	20
II	**Prose** 2.1 If You Are Wrong Admit it- Dale Carnegie 2.2 Kindly Adjust Please - Shashi Tharoor 2.3 The Spoon-fed Age- W.R. Inge	20
III	**Fiction** Alchemist - Paulo Coelho	20

IV	**Language Competency** 4.1 Homonyms, Homophones, Homographs Portmanteau words 4.2 Subject Verb Agreement	15
V	**English in the Workplace** 5.1 Reading for General and Specific information [charts, tables, schedules, graphs etc] 5.2 Reading news and weather reports 5.3 Writing paragraphs 5.4 Taking and making notes	15

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Learn to introduce themselves and talk about everyday activities confidently	PO1
CO2	Be able to write short paragraphs on people, places and events	PO1, PO2
CO3	Identify the purpose of using various tenses and effectively employ them in speaking and writing	PO4, PO6
CO4	Gain knowledge to write subjective and objective descriptions	PO4, PO5, PO6
CO5	Identify and use their skills effectively in formal contexts.	PO3, PO8

Text Books (Latest Editions)	
1	The Alchemist - Paulo Coelho Harper - 2005
References Books **(Latest editions, and the style as given below must be strictly adhered to)**	
1	Advanced English Grammar. Martin Hewings. Cambridge University Press, 2000
2	Descriptive English. SP Bakshi, Richa Sharma · 2019, Arihant Publications (India) Ltd.
3	The Reading Book: A Complete Guide to Teaching Reading. Sheena Cameron, Louise Dempsey, S & L. Publishing, 2019.
4	Skimming and Scanning Techniques, Barbara Sherman, Liberty University Press, 2014
5	Brilliant Speed Reading: Whatever you need to read, however. Phil Chambers, Pearson, 2013.
6	The Archer, Paulo Coelho. Penguin Viking, 2020.

WebResources	
1	Very Indian poem by Nissim Ezekiel http://econtent.in/pacc.in/admin/contents/40_%20_2020103001102714.pdf
2	Still I Rise by Maya Angelou https://www.poetryfoundation.org/poems/46446/still-i-rise
3	The Flower by Tennyson: https://www.poemhunter.com/poem/the-flower-2/
4	On Killing a tree by Gieve Patel: https://www.poemhunter.com/poem/on-killing-a-tree/
5	If you are wrong, admit it: https://www.tbr.fun/if-youre-wrong-admit-it/
6	Kindly Adjust please - Shashi Tharoor https://www.theweek.in/columns/shashi-tharoor/2018/05/25/kindly-adjust-to-our-english.html?fbclid=IwAR3IhtdXqvuV4ySECn9S7SA6HmCEYISyd1QHd3BlwKgiNKKwdkeSg3qWp-U/
7	The Spoon Fed Age: https://www.nrkacademy.com/2016/04/spoon-feeding-by-wringe.html
8	The Alchemist: https://www.youtube.com/watch?v=lxBYpmxjeDU

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

3 - Strong, 2 - Medium, 1 - Low

CELL BIOLOGY

Course Code	Course Title	L	T	P	C
23115AEC23	Cell Biology	4	1	0	3

Learning Objectives

The main objectives of this course are to

- Provide basic understanding of architecture of cells and its organelles.
- Understand the organization of prokaryotic and eukaryotic genome.

- Educate on the structural organization of bio membrane and transport mechanism
- Impart knowledge on cell cycle, cell division and basics of cells
- Familiarize the concept of mechanism of cell-cell interactions.

Unit I: Architecture of cells- Structural organization of prokaryotic and eukaryotic cells microbial, plant and animal cells. The ultrastructure of nucleus, mitochondria, RER, SER, golgi apparatus, lysosome, peroxisome and their functions 12 Hrs

Unit II: Cytoskeleton- microfilament, microtubules and intermediary filament- structure, composition and functions. Organization of Genome -prokaryotic, and eukaryotic genome. Organization of chromatin - histones, nucleosome concept, formation of chromatin structure. Special types of chromosomes - lamp brush chromosomes, polytene chromosomes. 12 Hrs

Unit III: Bio membranes - Structural organization of bilipid layer model and basic functions - transport across cell membranes- uniport, symport and antiport. Passive and active transport. 12Hrs

Unit IV: Cell cycle - Definition and Phases of Cell cycle - Cell division - Mitosis and Meiosis and its significance, Cancer cells- definition, types and characteristics of cancer cells. 12 Hrs

Unit V: Extracellular matrix – Collagen, laminin, fibronectin and proteoglycans- structure and biological role. Structure and role of cadherin, selectins, integrins, Cell -cell interactions- Types-gap junctions, tight junctions and Desmosomes. 12 Hrs

Course Outcomes

CO	**On completion of this course, students will be able to**	**Program outcomes**
CO1	Explain the structure and functions of basic components of prokaryotic and eukaryotic cells, especially the organelles.	PO1
CO2	Familiarize the cytoskeleton and chromatin	PO1, PO2
CO3	Illustrate the structure, composition and functions of cell membrane related to membrane transport	PO1, PO2
CO4	Elaborate the phases of cell cycle and cell division-mitosis and meiosis and characteristics of cancer cells.	PO1, PO2
CO5	Relate the structure and biological role of extra cellular matrix in cellular interactions	PO1, PO2

Text books

1. Arumugam. N, Cell biology. Saras publication (10ed, paperback), 2019
2. Devasena. T. Cell Biology. Oxford University Press India-ISBN: 9780198075516, 0198075510, 2012**.**
3. Bruce Alberts and Dennis Bray. 2013, Essential Cell Biology. (4th ed). Garland Science.

Reference books

1. S.C.R. Cell Biology. Newage Publishers -ISBN-10: 8122416888/ISBN-13: 978-8122416886, 2008
2. Cooper. G.A. The Cell: A Molecular Approach. Sinauer Associates, Inc -ISBN10: 0878931066 / ISBN 13: 9780878931064, 2013
3. E.M.F. D.R. Cell and Molecular Biology. Lippincott Williams & Wilkins Philadelphia - ISBN: 0781734932 9780781734936, 2006.
4. LodishH. A, Berk C.A, Kaiser M, Krieger M.P, Scott A, Bretscher H, Ploegh and Matsudaira. 2007. Molecular Cell Biology, 6th Edition, WH. Freeman Publishers, New York, USA.

Web resources

1. https://nicholls.edu/biol-ds/bio1155/Lectures/Cell%20Biology.pdf
2. https://www.medicalnewstoday.com/article/320878.php
3. https://biologydictionary.net /cell

Mapping with Program Outcome

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	3						3			3
CO 2	3	3					3			3
CO 3	3	3					3			3
CO 4	3	3					3	3		3
CO5	3	3					3			3

S-Strong (3) M-Medium (2) L-Low (1)

ALLIED CHEMISTRY - II

Course Code	Course Title	L	T	P	C
23114GEC24	Allied Chemistry - II	4	1	0	3

Course Objectives:

1. To learn the basics of nuclear chemistry and metallic bond.

2. To understand the properties and applications of carbohydrates, amino acids and proteins.

3. To study the basic concepts of polymers, heterocyclic compounds and stereoisomerism.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

1. To explain theory of nuclear chemistry and chemical bonding.

2. To classify carbohydrates and proteins.

3. To synthesise polymers and hetero cyclic compounds.

4. To apply conductivity measurements to determine degree of dissociation of weak electrolyte and pH of buffer solution.

5. To explain preparation and applications of emulsion and gels in chromatography.

UNIT I: Nuclear Chemistry and Metallic bond:

1.1 Nuclear Chemistry: Fundamental particles of nucleus- isotopes, isobars, isotones and isomers – differences between chemical reactions and nuclear reactions, nuclear fusion and fission- radioactive series.

1.2 Metallic bond: Electron gas, Pauling and band theories, semiconductors – intrinsic, extrinsic – type and p – type semiconductors.

1.3 Compounds of sulphur and sodiumthiosulphate

UNIT II: Carbohydrates, Amino Acids and Proteins:

2.1 Carbohydrates: classification –glucose and fructose–preparation and properties – structure of glucose –Fischer and Haworth cyclic structures.

2.2 Amino acids and proteins: Amino acids – Classification based on structure. Essential and non – essentials amino acids – preparation, properties and uses – peptides (elementary treatment only) – proteins – Classification based on physical properties and biological functions. Structure of proteins–primary and secondary (elementary treatment).

UNIT III: Polymers, Heterocyclic Compound and Stereoisomerism:

3.1 Synthetic polymers: preparation, properties and uses of Teflon, epoxy resins, polyester resin.

3.2 Heterocyclic compounds: Furan, pyrrole and pyridine –preparation, properties and uses – basic properties of pyridine and pyrrole.

3.3 Stereoisomerism: Optical isomerism – Lactic and tartaric acid – racemic mixture and resolution. Geometrical isomerism–maleic and fumaricacids.

Unit IV: Surface and photochemistry:

4.1 Surface Chemistry: Emulsions, gels–preparation, properties - Electrophoresis and applications, chromatography – Column, paper and thin layer Chromatography.

4.2 Photochemistry: Laws of photochemistry and applications.

Unit V: Electrochemistry, pH and Buffer

5.1 Electrochemistry: Specific and equivalent conductivity–their determination – effect of dilution on conductivity. Ostwald's Dilution law, Kohlrausch law, conductivity measurements, and conduct metric titrations.

5.2 pH and buffer: Importance of Ph and buffers –pH determination by colorimetric and electrometric methods.

REFERENCES:

1. B.R. Puri, L.R. Sharma, K.C. Kalia, 'Principles of Inorganic Chemistry', 21st edition, Vallabh Publications, 2004-2005.
2. Bahl, B.S. and Bahl, A., Organic Chemistry, (12thedition), New Delhi, Sultan Chand & Co., (2010).
3. Puri B.R., Sharma L.R. and Pathania M.S. (2013), Principles of Physical Chemistry, (35th edition), New Delhi: Shoban Lal Nagin Chand and Co.
4. https://oms.bdu.ac.in/ec/browse.php?type=UG

CELL BIOLOGY LAB

Course Code	Course Title	L	T	P	C
23115SEC25L	Cell Biology Lab	0	0	3	3

Learning Objectives

The aim objectives of this course are to

- Learn the parts of microscope
- Investigate the cells under microscope.
- Image the cells using different stains
- Identify the cells, organelles and stages of cell division
- Identify the spotters

I MICROSCOPYANDSTAININGTECHNIQUES

1. Study the parts of light and compound microscope
2. Preparation of Slides and Micrometry
3. Examination of prokaryotic and eukaryotic cell
4. Visualization of animal and plant cell by methylene blue
5. Visualization of nuclear fraction by acetocarmine stain
6. Staining and visualization of mitochondria by Janus green stain

II GROUP EXPERIMENT

1. Identification of different stages of mitosis in onion root tip
2. Identification of different stages of meiosis in onion bulb

III SPOTTERS

9. a) **Cells**: Nerve, plant and Animal cell

   b) **Organelles**: Mitochondria, Chloroplast, Endoplasmic reticulum,

   c) **Mitosis stages** – Prophase, Anaphase, Metaphase, Telophase

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Identify the parts of microscope.	PO1, PO2
CO2	Preparation of Slides	PO1, PO2
CO3	Identify the stages of mitosis & meiosis	PO1, PO2
CO4	Visualize nucleus and mitochondria by staining methods	PO1, PO2
CO5	Identify the spotters of cells, organelles and stages ofc ell division	PO1, PO2

Text books

1. Rickwood, Dand J.R. Harris cell Biology: Essential Techniques, Johnwikey 1996.
3. Davis, J.M. Basic Cell culture: A practical approach, IRL 1994.
4. Ganesh M.K. and Shivashankara A.R. 2012. Laboratory Manual for Practical Biochemistry Jaypee publications, 2nd edition.

Reference books

1. Essential practical handbook of Cell biology, Genetics and Microbiology - A Practical manual - Debarati Das Academic publishers
2. Cell biology Practical, Dr. Venugupta. Prestige publisher

3. Cell and Molecular biology, DeRobertis, 8th edition, 1st June, 1987

Mapping with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3					3	3	3	3
CO 2	2	3					3	3	3	3
CO 3	2	3					3	3	3	3
CO 4	2	3					3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

CHEMISTRY LAB–II

Course Code	Course Title	L	T	P	C
23114GEC26L	Chemistry Lab - II	0	0	3	3

COURSE OBJECTIVES:

1. To learn the techniques of titrimetric analyses.
2. To know the estimation of several cations and anions.
3. To learn the techniques of qualitative analysis of organic compounds

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

1. To understand the use of volumetric pipette, burette and analytical balance.
2. To explain the principles of volumetric analysis,

Organic Analysis:

Analyse the following organic Compounds.

1. Carbohydrate
2. Amide
3. Aldehyde
4. Ketone
5. Acid
6. Amine

The students may be trained to perform the specific reactions like tests for aliphatic or aromatic, saturated or unsaturated and functional group present and record their observations.

REFERENCES:

1. R. Gopalan, Elements of analytical chemistry, S. Chand, New Delhi, 2000.
2. N.S. Gnanapragasam and G. Ramamurthy, Organic Chemistry lab manual, S. Viswanathan and Co. Pvt. Ltd. Chennai-1998

LIFESTYLE DISEASES (NON-MAJOR ELECTIVE)

Skill Enhancement Course

Course Code	Course Title	L	T	P	C
23115SEC27	Lifestyle Diseases (Non-Major Elective)	2	0	0	2

Learning Objectives

- The objectives of this course are to
- Create awareness on life style diseases among adolescents.
- List out the lifestyle diseases.
- Explain the common lifestyle diseases and their prevention.
- Acquaint the disorders associated with women's health.
- Impart life skills so as to prevent lifestyle diseases.

Unit I: Lifestyle diseases: Definition, Factors contributing to lifestyle diseases - Physical in activity, Poor food habits, disturbed biological clock, sleep deprivation. 6Hrs

Unit II: Top lifestyle diseases, Impact of Lifestyle diseases on family, society and economy of country. **6** Hrs

Unit III: Causes, symptoms**,** types, preventive measures and treatment of Obesity, cardiovascular diseases, diabetes and cancer. 6 hrs

Unit IV: Women's lifestyle diseases: Polycystic Ovarian Disease, Infertility, Breast and cervical cancer and Osteoporosis. 6 hrs

Unit V: Prevention of lifestyle diseases: Balanced diet, sufficient intake of water, physical activity, sleep-wake cycle, stress management and meditation. 6Hrs

Course outcomes

CO	On completion of the course the students will be able to	Program Outcomes
CO1	Define Life style diseases and describe the	PO1

	contributing factors	
CO2	Enumerate the top lifestyle diseases and its impact on life.	PO1, PO4, PO5
CO3	Elaborate the treatment and prevention measures of common lifestyle diseases.	PO1, PO4, PO5
CO4	Highlight the lifestyle diseases that affects the women's health	PO1, PO4, PO5
CO5	Illustrate the various measures for prevention of lifestyle diseases	PO1, PO4, PO5

Textbooks

1. JamesM R, Lifestyle Medicine, 2nd Edition, CRC Press, 2013
2. Akira Miyazaki, New Frontiers in Lifestyle-Related Disease, Springer, 2008

Reference books

1. Steyn K, Life style and related risk factors for chronic diseases
2. Willett WC, Prevention of chronic disease by means of diet and lifestyle.
3. Kumar M & R. Kumar, Guide to prevention of lifestyle diseases. Deep & Deep publications

Web resources

1. https://youtu.be/jDdL2bMQXfE
2. https://youtu.be/7WnpSB14nDM
3. https://youtu.be/ollz9MqtW-U

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2						3	3		3
CO 2	2			2	3		3	3		3
CO 3	2			2	3		3	3		3
CO 4	2			2	3		3	3		3
CO 5	2			2	3		3	3		3

S-Strong (3) M-Medium (2) L-Low (1)

FIRST AID

Course Code	Course Title	L	T	P	C
23115SEC28	First Aid	2	0	0	2

Learning Objectives

The main objectives of this course are to:

- Provide knowledge on the basics of first aid.
- Perform first aid during various respiratory issues.
- Demonstrate the first aid to treat injuries.
- Learn the first aid techniques to be given during emergency.
- Familiarize the first aid during poisoning.

Unit I: Aims and important rules of first aid, dealing with emergency, types and content of a first aid kit. First aid technique – Dressing and Bandages, fast evacuation technique, transport techniques.6 Hrs

Unit II: Basics of Respiration – CPR, first aid during difficult breathing, drowning, choking, strangulation and hanging, swelling within the throat, suffocation by smoke or gases and asthma. 6 Hrs

Unit III: Common medical aid - first aid for wounds, cuts, head, chest, abdominal injuries, shocks, burns, amputations, fractures, dislocation of bones. 6Hrs

Unit IV: First aid related to unconsciousness, stroke, fits, convulsions - seizures, epilepsy. 6Hrs

Unit V: First aid in poisonous bites (Insects and snakes), honey bee stings, animal bites, disinfectant, acid and alkali poisoning. 6Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Discuss on the rules of first aid, dealing during emergency and first aid techniques	PO1, PO4, PO5
CO2	Understand the first aid techniques to be given during different types of respiratory problems	PO1, PO4, PO5
CO3	Provide first aid for injuries, shocks and bone injury	PO1, PO4, PO5

CO4	Detail on the first aid to be given for unconsciousness, stroke, fits and convulsions	PO1. PO4, PO5
CO5	Gain expertise in giving first aid for insect bites and chemical poisoning	PO1. PO4, PO5

Text books

1) First aid and health Dr. Gauri Goel, Dr. Kumkum Rajput, Dr. Manjul Mungali, ISBN 978-93-92208-19-5
2) Indian First Aid Mannual-https://www.indianredcross.org/publications/FA-manual.pdf
3) Red Cross First Aid/CPR/AED Instructor Manual

Web resources

1. https://www.redcross.org/take-a-class/first-aid/first-aid-training/first-aid-online
2. https://www.firstaidforfree.com/

Mapping with Program Outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2						3	3	3	3
CO 2	2			3	3		3	3	3	3
CO 3	2			3	3		3	3	3	3
CO 4	2			3	3		3	3	3	3
CO5	2			3	3		3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

COMMUNICATION SKILLS

Course Code	**Course Title**	**L**	**T**	**P**	**C**
231AECCCMS	Communication Skills	2	0	0	2

Aim: The aim to develop communication skills

Course Objectives:

This course has been developed with the following objectives:

- Identify common communication problems that may be holding learners back
- Identify what their non-verbal messages are communicating to others

- Understand role of communication in teaching-learning process
- Learning to communicate through the digital media
- Understand the importance of empathetic listening
- Explore communication beyond language.

Course Outcome:

- By the end of this program, participants should have a clear understanding of what good communication skills are and what they can do to improve their abilities.

Unit I: Techniques of effective listening, Listening and comprehension, Probing questions, Barriers to listening, Pronunciation, Enunciation, Vocabulary, Fluency, Common Errors.

Unit II: Techniques of effective reading, gathering ideas and information from a given text, Identify the main claim of the text, Identify the purpose of the text, Identify the context of the text, Identify the concepts mentioned. Evaluating these ideas and information - Identify the arguments employed in the text, Identify the theories employed or assumed in the text. Interpret the text - To understand what a text says, to understand what a text does, To understand what a text means

Unit III: Clearly state the claims, Avoid ambiguity, vagueness, unwanted generalizations and over simplification of issues, Provide background information, Effectively argue the claim, Provide evidence for the claims, Use examples to explain concepts, Follow convention, Be properly sequenced, Use proper signposting techniques, Be well structured. Well-knit logical sequence - Narrative sequence, Category groupings, Different modes of Writing - E-mails, Proposal writing for Higher Studies, Recording the proceedings of meetings, Any other mode of writing relevant for learners

Unit IV: Role of Digital literacy in professional life, Trends and opportunities in using digital technology in the workplace, Internet Basics, Introduction to MS Office tools: Paint, Office, Excel, Power point. Introduction to social media websites, Advantages of social media, Ethics and etiquettes of social media, How to use Google search better, Effective ways of using Social Media, Introduction to l Marketing

Unit V: Meaning of non-verbal communication, Introduction to modes of non-verbal communication, Breaking the misbeliefs, Open and Closed Body language, Eye Contact and Facial Expression, Hand Gestures, Do's and Don'ts, Learning from experts, Activities-Based Learning

Reference:

1. Sen Madhu Chanda (2010), An Introduction to Critical Thinking, Pearson, Delhi
2. Silvia P. J. (2007), How to Read a Lot, American Psychological Association, Washington DC

AUDIT COURSE

Course Code	Course Title	L	T	P	C	
231SSCBE	Basic Behavioural Etiquette	-	-	-	1	

Objectives:

Training is mainly focused on discipline, grooming, career planning and building personality. As it is the first year of the university, students are given awareness about the job market right from the start so that they prepare accordingly at their own pace and potential.

Eliminating negative thought, developing enriching habits, unlocking individual potentials and well-versed communication is the aim of this program. The module consists of

a) Communication Skills
b) Goal Setting
c) Career Planning
d) Reaching your Potential
e) Time Management
f) Stress Management
g) Grooming and Discipline
h) Learning skills
i) Listening Skills
j) Team Building

Reference Book

1 Barbara Pachter, Marjorie Brody. Complete Business Etiquette Handbook. Prentice Hall, 2015.
2 Dhanavel, S.P. English and Soft Skills. Hyderabad: Orient BlackSwan, 2021.
3 Koneru, Aruna. Professional Communication. Delhi: McGraw, 2008.
4 Mahanand, Anand. English for Academic and Professional Skills. Delhi: McGraw, 2013. Print.
5 Nancy Mitchell. Etiquette Rules : A Field Guide to Modern Manners. Wellfleet Press, 2015.
6 Rani, D Sudha, TVS Reddy, D Ravi, and AS Jyotsna. A Workbook on English Grammar and Composition. Delhi: McGraw, 2016.

SECOND YEAR: SEMESTER III

Course Code	Course Title	L	T	P	C
23110AEC31	**Tamil – III**	3	1	0	3

காப்பிய இலக்கியம் - **23110AEC31**
மூன்றாம் பருவம்

பாடநோக்கங்கள்

- தமிழ்க் காப்பியங்களை அறிமுகப்படுத்துதல்.
- காப்பியங்கள் கூறும் வாழ்வியல் அறங்களை உணர்த்துதல்.
- காப்பிய இலக்கியங்களில் இலக்கியச் சுவையை பயிற்றுவித்தல்.
- நாடக இலக்கியத்தின் தனித்துவத்தைக் கற்பித்தல்.
- புராணச் செய்திகளை மேம்படுத்திக் கொள்ளச்செய்தல்

பயன்கள்

- இலக்கியங்களின் சிறப்புகளை அறிவர்
- காப்பியக் கதைகள் வழி அறச் சிந்தனை பெறுவர்
- பல்வேறு காப்பிய வடிவங்களை பற்றிய அறிவு பெறுவர்.
- நாடக படைப்பாக்கத்திற்கான தூண்டுதலைப் பெறுவர்
- புராணச் செய்திகள் வழி தமிழ் கலாச்சாரத்தை அறிவர்.

அலகு-**1** காப்பியங்கள்

1.சிலப்பதிகாரம் - மதுரை காண்டம் (வழக்குரை காதை)]
2.மணிமேகலை - விழாவறை காதை
3.சீவக சிந்தாமணி - குணமாலையார் இலம்பகம்

அலகு-**2** காவியங்கள்

1.கம்பராமாயணம்- மந்தரை சூழ்ச்சி படலம்
2.மகாபாரதம் - ஆரண்ய பருவம்

அலகு-**3** புராணங்கள்

1. பெரியபுராணம்- இளையான்குடி மாற நாயனார் புராணம்
2. சீறாப்புராணம் - ஈத்தங்குழை வரவழைத்தப் படலம்
3.தேம்பாவணி- பிரிந்த மகனை காண்படலம்

அலகு-**4** நாடகம் - சாபம்? விமோசனம்

அலகு-**5** இலக்கிய வரலாறு

1. காப்பியங்கள்
2. இரட்டைக் காப்பியங்கள்
3. நாடக இலக்கியம்

பார்வை நூல்கள் :

1. காப்பியத்திறன்- மணிவாசகர் நூலகம், சிதம்பரம்.
2 . தமிழ் காப்பியங்கள் - கி. வா .ஜகன் ஜெகநாதன் , அமுத நிலையம், சென்னை .
3 .நவீன நாடக உருவாக்கம் - கோ பழனி , தமிழ் பல்கலைக்கழகம், தஞ்சாவூர்.
4. இணையதளம் -www.tamilvu.org , www.noolulagam.com
5. சாபம்? விமோசனம்
மு.இராமசுவாமி,
செண்பகம் இராமசுவாமி,
பாவை பதிப்பகம்,ஜானிஜான் சாலை,
சென்னை - 14

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

English-III

Course Code	Course Title	L	T	P	C
23111AEC32	**English-III**	**3**	**1**	**0**	**3**

Learning Objectives	
LO1	To enhance the level of literary and aesthetic experience of students and to help them respond creatively.
LO2	To sensitize them to the major issues in the society and the world.
LO3	To provide them with an ability to build and enrich their communication skills
LO4	To equip them to utilize the digital knowledge resources effectively for their chosen fields of study
LO5	To help them think and write imaginatively and critically.

Unit No.	**Unit Title & Text**	**No. of Periods for the Unit**
I	**Poetry:** 1.1 The Voice of the Mountains - Mamang Dai 1.2 A Song of Hope - Oodgeroo Noonuccal 1.3 In an Artist's Studio - Christina Rossetti	20
II	**Scenes From Shakespeare:** 2.1 Romeo & Juliet -The Balcony Scene 2.2 Macbeth-Banquet Scene 2.3 Julius Caesar - Murder Scene	20
III	**Speeches of Famous personalities** 3.1 Yes, We Can-Barack Obama 3.2 You've Got to Find What You Love-Steve Jobs	20
IV	**Language Competency** 4.1 Writing letters and emails 4.2 Writing and messaging in social media platforms [blogs, twitter, instagram.facebook] 4.3 Learning netiquette, email etiquette	15

V	**English for Workplace** 5.1 Data Interpretation and Reporting 5.2 Data Presentation and analysis 5.3 Meeting Etiquettes - language, dress code, voice modulation. Online Meetings - Terms and expressions used 5.4 Conducting and participating in a meeting	15

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Broaden their outlook and sensibility and be acquainted with cultural diversity and divergence in perspectives.	PO1
CO2	Be updated with basic informatics skills and attitudes relevant to the emerging knowledge society	PO1,PO2
CO3	Produce grammatically and idiomatically correct language.	PO4,PO6
CO4	Gain knowledge in writing techniques to meet academic and professional needs.	PO4,PO5,PO6
CO5	Be equipped with sufficient practice in Vocabulary, Grammar, Comprehension and Remedial English from the perspective of career-oriented tests.	PO3,PO8

Text Books (Latest Editions)	
1	Arden Shakespeare Complete works by Shakespeare (Author), William (Author), Bloomsbury, 2011)
References Books **(Latest Editions, and the style as given below must be strictly adhered to)**	
1	The Shakespeare Book: Big Ideas Simply Explained, Stanley Wells et al. DK Publishing, 2015
3	Famous Speeches by Mahatma Gandhi, CreateSpace Independent Publishing Platform, 2016
4	**How to Build a Professional Digital Profile Kindle Edition** by Jeanne Kelly Bernish, Bernish Communications Associates, LLC; 1st edition (May 29, 2012)
5	Keys to Teaching Grammar to English Language Learners, Second Ed.: A Practical Handbook by Keith S Folse, Michigan Teacher Training, 2016.
6	Role Play-Theory and Practice.Krysia M Yardley-Matwiejczuk, SAGE publications ltd, 1997

BIOMOLECULES

Course Code	Course Title	L	T	P	C
23115AEC33	**Biomolecules**	4	1	0	3

Learning objectives

- The main objectives of this course are to:
- Introduce the structure, properties and biological significance of carbohydrates
- Comprehend the classification, functions and acid base properties of amino acids
- Elucidate the various levels of organization of Proteins.
- Impart knowledge on the classification, properties and characterization of lipids.
- Acquaint with the classification, structure, properties and functions of nucleic acids

Unit I: Carbohydrates-Classification and biological significance, physical properties - stereo isomerism, optical isomerism, anomers, epimers and mutarotation. Monosaccharides: Occurrence, linear and cyclic structure, Reactions of monosaccharides due to the presence of hydroxyl, aldehyde and keto groups. Disaccharides: Structure and properties of reducing disaccharides (lactose and mannose), non-reducing disaccharide(sucrose). Polysaccharides: Homopolysaccharides - Occurrence, structure and biological significance of starch, glycogen and cellulose. Heteropolysaccharides - Structure and biological significance of mucopolysaccharides - hyaluronic acid, chondroitin sulphate and heparin. (Structural elucidation not needed). 12 hrs

Unit II: Amino acids -Classification based on composition of side chain and nutritional significance. General structure of amino acids. 3 - and 1- letter abbreviations. Modified amino acids in protein non - protein amino acids. Physical properties of amino acids, isoelectric point, titration curve (alanine, lysine, glutamic acid), optical activity. Chemical reactions due to carboxyl group, amino group and side chains. Colour reactions of amino acids. 12Hrs

Unit III: Proteins-Classification based on shape, composition, solubility and functions. Properties of proteins - Ampholytes, isoelectricpoint, salting in and salting out, denaturation and renaturation, UV absorption. Levels of Organization of protein structure- Primary structure, Formation and characteristics of peptide bond, phi and psi angle, Secondary structure-α helix (egg albumin), β- pleated sheath (keratin), triple helix (collagen). Tertiary structure - with reference to myoglobin. Quaternary structure with reference to haemoglobin. 12 Hrs

Unit IV: Lipids- Lipids: Bloor's classification, chemical nature and biological functions. Fatty acids: classification, nomenclature, structure and properties of fatty acids. Simple and

mixed triglycerides: structure and general properties, Characterization of fats- iodine value, saponification value, acid number, acetyl number, polensky number, Reichert-Meissl number along with their significance. Compound lipids-Structure and functions of phospholipids and glycolipids. Derived lipids-Structure and functions of cholesterol, bile acids and bile salts. 12Hrs

Unit V: Nucleic Acids-Structure of purine and pyrimidine bases, nucleosides and nucleotides and their biological importance. Types of DNA: A, B, C, Z DNA, structure and biological significance, super helicity. Types of RNA: mRNA, tRNA, rRNA, hnRNA, snRNA, Secondary and tertiary structure of tRNA. Properties of DNA-Hypochromic and hyperchromic effect, melting temperature, viscosity. Denaturation and annealing. 12Hrs

Course Outcomes

CO	**On completion of this course, students will be able to**	**Program outcomes**
CO1	Classify, illustrate the structure and explain the physical and chemical properties of carbohydrates.	PO1
CO2	Indicate the classification, structure, properties and biological functions of amino acids.	PO1
CO3	Explain the classification and elucidate the different levels of structural organization of proteins.	PO1
CO4	Elaborate on classification, structure, properties, functions and characterization of lipids	PO1, PO4
CO5	Describe the structure, properties and functions of different types of nucleic acids	PO1

Textbooks

1. Biochemistry, U. Sathyanarayana & U. Chakrapani, 2013, 5th edition Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd.
2. Fundamentals of Biochemistry, J.L. Jain, Sunjay Jain, Nitin Jain, 2013, 7th edition S. Chand & Company Ltd.
3. Text book of Medical Biochemistry, M.N. Chatterjea, Rana Shinde, 2002, 8th edition, Jaypee Brothers.

Reference books

1. David L. Nelson, Michael M. Cox, 2005, Principles of Biochemistry, 4th edition W.H. Freeman and Company.
2. Voet. D, Voet. J.G. and Pratt, C.W, 2004, Principles of Biochemistry, 4th edition John

Wiley & Sons, Inc.
3. Zubay G.L, *et.al*., 1995, Principles of Biochemistry, 1st edition, WmC. Brown Publishers.

Web resources

1. https://www.britannica.com/science/biomolecule
2. https://en.wikipedia.org/wiki/Biomoleculehttps://www.khanacademy.org/science/biology/macromolecules

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3			3
CO 2	3						3			3
CO 3	3						3			3
CO 4	3			2			3	2		3
CO5	3						3			3

S-Strong (3) M-Medium (2) L-Low

MICROBIOLOGY-I

Course Code	Course Title	L	T	P	C
23116GEC34	**Microbiology-I**	4	1	0	3

Aim:

Students should have knowledge about the history and development of Microbiology

Objectives:

The contents of this course will help students understand history, biology of microorganisms, growth and control of microbes. Thus the beginners are rightly exposed to foundation of Microbiology which would lead them towards progressive advancement of the subject

Outcomes:

On the successful completion of the course, student will be able to:

1. Understand the history of microbiology
2. Analyze the types of microscopes

3. Understand the general characteristics of microbes
4. Evaluate the success of understanding the characterization and cultivation of microbes.

Unit I: History of microbiology - Historical development of Microbiology- Theories of spontaneous generation - The scope of Microbiology - prokaryotic and eukaryotic microorganisms. General principles and nomenclature - Haeckel's three kingdom concept, Whittaker's five kingdom concept- Carl Woese three domain classification.

Unit II: **Microscopy** - Microscopy: Principles and applications of bright field, dark field, phase contrast, fluorescent SEM and TEM. Principles and types of staining - Simple, differential (Gram, Spore, AFB) Capsule staining (Negative), Sterilization: Principles and methods – physical moist heat, dry heat, filtration (Membrane and HEPA).

Unit III: General characteristics of microbes - General characteristics and nature of Archaebacteria, Cyanobacteria, Mycoplasma, Rickettsiae, Chlamydia, Spirochaetes, Actinobacteria, Protozoa, Algae, Fungi and Viruses. Basic understanding of classification of viruses, algae, fungi and protozoa.

Unit IV: Classification of bacteria - Outline classification for bacteria as per the Bergey's Manual of Systematic Bacteriology - Structural organization of bacteria - Size, shape and arrangement of bacterial cells -Ultrastructure of a bacterial cell - cell wall, cell membrane, ribosomes, nucleoid, slime, capsule, flagella, fimbriae, spores, cysts, plasmid, mesosomes and cytoplasmic inclusions.

Unit V: Cultivation of microbes - Cultivation of microbes- Types of culture media with specific examples for each type. Aerobic and Anaerobic culture techniques-Pure culture techniques (Tube dilution, Pour plate, Spread plate and Streak plate).

REFERENCES

1. Alcamo IE. Fundamentals of Microbiology, sixth edition, Addison wesley Longman, Inc. California. 2001.
2. Alexopoulos CJ, Mims CW and Blackwell M. Introductory Mycology. Fifth edition John Wiley and Sons. Chichester. 2000.
3. Atlas RA and Bartha R. Microbial Ecology. Fundamentals and Application, Benjamin Cummings, New York. 2000.
4. Black JG. Microbiology-principles and explorations, 6th edition. John Wiley and Sons, Inc. New York. 2005.
5. Cappuccino and Sherman. Microbiology – A Laboratory Manual. 7th edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi. 2012.

Text Book

1. Dubey RC and Maheswari DK. A Text Book of Microbiology. S Chand, New Delhi. 2010 7. Johri RM, Snehlatha, Sandhya Shrama. A Textbook of Algae. Wisdom Press, New Delhi. 2010.
2. Kanika Sharma. Textbook of Microbiology – Tools and Techniques. 1st edition, Ane Books Pvt. Ltd., New Delhi. 2011.
3. Madigan MT, Martinko JM, and Parker J. Biology of Microorganisms, 12th Edition, MacMillan Press, England. 2009.
4. Moselio Schaechter and Joshua Leaderberg. The Desk encyclopedia of Microbiology. Elseiver Academic press, California. 2004.
5. Pelczar MJ, Chan ECS and Kreig NR. Microbiology, fifth edition. McGrawHill. Book Co. Singapore. 2009.
6. Prescott LM, Harley JP, and Klein DA. Microbiology (7th edition) McGraw Hill, Newyork. 2008.
7. Schlegel HG. General Microbiology, Cambridge University Press, U.K. 2008.
8. Tortora GJ, Funke BR and Case CL. Microbiology: An Introduction. 9th Edition, Pearson Education, Singapore. 2009.
9. Rajan S and Selvi Christy R. Essentials of Microbiology, Anjanaa Book House, Chennai, 2015.

BIOMOLECULES LAB

Course Code	Course Title	L	T	P	C
23115SEC35L	**Biomolecules Lab**	0	0	3	3

Learning Objectives

The main objectives of this course are to

- Identify the biomolecules carbohydrates and amino acids by qualitative test
- Determine the quality of Lipids by titrimetric methods
- Isolate nucleic acids from plant and animal source

I) Qualitative test for 15 Hrs

1) Carbohydrates

a) Glucose b) Fructose c) Arabinose d) Maltose e) Sucrose f) Lactose g) Starch

2) Amino acids

a) Arginine b) Cysteine c) Histidine d) Proline e) Tryptophan f) Tyrosine g) Methionine

II Titrimetric methods 15 Hrs

1) Determination of Saponification value of an edible oil

2) Determination of Iodine number of an edible oil

3) Determination of Acid number of an edible oil

III. Group Experiments 15 hrs

1) Isolation of DNA from plant/animal source.

2) Isolation of RNA from rich source.

Course Outcomes

CO	**On completion of this course, students will be able to**	**Program outcomes**
CO1	Qualitatively analyze the carbohydrates and report the type of carbohydrate based on specific tests	PO1, PO2, PO3
CO2	Qualitatively analyze amino acids and report the type of amino acids based on specific tests	PO1, PO2, PO3
CO3	Determine the Saponification, Iodine and acid number of edible oil	PO1, PO3, PO4
CO4	Isolate the nucleic acid from biological sources	PO1, PO3

Text books

1. David T Plummer, An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw-Hill Edition
2. J. Jayaraman Laboratory Manual in Biochemistry New Age International (P) Limited Fifth edition 2015
3. S. Sadasivam A. Manickam Biochemical Methods New Age International Pvt Ltd publisher's third edition 2018

Reference books

1. Rageeb, Kiran Patil, M. Bakshi Rahman, Sufiyan Ahmad Raees. A Practical book on Biochemistry, Everest publishing house1stEdition, 2019
2. Introductory practical Biochemistry - S.K. Sawhney, Randhir Singh, 2nd ed, 2005.

3. Biochemical Tests - Principles and Protocols. Anil Kumar, Sarika Garg and Neha Garg. Vinod Vasishtha Viva Books Pvt Ltd, 2012.
4. Harold Varley, Practical Clinical Biochemistry, CBS. 6th edition, 2006.
5. Keith Wilson and John Walker. Principles and Techniques of Practical Biochemistry, 4th edition, Cambridge University press, Britain, 1995.

Web resources

1. https://www.pdfdrive.com/instant-notes-analytical-chemistry-e912659.html 14
2. https://www.pdfdrive.com/analytical-biochemistry-e46164604.html
3. https://www.pdfdrive.com/biochemistry-books.html

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3	3				3	3	3	3
3CO 2	2	3	3				3	3	3	3
CO 3	2		3	2			3	3	3	3
CO 4	2		3				3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

MICROBIOLOGY LAB-I

Course Code	Course Title	L	T	P	C
23116SEC36L	**Microbiology Lab-I**	0	0	3	3

1. Safety practices in Microbiological laboratory
2. Microscope and its operation
3. Principles and operations - Autoclave, Hot Air Oven, Filtration, Laminar Air Flow, Incubators, colony counter, Centrifuge, pH meter, Colorimeter and Spectrophotometer
4. Preparation of culture media, cleaning of glassware and sterilization methods
5. Demonstration of ubiquitous nature of microorganisms.
6. Measurement of size of microbes – micrometry.
7. Observation of permanent slides to study the structural characteristics of algae (Anabena, Nostoc, Spirulina, Oscillotoria), fungi (Pythium, Rhizopus, Saccharomyces, Penicillium, Aspergillus, Agaricus) and protozoa (Entamoeba histolytica and Plasmodium spp.).

8. Enumeration of bacterial numbers by Viable count (Plate count) and Total count (Haemo cytometer count)
9. Pure culture techniques - Streak plate, Pour plate and Spread plate.
10. Test for motility of bacteria - Hanging drop method.
11. Staining techniques - Simple staining, Gram's staining, Spore-staining, Capsular staining.
12. Isolation of bacteria, actinobacteria, fungi and cyanobacteria.

BASICS OF FORENSIC SCIENCE

Skill Enhancement Course

Course Code	Course Title	L	T	P	C
23115SEC37	Basics of Forensic science	2	0	0	1

Learning Objectives

The main objectives of this course are to

C1 Gain knowledge on the basic practices of forensic analysis.

C 2 Perform investigation using fresh blood.

C 3 Carry out the analysis using body fluids

C 4 Investigate the presence of forms of drugs and poisons in body fluids.

C5 Execute the identification test on multiple samples.

Unit I: Forensic Science: Definition, History and Development. Crime scene management and investigation; collection, preservation, packing and forwarding of physical and trace evidences for analysis. 6Hrs

Unit II: Blood – grouping and typing of fresh blood samples including enzyme. Cases of disputed paternity and maternity problems, DNA profiling. 6Hrs

Unit III: Analysis of body fluids- Analysis of illicit liquor including methyl and ethyl alcohol in body fluids and breathe. Chemical examination, physiology and pharmacology of Insecticides and pesticides. 6Hrs

Unit IV: Psychotropic drugs -Sedatives, stimulants, opiates and drugs of abuse. Identification of poisons from viscera, tissues and body fluids. 6Hrs

Unit V: Identification tests- Identification of hair, determination of species origin, sex, site and individual identification from hair. Classification and identification of fibers. Examination and identification of saliva, milk, urine and faecal matter 6Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Gain knowledge on basics of forensic science and method for collection and preservation of samples	PO1, PO2, PO6
6CO2	Assess the paternity, maternity problems and DNA profiling	PO1, PO2
CO3	Identify the presence of alcohol, insecticides and pesticides in body fluids	PO1, PO2
CO4	Detail on the test performed to identify the presence of drugs and poisons in body fluids	PO1, PO2
CO5	Identify species and sex from the available body fluids	PO1, PO2

Reference books

1. An Introduction to Forensic DNA Analysis by Norah Rudin & Keith Inman USA, Second edition.
2. Forensic Science Handbook, Volume 2 & 3 by Saferstein, Richard E.
3. Forensics by Embar-Seddon, Ayn and Pass. Allan D.
4. Forensic Medicine by Adelman, Howard C & Kobilinsky, Lawrence Page 24 of 63

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3					3		3	3
CO 2	2	3					3		3	3
CO 3	2	3					3		3	3
CO 4	2	3					3		3	3
CO5	2	3					3		3	3

S-Strong (3) M-Medium (2) L-Low (1)

MEDICAL LABORATORY TECHNOLOGY

Course Code	Course Title	L	T	P	C
23115SEC38	Medical Laboratory technology	2	0	0	2

Learning Objectives

The main objectives of this course are to

- Impart knowledge on specimen collection and disposal of waste.
- Acquaint knowledge on collection, preservation and transfusion of blood.
- Quantify the biomolecules in biological sample
- Understand the significance of various tests and their interpretation in diseased conditions
- Acquaint knowledge on enzymes, hormones and Immunoglobulins as markers for diagnosis.

Unit I: Collection, transport, analysis of specimen – blood, routine urine, feces, sputum, semen, CSF Documentation of samples & results. Disposal of laboratory/ hospital waste- Noninfectious waste, biomedical waste, infected sharp waste disposal, infected non sharp disposal - color coding as per guidelines. 6 Hrs

Unit II: Determination of Blood group and Rh factor -Basic blood banking procedures- cross matching, screening test. Blood transfusion and hazards. 6 Hrs

Unit III: Estimation of blood sugar - Enzymatic method, HbA1C, Qualitative and quantitative analysis of urine sample- NPN-urea, uric acid, creatinine. Mineral, vitamin and CSF analysis. 6 Hrs

Unit IV: Immuno diagnostics - Widal test, VDRL test, ASO, RA, CRP and Complement fixation Test. RIA, ELISA, Skin test - Montaux and Lepramin test. 6 Hrs

Unit V: Assay of clinically important enzymes- Estimation of clinically important hormones - Insulin, Thyroid and Reproductive hormones and its clinical significance. 6 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Collect & preserve of biological samples.	PO1, PO2
CO2	Estimate the various constituents in biological sample	PO1, PO2, PO6
CO3	Perform the routine procedures adopted in blood bank	PO1, PO2,

		PO6
CO4	Analyze and interpret the values for both normal and disease conditions.	PO1, PO2, PO6
CO5	Assay the enzymes and hormones &interpret clinical implications	PO1, PO2, PO6

Text Books

1. Kanai L Mukherjee and Anuradha Chakravarthy Medical Laboratory Technology IVth edition, Vol I, 2022
2. Ramnik Sood, Text Book of Medical Laboratory Technology, Jaypee Publishers, 2006
3. Tietz, N. (2018) Fundamentals of Clinical Chemistry and Molecular Diagnostics 8th edition, W.B. Saunders Company

Web Resources

1. https://www.youtube.com/watch?v=QNYlX5Ne9lQ
2. https://www.slideshare.net/doctorrao/agglutination-tests-and-immunoassys
3. https://microbenotes.com/introduction-to-precipitation-reaction/

Mapping with Program Outcome

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2	3					3	3	3	3
CO 2	2	3				2	3	3	3	3
CO 3	2	3				2	3	3	3	3
CO 4	2	3				2	3	3	3	3
CO5	2	3				2	3	3	3	3

S - Strong (3) M - Medium (2) L -Low (1)

RESEARCH METHODOLOGY

Ability Enhancement Compulsory course

Course Code	**Course Title**	**L**	**T**	**P**	**C**
23115RMC39	Research Methodology	2	0	0	2

Aim:

To create a basic appreciation towards research process and awareness of various research publication

Course objectives:

- To understand the steps in research process and the suitable methods.
- To identify various research communications and their salient features
- To carry out basic literature survey using the common data-bases
- To give exposure to MATLAB platform for effective computational and graphic works required for quality research

Course outcome:

Ability to carry out independent literature survey corresponding to the specific publication type and assess basic computational frameworks used in mathematical researches.

Unit I: Introduction to Research Methodology

Meaning of research – Objectives of research – Types of research – Significance of research – Research approaches

Unit II: Research Methods

Research methods versus methodology - Research and scientific method - Criteria of good research - Problems encountered by researchers in India.

Unit III: Literature Survey

Articles - Thesis - Journals - Patents - Primary sources of journals and patents - Secondary sources - Listing of titles - Abstracts - Reviews - General treatises - Monographs.

Unit IV: Database Survey

Database search - NIST - MSDS - PubMed - Scopus - Science citation index - Information about a specific search.

Unit V: Basic Principles of Laboratory Life Sciences Laboratory

Introduction - Access to Laboratory and Emergency Exits - Basic Biostatistics, Mean, Median, Mode and its Application - Fundamental of Biosafety, Bioethics, Replication – Advantages and Disadvantages, Standard division, Standard Error, Preparation of Chemicals – Percentage, Molarlity and Normality, Ratio Solution, PPM Solution etc. Ethical Issue in Animal Handling, Basic of DMRT, ANOVA etc.

Reference Book

1. John W. Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods, Approaches, 4th Edition SAGE

2. Sharan B. Merriam & Elizabeth J. Tisdell, Qualitative Research: A Guide to Design and Implementation, 4th Edition, John Wiley & Sons
3. Introductory Statistics. Fifth Edition. (2004) Prem S. Mann. John Wiley and Sons, (ASIA) Pvt. Ltd.
4. Research Methodology Methods and Statistical Techniques - Santosh Gupta
5. Biostatistical analysis. J.H. Zar, 4th edition. Pearson Education, Inc. India.
6. Braun, R.P. Introduction to instrumental analysis, McGraw Hill.
7. Wilson & Walker, Principles and Techniques of Biochemistry and Molecular Biology. 6th Edn, Cambridge Univ. Press.

AUDIT COURSE

Course Code	Course Title	L	T	P	C
231ACLSOAN	Office Automation	-	-	-	1

Course Objectives:

To provide an in-depth training in the use of office automation, internet and internet tools. The course also helps the candidates to get acquainted with IT.

Course Outcomes:

After completion of the course, students would be able to documents, spreadsheets, make small presentations and would be acquainted with the internet.

Unit I: Knowing the basics of Computers

Unit II: Word Processing (MS word)

Unit III: Spread Sheet (MS XL)

Unit IV: Presentation (MS Power Point)

Unit V: Communicating with Internet

Reference:

1. Fundamentals of computers - V. Rajaraman - Prentice- Hall of India
2. Microsoft Office 2007 Bible - John Walkenbach, Herb Tyson, Faithe Wempen, cary N. Prague, Michael R Groh, Peter G. Aitken, and Lisa a. Bucki -Wiley India pvt. ltd.
3. Introduction to Information Technology - Alexis Leon, Mathews Leon, and Leena Leon, Vijay Nicole Imprints Pvt. Ltd., 2013.
4. Computer Fundamentals - P. K. Sinha Publisher: BPB Publications

Web Reference

1. https://en.wikipedia.org
2. https://wiki.openoffice.org/wiki/Documentation
3. http://windows.microsoft.com/en-in/windows/windows-basics-all-topics

SEMESTER – IV - TAMIL-IV

Course Code	Course Title	L	T	P	C
23110AEC41	Tamil-IV	3	0	0	3

சங்க இலக்கியம் **- 23110AEC41**

நான்காம் பருவம்

பாடநோக்கங்கள்

- இலக்கியங்கள் வாயிலாக சமுதாயக் கருத்தக்களை
- பழந்தமிழ் இலக்கிய வளத்தை உணர்த்துதல்.
- சங்க அக, புற பாடல் மரபுகளைப் பயிற்றுவித்தல்
- வாழ்வியல் அறங்கள் மற்றும் வரலாற்றுச் செய்திகளை . பயிற்றுவித்தல்
- புற இலக்கியங்கள் காட்டும் வாழ்வியல் அறங்களை எடுத்துக் கூறுதல்

பயன்கள்

- பழந்தமிழ் இலக்கிய மரபை அறிவர்.
- சங்க இலக்கியங்களில் உள்ள அழகியல் கூறுகளை உணர்வர்.
- வாழ்வியல் அறங்கள் மற்றும் வரலாற்றுச் செய்திகளை அறிவர்.
- சங்க அக, புற பாடல் மரபுகளை புரிந்துக்கொள்வர்.
- புற இலக்கியங்கள் காட்டும் வாழ்வியல் அறங்களை உணர்வர்.

அலகு**-1**

1. குறுந்தொகை– பாடல் எண்: 28,38
2. நற்றிணை– பாடல் எண்: 1,27,28,167,168
3. ஐங்குறுநூறு– பாடல் எண்: இளவேனில் பத்து

அலகு**-2**

1. கலித்தொகை– பாடல் எண்: 3,7
2. அகநானூறு– பாடல் எண்:5,42,100
3. புறநானூறு– பாடல் எண்: 182,204,41,121

அலகு**-3**

1 சிறுபாணாற்றுப்படை முழுவதும்

அலகு**-4**

1. திருக்குறள்– செய்நன்றி அறிதல், கூடா நட்பு ,நலம்புனைந்துரைத்தல்
2. நாலடியார் – பாடல் எண்: 1,172,215,253

அலகு**-5**

இலக்கிய வரலாறு

1. சங்க இலக்கியம்
2. எட்டுத்தொகை, பத்துப்பாட்டு
3. பதினெண் கீழ்க்கணக்கு நூல்கள்

பார்வை நூல்கள்

1. குறுந்தொகை - கழக வெளியீடு ,சென்னை
2. நற்றிணை - கழக வெளியீடு ,சென்னை
3. ஐங்குறுநூறு - கழக வெளியீடு ,சென்னை
4. கலித்தொகை - கழக வெளியீடு ,சென்னை
5. அகநானூறு - கழக வெளியீடு ,சென்னை
6. புறநானூறு - கழக வெளியீடு ,சென்னை
7. திருக்குறள் - பரிமேலழகர் உரை ,கழக வெளியீடு ,சென்னை
8. இணையதளம் -www.tamilvu.org , www.noolulagam.com

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

ENGLISH-IV

Course Code	Course Title	L	T	P	C
23111AEC42	English-IV	3	0	0	3

Learning Objectives	
LO1	To help learners imbibe the rules of language unconsciously and tune to deduce language structure and usage.
LO2	To enable them use receptive skills through reading and listening to acquire good exposure to language and literature.
LO3	To help them develop style in speech and writing and manipulate the tools of language for effective communication.
LO4	To provide exposure to plays, autobiographies and expose them to value based ideas.
LO5	To enhance their language skills especially in the areas of grammar and pronunciation.

Unit No.	Unit Title & Text	No. of Periods for the Unit
I	**Life Writing** 1.1 I am Malala-Malala Yousafzai - Chapter 1 1.2 My Inventions - Nikola Tesla - Chapter 2	20
II	**One Act Plays** 2.1The Zoo Story- Edward Albee 2.2 The Proposal- Anton Chekhov	20
III	**Interviews** 3.1 Nelson Mandela’s Interview with Larry King. 3.2 Rakesh Sharma’s Interview with Indira Gandhi	20

	from Space 3.3 Lionel Messi with Sid Lowe (Print)	
IV	**Language Competency** 4.1 Refuting, Arguing & Debating 4.2 Making Suggestions & Responding to Suggestions, Asking for and Giving Advice or Help4.3 Interviews (face to face, telephone and video conferencing)	15
V	**English for Workplace** 5.1 Job Applications: Covering letters, CV and Resume 5.2 Creating a digital profile - Linkedin 5.3 Filling Forms (Online & Manual): creation of account, railway reservation, ATM,Credit/debit card 5.4. Body Language -Practical Skills for Interviews	15

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Learn to communicate effectively and appropriately in real life situation.	PO1
CO2	Use English effectively for study purpose across the curriculum	PO1, PO2
CO3	Develop interest in and appreciation of Literature	PO4, PO6
CO4	Develop and integrate the use of the four language skills	PO4, PO5, PO6
CO5	Enhance their language skills especially in the areas of grammar and pronunciation.	PO3, PO8

Text Books (Latest Editions)	
1	I Am Malala The Girl Who Stood Up for Education and Was Shot by the Taliban by Malala Yousafzai, Christina Lamb , Little Brown, 2013.
2	My Inventions by Nikola Tesla Ingram Short title, 2011 Edition

References Books (Latest editions, And the style as given below must be strictly adhered to)	
1	Writing Your Life: A Guide to Writing Auto biographies, Mary Borg, Taylor & Francis, 2021
2	One-act Plays for Acting Students: An Anthology of Short Norman A. Bert · 1987 ·
3	The One-Act Play Companion: A Guide to plays, playwrights ... Colin Dolley, Rex Walford · 2015
4	How to Build a Professional Digital Profile Kindle Edition by Jeanne Kelly Bernish, Bernish Communications Associates, LLC; 1st edition (May 29, 2012)
5	Role Play-Theory and Practice. Krysia M Yardley-Matwiejczuk, SAGE publications ltd, 1997

Web Resources	
1	For Readers' Theatre: https://www.youtube.com/watch?v=JaLQJt8orSw&t=469s(the link to the performance; refer scripts by Aaron Sheperd)
2	http://BBC learn English.com
3	http://onestopenglish.com
4	http://hearn-english-today.com
5	http://talkenglish.com
6	The Zoo Story: http://www.lem.seed.pr.gov.br/arquivos/File/livrosliteraturaingles/zoostory.pdf

BIOCHEMICAL TECHNIQUES

Course Code	Course Title	L	T	P	C
23115AEC43	Biochemical Techniques	4	1	0	3

Learning objectives

The objectives of this course are to

- Introduce the basic principles, types and applications of various sedimentation technique.
- Provide an understanding of the underlying principles of chromatographic techniques
- Demonstrate experimental skills in various electrophoretic techniques.
- Appraise the use of colorimetric and spectroscopic techniques in biology

- Impart knowledge about the measurement of radioactivity and safety aspects of radioactive isotopes.

Unit I: Centrifugation - Basic principles, RCF**,** Sedimentation coefficient, Svedberg constant. Types of rotors. Preparative centrifugation- differential and density gradient centrifugation, Rate zonal and Isopycnic techniques, construction, working and applications of analytical ultracentrifuge-Determination of molecular weight (Derivation excluded) 9 Hrs

Unit II: Chromatography - adsorption, partition. Principle, instrumentation and applications of paper chromatography, thin layer chromatography, ion-exchange chromatography, gel permeation chromatography and affinity chromatography. 9 Hrs

Unit III: Electrophoresis -General principles, factors affecting electrophoretic mobility. Tiselius moving boundary electrophoresis. Electrophoresis with paper and starch. Principle, instrumentationandapplicationsofagarosegelelectrophoresisandSDS-PAGE. 9Hrs

Unit IV: Basics of Electromagnetic radiations- Energy, wavelength, wavenumber and frequency. Absorption and emission spectra, Lambert - Beer Law, Light absorption and transmittance. Colorimetry-Principle, instrumentation and applications. Visible and UV spectrophotometry – Principle, instrumentation and applications - enzyme assay, structural studies of proteins and nucleic acids. 9 hrs

Unit V: Radioactivity - Types of Radioactive decay, half-life, units of radioactivity, Detection and measurement of radioactivity - Methods based upon ionization -Geiger Muller Counter. Methods based upon excitation - Solid &Liquid scintillation counters. Autoradiography. Biological applications and safety aspects of radioisotopes. 9 Hrs

Course Outcomes

CO	**On completion of this course, students will be able to**	**Program outcomes**
CO1	Describe types of rotors and identify the centrifugation technique for the separation of biomolecules.	PO1, PO2, PO6
CO2	Demonstrate the principles, operational procedure and applications of planar and column chromatography.	PO1, PO2, PO6
CO3	Specify the factors and explain the separation of DNA and protein using electrophoretic technique.	PO1, PO2, PO6
CO4	State Beer's Law and illustrate the instrumentation and uses of colorimeter and spectrophotometer.	PO1, PO2, PO6
CO5	Enumerate various methods of measurement of radioactivity and safety aspects of radioactive isotopes.	PO1, PO2, PO6

Textbooks

1. Avinash Upadhyay, Kakoli Upadhyay & Nirmalendu Nath, 2002, Biophysical Chemistry, Principles and Techniques, 3rd edition, Himalaya Publishing House.
2. L. Veerakumari, 2009, Bioinstrumentation, 1st edition, MJP Publishers.
3. Keith Wilson & John Walker, 2000, Practical Biochemistry-Principles and techniques, Cambridge University Press, 4th edition.

Reference books

1. Terrance G. Cooper The tools of Biochemistry, 1977, John Wiley & Sons, Singapore.
2. Gurumani, Research Methodology for Biological Sciences, 2011, 1st edition, MJP Publishers.
3. Saroj Dua, Neera Garg, Biochemical Methods of Analysis, 2010, 1st edition, Narosa Publishing house.

Web Resources

1. 1.https://www.britannica.com/science/chromatography
2. 2.https://www.youtube.com/watch?v=xgxFBQZYXlE
3. 3.https://www.youtube.com/watch?v=7onjVBsQwQ8

Mapping with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3				2	3	3	3	3
CO 2	2	3				2	3	3	3	3
CO 3	2	3				2	3	3	3	3
CO 4	2	3				2	3	3	3	3
CO 5	2	3				2	3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

MICROBIOLOGY – II

Course Code	Course Title	L	T	P	C
23116AEC44	MICROBIOLOGY – II	0	0	3	3

Aim:

Students should have knowledge about the microbes and their metabolism

Objectives:

- To equip the students with the real knowledge of working with different types of Microbes.

- To understand the variety of microorganisms and to analyse their true potential.

Outcomes:

On the successful completion of the course, student will be able to:

1. Understand the different types of microbial associations.
2. Analyze the nutritional types of microorganisms
3. Apply the knowledge to enumerate the microorganisms from natural environment.
4. Evaluate the success of understanding the metabolism of microbes.

Unit I: Microbes and its associations: Microbes in Extreme Environment – thermophilic, methanogenic and halophilic. Archaea - live in extreme conditions. Beneficial aspects of microorganisms. Physiology and biochemistry of microbes- Photo-autotrophs, Chemo-autotrophs, Parasitism, Saprophytism, Mutualism and Symbiosis, Commensalisms, endozoic microbes.

Unit II: Nutrition and growth of microorganisms: Nutritional types of microorganisms, nutritional requirements. Factors influencing the growth of microorganisms – temperature, pH, Osmotic pressure, moisture, radiations and different chemicals, Physiology of growth – Significance of various phases of growth. Growth measurements – batch, continuous and synchronous.

Unit III: Microbial enzymes and their Reproduction: Bacterial enzymes – classification, properties, kinetics of enzyme action – Michaelis Menton equation for simple enzymes - coenzymes and cofactors, isozymes. A detailed account of General structure, growth and reproduction of Bacteria, fungi and Virus. Economic and industrial importance of yeast and moulds

Unit IV: Microbial metabolism: Metabolism of carbohydrates: Anabolism – phototsynthesis – oxygenic – an oxygenic, synthesis of carbohydrate – catabolism of glucose – Embden Mayer – Hoff – Parnas pathway – Pentose pathway, Kreb's cycle (TCA) – electron transport system and ATP production. Metabolism of protein – synthesis and degradation of amino acids – glycine tyrosine, cysteine, serine, glutamine, synthesis of peptides and proteins – urea cycle.

Unit V: Microbes and their Respiration: Anaerobic Respiration – Nitrate, sulphate and Methane respiration – Fermentations – alcohol, mixed acid, lactic acid fermentation – Metabolism of lipids – biosynthesis of fatty acids and cholesterol – oxidation of fatty acids.

Text Book(s)

1. Pelczar, JR. M. J. (1993). Microbiology: Concepts and Applications. McGraw-Hill. Inc.

2. Prescott, L.M., Harley, J.P and Klein, D. A. Brown (2019). Microbiology. 11th edition, Mc Graw publishers.
3. Stanier, R. Y., Ingraham, J. I., Wheelis, M. I. and Painter, P. R. (2005). General Microbiology. Macmillan Press Ltd. Hampshire.

Reference Books

1. Madigan, M. T., Bender, K. S., Buckley, D. H., Sattley, W. M. and Stahl, D. A. (2017). Brock Biology of Microorganisms. 15th edition. Pearson.
2. Tortora, G. J., Funke, B. R. and Case, C. L. (2016). Microbiology: An introduction. 12th Edition, Pearson.

BIOCHEMICAL TECHNIQUES LAB

Course Code	Course Title	L	T	P	C
23115SEC45L	Biochemical Techniques Lab	0	0	3	3

Learning objectives

The objectives of this course are to:

- Acquaint the students with colorimetric estimations of biomolecules.
- Equip skills on various separation techniques.
- Impart knowledge about the estimation of minerals and vitamins.

I Colorimetry

1. Estimation of amino acid by Ninhydrin method.
2. Estimation of protein by Biuret method.
3. Estimation of DNA by Diphenylamine method.
4. Estimation of RNA by Orcinol method.
5. Estimation of Phosphorus by Fiske and Subbarow method.

II Chromatography

6. Separation and identification of sugars and amino acids by paper chromatography.
7. Separation and identification of amino acids and lipids by thin layer chromatography.

III Demonstration

1. Separation of serum and plasma from blood by centrifugation.
2. Separation of serum proteins by SDS-PAGE.

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Estimate the amount of biomolecules by Colorimetric method.	PO1, PO3, PO6
CO2	Quantify the amount of minerals by Colorimetric method	PO1, PO3, PO6
CO3	Separate and identify sugars, lipids and amino acids by chromatography	PO1, PO3
CO4	Operate centrifuge for the separation of serum and plasma	PO1, PO3, PO6
CO5	Demonstrate the separation of proteins electrophoretically	PO1, PO3, PO6

Text books

1. J. Jayaraman, Laboratory Manual in Biochemistry New Age International (P) Limited Fifth edition 2015.
2. Sadasivam A. Manickam Biochemical Methods New Age International Pvt Ltd publishers third edition 2018.
3. Keith Wilson and John Walker Principles and techniques of Practical Biochemistry Cambridge University Press, 2010, Seventh edition.

Reference books

1. S. K. Sawhney and Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd 2nd edition, 2005.
2. David T. Plummer, 2001, An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw- Hill publishing company limited.

3 . Varley's Practical Clinical Biochemistry by Alan H Gowenlock, published by CBS Publishers and distributors, India Sixth Edition,1988.

MICROBIOLOGY LAB-II

Course Code	Course Title	L	T	P	C
23116SEC46L	Microbiology Lab-II	0	0	3	3

Learning objectives

- 1.Aquire knowledge on bacterial growth
- Gain knowledge on carbohydrates fermentation for bacteria.
- Learn the biochemical identification of the bacteria

Experiments

1. Bacterial growth curve: Cell count/viable count/absorbance (total count)
2. Carbohydrate fermentation tests: Glucose, Lactose, Sucrose and Mannitol.
3. Biochemical test for identification of bacteria: IMViC tests - TSI agar test Urease- Catalase- Oxidase.

Course Outcome

- Describe the bacteria growth
- Explain the carbohydrate test for bacteria characteristics.
- Elaborate on the biochemical test for bacterial identification

BIOMEDICAL INSTRUMENTATION

Course Code	Course Title	L	T	P	C
23115SEC47A	Biomedical Instrumentation	2	0	0	2

Learning Objectives

- The objectives of this course are to
- Provide insights about the blood pressure and its measurement.
- Elaborate the mechanism of instruments related to respiration.
- Highlight the importance of imaging techniques.
- Acquaint students about the basics of medical assisting devices.
- Familiarize about the life saving therapeutic equipment's.

Unit I: Measurement of blood pressure - sphygmomanometer. Cardiac output - Cardiac rate - Heart sound - Stethoscope, ECG - EEG - EMG - ERG. 6 Hrs

Unit II: Monitoring of inspired/expired anaesthetic gases, manograph, inhalators, nebulizers, aspirators, infant respirator, Plethysmography.6 Hrs

Unit III: Medical imaging: X-ray machine - Radio graphic and fluoroscopic techniques – Computed tomography - MRI - PET, Ultrasonography - Endoscopy - Thermography.6 Hrs

Unit IV: Assisting equipment's: Pacemakers - Defibrillators - Ventilators6 Hrs

Unit V: Therapeutic equipment's: Nerve and muscle stimulators - Diathermy - Heart - Lung machine - Audio meters - Dialyzers. 6 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Programme outcome
CO1	Illustrate the functions of instruments used for measuring blood pressure.	PO1, PO2, PO5
CO2	Elaborate the devices required for monitoring of respiratory gases.	PO1, PO2, PO5
CO3	Understand the operation of the imaging and sonographic instruments.	PO1, PO2, PO5
CO4	Differentiate between the action of pacemakers, defibrillators and ventilators.	PO1, PO2, PO5
CO5	Demonstrate the function of therapeutic equipment's	PO1, PO2, PO5

Text books

1. M. Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies.
2. L.A. Geddes and L.E. Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons.
3. J. Webster, 'Medical Instrumentation', John Wiley & Sons.
4. C. Rajarao and S.K. Guha, 'Principles of Medical Electronics and Biomedical instrumentation', Universities (India) Ltd, Orient Longman Ltd.

Reference books

1. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II Edition, Pearson Education, 2002.
2. R.S. Khandpur, 'Handbook of Bio-Medical instrumentation', Tata McGraw HillPublishing Co Ltd.,

Web Resources

1. https://youtu.be/GkUCmb0cKwo?list=PLCZ9KmODEcu138IlVeHClJ4nskArYr1Dg

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3			3		3	3	3	3
CO 2	2	3			3		3	3	3	3
CO 3	2	3			3		3	3	3	3
CO 4	2	3			3		3	3	3	3
CO 5	2	3			3		3	3	3	3

S-Strong (3) M-Medium (2) L-Low

TISSUE CULTURE

Course Code	Course Title	L	T	P	C
23115SEC47B	Tissue Culture	2	0	0	2

Learning Oobjectives

The objectives of this course are to

- Introduce the tools and techniques used in tissue culture technique.
- Acquire knowledge on preparation of growth medium for culture techniques.
- Impart knowledge on procedures involved gene transfer.
- Acquaint with the process of tissue culture technique.
- Understand the importance of plant and animal tissue culture for the production and evaluation of bioactive compounds

Unit l: Introduction to Tissue culture, Types- seed, embryo, Callus, Organ, Protoplast culture, Advantages and importance of tissue culture, Tools and techniques 6 Hrs

Unit II: Media and Culture Preparation - pH, temperature, solidifying agents. Role of Micro and macro nutrients. Maintenance of cultures.6 Hrs

Unit III: Methods of gene transfer in plants and animals - direct and indirect gene transfer methods.6 Hrs

Unit IV: Cell culture technique - Explants selection, sterilization and inoculation. 6 Hrs

Unit V: Transgenic plants for crop improvement. Transgenic plants for molecular farming. Animal Cloning - an Overview-Applications of animal cell culture 6 Hrs

Course outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Introduction to plant tissue culture	PO1, PO2, PO3
CO2	Brief knowledge on preparation of tissue culture media	PO1, PO2
CO3	Understanding on different methods of gene transfer	PO1, PO2, PO3
CO4	Gain knowledge on plant and animal cell culture techniques	PO1, PO2, PO3

CO5	Study of applications of genetically modified plants and animals.	PO1,PO2,PO3

Text books

1. Trivedi, P.C.2000. Applied Biotechnology: Recent Advances. PANIMA Publishing corporation.
2. Ignacimuthu. 1996. Applied Plant Biotechnology. Tata McGraw – Hill.
3. Lycett, G.W. and Grierson, D. (ed). 1990. Genetic Engineering of crop plants.
4. Grierson and Covey, S.N.1988. Plant Molecular biology. Blackie.
5. Chawla, H.S., "Introduction to Plant Biotechnology", 3rd Edition, Science Publishers, 2009.

Reference books

1. Gamburg OL, Philips GC, Plant Tissue & Organ Culture fundamental Methods, arias Publications. 1995.
2. Stewart Jr., C.N., "Plant Biotechnology and Genetics: Principles, Techniques and Applications" Wiley-Interscience, 2008.
3. Freshney, R. I. (2010). Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. Wiley-Blackwell, 2010. 6th Edition.
4. Davis, J. M. (2008). Basic Cell Culture. Oxford University Press. New Delhi.
5. Davis, J. M. (2011). Animal Cell Culture. John Willy and Sons Ltd. USA.6Freshmen R. I. (2005). Culture of Animal Cells. John Willy and Sons Ltd. USA.
6. Butler, M. (2004). Animal Cell Culture and Technology. Taylor and Francis. Keywork USA.
7. Verma, A. S. and Singh, A. (2014). Animal Biotechnology. Academic Press, ELSEVIER, USA

Web Resources

1. https://www.britannica.com/science/tissue-culture
2. https://en.wikipedia.org/wiki/Plant_tissue_culture
3. https://microbeonline.com/animal-cell-culture-introduction-types-methods-applications/

Mapping with Program Outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2	3	3				3	3	3	3
CO 2	2	3					3	3	3	3

CO 3	2	3	3				3	3	3	3
CO 4	2	3	3				3	3	3	3
CO5	2	3	3				3	3	3	3

S - Strong (3) M - Medium (2) L -Low (1)

MEDICAL CODING

Course Code	Course Title	L	T	P	C
23115SEC48A	Medical Coding	2	0	0	2

Course objectives

The objectives of this course are to

- Understand the basic concept of medical coding
- Familiarize the student about medical terminology
- Understand about the classification of diseases based on WHO/AHA
- Understand about the CPT code used for diseases as per American Medical Association (AMA)

Unit I: Introduction to Medical coding, coding theory, Healthcare Common Procedure Coding, First Aid and CPR 6Hrs

Unit II: Introduction to Medical Terminology, specialization I & II, Diagnostic coding, factors affecting diagnostic coding 6Hrs

Unit III: Documenting medical records- Importance of Documentation, Types of dictation formats. 6Hrs

Unit IV: Introduction to Human Anatomy and Coding, ICD-10- CM classification system. 6Hrs

Unit - V: Introduction to CPT coding, types of CPT coding Medical Law and Ethics. 6hrs

Course Outcome

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Explaining the basic concept of coding and its application. Possess the knowledge about the First aid and CPR	PO1, PO2, PO6
CO2	Possess the knowledge about medical terminology used in medical coding industry	PO1, PO2, PO6
CO3	Possess the knowledge about the ICD-10 CM international classification of diseases based on WHO	PO1, PO2, PO6

CO4	Possess the knowledge about the CPT codes used for diseases as per American Medical Association (AMA)	PO1, PO2, PO6
CO5	Understand CPT coding and its types	PO1, PO2, PO6

Text books

1. Understanding Medical Coding, A comprehensive guide Sandra L Johnson Robin Linker**.**
2. Buck's Step – by – step Medical Coding Elsevier reference

Reference books

1. Terry Tropin M Shai, RHIA, CCS-P, AHIMAICD-10-CMcoding guidelines made easy 2017.
2. Besty J Shiland - Medical terminology and anatomy for ICD-10.

Mapping with Program Outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2	3				3	3		2	3
CO 2	2	3				3	3		2	3
CO 3	2	3				3	3		2	3
CO 4	2	3				3	3		2	3
CO5	2	2				2	3		2	3

S - Strong (3) M - Medium (2) L -Low (1)

MICROBIAL TECHNIQUES

Course Code	**Course Title**	**L**	**T**	**P**	**C**
23115SEC48B	Microbial techniques	2	0	0	2

Learning objectives

The objectives of this course are to

- Study the growth of bacteria
- Know the parts & uses of microscope
- Learn staining methods to identify microbes
- Learn different types of culture methods
- Study food preservation methods

Unit I: Growth of bacteria- Definition, growth phases, factors affecting growth (pH, temperature, and oxygen), cell count (hemocytometer, Bacterial cell- Bacillus subtilis), fungal cell (Saccharomyces) and human blood cell. 6 Hrs

Unit II: Microscopy- Principle, types - Compound microscope, electron microscope - TEM, SEM, use of oil immersion objective. 6 Hrs

Unit III: Stains and staining- Principles of staining, simple staining, negative staining, Differential staining, Gram and acid-fast staining, flagella staining, capsule and endospore Staining. Staining of yeast (methylene blue), lactophenol cotton blue, staining of mold (Penicillium, Aspergillus), Agaricus. 6 Hrs

Unit IV: Cultivation of bacteria - Types of growth media (natural, synthetic, complex, enriched, selective- definition with example), culture methods (streak plate, spread plate, pour plate, stab culture, slant culture, liquid shake culture, anaerobiosis) - aerobic and Anaerobic bacteria. 6 Hrs

Unit V: Food microbiology- Microbiological examination of food: microscopic examination and culture, phosphatase test of Pasteurized milk. Preservation of food- High temperature (boiling, pasteurization, appreciation), low temperature (freezing), dehydration, osmotic pressure, chemical preservations, radiation. Microorganisms as food SCP. 6 Hrs

Course Outcome

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Understand the growth of bacteria and to perform cell count	PO1, PO2
CO2	Acquire knowledge of microscope and its uses	PO1, PO2
CO3	Identify the microbes by staining methods	PO1, PO2, PO6
CO4	Culture microbes by various methods	PO1, PO2, PO6
CO5	Preserve foods at high and low temperature	PO, PO2, PO6

Text books

1. Sherris Medical Microbiology, 7th Edition by Authors: Kenneth Ryan, C. George Ray, Nafees Ahmad, W. Lawrence Drew, Michael Lagunoff, Paul Pottinger, L. Barth Reller and Charles R. Sterling
2. Food Microbiology: Fundamentals and Frontiers, 5th Edition by Editor(s): Michael P. Doyle, Francisco Diez-Gonzalez, Colin Hill
3. Text book of microbiology by Ananthanarayan and Panicker's

4. Textbook of microbiology by P.C. Trivedi Sonali Pandey Seema Bhadauria.
5. Prescott's Microbiology, 10th Edition by Authors: Joanne Willey, Linda Sherwood and Christopher J. Woolverton

Reference books

1. Bailey & Scott's Diagnostic Microbiology, 14th Edition by Author: Patricia Title
2. Medical Microbiology, 7th Edition Authors: Patrick R. Murray, Ken S. Rosenthal and Michael A. Pfaller
3. Microbiology: Laboratory Theory and Application, 3rd Edition Authors: Michael J. Leboffe and Burton E. Pierce

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3					3	3	3	3
CO 2	2	3					3	3	3	3
CO 3	2	3				2	3	3	3	3
CO 4	2	3				2	3	3	3	3
CO5	2	3				2	3	3	3	3

S - Strong (3) M - Medium (2) L -Low (1)

Ability Enhancement Compulsory course

ENVIRONMENTAL STUDIES

Course Code	Course Title	L	T	P	C
231AECCEVS	Environmental Studies	2	0	0	2

Aim

Creating awareness about the environmental problems among people. Imparting basic knowledge about the environment and its allied problems

Course Objectives:

- Creating the awareness about environmental problems among people.
- Imparting basic knowledge about the environment and its allied problems.
- Developing an attitude of concern for the environment.
- Motivating public to participate in environment protection and environment improvement.
- Acquiring skills to help the concerned individuals in identifying and solving environmental problems.

- Striving to attain harmony with Nature.

Course Outcomes:

Students who graduate with a major in environmental science will be able to:

CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale;

CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment;

CO3: Demonstrate ecology knowledge of a complex relationship between predators, prey, and the plant community;

CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues; and

CO5: Understand how politics and management have ecological consequences.

Unit I: Nature of Environmental Studies - Definition, scope and importance. Multidisciplinary nature of environmental studies. Need for public awareness.

Unit II: Natural Resources and Associated Problems. Forest resources: Use and over - exploitation, deforestation, dams and their effects on forests and tribal people. Water resources: Use and over - utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems. Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources. Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer - pesticide problems. Energy resources: Growing energy needs, renewable and non - renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy. Land resources: Solar energy, Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individuals in conservation of natural resources.

Unit III: Ecosystems. Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following ecosystem: a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit VI: Biodiversity and its conservation

Introduction - Definition: genetic, species and ecosystem diversity. Bio - geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. India as a mega - diversity nation. Western Ghat as a biodiversity region. Hot - spot of biodiversity. Threats to biodiversity habitat loss, poaching

of wildlife, man - wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In - situ and Ex - situ conservation of biodiversity.

Unit V: Environmental Pollution. Definition: Causes, effects and control measures of: Air pollution, Water pollution, soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of a individual in prevention of pollution. **Social Issues and the Environment.** Disaster management: floods, earthquake, cyclone, tsunami and landslides. Urban problems related to energy Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issue and possible solutions. Global waming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products.

Field Work

Visit to a local area to document environmental assets - River / Forest / Grassland / Hill / Mountain.

or

Visit to a local polluted site - Urban / Rural *I* lad Listrial / Agricultural.

or

Study of common plants, insects, birds.

or

Study of simple ecosystems - ponds, river, hill slopes, etc.

References:

1. Agarwal, K.C,200l, Environmental Biology, Nidi Pub. Ltd., Bikaner.
2. Bharucha Erach, The l3iodiversity of India, Mapin Publishing Pvt, Ltd., Ahmedabad 380013, India, Email: rn4pin@icenet.net (R)
3. Brunner R.C., 1989, 1-lazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clank R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E. & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Pub. Mumbai, Il96p
6. De A.K., Environmental Chemistry, Wiley Wastern Ltd.
7. Down to Earth, Centre for Science and Environment, New Delhi. (R)
8. Gleick, H., 1993, Water in crisis, Pacific Institute for studies in Dcv., Environment & Security. Stockholm Env Institute. Oxford Univ. Press 473p
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bompay (R)
10. Heywood, V.K. & Watson, R.T.1995, Global Biodiversity Assessment, Crnbridge Univ. Press 1140 p.
11. Jadhav, H. and Bhosale, VJvI. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.

12. Mickinney, M.L. and School. R.M. 1196, Environmental Science Systems and Solutions, Web enhanced edition, 639p.
13. Miller T.G. Jr. Environmental Science. Wadsworth Publications Co. (TB).
14. Odum, E.P. 1971, Fundamentals of Ecology, W.B. Saunders Co. USA,574zp.
15. Rao M.N. and Dana, A.K. 1987, Waste Water Treatment, Wxford &IBH Publ. Co. Pvt. Ltd., 345p
16. Sharma B.K., 2001, Environmental Chemistry, Gokel PubI. Hkouse, Meerut
17. Survey of the Environment, The Hindu (M)
18. Townsend C., Harper, J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)

AUDIT COURSE

Course Code	Course Title	L	T	P	C
231LCSCLS	Leadership and Management Skills	0	0	0	1

Aim:

The aim of the course cultivating and nurturing the innate leadership skills of the youth so that they may trans form these challenges into opportunities and become torch bearers of the future by developing creative solutions.

Course Objective:

The Module is designed to**:**

Help students to develop essential skills to influence and motivate others

- Inculcate emotional and social intelligence, and integrative thinking for effective leadership
- Create and maintain an effective and motivated team to work for the society
- Nurture a creative and entrepreneurial mindset
- Make students understand the personal values and apply ethical principles in professional and social contexts.

Course Outcomes:

Upon completion of the course, students will be able to:

- Examine various leadership models and understand/assess their skills, strengths and abilities that affect their own leadership style and can create their leadership vision
- Learn and demonstrate a set of practical skills such as time management, self-management, handling conflicts, team leadership, etc.

- Understand the basics of entrepreneurship and develop business plans
- Apply the design thinking approach to leadership
- Appreciate the importance of ethics and moral values for making of a balanced personality.

Unit I: Leadership Skills: Understanding Leadership and its Importance - What is leadership? - Why Leader ship required? - Whom do you consider as an ideal leader? - Traits and Models of Leadership - Are leaders born or made? - Key characteristics of an effective leader - Leadership styles - Perspectives of different leaders - Basic Leadership Skills – Motivation – Teamwork Negotiation – Networking.

Unit I: Managerial Skills: Basic Managerial Skills - Planning for effective management - How to organize teams? - Recruiting and retaining talent - Delegation of tasks - Learn to coordinate – Conflict management - Self-Management Skills - Understanding self-concept – Developing self – awareness - Self-examination - Self-regulation

Unit III: Entrepreneurial Skills: Basics of Entrepreneurship - Meaning of entrepreneurship - Classification and types of entrepreneurships - Traits and competencies of entrepreneur - Creating Business Plan - Problem identification and idea generation - Idea validation – Pitch making

Unit IV: Innovative Leadership and Design Thinking: Innovative Leadership - Concept of emotional and social intelligence - Synthesis of human and artificial intelligence - Why does culture matter for today's global leaders – Design Thinking - What is design thinking? - Key elements of design thinking: Discovery – Interpretation - Ideation - Experimentation - Evolution. How to transform challenges in to opportunities? - How to develop human-centric solutions for creating social good?

Unit V: Ethics and Integrity - Learning through Biographies - What makes an individual great? - Understanding the persona of a leader for deriving holistic inspiration - Drawing insights for leadership - How leaders sail through difficult situations? - Ethics and Conduct - Importance of ethics - Ethical decision making - Personal and professional moral codes of conduct - Creating a harmonious life

Book

- Ashokan, M. S. (2015). Karmayogi: A Biography of E. Sreedharan. Penguin, UK.
- Brown, T. (2012). Change by Design. Harper Business
- Elkington, J., & Hartigan, P. (2008). The Power of Unreasonable People: How Social Entrepreneurs Create Markets that Change the World. Harvard Business Press.
- Goleman D. (1995). Emotional Intelligence. Bloomsbury Publishing India Private Limited

- Kalam A. A. (2003). Ignited Minds: Unleashing the Power within India. Penguin Books India
- Kelly T., Kelly D. (2014). Creative Confidence: Unleashing the Creative Potential WithinUsAll. William Collins

E-Resources

- HowtoBuildYourCreativeConfidence,TedTalkbyDavidKelly
- India's Hidden Hot Beds of Invention Ted Talk by Anil Gupta - https://www.ted.com/talks/anil_gupta_india_s_hidden_hotbeds_of_invention
- Knowledge@Wharton Interviews Former Indian President APJ Abdul Kalam - . "A Leader Should Know How to Manage Failure" https://www.youtube.com/watch?v=laGZaS4sdeU
- Martin, R. (2007). How Successful Leaders Think. Harvard Business Review, 85(6):60.

SEMESTER V

Course Code	Course Title	L	T	P	C
23115AEC51	Enzymes	5	1	0	4

Course objectives

The main objectives of this course are to

- Provide fundamental knowledge on enzymes and their properties.
- Understand the mechanism of action of enzymes and the role of coenzymes in catalysis.
- Introduce the kinetics of enzymes and determine the Km and Vmax.
- Explain the effect of inhibitors on enzyme activity
- Understand the role of enzymes in clinical diagnosis and industries.

Course outcome

- To explain basic properties and basic functions of enzymes
- To explain working principle of enzymes and the relationship between enzyme and substrate
- To explain the properties of enzyme-catalysed reactions, Michaelis-Menten kinetics and the Lineweaver-Burke graphic
- To define the mechanisms of enzyme activity regulation, allosteric regulation
- To explain the Industrial applications of enzymes

Unit I: Introduction to enzymes: Nomenclature and Classification based on IUB with

examples, enzyme as catalyst-Activation energy, Enzyme specificity-absolute, Group, linkage and stereo specificities. Concept of Active site, Lock and key hypothesis and induced fit theory, Enzyme expression Units-IU, turnover number, katal and specific activity.12 Hrs

Unit II: Mechanism of enzyme catalysis - Acid Base catalysis, covalent catalysis, electrostatic catalysis, metal ion catalysis, proximity and orientation effect. Coenzymes - Definition, types, co-enzymatic forms of vitamins- NAD/NADP, FAD, FMN, Coenzyme A TPP, PLP, lipoic acid and biotin. Multienzyme complexes - Pyruvate dehydrogenase complex. Isoenzyme with reference to LDH and CK.12 Hrs

Unit III: Enzyme kinetics - Definition of kinetics, Factors affecting enzyme activity - temperature, pH, substrate and enzyme concentration, activators-cofactors, Derivation of Michaelis-Menton equation for unisubstrate reactions, Lineweaver - Burk plot, Eadie - Hofstee plot Significance of Km and V max and their determination using the plots. 12 Hrs

Unit IV: Enzyme inhibition - Reversible and irreversible inhibition-types of reversible inhibitors, competitive, non-competitive, un-competitive inhibitors. Graphical representation by L-B plot, (Kinetic derivations not required), Determination of Km and Vmax in the presence and absence of inhibitors. Allosteric enzymes - Sigmoidal curve, positive and negative modulators. 12 Hrs

Unit V: Applications of enzymes -Immobilized enzymes - methods of immobilization-adsorption, covalent bonding, crosslinking, encapsulation, entrapment and applications of immobilized enzymes. Biosensors – e.g. Glucose sensors. Industrial applications of enzymes - Food, textile and pharmaceutical industries.12Hrs

Course Outcomes

CO	**On completion of this course, students will be able to**	**Programme outcome**
CO1	Identify the major classes of enzymes, differentiate between a chemical catalyst and a biocatalyst and define the units of enzymes.	PO1
CO2	Explain the mechanism of enzyme catalysis and the role of coenzymes in enzyme action.	PO1, PO2
CO3	Illustrate the steady state kinetics, interpret MM plot and LB plot based on kinetics data, and determine Km and Vmax.	PO1, PO3
CO4	Distinguish the types of inhibition along with its importance in biochemical reactions.	PO1, PO3
CO5	Comprehend the various methods for production of immobilized enzymes and discuss the application of enzymes in clinical diagnosis and various industries.	PO1, PO2, PO6

Textbooks

1. U. Sathyanarayana & U. Chakrapani, 2013, Biochemistry, 4th edition, Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd.
2. Dr. G.R Agarwal, Dr. Kiran Agarwal & O.P. Agarwal, 2015, Textbook of Biochemistry (Physiological chemistry), 18th edition, Goel Publishing House,
3. T. Devasena, 2010, Enzymology, 1st edition, Oxford University Press.

Reference books

1. Trevor Palmer, 2008, Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, 2nd edition, East West Press Pvt. Ltd.
2. David L. Nelson, Michael M. Cox, 2005, Principles of Biochemistry, 4th edition W.H. Freeman and Company,
3. Voet. D, Voet. J.G. and Pratt, C.W, 2004, Principles of Biochemistry, 4th edition John Wiley & Sons, Inc.
4. Zubay G.L, et. al., 1995, Principles of Biochemistry, 1st edition, WmC. Brown Publishers.

Web resources

1. www.biologydiscussion.com/notes/enzymes-notes

Mapping with Program Outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	3						3			3
CO 2	3	2					3			3
CO 3	3		2				3			3
CO 4	3		2				3			3
CO 5	3	2				2	3	3	3	3

S-Strong(3) M-Medium (2) L-Low (1)

INTERMEDIARY METABOLISM

Course Code	**Course Title**	**L**	**T**	**P**	**C**
23115AEC52	Intermediary Metabolism	5	1	0	4

The main objectives of this course are to

- Review the basic concepts of free energy transformation and describe biological oxidation.
- Illustrate the pathways of carbohydrate metabolism.

- Explain the pathways of oxidation and biosynthesis of lipids.
- Detail the catabolism of amino acids and synthesis of specialized products from amino acids.
- Acquaint the metabolism of nucleic acids and its regulation

Unit I: Bioenergetics-High energy compounds: Role of high energy compounds, free energy hydrolysis of ATP and other organophosphates, ATP-ADP cycle.

Biological Oxidation: Electron transport chain -its organization and function. Inhibitors of ETC. Oxidative phosphorylation, P/O ratio, Peter Mitchell's chemiosmotic hypothesis. Mechanism of ATP synthesis, uncouplers of oxidative phosphorylation, substrate level phosphorylation with examples. 15 Hrs

Unit II: Metabolism of carbohydrates - Glycolysis, TCA Cycle, Amphibolic nature and integrating role of TCA cycle. Anaplerosis, Pentose Phosphate Pathway (HMP shunt), Gluconeogenesis, Glycogenesis, Glycogenolysis and its regulation, glyoxylate cycle, Entner-Doudoroff pathway and Coricycle.15 Hrs

Unit III: Metabolism of lipids - Oxidation of fatty acids - α, β and ω -oxidation of saturated fatty acids, Oxidation of fatty acids with odd number of carbon atoms and unsaturated fatty acids, Ketogenesis, Biosynthesis of saturated fatty acids and unsaturated fatty acids, Biosynthesis and degradation of triglycerides, phospholipids and cholesterol.15 Hrs

Unit IV: Metabolism of amino acid- Metabolic nitrogen pool, Catabolism of amino acid: Oxidative deamination, non-oxidative deamination, transamination and decarboxylation, Biogenic amines, Urea cycle and its regulation.15 Hrs

Unit V: Metabolism of nucleotides - Biosynthesis of purines and pyrimidines, - de novo synthesis and salvage pathways, Degradation of purines and pyrimidines, Conversion of ribonucleotide to deoxyribonucleotide. 15 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	State the concepts of bioenergetics and illustrate the mechanism off law of electrons and the production of ATP.	PO1, PO2
CO2	Elaborate the biochemical reactions and integration of pathways of carbohydrate metabolism.	PO1,
CO3	Sketch the oxidation and biosynthesis of fatty acids, phospholipids, triglycerides and cholesterol with suitable examples	PO1
CO4	Explain catabolism of amino acids, synthesis of non-essential amino acids and specialized products from amino acids.	PO1
CO5	Describe the metabolism of nucleic acids with necessary illustrations and its regulation.	PO1

Textbooks

1. U. Sathyanarayana & U. Chakrapani, 2015, Biochemistry, 4th Elsevier India Pvt. Ltd.,
2. M.N. Chatterjea and Rana Shinde, 2002, Textbook of Medical Biochemistry, 5th edition Jaypee Brothers Medical Publishers Pvt. Ltd.

Reference books

1. Lehninger Principles of Biochemistry, David L. Nelson, Michael M. Cox, 2008, 5th edition, W.H. Freeman and Company.
2. Robert K. Murray, Daryl K. Granner, Victor W. Rodwell, 2006, Harper's Illustrated Biochemistry, 27th edition, McGraw Hill Publishers.
3. Principles of Biochemistry. Voet. D. Voet, J.G. Voet and Pratt C.W. 2010, Fourth edition, John Wiley & Sons, Inc,.
4. Principles of Biochemistry, Geoffrey L. Zubay, William W. Parson, Dennis E. Vance, 1995, 2nd Edition, Wm.C. Brown Publishers.
5. Biochemistry, Garret, R.H. and Grisham, C.M. 2005, 3rd Edition. Thomson Learning INC.

Web resources

1. https://nptel.ac.in/courses/104/105/104105102/
2. http://www.nptelvideos.in/2012/11/biochemistry-i.html
3. https://www.saddleback.edu/faculty/jzoval/mypptlectures/ch15_metabolism/lecture_notes_ ch15_metabolism_current-v2.0.pdf

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3	2					3			3
CO 2	3						3			3
CO 3	3						3			3
CO 4	3						3			3
CO 5	3						3			3

S-Strong (3) M-Medium (2) L-Low (1)

CLINICAL BIOCHEMISTRY

Course Code	Course Title	L	T	P	C
23115AEC53	Clinical Biochemistry	5	1	0	4

Learning objectives

The main objectives of this course are to

- Comprehend the basic concepts and disorders of carbohydrate metabolism
- Explain the disorders of lipid metabolism.
- Elucidate the liver function test and kidney function test.
- Designate the gastric function test.
- Familiarize the clinical enzymology.

Unit I: Disorders of carbohydrate metabolism: Maintenance of blood glucose by hormone with special reference to insulin and glucagon. Abnormalities in glucose metabolism: Diabetes mellitus; types, causes, biochemical manifestations, diagnosis and treatment, glycated hemoglobin. Inborn errors of carbohydrate metabolism, glycosuria, Fructosuria, Pentosuria, Galactosemia and Glycogen storage diseases. 15 hrs

Unit II: Disorders of Lipid Metabolism: Lipid Profile, Atherosclerosis, Fatty liver and hyperlipidemia. Hyper cholesterolemia, Lipidosis and Xanthomatosis, Tay-Sach`s disease, Niemann-Pick disease, lipotropic agents. 15 Hrs

Unit III: Liver Function Tests: Bilirubin metabolism and jaundice, Estimation of conjugated and total bilirubin in serum (Diazo method). Detection of bilirubin and bile salts in urine (Fouchet's test and Hay's Sulphur test). Thymol turbidity test, prothrombin time, serum enzymes in liver disease serum transaminases (SGPT & SGOT) and lactate dehydrogenase (LDH). 15 Hrs

Kidney Function Tests: Measurement of urine pH, volume, specific gravity, osmolality, sediments in urine, inulin, urea and creatinine clearance tests. Concentration and dilution tests. Phenol red test. Levels of plasma protein and its significance related to kidney function. Proteinuria. 15Hrs

Unit VI: Gastric Function test: Composition of gastric juice, collection of gastric contents, examination of gastric residuum, fractional test meal (FTM), stimulation test-alcohol and histamine stimulation, Tubeless gastric analysis1.5 Hrs

Unit V: Clinical enzymology: Enzymes of diagnostic importance- LDH, creatine kinase, transaminases, phosphatases, Isoenzymes of lactate dehydrogenase.15 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Explain the concepts of hormones and their importance to maintain glucose and types of Diabetes, diagnosis and treatment.	PO1, PO3, PO6
CO2	Analyze the lipid profile and different deficiency state.	PO1, PO3, PO6
CO3	Describe the liver and kidney functions and specific diagnostic methods used for biological sample.	PO1, PO3, PO6
CO4	Detail about the composition of gastric juice and special test for diagnosis.	PO1, PO3, PO6
CO5	Elaborate the enzyme markers used for diagnostic studies.	PO1, PO3, PO6

Text books

1. M.N. Chatterjee and Rana Shinde, Text Book of Medical Biochemistry, Jaypee Brothers Medical Publishers (P) LTD, New Delhi, 8th Edition, 2012
2. Ambika Shanmugam's Biochemistry for medical students, 8th edition, published by Wolters Kluwer India Pvt. Ltd.

Reference books

1. Philip. D. Mayne, Clinical Chemistry in diagnosis and treatment. ELBS Publication, 6th edition, 1994.
2. Thomas M. Devlin (2014) Text book of Biochemistry with clinical correlations (7th ed). John Wiley and sons.
3. Tietz Fundamentals of clinical chemistry and molecular Diagnostics (2014) (7th ed) Saunders.

Web Resources

1. https://www.britannica.com/science/metabolic-disease/Disorders-of-carbohydrate-metabolism
2. https://www.slideshare.net/MohitAdhikary/gastric-and-pancreatic-function-tests
3. https://onlinecourses.nptel.ac.in/noc20_ge13/preview

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3		3			2	3	2	2	3
CO 2	3		3			2	3	2		3
CO 3	3		3			2	3	3	2	3
O 4	3		3			2	3	3	2	3
CO 5	3		3			2	3	3	2	3

S-Strong (3) M-Medium (2) L-Low (1)

IMMUNOLOGY

Course Code	Course Title	L	T	P	C
23115DSC54__	Immunology	4	0	0	3

Learning Objectives

The objective of this course are to

- Introduce the structure and functions of lymphoid organs and cells of the immune system
- Illustrate the structure and classification of antibodies and adaptive immune response
- Impart knowledge on the types of immunity and uses of vaccines
- Provide an understanding of immune related diseases and transplantation
- Study the Ag-Ab interaction and immunological techniques to identify antigens and antibodies

Unit I: Structure and function of primary lymphoid organs (thymus, bone marrow), secondary lymphoid organs (spleen, lymph node), Cells involved in immune system-Functions-Phagocytosis -Inflammation 15 Hrs

Unit II: Antigens - Nature, Immunogens, haptens, cross reactions - Immunoglobulin- types-structure and function. Cells involved in antibody formation, Clonal selection theory, Co-operation of T-cell with B-cell. Differentiation of T and B lymphocyte - Humoral and cell mediated immunity. Monoclonal antibody – Production and application in biology. 15Hrs

Unit III- Immunity and its types-Innate, Acquired, active and passive. - Natural and Artificial - Commonly used toxoid vaccines, killed vaccines, live attenuated vaccines, rDNA Vaccines, DNA and subunit vaccines 15Hrs

Unit IV: Hypersensitivity – Immediate (Type 1) and Delayed (Type IV), Auto- immune diseases with examples. Organ specific and systemic autoimmunity. SLE, RA. Transplantation – Types of Grafts, structure& functions of MHC, graft Vs host reaction, immunosuppressive Agents. 15Hrs

Unit V: Antigen-antibody reactions, General features of Antigen Antibody reactions. Precipitation, Immuno diffusion, SID and DID - Oudin Procedure, Oakley Fulthrope Procedure, Radio immune diffusion, Ouchterlony double diffusion, CIE, Rocket electrophoresis, Agglutination-Coomb's test Complement Fixation test-Wasserman's reaction, RIA, ELISA. 15Hr

Course Outcomes

CO	**On completion of this course, students will be able to**	**Program outcomes**
CO1	Associate structure and function of the organs involved in our body's natural Defence	PO1
CO2	Classify antigens and antibodies and the role of lymphocytes in defending the host	PO1, PO2
CO3	Describe the types of immunity and the uses of vaccines	PO1, PO4
CO4	Understand the immune related diseases and mechanism of transplantation	PO1, PO2
CO5	Examine the immunological tests and relate it to the immune status of an Individual	PO1, PO3

Text Books

1. Kuby, J. (2018). Immunology (5th ed). W.H. Freeman - ISBN-10 : 1319114709 / ISBN-13 : 978-1319114701
2. Rao, C. V. (2017). Immunology (3rd ed). Chennai: Alpha Science Int. Ltd - ISBN-10 : 1842652559/ ISBN 13:978-1842652558
3. Tizard (1995). An Introduction to Immunology. Harcourt Brace College Publications

References Books

1. Kenneth M. Murphy, Paul Travers, Mark Walport - (2007), Janeway's Immunobiology, 7thedition, Garland Science.
2. Abul K. Abbas, Andrew H. Lichtman, Jordan S. Pober - (1994), Cellular and molecular immunology, 2ndedition, B. Saunders Company.
3. Basic Immunology Functions and Disorders of the Immune System, 6th Edition - January 25, 2019 Authors: Abul Abbas, Andrew Lichtman, Shiv Pillai, ISBN: 9780323549431eBook ISBN: 9780323639095

4. Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt - (2006), Roitt's Essential Immunology, 11th edition, Wiley-Blackwell

Web resources

1. https://onlinecourses.nptel.ac.in/noc22_bt40/preview
2. https://onlinecourses.swayam2.ac.in/cec20_bt05/preview
3. https://youtu.be/8uahFPl6ny8

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3			3
CO 2	3		2				3			3
CO 3	3			2			3	3		3
CO 4	3	2					3	1		3
CO 5	3		3				3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

BIOCHEMICAL PHARMACOLOGY

Course Code	Course Title	L	T	P	C
23115DSC54__	Biochemical Pharmacology	4	0	0	3

Learning Objectives

The objectives of this course are to

- Introduce the basic concepts of pharmacology.
- Explain the metabolism of drugs and factors responsible for metabolism.
- Acquaint the adverse response and side effects of drugs.
- Familiarize important drugs used for common metabolic disorders.
- Provide an understanding about the action of antibiotics.

Unit I: Drugs – classification based on sources, routes of drug administration - Oral/Enteral, Parenteral and Local application. Absorption of drugs, factors influencing drug absorption, distribution and excretion of drugs. 15 Hrs

Unit II: Drug metabolism - Phase I and Phase II reactions, role of cytochrome P_{450}, non-microsomal reactions of drug metabolism. Factors influencing drug metabolism. Therapeutic index. 15 Hrs

Unit III: Drug allergy, Drug tolerance - IC 50, LD50 of a drug, Drug intolerance, Drug addiction, Drug abuses and their biological effects. Drug resistance - biochemical mechanism. 15 Hrs

Unit IV: Therapeutic Drugs - Analgesics and Non-steroidal anti-inflammatory drugs (NSAIDs) - Aspirin and Acetaminophen. Insulin, Oral antidiabetic drugs - Sulfonylureas, Biguanides. Antihypertensive drugs - ACE inhibitors, Calcium channel blockers. Anti-cancer agents - Antimetabolites. 15 Hrs

Unit V: Antibiotics - Definition, Examples and Biochemical mode of action of penicillin, streptomycin, tetracyclines and chloramphenicol. 15 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Classify the different routes of drug administration, describe the absorption, distribution, metabolism and excretion of drugs.	PO1
CO2	Illustrate the metabolism of drugs, classify the microsomal and non-microsomal reactions and explain the role of cytochromes.	PO1
CO3	List out the various adverse response and side effects of drugs.	PO1, PO2, PO4
CO4	Justify the use of synthetic drugs and elucidate its pharmacological actions and its adverse effects for different disease.	PO1, PO4
CO5	Highlight the importance and explain the mode of action of important antibiotics.	PO1, PO4

Text Books

1. N. Murugesh, A concise text book of Pharmacology - Sathya Publishers.
2. Jayashree Ghosh, A Textbook of Pharmaceutical chemistry –S. Chand & Company Ltd.
3. S.C. Metha, Ashutosh Kar, Pharmaceutical Pharmacology - New Age International (P) Limited, Publishers.

References Books

1. Lippincott's illustrated Reviews- Pharmacology by Mary J. Mycek, Richard A. Harvey,
2. Pamela C. Champe, Lippincott – Raven publishers, New Delhi.
3. David. E. Golan, Principles of Pharmacology, Wolters Kluwer (India) Pvt. Ltd.

4. R.S. Satoskar, S. B. Elsevier Pharmacology and pharmacotherapy. - ISBN-10: 9788131248867 / ISBN-13: 978-8131248867, 2017.
5. Tripathi, K. Essentials of Medical Pharmacology. Jaypee Publishers- ISBN-10: 9350259370 / ISBN-13: 978-9350259375, 2018.

Web Resources

1. https://slideplayer.com/slide/3728296/64/video/What+is+bioremediation%3F.mp4

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3			3
CO 2	3						3			3
CO 3	3	2		2			3	2		3
CO 4	3			2			3	2		3
CO 5	3			2			3	2		3

S-Strong (3) M-Medium (2) L-Low (1)

DISASTER MANAGEMENT

Course Code	Course Title	L	T	P	C
23115DSC54__	Disaster Management	4	0	0	3

Course Objectives:

- To provide students an understanding the need for studying the disaster management
- Develop an understanding about the various types of disasters.
- To expose students to the risk and vulnerability analysis
- To create awareness about disaster prevention and risk reduction
- To establish relationship between disasters and developments.
- To understand Rehabilitation, Reconstruction and Recovery in the event of Disaster
- To gain knowledge on Climate Change Adaptation and IPCC Scenario and Scenarios in the context of India.

Course Outcomes:

CO1: Understand the need and significance of studying disaster management

CO2: Understand the different types of disasters and causes for disasters.

CO3: Gain knowledge on the impacts Disasters on environment and society

CO4: Study and assess vulnerability of a geographical area.

CO5: Students will be equipped with various methods of risk reduction measures and risk mitigation.

CO6: Understand the role of Information Technology in Disaster Management

CO7: Understand Geographical Information System applications in Disaster Management

Content of Course

Unit I: Introduction to Disasters

Chapter No.1: Disaster: Concept, Meaning, and Definition
Chapter No.2: History of Major Disaster Events in India
ChapterNo.3: Types of Disasters - Natural Disasters: Famine, Drought, Flood, Cyclone, Tsunami, Earthquake

Unit II: Disaster Mitigation and Disaster Management

Chapter No.4: Man-made Disasters: Riots, Blasts, Industrial, Militancy
Chapter No.5: Profile, Forms and Reduction of Vulnerability
Chapter No. 6: Disaster Mitigation: Concept and Principles

Unit III: Impact of Disaster

Chapter No.7: Disaster Management: Concept and Principles

Chapter No.8: Pre-disaster-Prevention and Preparedness

Chapter No.9: Physical, Economic, Social, Psycho-socio Aspects, Environmental Impacts

Unit IV: Disaster Process and Intervention

Chapter No.10: During Disaster – Rescue and Relief

Chapter No.11: Post-disaster – Rehabilitation and Reconstruction
Chapter No.12: Victims of Disaster-Children, Elderly, and Women
Chapter No.13: Displacement-Causes, Effects and Impact

Unit V: Disaster Intervention

Chapter No.14: Major Issues and Dynamics in the Administration of Rescue, Relief, Reconstruction and Rehabilitation
Chapter No.15: Components of Rescue, Relief, Reconstruction; Rehabilitation
Chapter No.16: Disaster Policy in India; Disaster Management Authority-NDMA, SDMA, DDMA; Disaster Management Act, 2005

References:

1. Anil Sinha (2001), Disaster Management-Lessons Drawn and Strategies for Future. New Delhi, Jain Publications.
2. Backer, C.W. and Chapman, W. (ed.). (1969), Man and Society in Disasters, New

Delhi,
3. Clarke, J.I., Peter Curson, et.al. (ed.) (1991), Population and Disaster, Oxford, Basil Blackwell Ltd.
4. Cuny, Frederick (1984), Disasters and Development, Oxford, Oxford University Press. Disaster Management Act 2005
5. Garb, S. and Eng.E (1969), Disasters Hand Book, New York, Springer.
6. Gupta, M.C, L.C. Gupta, B. K. Tamini and Vinod K. Sharma (2000), Manual on Natural Disaster Management in India, New Delhi, National Institute of Disaster Management. Hoff, A (1978), People in Crisis-Understanding and Helping, California, Addison Wesley.
7. Maskrey Andrew (1989), Disaster Mitigation: A Community Based Approach, Oxford, Oxfarm.
8. Narayan, Sachindra (ed.) (2000), Anthropology of Disaster Management, New Delhi, Gyan Publishing House.
9. Nidhi G Dhawan (2014), Disaster Management and Preparedness, New Delhi, Jain Publications.
10. Parasuraman, S. and Unnikrishnan, P.V. (2000), India Disasters Report: Towards Policy Initiative, New Delhi, Oxford University Press.

CLINICAL BIOCHEMISTRY LAB

Course Code	Course Title	L	T	P	C
23115SEC55L	Clinical Biochemistry Lab	0	0	3	3

Course Objectives:

The objectives of this course are to

- Introduce the methods of sample collection (blood & urine) for analytical purpose.
- Impart practical knowledge on the assay of activity of various diagnostically important enzymes
- Understand the estimation procedure for various important biomolecules.
- Help students learn the routine qualitative analysis of urine sample for diagnostic purpose.
- Train students on various hematological tests and its significance.

EXPERIMENTS **80 Hrs**

1. Collection and preservation of blood and urine samples.
2. Estimation of creatinine by Jaffe's method (serum & urine)
3. Estimation of urea by diacetyl monoxime method (serum & urine)
4. Estimation of uric acid (serum & urine)

5. Estimation of cholesterol by Zak's method
6. Estimation of Glucose by Ortho Toluidine method
7. Estimation of Protein by Lowry's method
8. Estimation of Hemoglobin by Shali's/Drabkins method
9. Assay of SGPT and SGOT

Qualitative analysis of normal constituents of urine

Urea, Creatinine, Phosphorus, Calcium

Abnormal constituents

Calcium

Sugar (Glucose, fructose, pentose)

Protein

Amino acids (Tyrosine, Histidine, Tryptophan)

Ketone bodies

Bile pigments with clinical significance.

DEMONSTRATION EXPERIMENTS (10 Hrs)

HEMATOLOGY

a) RBC Counting
b) Total and differential count of white blood cells
c) Packed cell volume
d) Erythrocyte sedimentation rate
e) Blood clotting time
f) Blood grouping

Course Outcomes

CO	On completion of this course, students will be able to	Programme outcome
CO1	Acquaint knowledge on collection of biological samples (urine, blood) and their preparation for diagnostic purpose.	PO1, PO2
CO2	Assay the activity of various clinically important enzymes and relate their clinical importance.	PO1, PO2

CO3	Estimate the important biomolecules in biological samples and relate their clinical significance	PO1, PO2, PO3, PO6
CO4	Qualitatively analyze urine sample for normal and abnormal constituents in urine and interpret the results	PO1, PO2, PO3
CO5	Perform the routine haematological tests.	PO1, PO2, PO3, PO6

Text Books

1. Manickam. S.S. (2018). Biochemical Methods (3rd ed.). Newage International Pvt Ltd publishers.
2. Plummer. D.T. An Introduction to Practical Biochemistry. Tata McGraw Hill.
3. Alan H Gowenlock. 1998. Varley's Practical Clinical Biochemistry, 6th edition, CBS Publishers, India.
4. Godkar, B. 2020. Textbook of Medical Laboratory Technology Vol 1 & 2 Paperback, 3rd edition, Bhalani Publishers.
5. Kanai L Mukerjee. 1996. Medical Lab Technology, Vol I& II, 1st edition, Tata Mcgraw Hill, Pennsylvania.
6. Ranjna Chawla. 2014. Practical Clinical Biochemistry Methods and interpretations 58 (Paperback). 4th edition, Jaypee Brothers Medical Publishers, New York.

Reference books

1. Singh, S.K. (2005). Introductory Practical Biochemistry (2nd ed.). Alpha Science International, Ltd
2. Ashwood, B. a. (2001). Tietz Fundamentals of Clinical chemistry. WB Saunders Company, Oxford Science Publications USA

Web resources

1. https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-for-authors
2. http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/ Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf
3. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y
4. https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3	3					3	3	3	3
CO 2	3	3					3	3	3	3
CO 3	3	3	3			3	3	3	3	3
CO 4	3	3	2				3	3	3	3
CO 5	3	3	3			3	3	3	3	3

S-Strong (3) M-Medium (2) L-Low (1)

ENZYME AND IMMUNOLOGY LAB

Course Code	Course Title	L	T	P	C
23115SEC55L	Enzyme and Immunology Lab	0	0	3	3

Course Objective

Upon successful completion students will -

- To promote critical thinking among students;
- To provide students with a foundation in immunological processes;
- To provide students with knowledge on how the immune system works building on their previous knowledge from biochemistry, genetics, cell biology and microbiology;

Course Outcome

- Study the principle and applications of various immuno techniques ranging from precipitation and agglutination reactions to ELISA, Radio immunoassay
- Besides, students will get an opportunity to learn diffusion and electrophoresis.
- To estimate the mineral content in food
- To know the sources of enzymes and study the extraction and partial purification of enzyme acid phosphatase
- To standardize the optimum pH, optimum substrate concentration required for the maximum activity of acid phosphatase
- To analyse the inhibition pattern by various competitive inhibitors for the enzyme acid phosphatase purified from germinated mung bean

- To assay the activity of Lactate dehydrogenase and glucose-6-phosphate dehydrogenase enzymes

EXPERIMENTS

ENZYMES

1. Determination of Alkaline Phosphatase Activity.
    a. Effect of PH
    b. Effect of Temperature.
    c. Specific Activity
    d. Km (Saturation Method).
2. Determination of Salivary Amylase Activity.
    a. Effect of PH
    b. Effect of Temperature.
    c. Specific Activity
    d. Km (Saturation Method).

IMMUNOLOGY

1. Double Immunodiffusion
2. Single Radial Immuno diffusion
3. Rocket Immunoelectrophoresis
4. Direct ELISA
5. Hemagglutination tests for identification of human blood groups
6. Detection by viral fever by slide agglutination tests.
7. Dialysis.

REFERENCES:

1. Manuals in Biochemistry - Dr.J.Jayaraman.
2. Practical Biochemistry - Plummer.
3. Manuals in Biochemistry - Dr.S.Ramakrishnan.
4. Klemir and others: Practical Biological Chemistry.
5. Practical Biochemistry – Koch and Hank Dunn and Drell
6. Practical Biochemistry – Sawhney (2000)

7. Varley's Practical Clinical Biochemistry – Ed. Alan W. Gowenlock (Heinemann Medical Books, London,1988).

AUDIT COURSE

PROFESSIONAL SKILLS

Course Code	Course Title	L	T	P	C
231ACLSPSL	Professional Skills	-	-	-	1

Course Objectives:

The Objectives of the course are to help students/candidates:

- Acquire career skills and fully pursue to partake in a successful career path
- Prepare a good resume, prepare for interviews and groupdiscussions
- Explore desired career opportunities in the employment market in consideration ofan individual SWOT.

Course Outcomes:

At the end of this course the students will be able to:

- Prepare their resume in an appropriate template without grammatical and other errors and using proper syntax
- Participate in a simulated interview
- Actively participate in group discussions towards gainful employment
- Capture a self - interview simulation video regarding the job role concerned
- Enlist the common errors generally made by candidates in an interview
- Perform appropriately and effectively in group discussions
- Explore sources (online/offline) of career opportunities
- Identify career opportunities in consideration of their own potential and aspirations
- Use the necessary components required to prepare for a career in an identified occupation (as a case study).

Unit I: Resume Skills: Preparation and Presentation, Introduction of resume and its importance, Difference between a CV, Resume and Biodata, Essential components of a good resume, Resume skills: common errors, Common errors people generally make in preparing their resume, prepare a good resume of her/his considering all essential components

Unit II: Interview Skills: Preparation and Presentation, Meaning and types of interviews (F2F, telephonic, video, etc.). Dress Code, Background Research, Do's and Don'ts, Situation, Task, Approach and Response (STAR Approach) for facing an interview. Interview

procedure (opening, listening skills, closure, etc.). Important questions generally asked in job interview (open and closed ended questions).

Unit III: Interview Skills: Simulation Observation of exemplary interviews Comment critically on simulated interviews, Interview Skills: Common Errors: Discuss the common errors generally candidates make in interview Demonstrate an ideal interview

Unit IV: Group Discussion Skills: Meaning and methods of Group Discussion, Procedure of Group Discussion, Group Discussion-Simulation, Group Discussion - Common Errors.

Unit V: Exploring Career Opportunities: Knowing yourself - personal characteristics, Knowledge about the world of work, requirements of jobs including self-employment. Sources of career information, preparing for a career based on their potentials and availability of opportunities,

VALUE EDUCATION

Course Code	Course Title	L	T	P	C
231AECCVED	Value Education	2	0	0	2

Course Objectives

- Provide insights into the central dogma of molecular biology and explain the mechanism of DNA replication.
- Elaborate the mechanism of transcription and reverse transcription.
- Highlight the characteristics of genetic code and describe the process of protein synthesis.
- Introduce the concept of regulation of gene expression in prokaryotes
- Familiarize the different types of mutations and explain the mechanism of DNA repair.

Course Content:

UNIT I: Central Dogma of molecular Biology, DNA as the unit of inheritance. Experimental evidences by Griffith's transforming principle, Avery, McLeod and McCarthy's experiment, and Hershey and Chase Experiment. Replication in prokaryotes: Modes of replication, Meselson and Stahl's experimental proof for semiconservative replication. Mechanism of Replication – Initiation, events at Ori C, Elongation – replication fork, semi discontinuous replication, Okazaki fragments, and termination. Bidirectional replication, Inhibitors of replication. Models of replication-theta, rolling circle and D loop model.

UNIT II: Transcription - Mechanism of transcription: DNA dependent RNA polymerase(s), recognition, binding and initiation sites, TATA/ Pribnow box, elongation and termination. Post-transcriptional modifications; inhibitors of transcription. RNA splicing and processing of mRNA, tRNA and rRNA. Reverse transcription.

UNIT III: Genetic Code and its characteristics, Wobble hypothesis. Translation: Adaptor role of tRNA, Activation of amino acids, Initiation, elongation and termination of protein synthesis, post-translational modifications and inhibitors of protein synthesis

UNIT IV: Regulation of Gene Expression In Prokaryotes - Principles of gene regulation, negative and positive regulation, concept of operons, regulatory proteins, activators, repressors, regulation of lac operon and trp operon.

UNIT V: Mutation: Types-Nutritional, Lethal, Conditional mutants. Missense mutation and other point mutations. Spontaneous mutations; chemical and radiation – induced mutations. DNA repair: Direct repair, Photo reactivation, Excision repair, Mismatch repair, Recombination repair and SOS repair.

Course Outcomes

- Illustrate the Central Dogma of molecular biology, explain the multiplication of DNA in the cell and describe the types and modes of replication.
- Elaborate the mechanism of transcribing DNA into RNA, discuss the formation of different types of RNA.
- Decipher the genetic code and summarize the process of translation.
- Comprehend the principles of gene expression and explain the concept of operon in prokaryotes.
- Distinguish the types of mutations and explain the various mechanisms of DNA repair.

Text Books (Latest Editions)

1. Veer Bala Rastogi, 2008, Fundamentals of Molecular Biology, 1st edition, Anebooks India.
2. David Friefelder,1987, Molecular Biology, 2nd edition, Narosa Publishing House.
3. Dr. P.S. Verma and Dr. V.K. Agarwal, 2013, Cell biology, Genetics, Molecular Biology, Evolution and Ecology,1st edition, S. Chand & Company Pvt. Ltd.

References Books

1. Karp, G., 2010, Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc.
2. DeRobertis, E.D.P. and De Robertis, E.M.F., 2010, Cell and Molecular Biology, 8th edition, Lippincott Williams and Wilkins, Philadelphia.
3. James. D. Watson, 2013, Molecular Biology of the Gene 7th edition, Benjamin Cummings.

SEMESTER: VI

MOLECULAR BIOLOGY

Course Code	Course Title	L	T	P	C
23115AEC61	Molecular Biology	5	0	0	4

Learning Objectives

- The objectives of this course are to
- Provide insights in to the central dogma of molecular biology and explain the mechanism of DNA replication.
- Elaborate the mechanism of transcription and reverse transcription.
- Highlight the characteristics of genetic code and describe the process of protein synthesis.
- Introduce the concept of regulation of gene expression in prokaryotes
- Familiarize the different types of mutations and explain the mechanism of DNA repair.

Unit I: Central Dogma of molecular Biology, DNA as the unit of inheritance. Experimental evidences by Griffith's transforming principle, Avery, McLeod and McCarthy's experiment, and Hershey and Chase Experiment. Replication in prokaryotes: Modes of replication, Meselson and Stahl's experimental proof for semiconservative replication. Mechanism of Replication – Initiation, events at Ori C, Elongation – replication fork, semi discontinuous replication, Okazaki fragments, and termination. Bidirectional replication, Inhibitors of replication. Models of replication-the rolling circle and D loop model. 15 Hrs

Unit II: Transcription - Mechanism of transcription: DNA dependent RNA polymerase(s), recognition, binding and initiation sites, TATA/ Pribnow box, elongation and termination. Post-transcriptional modifications; inhibitors of transcription. RNA splicing and processing of mRNA, tRNA and rRNA. Reverse transcription. 15 Hrs

Unit III: Genetic Code and its characteristics, Wobble hypothesis. Translation: Adaptor role of tRNA, Activation of amino acids, Initiation, elongation and termination of protein synthesis, post-translational modifications and inhibitors of protein synthesis. 15 Hrs

Unit IV: Regulation of Gene Expression In Prokaryotes–Principles of gene regulation, negative and positive regulation, concept of operons, regulatory proteins, activators, repressors, regulation of lac operon and trp operon.15 Hrs

Unit V: Mutation: Types-Nutritional, Lethal, Conditional mutants. Missense mutation and other point mutations. Spontaneous mutations; chemical and radiation – induced mutations.

DNA repair: Direct repair, Photo reactivation, Excision repair, Mismatch repair, Recombination repair and SOS repair. 15 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Illustrate the Central Dogma of molecular biology, explain the multiplication of DNA in the cell and describe the types and modes of replication.	PO1
CO2	Elaborate the mechanism of transcribing DNA into RNA, discuss the formation of different types of RNA.	PO1
CO3	Decipher the genetic code and summarize the process of translation.	PO1
CO4	Comprehend the principles of gene expression and explain the concept of operon in prokaryotes.	PO1, PO2
CO5	Distinguish the types of mutations and explain the various mechanisms of DNA repair.	PO1, PO2

Textbooks

1. Veer Bala Rastogi, 2008, Fundamentals of Molecular Biology, 1st edition, Anebooks India.
2. David Friefelder, 1987. Molecular Biology, 2nd edition, Narosa Publishing House.
3. Dr.P.S.Verma and Dr.V.K.Agarwal, 2013, Cell biology, Genetics, Molecular Biology Evolution and Ecology, 1stedition, S.Chand & Company Pvt .Ltd.

Reference books

1. Karp, G., 2010, Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc.
2. DeRobertis, E.D.P. and DeRobertis, E.M.F., 2010, Cell and Molecular Biology, 8th edition, Lippincott Williams and Wilkins, Philadelphia.
3. James. D. Watson, 2013, Molecular Biology of the Gene 7th edition, Benjamin Cummings.
4. George M. Malacinski, 1992, Freifelder's Essentials of Molecular Biology, 4th edition, Narosa publishing House.

Web resources

1. www.mednotes.net/notes/biology
2. https://www.onlinebiologynotes.com/repair-mechanism-of mutation/

3. https://teachmephysiology.com/biochemistry/protein-synthesis/dna-translation/

Mapping with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3			3
CO 2	3						3			3
CO 3	3						3			3
CO 4	3	2					3			3
CO 5	3	2					3	1		3

S-Strong (3) M-Medium (2) L-Low (1)

HUMAN PHYSIOLOGY

Course Code	Course Title	L	T	P	C
23115AEC62	Human Physiology	5	0	0	4

Learning Objectives

The main objectives of this course are to

- Aid in understanding the physiology of respiratory and circulatory systems
- Explain the structure and physiology of the nervous and muscular system
- Explicate the functions of digestive and excretory system of the body.
- Impart knowledge about the process of reproduction.
- Emphasize the importance of various endocrine factors that regulate metabolism, growth, homeostasis and reproduction.

Unit I: Respiratory System – Overview of respiratory system, Types of respiration, Transport of respiratory gases, Exchange of respiratory gases in lungs and tissues –Chloride Shift & Bohr's effect, Lung surfactant. Circulatory System-Structure and functions of the Heart. Arterial and venous system, Cardiac cycle, Pace maker, Blood pressure and Factors affecting blood pressure. 15Hrs

Unit II: Nervous system- Structure of neuron, synaptic transmission, reflex action, neurotransmission- Resting membrane and Action potential. Neuro transmitters- acetyl choline, Noradrenaline, Dopamine, Serotonin, Histamine, GABA, Substance P.Muscular

system-structure and types of muscles - skeletal, smooth and cardiac muscles, muscle proteins- types and functions, mechanism of muscle contraction. 15Hrs

Unit III: Digestive system- composition, functions of saliva, gastric pancreatic intestine and bile secretions, structure of digestive system, Digestion, absorption of carbohydrates, lipids, proteins. Excretory system- Structure of nephron, mechanism of urine formation, Concentration and acidification of Urine. Role of kidneys in the maintenance of acid base balance. 15Hrs

Unit IV: Reproductive system: Oogenesis, spermatogenesis, capacitation and transport of sperm, blood-testis barrier. Fertilization, early development, Implantation, Placentation and Parturition. 15Hrs

Unit V: Endocrinology- Classification of hormones, endocrine glands and their secretions, structure and functions of Insulin, thyroxine. Steroid hormones - Corticosteroids, Sex hormones - testosterone and estrogen, menstrual cycle. 15Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Explain the exchange of gases, design of blood vessels and cardiac cycle.	PO1
CO2	Summarize the events in transmission of nerve impulses and mechanism of muscle contraction.	PO1
CO3	Elaborate the structure and functions of digestive system, structure of nephron and mechanism of urine formation and role of kidney in maintenance of pH.	PO1
CO4	Describe the process of Oogenesis, Spermatogenesis, Fertilization, and Parturition.	PO1, PO2
CO5	Understand the role of different hormones that regulate metabolism, growth, glucose homeostasis and reproductive function.	PO1, PO2

Textbooks

1. K. Sembulingam & Prema Sembulingam, 2016, Essentials of Medical Physiology, 7th edition, Jaypee Brothers Medical Publishers (P) Ltd.
2. Chatterjee. C.C., 1988, Human Physiology-Vol I & II, 1st edition, Medical Allied Agency.
3. Animal Physiology-Mariakuttikan and Arumugam, Saras publication, 2017.

Reference books

1. Text book of medical biochemistry physiology- MN. Chatterjee and Rana shinde, 7th edition, Jaypee brothers- medical publishers, 2007.
2. Meyer, Meyer & Meij, 2002, Human Physiology, 3rd edition, A.I.T.B.S Publishers.
3. Guytonand Hall, 2011, Text book of Medical Physiology, 12th edition, W.B. Saunders Company.
4. Test book of Medical Physiology–Guyton & Hall, 12th edition, Saunders Publishers, 2010
5. Human anatomy and physiology-Elaine N. Marieb, 3rd edition, Benjamin/Cummings (a Pearson education company), 1995.

Web resources

1. https://www.youtube.com/watch?v=6qnSsV2syUE
2. https://www.youtube.com/watch?v=9_h0ZXx1lFw
3. https://slideplayer.com/slide/9431799/

BIOTECHNOLOGY

Course Code	Course Title	L	T	P	C
23115DSC63__	Biotechnology	5	0	0	3

Course objectives

The main objectives of this course are to

- Impart knowledge on gene manipulation and gene transfer technologies
- Make the students understand the procedures involved in plant tissue culture.
- Acquire knowledge on animal cell culture and stem cell technology.
- Improve the employability skills of students by providing knowledge in recent techniques such as PCR, blotting, ELISA etc.
- Understand the application of fermentation technology.

Unit I: Recombinant DNA technology

Recombinant DNA technology - Principles of gene cloning: restriction endonucleases and other enzymes used in manipulating DNA molecules. Ligation of DNA molecules, DNA ligase, linkers and adapters, homopolymer tailing. end labeling and construction maps of PBR322, λ bacteriophage. 15 Hrs

Unit II: Plant Tissue culture

Plant tissue culture- basic requirements for culture, M S medium, callus culture, protoplast culture. Vectors – Ti plasmid (cointegration vector and binary vector), Viral vectors- TMV, CaMV and their applications. Transgenic plants – pest resistant, herbicide resistant and stress tolerant plants**.** 15 Hrs

Unit III: Animal Tissue culture

Animal cell lines and organ culture - culture methods and applications. Transgenic animals: transgenic mice- Production and its applications. Stem cell technology: definition, types, and applications. 15 Hrs

Unit IV: Molecular Techniques

PCR – Principle, types and its application in clinical diagnosis and forensic science. Southern blotting, Northern blotting and DNA finger printing Technique-principle and their applications. 15 Hrs

Unit V: Fermentation technology

Fermentation technology – Fermentors - general design, fermentation processes - Media used, downstream processing. Production and applications of ethanol, Streptomycin and Proteases. Production of edible vaccines. 15 Hrs

Course Outcomes

CO	On completion of this course, students will be able to	Program outcomes
CO1	Acquire knowledge on rDNA technology, DNA manipulation, and use of restriction endonuclease	PO1, PO3
CO2	Get acquainted with the use of cloning and vectors in plant tissue culture.	PO1, PO2, PO3
CO3	Understand the methods for production of proteins using recombinant DNA technology and their applications, basics of tissue culture, transgenesis, stem cell technology, risks, and safety aspects and patenting in biotechnology	PO1, PO3
CO4	Gain knowledge about the importance of gene and gene manipulation technologies	PO1, PO3
CO5	Know the concept fermentation technology and its applications.	PO1, PO3

Text Books

1. James D. Watson, Amy A. Caudy, Richard M. Myers, Jan Witkowski (2006) Recombinant DNA: Genes and Genomes - a Short Course (3rd ed), W.H. Freeman & Co

2. Satyanarayana U (2008), Biotechnology, Books & Allied (P) Ltd.
3. Cassida L (2007) Industrial Microbiology, New Age International

Reference books

1. Reed G (2004) Prescott and Dunn's Industrial Microbiology, CBS Publishers & Distributors
2. Biotechnology: applying the genetic revolution- David P. Clark, Pazdernik N. J, Elsevier (2009).
3. Click B.R. and Pasternark J.J (2010). Molecular Biotechnology: Principles and Applications of Recombinant DNA. (4th ed) American Society for Microbiology

Web Sources

1. NPTEL Certification course - Gene Therapy by Sachin Kumar https://nptel.ac.in/courses/102/103/102103041/
2. Coursera Certification course –Vaccines
3. https://futureoflife.org/background/benefits-risks-biotechnology/
4. https://www.sciencedirect.com/topics/neuroscience/genetic-engineering
5. http://www.biologydiscussion.cm/biotechnology/techniques-biotechnology/important-techniques-of-biotechnology-3-techniques/15683
6. https://iopscience.iop.org/book/978-0-7503-1347-6/chapter/bk978-0-7503-1347-6ch1
7. https://www.slideshare.net/zeal_eagle/fermentation-technology
8. https://www.slideshare.net/zeal_eagle/fermentation-technology
9. https://www.slideshare.net/Chepkitwai/blotting-techniques-6129300

BIOINFORMATICS

Course Code	Course Title	L	T	P	C
23115DSC63__	Bioinformatics	5	0	0	3

The objective of this course are to

- Impart knowledge on bioinformatics and applications
- Learn about biological databases
- Understand the local and global sequence alignment
- Provide insights on BLAST and Microarray
- Familiarize about structural genomics and visualization tools

Unit I: Introduction to Bioinformatics - Bioinformatics and its applications. - Genome, Metabolome - Definition and its applications. Metabolome - Metabolome Database - E. coli metabolome database, Human Metabolome database. Transcriptome - Definition and applications. 15 Hrs

Unit II : Biological Databases - definition, types and examples –, Nucleotide sequence database (NCBI, EMBL, Gene bank, DDBJ) Protein sequence database- SwissProt, TrEMBL, Structural Database - PDB, Metabolic database-KEGG 15 Hrs

Unit III: Sequence Alignment-Local and Global alignment-Dot matrix analysis, PAM, BLOSUM. Dynamic Programming, Needleman- Wunch algorithm, Smith waterman algorithm. Heuristic methods of sequence alignment. 15 Hrs

Unit IV: BLAST - features, types (BLASTP, BLASTN, BLASTX), PSI BLAST, result format. DNA Microarray - Procedure and applications. 15 Hrs

Unit V: Structural Genomics-Whole genome sequencing (Shotgun approach), Comparative genomics-tools for genome comparison, VISTA servers and precomputed tools. Molecular visualization tools. RASMOL, Swiss PDB viewer. Nutrigenomics - Definition and applications 15 Hrs

Course Outcomes

CO	**On completion of this course, students will be able to**	**Program outcomes**
CO1	Introduce the fundamentals of Bioinformatics and its applications Genome, metabalome & Transcriptome.	PO1
CO2	Classify biological database and to correlate the different file formats used by nucleic acid, protein database, structural and metabolic database.	PO1, PO2, PO3
CO3	Develop algorithms for interpreting biological data.	PO1, PO2
CO4	Discuss the concepts of sequence alignment and its types. Understand the tool used to detect the expression of genes	PO1, PO2, PO3
CO5	Apply the various tools employed in genomic study and protein visualization. Analyse the entire genome by shot gun method.	PO1, PO2

Text books

1. Basic of Bioinformatics by Rui Jiang Xuegong Zhang and Michael Q. Zhang Editors
2. Bioinformatics for Beginners Genes, Genomes, Molecular Evolution, Databases and Analytical Tools By: Supratim Choudhuri (Author)
3. Bioinformatics by Saras publication
4. Introduction to Bioinformatics by Arthur Lesk

Reference books

1. Computation in Bioinformatics Multidisciplinary Applications S Balamurugan, Anand T. Krishnan, Dinesh Goyal, Balakumar Chandrasekaran
2. Chemoinformatics and Bioinformatics in the Pharmaceutical Sciences
3. Navneet Sharma PhD Pharmaceutics, Himanshu Ojha, Pawan Raghav, Ramesh K. Goyal

Web resources

1. https://nptel.ac.in/courses/102/106/102106065/
2. http://www.digimat.in/nptel/courses/video/102106065/L65.html
3. https://www.slideshare.net/sardar1109/bioinformatics-lecture-notes

BIO ENTREPRENEURSHIP

Course Code	Course Title	L	T	P	C
23115DSC63__	Bio entrepreneurship	5	0	0	3

Learning Objectives

The objective of this course are to

- Impart knowledge on bio entrepreneurship and the types of industries
- Learn about business plan, proposal and funding agencies
- Understand the market strategy and the role of information technology in expansion of business
- Provide insights on legal requirement and accounting to establish as Bio entrepreneurship
- Familiarize about business bio incubators centres

Unit I: Introduction to Bio entrepreneurship; Types of industries – Biopharma, Bio agriculture and CRO; Introduction to Trademarks, Copyrights and patents. 15 Hrs

Unit II: Business Plan, Budgeting and Funding Idea or opportunity; Business proposal preparation; funds/support from Government agencies like MSME/banks, DBT, BIRAC, Start-up and make in India Initiative; dispute resolution skills; external environment changes; avoiding/managing crisis; Decision making ability. 15 Hrs

Unit III: Market Strategy- Basics of market forecast for the industry; distribution channels – franchising, policies, promotion, advertising, branding and market; Introduction to information technology for business administration and Expansion. 15 Hrs

Unit IV: Legal Requirements, Finance and Accounting; Registration of company in India; Ministry of Corporate Affairs (MCA); basics in accounting: introduction to concepts of balance sheet, profit and loss statement, double entry, bookkeeping; finance and break-even analysis; difficulties of entrepreneurship in India. 15 Hrs

Unit V: Role of knowledge centres such as universities, innovation centres, research institutions (public & private) and business incubators in Entrepreneurship development; quality control and quality assurance; Definition, role and importance of CDSCO, NBA, GLP, GCP, GMP. 15 Hrs

Course Outcomes

After completion of the course the students will be able to

CO	**On completion of this course, students will be able to**	**Program outcomes**
CO1	Understand the concept and scope for entrepreneurship	PO1
CO2	Identify various operations involved in a venture creation	PO1, PO5, PO6
CO3	Gather funding and launching a winning business	PO1, PO5, PO6
CO4	Nurture the organization and harvest the rewards	PO1, PO5, PO6
CO5	Illustrate about the Business incubator centres and Bio entrepreneurship	PO1, PO5, PO6

Text books

1. Adams, D. J. (2008). Enterprise for life scientists: Developing innovation and entrepreneurship in the biosciences. Bloxham: Scion - ISBN 10: 1904842364 / ISBN 13: 9781904842361
2. Shimasaki, C. (2014). Biotechnology Entrepreneurship: Starting, managing, and Leading Biotech Companies. Academic London Press - ISBN 10: 0124047300 / ISBN 13: 9780124047303
3. Onetti, A. &. (2015). Business modeling for life science and biotech companies: Creating value and competitive advantage with the milestone bridge. Routledge - ISBN 10: 1138616907 / ISBN 13: 9781138616905
4. Kapeleris, D. H. (2006). Innovation and entrepreneurship in biotechnology: Concepts, theories & cases - ISBN-13: 978-1482210125, ISBN-10: 1482210126

Reference books

1. Desai, V. (2009). The Dynamics of Entrepreneurial Development and Management New Himalaya. New Himalaya House Delhi:pub - ISBN : 9789350440810 9350440814
2. Ono, R. D. (1991). The Business of Biotechnology, From the Bench of the Street. Butterworth-Heinemann - ISBN 10: 1138616907 / ISBN 13: 9781138616905
3. Jordan, J. F. (2014). Innovation, Commercialization, and Start-Ups in Life Sciences. London: CRC Press - ISBN-10 : 812243049X ,ISBN-13 : 978-8122430493

Web sources

1. http://www.simplynotes.in/e-notes/mbabba/entrepreneurship-development/
2. https://openpress.usask.ca/entrepreneurshipandinnovationtoolkit/chapter/chapter-1-introductionto-entrepreneurship/

PLANT BIOCHEMISTRY AND PLANT THERAPEUTICS

Course Code	Course Title	L	T	P	C
23115DSC63__	Plant Biochemistry and plant Therapeutics	5	0	0	3

Learning Objectives

The main objective of this course are to

- Convey the knowledge of photosynthesis.
- Detail the structure and types of secondary metabolites.

- Impart the idea on various plant hormones.
- Emphasize the effects of free radicals and the importance of antioxidants
- Understand the role of medicinal plants in treating diseases.

Unit I: Photosynthesis - Photosynthesis apparatus, pigments of photosynthesis, photo chemical reaction, photosynthetic electron transport chain, and path of carbon in photosynthesis - Calvin cycle, Hatch - lack pathway (4 ways) CAM path way, significance of photosynthesis. 15Hrs

Unit II: Secondary metabolites: Structure, Types, Sources, Biosynthesis and function of phenolics, tannins, lignins, terpenes and alkaloids. Medicinal properties of secondary metabolite. 15Hrs

Unit III: Plant hormones Structure and function of plant hormones such as ethylene, cytokinins, auxins, Absicic acid, Florigin and Gibberlins. 15Hrs

Unit IV: Free radicals, types, production, free radical induced damages, lipid peroxidation, reactive oxygen species, antioxidant defense system, enzymatic and non-enzymatic antioxidants, role of antioxidants in prevention of disease, phytochemicals as antioxidants. 15Hrs.

Unit V: Plant therapeutics: Bioactive principles in herbs, plants with antidiabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties. 15Hrs

Course Outcomes

CO	**On completion of this course, students will be able to**	**Program outcomes**
CO1	Gain knowledge on photosynthetic apparatus, pigments present, pathways, and significance of photosynthesis	PO1
CO2	Learn in detail about the structure, types, sources, biosynthesis and functions of secondary metabolites.	PO1,PO3
CO3	Understand the structure and functions of plant hormones.	PO1
CO4	Discuss about free radicals, types and its harmful effects. Role of enzymatic and non-enzymatic antioxidant in defence mechanism, prevention in disease.	PO1,PO2.PO3

CO5	Identify the plants with antidiabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties.	PO1, PO2,PO3

Text books

1. Singh M.P and Panda. H 2005. Medicinal Herbs with their formulations, Daya publishing house, Delhi
2. Plant Physiology – Devlin N. Robert and Francis H. Witham, CBS Publications
3. Molecular activities of plant cell – An Introduction to Plant Biochemistry. John. W.
4. Anderson and John Brardall, Black well Scientific Publications, 1994.

Reference books

1. Khan, I. A and Khanum. A 2004. Role of biotechnology in medicinal and aromatic plants, Vol.1 and Vol.10, Ukka2 publications, Hyderabad.
2. Plant Biochemistry and Molecular Biology - Hans Walter Heldt, Oxford University, 4th Edition, 2010
3. Plant biochemistry (2008), Caroline bowsher, Martin steer, Alyson Tobin, garland science.
4. Plant physiology and development (sixth edition) by Lincoln Taiz, Eduardo Zeiger , Ian Max Moller and Angus Murphy publisher ; Oxford university press

Web resources

1. https://www.intechopen.com/books/secondary-metabolites-sources-and-applications/anintroductory- chapter-secondary-metabolites
2. https://www.toppr.com/guides/biology/plant-growth-and development/plantgrowth

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3			3
CO 2	3		2				3	3		3
CO 3	3						3			3
CO 4	3	3	3				3	3		3
CO5	3	3	3				3	3		3

S-Strong (3) M-Medium (2) L-Low (1)

AUDIT COURSE
INDIAN KNOWLEDGE SYSTEM

Course Code	Course Title	L	T	P	C
231ACSIKWS	Indian Knowledge System	-	-	-	2

Course Objectives:

The course design seeks to address the following issues:

- To introduce to the students the overall organization of IKS
- To develop an appreciation among the students the role and importance of Veda, Vedāṅgas, Upa Vedas and Purāṇas
- To show case the multi-dimensional nature of IKS and their importance in the contemporary society
- To motivate the students to take up a detailed study of some of these topics and explore their application potential

Course Outcomes:

CO1: Explain the historicity of Indian Knowledge System and the broad classification of Indian philosophical systems

CO2: Explain the potential of Sanskrit in natural language processing

CO3: Explain the features of Indian numeral system and its role in science & technology advancement

CO4: Illustrate the basic elements of the Indian calendar and the components of Indian Panchanga

CO5: Outline the science, engineering & technology heritage of ancient and medieval India

Syllabus

Unit I: Introduction to Indian Knowledge System (IKS), Definition, Concept and Scope of IKS (4).

Definition, Concept and Scope of IKS. IKS based approaches on Knowledge Paradigms. IKS in ancient India and in modern India

Unit II: IKS and Indian Scholars, Indian Literature (8)

Philosophy and Literature (Maharishi Vyas, Manu, Kanad, Pingala, Parasar, Banabhatta, Nagarjuna and Panini). Mathematics and Astronomy (Aryabhatta, Mahaviracharya, Bodhayan, Bhashkaracharya, Varahamihira and Brahmgupta). Medicineand Yoga (Charak, Susruta, Maharishi Patanjali and Dhanwantri). Sahitya (Vedas, Upvedas, Upavedas (Ayurveda, Dhanurveda, Gandharvaveda). Puran and Upnishad and shaddarshan (Vedanta,

Nyaya. Vaisheshik, Sankhya, Mimamsa, Yoga, Adhyatma and Meditation). Shastra (Nyaya, vyakarana, Krishi, Shilp, Vastu, Natya and Sangeet).

Unit III: Indian Traditional/tribal/ethnic communities, their livelihood and local wisdom (6).

Geophysical aspects, Resources and Vulnerability. Resource availability, utilization pattern and limitations. Socio-Cultural linkages with Traditional Knowledge System. Tangible and intangible cultural heritage.

Unit IV: Unique Traditional Practices and Applied Traditional Knowledge (8)

Myths, Rituals, Spirituals, Taboos and Belief System, Folk Stories, Songs, Proverbs, Dance, Play, Acts and Traditional Narratives. Agriculture, animal husbandry, Forest, Sacred Groves, Water Mills, Sacred Water Bodies, Land, water and Soil Conservation and management Practices. Indigenous Bio-resource Conservation, Utilization Practices and Food Preservation Methods, Handicrafts, Wood Processing and Carving, - Fiber Extraction and Costumes. Vaidya (traditional health care system), Tantra-Mantra, Amchi Medicine System. Knowledge of dyeing, chemistry of dyes, pigments and chemicals

Unit V: Protection, preservation, conservation and Management of Indian Knowledge System (4)

Documentation and Preservation of IKS. Approaches for conservation and Management of nature and bio-resources. Approaches and strategies to protection and conservation of IKS.

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SCHOOLOFARTSAND SCIENCE

DEPARTMENT OF BIOCHEMISTRY

2023-2024
EMPLOYABILITY, SKILL DEVELOPMENT AND ENTREPRENURESHIP

1.	**Employability**	
2.	**Skill development**	
3.	**Entreprenuership**	
4.	**Employability, skill development, and entreprenuership**	

ProgrammeOutcomes:

PO1. To make students understand the importance of biochemistry as a subject that deals with life processes, as well as the concepts, theories and experimental approaches followed in biochemistry, in order to pursue a research career, either in an industryor academic setting.

PO2. Todevelopanalyticalandproblem-solving skills

PO3. To create an awareness among the students on the interconnection between the interdisciplinary areas of biochemistry.

PO4.To givethenecessarypracticalskillsrequired forbiochemicaltechniquesand analysis.

PO5.Todevelopacommunicationandwritingskillsin students.

PO6.Todevelopleadershipandteamwork skills

PO7. To emphasize the importance of good academic and work ethics and their social implications.

PO8. To emphasize the importance of continuous learning and to promote lifelong learning and career development.

PO9. Toteachstudentshowtoretrieve informationfromavarietyofsources, including libraries, databases and the internet.

PO10. To teach students to identify, design and execute a research problem, analyze andinterpret data and learn time andresource management.

PROGRAMMEEDUCATIONALOBJECTIVE (PEOs)

- **PEO 1**.The course aimsto impart advanced and indepthunderstanding onallthe human physiological and pathological state. To understand the molecular process and their perturbation during disease.

- **PEO2**.TheprogrammecoversvariousaspectsofBiomoleculeestimationandregulation to ascertain health and disease state. metabolic pathways alterations along with their regulation at the replication, transcriptional, translational, and post-translational levels including by studying DNA, RNA and protein molecules, immunology, endocrinology, advancements in rDNA technologies to circumvent genetic disorders.

- **PEO 3**. Further to enrich research understanding various genomic, proteomic and bioinformatics tools are added. Animal cell culture, IPR, Biostatistics, research methodology, clinical research and Plant tissue culture are offered as elective papers to get specialized in a specific area. The final semester is devoted exclusively to enrich the students to address specific research objective.

- **PEO4.:**Understandtheroleofcitizento maintainsustainableenvironment and encourage Eco-friendly initiatives.

- **PEO5.:**Acquiretheabilitytoengageinindependent andlife-longlearninginthe broadest context of health and disease.

ProgrammeSpecificOutcomes:

Onsuccessfulcompletionofthiscourse,studentsshouldbeableto:

PSO1. Understand the principles and methods of various techniques in Biochemistry, Immunology, Microbiology, Enzyme kinetics and Molecular Cell Biology. Based ontheir understanding, the students may would be able to design and execute experiments during their final semester project, and further research programs.

PSO2. Insight on the structure-function relationship of biomolecules, their synthesis and breakdown, the regulation of these pathways, and their importance in terms of clinical correlation. Students will also acquire knowledge of the principles of nutritional biochemistry and also understand diseases and their prevention.

PSO3.To understand the concepts of cellular signal transduction pathways and the association of aberrant signal processes with various diseases. Acquire insight into the immune system and its responses, and use this knowledge in the processes of immunization, vaccine development, transplantation and organ rejection.

PSO4. To visualize and appreciate the centraldogma of molecular biology, regulation of gene expression, molecular techniques used in rDNA technology, gene knock-out and knock-in techniques.

PSO5. To create awareness in students about the importance of good laboratorypractices and the importance of ethical and social responsibilities of a researcher. Teach them how to review literature and the art of designing and executing experiments independently and also work as a part of a team.

C1-BasicsofBiochemistry
C2-BiochemicalandMolecular BiologyTechniques
C3-Physiologyand CellBiology
C4-BiomoleculesandBiochemicalTechniquesLab
C5-Enzymology
C6-CellularMetabolism
C7-ClinicalBiochemistry
C8-Enzymology,MicrobiologyandCellBiologyLab
C9-NutritionalBiochemistry
C10-IndustrialMicrobiology
C11-Participation inBoundedResearch
C12-IndustrialMicrobiology
C13-IndustrialMicrobiology
C14-MolecularBiology
C15-ClinicalBiochemistryLab
C16-GeneEditing, CellandGene therapy
C17-Molecularbasisofdiseaseandtherapeutic strategies
C18-PharmaceuticalBiochemistry
C19-BiochemicalToxicology
C20-ProjectWork
C21-DisciplineSpecificElectiveI-V

M.Sc., CurriculumMapping
ProgrammeEducationalObjectivesvsProgrammeOutcome

POs	1	2	3	4	5	6	7	8	9	10
PEOI	*		*			*	*	*		
PEOII	*		*	*	*	*	*	*		*
PEOIII	*	*	*	*	*		*		*	
PEOIV		*		*		*		*		*
PEOV	*		*		*		*		*	

M.Sc., CurriculumMapping

ProgrammeOutcomevsCourseOutcome

ProgrammeOutcome-PO CourseOutcome-CO	PO1	PO2	PO3	PO4	PO5
CO1	*	*	*	*	*
CO2	*	*		*	*
CO3	*	*	*	*	*
CO4	*	*	*		
CO5	*	*	*	*	*
CO6	*	*	*	*	*
CO7				*	*
CO8	*	*	*	*	*
CO9				*	*
CO10	*	*	*	*	*
CO11			*	*	*

CO12	*	*	*	*	*
CO13	*	*	*	*	*
CO14				*	*
CO15	*	*	*	*	*
CO16				*	*
CO17	*	*	*	*	*
CO18		*	*	*	*
CO19	*	*	*	*	*
CO20	*	*	*		
CO21	*	*	*		

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CourseStructure

MScBiochemistry
2023 regulation

CourseCode	CourseTitle	L	T	P	C
	SEMESTERI				
23215AEC11	Basics of Biochemistry	**5**	1	**0**	**4**
23215AEC12	Biochemical and Molecular Biology Techniques	**5**	**1**	**0**	**4**
23215AEC13	Physiology and Cell Biology	**5**	**1**	**0**	**4**
23215SEC14L	Biomolecules and Biochemical Techniques Lab	**0**	**0**	**4**	**4**
23215DSC15___	Microbiology & Immunology OR **Endocrinology**	5	1	0	3
23215RMC16	**ResearchMethodology**	2	-	-	2
	Total	**22**	**4**	**4**	**21**
	SEMESTERII				
23215AEC21	Enzymology	4	1	0	4
23215AEC22	Cellular Metabolism	4	1	0	4
23215AEC23	Clinical Biochemistry	4	1	0	4
23215SEC24L	Enzymology, Microbiology and Cell Biology Lab	0	0	4	4
23215DSC25_	Energy and drug metabolism OR **Neuro Biochemistry**	4	1	0	3
23215SEC26	Nutritional Biochemistry	4	0	0	3

23215BRC27	Participation in bounded Research	2	0	0	2
23215SEC28	*Internship [Clinical Laboratory]	-	-	-	2
	Total	**22**	**3**	**4**	**26**
	SEMESTERIII				
23215AEC31	Industrial Microbiology	5	1	0	4
23215AEC32	Molecular Biology	4	1	0	4
23215AEC33	GeneEditing, Cell and Gene therapy	4	1	0	4
23215SEC34L	Clinical Biochemistry Lab	0	0	4	4
23215DSC35_	Biostatistics and Data Science OR Immunology	4	1	0	3
23215SEC36	Molecular basis of disease and therapeutic strategies	4	1	0	3
23215SEC37	Industrial Visit– Biotech	-	-	-	2
	Total	**21**	**5**	**4**	**24**
	SEMESTERIV				
23215AEC41	Pharmaceutical Biochemistry	4	1	0	4
23215AEC42	Biochemical Toxicology	4	1	0	4
23215PRW43	Project and viva	0	0	10	4
23215DSC44_	Bio safety, Lab Safety and IPR or Plant Biochemistry	4	1	0	3
23215DSC45_	Developmental Biology or Cancer Biology	4	1	0	3
23215SEC46	Industrial Visit–Pharma or Food Processing	-	-	-	2
	Total	**16**	**4**	**10**	**20**
	TotalCredits fortheProgramme				**91**

DisciplinespecificElectives

Semester	DisciplinespecificElectiveCourses-I
I	a) **20215DSC15A–**Microbiology&Immunology **b) 20215DSC15B–Endocrinology**
	DisciplinespecificElectiveCourses-II
II	a) 2015DSC25A-Energyand drugmetabolism b) 20215DSC25B-**NeuroBiochemistry**
	DisciplinespecificElectiveCourses-III
III	a) 20215DSC34A-BiostatisticsandDataScience b)20215DSC34B- Immunology
VI	a) 20215DSC44A– Biosafety,LabSafetyand IPR b) 20215DSC44B–PlantBiochemistry
V	a) 20215DSC45A-DevelopmentalBiology b) 20215DSC45B-Cancer Biology

CreditDistribution:

Sem	AEC	SEC	DSC	RSB Courses	Others	Total
I	12	4	3	2	-	21
II	12	7	3	2	2	26
III	12	7	3	-	2	24
IV	8	-	6	4	2	20
Total	**44**	**18**	**15**	**08**	**06**	**91**

CourseCode	Coursename	L	T	P	C
23215AEC11	**BASICS OF BIOCHEMISTRY**	5	1	0	4

Pre-requisites,ifany: Basic Knowledge of Biochemistry and Biomolecules

Course Objectives

The main objectives of this course are to:

1. Students will be introduced to the structure of biomolecules.
2. The significance of carbohydrates in biological processes will be understood.
3. The structure, properties and biological significance of lipids in the biological system will be studied
4. Students will learn about the concepts of protein structure and their significance in biological processes and creatively comprehend the role of membrane components with theirbiological significance.

Students will gain knowledge about the structures and functional roles of nucleic acids inthe biologicalsystem

Course Outcomes

On successful completion of the course ,the students should be able to:

CO1: Explain the chemical structure and functions of carbohydrates.(K1,K2)

CO2: Using the knowledge of lipid structure and function, explain how it plays arolein

Signalling pathways (K3,K4)

CO3: Describe the various levels of structural organization of proteins and the role of proteins in biological system (K4, K5)

CO4: Apply the knowledge of proteins in cell-cell interactions.(K3,K4)

CO5. Applying the knowledge of nucleic acids equencing in research and diagnosis (K2, K3,K4)

UNITI

Carbohydrates- Classification, structure (configurations and conformations, anomeric forms), function and properties of monosaccharides, mutarotation, Disaccharides and oligosaccharides with suitable examples . Polysaccharides - Homopolysaccharides (starch, glycogen, cellulose, inulin, dextrin, agar, pectin, dextran). Heteropolysaccharides - Glycosaminoglycans– source, structure, functions of hyaluronic acid, chondroitin sulphates, heparin, keratan sulphate,. Glycoproteins - proteoglycans. O- Linked and N-linked glycoproteins. Biological significance of glycan. Blood group polysaccharides. Bacterial cell wall (peptidoglycans, teichoic acid) andplant cell wall carbohydrates.

UNIT II: Lipids – Classification of lipids, structure, properties and functions of fatty acids, triacylglycerols, phospholipids, glycolipids, sphingolipids and steroids – Biological importance. Eicosanoids- classification, structure and functions of prostaglandins, thromboxanes, leukotrienes. Lipoproteins – Classification ,structure, transport (endogenous and exogenous Pathway) and their biological significance.

UNIT III: Over view of Aminoacids- classification, structure and properties of amino acids, Biological role.Non Protein amino acids and their biological significance. Proteins–

classification based on composition, structure and functions. Primary, secondary, supersecondary (motifs) (Helix-turn –helix, helix-loop-helix, Beta-alpha-beta motif, Rosemann Rossmann fold , Greek key),tertiary and quaternary structure of proteins. Structural characteristics of collagen and hemoglobin. Determination of amino acid sequence.Chemical synthesis of a peptide, Forces involved in stabilization of protein structure. Ramachandran plot. Folding of proteins. Molecular chaperons – Hsp 70 and Hsp 90 - biological role.

UNIT IV: Membrane Proteins - Types and their significance. Cytoskeleton proteins - actin , tubulin , intermediate filaments . Biological role of cytoskeletal proteins. Membrane structure-fluid mosaic model

UNIT V: Nucleic acids – types and forms (A, B, C and Z) of DNA. Watson-Crick model-Primary, secondary and tertiary structures of DNA. Triple helix and quadruplex DNA. Mitochondrial and chloroplast DNA. DNA supercoiling (calculation of Writhe, linking and twist number). Determination of nucleic acid sequences by Maxam Gilbert and Sanger's methods. Forces stabilizing nucleic acid structure. Properties of DNA and RNA. C-value, C-value paradox, Cot curve. Structure and role of nucleotides in cellular communications. Major and minor classes of RNA, their structure and biological functions.

Self-Study

1. ClassificationofSugars
2. Nutritionalclassifcationoffattyacids

Recommended Texts

1. David L.Nelson and Michael M.Cox (2012) LehningerPrinciples of Biochemistry (6th ed) W.H. Freeman.

2. Voet.D&Voet.J.G(2010) Biochemistry,(4thed),JohnWiley&Sons,Inc.

3. MetzlerD.E(2003).Thechemicalreactionsoflivingcells(2nded),AcademicPress.

4. ZubayG.L(1999)Biochemistry,(4thed),Mc Grew-Hill.

5. LubertStryer(2010)Biochemistry,(7thed),W.H.Freeman

Satyanarayan,U(2014)Biochemistry(4thed),ArunabhaSenBooks&Allied(P)Ltd,Kolkata.

Recall(K1)-Simpledefinitions, MCQ,Recallsteps,Conceptdefinitions.

Understand/Comprehend(K2)-MCQ,True/False,Shortessays,Concept explanations, short summary or overview.

Application(K3)- Suggestidea/conceptwith examples,Solveproblems,Observe, Explain.

Analyse(K4)–Problem-savingquestions,Finishaprocedureinmanysteps,Differentiate between various ideas.

Evaluate(K5)-Longeressay/Evaluationessay, Critiqueorjustifywithprosandcons

Create(K6)–Checkknowledgeinspecificoroffbeatsituations. Discussion.

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**L**	**M**	**S**	**M**	**M**	**M**	**S**	**M**	**M**
CO 2	**S**	**M**	**L**	**S**	**M**	**M**	**M**	**S**	**M**	**M**
CO 3	**S**	**M**	**M**	**S**	**S**	**M**	**L**	**S**	**M**	**M**
CO 4	**S**	**M**	**M**	**S**	**M**	**M**	**M**	**S**	**M**	**M**
CO 5	**S**	**S**	**M**	**S**	**S**	**M**	**M**	**S**	**M**	**M**

S-Strong M-Medium L-Low

CourseCode	Coursename	L	T	P	C
23215AEC12	**BIOCHEMICALAND MOLECULAR BIOLOGY TECHNIQUES**	5	1	0	4

Pre-requisites, if any: ComprehensiveKnowledgeofToolsofBiochemistry/Molecular Biology

Course Objectives

Biochemical techniques combine various inter-disciplinary methods in biological research and the course aims to provide students with the following objectives:

1. To understand the various techniques used in biochemical investigation and microscopy.
2. Toexplainchromatographictechniques.\andtheirapplications
3. Toexplainelectrophoretictechniques.
4. Tocomprehendthespectroscopictechniquesanddemonstratetheirapplications in biochemical investigations.
5. Toacquireknowledgeofradiolabellingtechniquesand centrifugation.

Course Outcomes

Aftercompletionofthecourse,thestudentsshouldbeableto:

CO1. Attain good knowledge in modern used in biochemical investigation and microscopyand applythe experimentalprotocols to plan and carryout simple investigations in biological research. (K1, K5)

CO2. Demonstrate knowledge to implement the theoretical basis of chromatography in upcoming practical course work. (K3, K5)

CO3. Demonstrateknowledgetoimplementthetheoreticalbasisof

electrophoretictechniquesinresearchwork.(K3,K5)

CO4. Tackle more advanced and specialized spectroscopic techniques that are pertinent to research. (K1, K2 & K5)

CO5. Tackle more advanced and specialized radioisotope and centrifugationtechniques that are pertinent to research work. (K1, K2 &K5)

UnitsI	General approaches to biochemical investigation, cell culture techniques and microscopic techniques. Organ and tissue slice technique, cell distributionand homogenizationtechniques, cellsorting, and cellcounting, tissue Culture techniques. Cryopreservation, Biosensors- principle and applications. Principle, working and applications of light microscope, dark field, phase contrast and fluorescent microscope. Electron microscope- Principle, instrumentation of TEM and SEM, Specimen preparation and applications-shadow casting, negative staining and freeze fracturing.
Unit**II**	**ChromatographicTechniques:**
	Basic principles of chromatography- adsorption and partition techniques. Chiral Chromatography and counter current Chromatography. Adsorption Chromatography – Hydroxy apatite chromatography and hydrophobic interaction Chromatography. Affinity chromatography.Gas liquid chromatography- principle, instrumentation, column development,detectors and applications. Low pressure column chromatography – principle, instrumentation, column packing, detection, quantitation and column efficiency, High pressure liquid chromatography- principle, instrumentation, delivery pump, sample injection unit, column packing, development,detectionandapplication.ReverseHPLC,capillaryelectro chromatographyandperfusionchromatography.

UnitIII	**ElectrophoreticTechniques:**
	General principles ofelectrophoresis, supporting medium, factors affecting electrophoresis, Isoelectric focusing-principle, ampholyte, development of pH gradient and application. PAGE-gel casting-horizontal, vertical, slab gels, sample application, detection-staining using CBB, silver, fluorescent stains. SDS PAGE-principle and application in molecular weight determination principle of disc gel electrophoresis ,2D PAGE. Electrophoresis of nucleic acids-agarose gel electrophoresis of DNA,pulsed field gel electrophoresis- principle, apparatus, application. Electrophoresis of RNA, curve. Microchip electrophoresis and 2D electrophoresis, Capillary electrophoresis.
UnitIV	**Spectroscopictechniques:**
	Basic laws of light absorption- principle, instrumentation and applications of UV-Visible, IR, ESR, NMR, Mass spectroscopy, Turbidimetry and Nephelometry. Luminometry(Luciferase system, chemiluminescence). X - ray diffraction. Atomic absorption spectroscopy - principle andapplications - Determination of trace elements
UnitV	**RadiolabelingTechniquesandCentrifugation:**
	Nature of radioactivity-detection and measurement of radioactivity, methods based upon ionisation (GM counter) and excitation (scintillation counter), autoradiography and applications of radioactive isotopes, Biological hazardsofradiationand safetymeasures inhandling radioactive isotopes. Basic principles of Centrifugation. Preparative ultracentrifugation - Differentialcentrifugation,Densitygradientcentrifugation.Analytical ultracentrifugation-Molecularweightdetermination.
Reading List **(PrintandOnline)**	Principles and techniques of biochemistry and molecular biology: https://www.kau.edu.sa/Files/0017514/Subjects/principals%20and%20techiniques%20of%20biochemistry%20and%20molecular%20biology%207th%20ed%

Self-Study	1.	Typesofrotors
	2.	Colorimetry–principleandapplications

Recommended Texts

1. Keith Wilson , John Walker (2010) Principles and Techniques of Biochemistry and Molecular Biology (7th ed) Cambridge University Press
2. David Sheehan (2009), Physical Biochemistry: Principles and Applications (2nd ed), Wiley-Blackwell
3. David M. Freifelder (1982) Physical Biochemistry: Applications to Biochemistry and Molecular Biology,W.H.Freeman
4. Rodney F.Boyer (2012), Biochemistry Laboratory: Modern Theory and techniques,(2nd ed),Prentice Hall
5. Kaloch Rajan (2011), Analytical techniques in Biochemistry and Molecular Biology, Springer
6. Segel I.H (1976) Biochemical Calculations (2nd ed),John Wiley and Sons
7. RobytJF(2015)Biochemicaltechniques:TheoryandPractice(1sted), CBSPublishers &Distributors

Methodsofassessment:

Recall(K1)-Simpledefinitions,MCQ,Recallsteps, Conceptdefinitions.

Understand/Comprehend(K2)-MCQ,True/False,Shortessays,Concept explanations, shortsummary or overview.

Application(K3)-Suggestidea/conceptwithexamples,Solveproblems,Observe, Explain.

Analyse(K4)–Problem-savingquestions,Finishaprocedureinmanysteps,Differentiate between various ideas.

Evaluate(K5)-Longer essay/Evaluationessay,Critiqueorjustifywithprosand cons

Create(K6)–Checkknowledgeinspecificoroffbeatsituations. Discussion.

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**L**	**M**	**S**	**S**	**L**	**L**	**S**	**S**	**M**
CO2	**S**	**M**	**M**	**S**	**M**	**L**	**M**	**S**	**S**	**L**
CO3	**S**	**M**	**L**	**S**	**M**	**M**	**M**	**S**	**M**	**L**
CO4	**S**	**S**	**L**	**S**	**S**	**M**	**M**	**S**	**M**	**M**
CO5	**S**	**S**	**M**	**S**	**M**	**M**	**M**	**S**	**M**	**M**

S-Strong MS-StrongM-Medium L-Low

CourseCode	Coursename	L	T	P	C
23215AEC13	**PHYSIOLOGYANDCELLBIOLOGY**	5	1	0	4

Pre-requisites,if any:	Anatomy,CellsandBiologicalCompounds
Course Objectives	To understand the functions and activities of organs, tissues or cells and of physical and chemical phenomena involved in the human body
Course Outcomes	Aftercompletionofthecourse,thestudentsshouldbeableto: **CO1.** specifically understand the biological and chemical processes withina human cell (K1, K2, K5, K6) **CO2.**identifyandpreventdiseases(K2, K3, K4, k5,K6) **CO3.** understand defects in digestion, nutritional deficiencies and intolerances, and gastrointestinal pathologies (K1, K2, K3, K4, K5, K6) **CO4.**identifygeneralcharacteristicsinindividualswithimbalancesof acid-base, fluid and electrolytes.(K1 , K2 , K3 , K4, K5, K6) **CO5.**processthe mechanism: the transmission of biochemical information between cell membrane and nucleus. (K1, K2, K5)
UnitI	Major classes of cell junctions- anchoring, tight and gap junctions. Major familiesofcelladhesionmolecules(CAMs)-cadherins,integrins.Types

	of tissues. Epithelium- organisation and types. The basement membrane. Cell cycle- mitosis and meiosis, Cell cycle-phases and regulation. Cell death mechanisms- an overview-apoptosis, necrosis.
UnitII	Reproductive system- sexual differentiation and development; sperm transport, sperm capacitation, semen analyses and Acrosome reaction. Clinical relevance of female reproductive physiology- menstrual cycle, pregnancy and menopause. Fertilisation and infertility issues.
UnitIII	Digestive system- structure and functions of different components of digestive system, digestion and absorption of carbohydrates, lipids and proteins, role of bile salts in digestion and absorption, mechanism of HCl formation in stomach, role of various enzymes and hormones involved in digestive system. Composition of blood, lymph and CSF. Blood cells - WBC, RBC and energy metabolism of RBC, Blood clotting mechanism and blood groups- ABO and Rhesus system.
UnitIV	Respiratory system-Gaseous transport and acid-base homeostasis. Mechanism of the movement of O2 and CO2 through lungs, arterial and venous circulation. Bohr effect, oxygen and carbon dioxide binding haemoglobin. pH maintenance by cellular and intracellular proteins. Phosphate and bicarbonate buffers, Metabolic acidosis and alkalosis. Respiratory acidosis and alkalosis. Regulation of fluid and electrolyte balance.
UnitV	Sensory transduction, Nerve impulse transmission- nerve cells, synapses, reflex arc structure, resting membrane potential, Nernst equation, action potential, voltage gated ion-channels, impulse transmission, neurotransmission, neurotransmitter receptors, synaptosomes, synaptotagmin, rod and cone cells in the retina, changes in the visualcycle, photochemical reaction and regulation of rhodopsin, odour receptors,learningandmemory.Chemistryofmusclecontraction–actin andmyosinfilaments,theories involvedinmusclecontraction,mechanism

	ofmusclecontraction,energysourcesformusclecontraction.
VI	Hormones – Classification, Biosynthesis, circulation in blood, modification and degradation. Mechanism of hormone action, Target cell concept. Hormones of Hypothalamus, pituitary, Pancreatic, thyroid & parathyroid, adrenal and gonadal hormones. Synthesis, secretion, physiological actions and feedback regulation of synthesis.

Reading List (Print and online)

https://www.genome.gov/genetics-glossary/Cell-Cyclehttps://my.clevelandclinic.org/health/diseases/16083-infertility-causeshttps://www.webmd.com/heartburn-gerd/reflux-diseasehttps://www.ncbi.nlm.nih.gov/pmc/articles/PMC5760509/ https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3249628/

Self-Study

1. Variationincelldifferentiationand progression
2. LeschNyhansyndrome,oroticaciduriaandGERD

Recommended Texts

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments (6th ed). John Wiley & Sons. Inc.
2. Bruce Alberts and Dennis Bray (2013),Essential Cell Biology,(4th ed),Garland Science.
3. De Robertis, E.D.P. and De Robertis, E.M.F. (2010). Cell and Molecular Biology.(8th ed). Lippincott Williams and Wilkins, Philadelphia.
4. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. (5th ed). Sunderland, Mass. Sinauer Associates, Inc.
5. Wayne M. Baker (2008) the World of the Cell. (7th ed). Pearson Benjamin Cummings Publishing, San Francisco. Cell Biology
6. John E. Hall (2010). Guyton and Hall Textbook of Medical Physiology (12th ed), Saunders
7. Harrison'sEndocrinologybyJ.LarryJamesonSeries:Harrison's Specialty, 19thEditionPublisher:McGraw-Hill,Year:2016.

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ, Recallsteps,Conceptdefinitions.

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview.

Application(K3)-Suggestidea/conceptwithexamples,Solveproblems,Observe, Explain.

Analyse(K4)-Problem-savingquestions,Finishaprocedureinmanysteps,Differentiate between various ideas.

Evaluate(K5)-Longer essay/Evaluationessay,Critiqueorjustifywithprosand cons.

Create(K6)-Checkknowledgeinspecificoroffbeatsituations. Discussion

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	S	S	S	M
CO2	S	S	S	S	S	L	S	S	S	M
CO3	S	S	S	S	S	M	M	S	S	M
CO4	S	S	S	S	S	M	M	S	S	M
CO5	M	S	L	S	S	L	M	M	L	L

S-Strong M-Medium L-Low

CourseCode	Coursename	L	T	P	C
23215SEC14L	BiomoleculesandBiochemicalTechniquesLab	**0**	**0**	**4**	**4**

Pre-requisites Knowledge on basic principles, Instrumentation of Biochemical techniquesandmetabolicreactions

Course Objectives

1. To instill skill in students enabling them to apprehend the wider knowledge about principles and techniques to be employed for the biomolecules under investigation.
2. To inculcate the knowledge of various isolation and purification techniques of macromolecules like DNA, RNA, Glycogen and Starch,
3. To perform colorimetric estimations to quantify important metaboliteslikelactateandtryptophanandmineralslikecalciumand iron from various sources.
4. To achieve training in subcellular fractionation and to identify them by markers.

5To achievetraining invariouschromatographictechniques.

6. To perform the isolation and identification of the organelles of a cell using differential centrifugation.
7. Toperformphytochemicalscreeningandquantificationenabling themtogiveaninsightonphytochemicalsthiswillbeusefulfor future research.

Course Outcomes **Onsuccessfulcompletionofthiscourse,studentsshouldbeableto:**

Aftercompletionofthecourse,thestudentsshouldbeableto:

CO1. The student will be able to acquire knowledge and skill in the techniques used in the isolation, purification and estimation ofdifferent biomolecules that are widely employed in research (K1, K2, K4)

CO2. The students will get acquainted with Principle, Instrumentation and methodofPerforming UV absorptionstudies ofDNA, Proteinand interpretingthealterationoccurredduringtheprocessofdenaturation (K1,K2,K3,K4).

CO3. The student will be fine-tune in handling the instrumentslike colorimeter, spectrophotometer and will be able to estimate the biomolecules and minerals from the given samples (K1,K2,K4,)

CO4. The student, in addition to acquiring skill in performing various biochemical techniques can also learn to detect presence of phytochemicals and quantify them in the plant sample. (K1,K2,K3,K4 & K6)

CO5. The students will develop skill in analytical techniques like subcellular fractionation, Paper, Column and Thin layer Chromatography and the group experiments will enable them to build learning skills like team work, Problem solving, Communication ability. (K1, K2,K3,K4 & K6)

UnitsI	Biochemicalstudiesandestimationofmacromolecules
	1. Isolationandestimationofglycogenfromliver. 2. IsolationandestimationofDNA fromanimaltissue. 3. Isolationand estimationofRNAfromyeast. 4. PurificationofPolysaccharides–Starchandassessmentofitspurity
UnitsII	UVabsorption
	1. DenaturationofDNAand absorptionstudiesat260nm. 2. DenaturationofProteinand absorptionstudiesat280nm.
UnitsIII	Colorimetricestimations
	1. EstimationofPyruvate 2. Estimationoftryptophan.
UnitsIV	Estimationofminerals
	1. Estimationofcalcium 2. Estimationofiron

Units V	Plant Biochemistry
	1. QualitativeanalysisPhytochemicalscreening
	2. EstimationofFlavonoids-Quantitativeanalysis
UnitsVI	GroupExperiments
	1. Fractionation of sub-cellular organelles by differential centrifugation-Mitochondria and nucleus 2. Identificationof theseparatedsub-cellularfractionsusingmarker enzymes (any one) 3. Separationofidentificationoflipidsbythin layerchromatography.. 4. Separationofplantpigments fromleavesbycolumnchromatography 5. IdentificationofSugars byPaperChromatography 6. IdentificationofAminoacidsbyPaper Chromatography
Reading List (PrintandOnline)	1. https://www.researchgate.net/publication/313745155_Practical_Biochemistry_A_Student_Companion 2. https://doi.org/10.1186/s13020-018-0177-x 3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5368116/ 4. https://www.life.illinois.edu/biochem/455/Lab%20exercises/2Photometry/spectrophotometry.pdf 5. https://ijpsr.com/bft-article/determination-of-total-flavonoid-and-phenol-content-in-mimusops-elengi-linn/?view=fulltext 6. https://skyfox.co/wp-content/uploads/2020/12/Practical-Manual-of-Biochemistry.pdf
Self-Study	1. LaboratorySafetyRules,RequirementsandRegulations. 2. Preparationofstandardsolutionsand reagent
BooksRecommended	1. DavidPlummer(2001)AnIntroductiontoPractical Biochemistry (3rd ed) McGraw Hill Education (India) Private Ltd 2. Jayaraman,J(2011),laboratory Manual inBiochemistry,Newage publishers 3. VarleyH(2006)PracticalClinicalBiochemistry(6thed),CBS Publishers

4. O. Debiyi and F. A. Sofowora, (1978)"Phytochemical screening of medical plants," Iloyidia, vol. 3, pp. 234–246,
5. Prof.SarinA.Chavhan,Prof.SushilkumarA.Shinde(2019)A Guide to Chromatography TechniquesEdition:1
6. AnalyticaltechniquesinBiochemistryandMolecularBiology; Katoch, Rajan. Springer (2011)

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ, Recallsteps,Conceptdefinitions.

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview.

Application(K3)-Suggestidea/conceptwithexamples,Solveproblems,Observe, Explain.

Analyse(K4)-Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiatebetween various ideas

Evaluate(K5)-Longeressay/Evaluationessay,Critiqueorjustifywithprosand cons.

Create(K6)-Checkknowledgeinspecificoroffbeatsituations, Discussion.

MappingwithProgrammeOutcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	M	S	L	S	M	S
CO2	S	S	S	S	M	S	L	S	M	S
CO3	S	S	S	S	M	S	M	S	M	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S-Strong M-Medium L-Low

CourseCode	Coursename	L	T	P	C
23215DSC15A	**MICROBIOLOGY& IMMUNOLOGY**	5	1	0	3

Pre-requisites, if any: Thestudent should possess basic knowledge about microorganisms,types and their general characteristics. The students are also expected to possess basic understandingabouttheprocessofinfection,immunologicaldefenceand pathologicaloutcomes,ifany.

Course Objectives

1. To appreciate the classification of microorganisms based on their structure, size and shape with an insight into the ancient scriptures about microbes.
2. To understand the role of microorganisms in environment and also to learn the culture conditions.
3. To recognize the possible contamination of foods by microorganisms, to learn about counteracting preservative measures and to know aboutprobiotic nature of microorganisms.
4. To gain knowledge on pathogenic mediation by microorganisms and preventive measures as well.
5. To comprehend the features of antimicrobial agents, their mechanism of action along with the side effects and also to explore natural remedial measures against microbes.
6. Tobeabletoexploitthevariousfeaturesofmicroorganismsforthe beneficialindustrialproduction.

Course Outcomes

Aftercompletionofthecourse,thestudentsshouldbeableto:

CO1. To classify (by both ancient and modern modes) different types of microorganisms and explain life cycle ofthe microbes (K1, K2 & K5)

CO2. To recognize the microorganisms involved in decay of foods and willbeabletoapplyvariouscounteractingmeasures.Thestudentsalso will be able torelatetheroleofcertainbeneficialmicrobesinday-to-day'sfood consumption.(K1,K2 &K4)

CO3. Tounderstand thecommon pathogenicbacterial andfungi thatcause toxic effects and also will be able to employ curative measures. (K1 & K2)

CO4. Toanalysevariousfeaturesofwidevarietyofantimicrobialagentsalong with their mode of action,in addition,being able to apprehend the valuable potentials of traditional and easily available herbs. (K2,K5& K6)

CO5. Toapplyknowledgegainedinproductionofindustriallyimportant productsasbothpharmaceuticalandnutraceutical.(K2, K4&K5)

UnitsI

Taxonomical classification - bacteria, viruses (DNA, RNA), algae, fungi and protozoa. Distribution and role of microorganisms in soil, water and air. Charaka'sclassificationofmicrobes, lytic cycle and lysogeny. Typesofculture media,isolationofpureculture,growthcurveandthemeasurementof microbialgrowth.

UnitsII

Contamination and spoilage of foods – cereals, cereal products, fruits, vegetables, meat, fish, poultry, eggs, milk and milk products. General principles of traditional and modern methods of food preservation - Removal or inactivation of microorganisms, boiling, steaming, curing, pasteurization, cold processing, freeze drying, irradiation, vacuumpacking, controlofoxygen and enzymes. Microbes involved in preparation of fermented foods - cheese, yoghurt,curd,pickles,ricepancake,appam,ragiporridge(கேழ்வரகு கூழ்)andbread.

UnitsIII

Food poisoning- bacterial food poisoning, *Salmonella*, *Clostridium blotulinum* (botulism), *Staphylococcus aureus*, fungal food poisoning – aflatoxin, food infection – *Clostridium*, *Staphylococcus* and *Salmonella*. Pathogenic microorganisms, *E. coli*, *Pseudomonas*, *Klebsilla*, *Streptococcus*, *Haemophilus*, *& Mycobacterium*, causes, control, prevention, cure and safety. Food microbiological screening- Real time PCR, ELISA, Aerobic and anaerobicPlateCount,dyereductionmethod,anaerobiclacticacidbacteria, anaerobicsporeformers, Hazardanalysiscriticalcontrolpoint(HACCP)

UnitsIV	Antimicrobial chemotherapy, General characteristics of antimicrobial agents. Mechanism of action – sulfonamides, sulphones and PAS. Penicillin, streptomycin- spectra of activity, mode of administration, mode of action, adverse effects and sensitivity test., Antiviral and antiretroviral agents, Antiviral RNA interference, natural intervention (Natural immunomodulators routinely used in Indian medical philosophy).
UnitsV	Immune system- definition and properties. Cells of the immune system – neutrophils, eosinophils, basophils, mast cells, monocytes, macrophages, dendritic cells, natural killer cells, and lymphocytes (B cells and T cells). Lymphoid organs- Primary and Secondary; structure and functions. Antigens and Complement System: definition, properties- antigenicity and immunogenicity, antigenic determinants and haptens. Antigen - antibody interactions - molecular mechanism of binding. Affinity, avidity, valency,cross reactivity and multivalent binding. Immunoglobulins & Immune Response: Structure, classes and distributionofantibodies. Antibodydiversity. Immune system in health & disease, Transplantation immunology- graft rejection andHLAantigens.Immunological techniques,Flowcytometry and itsapplication.
Reading List (Print and Online)	https://www.ijam.co.in/index.php/ijam/article/view/1326 (Krumi (Microorganisms) in Ayurveda- a critical review) Virtual Lectures in Microbiology and Immunology, University of Rochester https://www.frontiersin.org/articles/10.3389/fphar.2020.578970/full#h9https://www.frontiersin.org/articles/10.3389/fmicb.2018.02151/full https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7559905/
Self-Study	1. Microbialinfectionsandgutmicrobiomewithrelevanceto*tridoshas* 2. MicrobialpopulationandpHvariations indifferentdairyproducts.
Recommended	1. MichaelJ.PelczarJr.(2001)Microbiology(5thed),McGrawHillEducation (India)PrivateLimited

Texts

2. FrazierWC,WesthoffDC,VanithaNM(2010)FoodMicrobiology(5th ed), McGraw Hill Education (India) Private Limited
3. Willey J and Sherwood L (2011) ,Prescott's Microbiology(8th ed) McGraw Hill Education (India)
4. Ananthanarayanan , Paniker and Arti Kapil (2013) Textbook of Microbiology (9th ed) Orient BlackSwan
5. JudyOwen,JenniPuntKuby(2013),Immunology(Kindt,Kuby Immunology) (7th ed) W. H. Freeman & Co
6. BrooksGFandCarrollKC(2013)JawetzMelnick&AdelbergsMedical Microbiology,(26th ed) McGraw Hill Education
7. GreenwoodD(2012),MedicalMicrobiology, ElsevierHealth

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ, Recallsteps,Conceptdefinitions.

Understand/Comprehend(K2) -MCQ,True/False,Short essays,Concept explanations,Short summary or overview.

Application(K3)-Suggestidea/conceptwithexamples,Observe, Explain.

Analyse(K4)-Finishprocedureinstepwisemanner,Differentiationbetweenvariousideas, Map knowledge

Evaluate(K5)-Longer essay/Evaluationessay,Critiqueorjustifywithprosand cons.
Create(K6)-Checkknowledgeinspecificoroffbeatsituations,Discussion,Debating, Presentation

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**L**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**
CO2	**S**	**S**	**S**	**S**	**S**	**M**	**L**	**M**	**S**	**S**
CO3	**S**	**M**	**M**	**S**	**M**	**M**	**M**	**M**	**L**	**M**
CO4	**S**	**M**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**
CO5	**S**	**L**	**S**	**S**	**M**	**L**	**L**	**S**	**S**	**S**

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215DSC15B	Endocrinology	5	1	0	3

Aim:

Tohaveabasicunderstandingoftheendocrine system

Course Objective:

Thespecificobjectivesoftheprogramareto train thefellowsto:

- History and physical examination with emphasis on examination of the thyroid, breasts, penis, testes and female reproductive organs.
- Selectionandinterpretationofendocrinebiochemicaltests.

Course Outcomes:

- CO1Applytheknowledgefromthiscoursewhileworkinginmedicallaboratoryto diagnose different hormone disorders
- CO2Explainrecentlaboratorymethodsindiagnosis hormone disorders
- CO3KnowledgeandUnderstandingthesynthesisofdifferentendocrineglandhormones
- CO4Abilitytoanalyzeandsolveproblemsrelatedtohormonetests
- CO5 To know the pathophysiology significance of the system with special reference tohumans
- CO6-Understandthesynthesisofvarioushormonesbyrespectivegland

UNIT:I

Hormones in general -definition – types of secretions – nature – classification synthesis and their role – Feed back control with specific examples Hormones action Proteinsand Steroids – Cell Signaling in hormone action.

UNIT: II

Hypothalomo hypophysial axis - Hormones of hypothalamus and their role Structure of pituitary - Secretions - Physiology role -Pathophysiology Current status of pituitary as a master gland.

UNIT: III

Thyroid - Parathyroid - structure -hormones – synthesis – storage – releases- carrier proteins (eg. TBA and TBG) – Physiology role – Pathophysiology

UNIT: IV

AdrenalandGonadalHormones–Steroidbiosynthesis–maintenanceofcyclicity. Physiologicalrole –Pathophysiology–Steroids inmetabolism

UNIT:V

Gastro intestinal hormones – pancreas as an endocrine organ – secretions- functions – physiological role and pathophysiology other endocrine organs in vertebrate Insect and crustacean hormones – their role in growth and metamorphosis.

REFERENCE:

1. TextBookofendocrinology–Williams
2. PhysiologicalreviewofBiochemistry– Harper andothers
3. Endocrinology–Turner
4. Invertebratereproduction – KKNayar

CourseCode	CourseTitle	L	T	P	C
20215RMC26	**ResearchMethodology**	**3**	**0**	**0**	**2**

AIM:

Tocreateabasicappreciationtowardsresearchprocessandawarenessofvarious researchpublication

COURSE OBJECTIVES:

- Tounderstandthestepsinresearchprocessandthesuitablemethods.
- Toidentifyvariousresearchcommunicationsandtheirsalientfeatures
- Tocarryoutbasicliterature surveyusingthe commondata-bases
- To give exposure to MATLAB platform for effective computational and graphic worksrequired for quality research

COURSEOUTCOME:

- CO1Understandingresearchquestionsandtools
- CO2Experience inscientificwritings
- CO3Practiceinvariousaspectsofscientific publications
- CO4 Inculcationofresearchethics

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UNITI:

Selection ofproblem-stages in the execution ofresearch: choosing a topic to publication-preparation of manuscript-report writing- format of journals – proof reading – sources of information: Journals, reviews, books, monographs, etc, Bibilograpy. Journal ; standard of research journals – Impact factor.

UNITII:

Measures of dispersion: Universe and population – delimiting population – sampling method – random sampling, stratified random sampling – types of variables: qualitative and quantitative variables – continuous and discontinuous variables – scaling method S- mean – standard deviation – standard error – coefficient of variation.

UNITIII:

Coparision of means, chisquard test, student test (ANOVA ‘’portioning of variation). F test – modelsums on one way ANOVA with interpretation ofdata – introduction to MANIVA – Statistical and their use – significance test and fixing levels of significance – use of statistical software like COSTAT and STATISTICA. Breif introduction to pie and histograms. Use ofLCD.

UNITIV:

Chromatography – priniciple, operative technique and applications of paper, TLC, adsorption chromatography, GLC and HPLC. Ion-Exchange, molecular sieve, Electrophoretic techniques – principle and technique of gel, SDS, high voltage and discontinuouselectrophoresis, Isoelectric focusing, plused field gel electrophoresis and capillary electrophoresis. Spectrometry – Centrifugation techniques.

UNITV:

X-Rays – X-Ray diffraction, crystals and detectors, quantitative analysis andapplications. Radio chemical methods – Basic concepts, counting methods and applications. Autoradiography, detection and measurement of radioactivity, applications of radioisotopes in biology.

REFERENCES:

1. AnintroductiontopracticalbiochemistrybyDavid T. Plummer.
2. LaboratoryManual inBiochemistrybyPattabiramanandAcharya
3. PracticalBiochemistrybyJ.Jayaraman.
4. AnalyticalBiochemistry, D. J.HomieandHazelPeck,Longmangroup,3rdedition,1998.
5. PhysicalBiochemistry–ApplicationofBiochemistryandMolecularBiology, David Friefelder, W.H Freeman and Co, 2nd Edition 1999.
6. ExperimentalBiochemistry,RobertSwitzerandLiamgarrity,W.H.FreemanandCo,3rd 1999.
7. Davis,G.BandC.AParker,1997.Writingthedoctoraldissertation,BarronsEducation series, 2nd edition, Pp 160, ISBN: 081208005
8. Duneary,P.2003.AuthoringaPh.Dthesis:howtoplan,draft,writeandfinishadoctoral dissertation. Plagrave Macmillan, Pp256. ISBN 1403905843

SEMESTERII

CourseCode	CourseTitle	L	T	P	C
23215AEC21	Enzymology	4	1	0	4

Pre-requisites Basicknowledgeaboutcatalysis,kineticsandchemicalreaction mechanisms.

Course Objectives

1. Studentswill beintroducedtothe theoryand practiceofenzymology.
2. Mechanismsofcatalysisandfactorsaffectingcatalysiswillbeunderstood
3. Thekineticsofenzymecatalyzedreactionsintheabsenceandpresenceofinhibitorswillbestudiedandtheoptionsforapplying enzymesandtheirinhibitorsinmedicinewillbeanalyzed.
4. Students will learn about the applications of enzymes in research, medicine, and industry, which will prepare them for careers in industrial and biomedical research.
5. Thecontrolofmetabolicpathwaysandcellularresponsesthrough enzymeregulationwillbeemphasized.

Course Outcomes **Onsuccessfulcompletionofthiscourse,studentsshouldbeableto:**

CO1: Describe the catalytic mechanisms employed by enzymes (K1, K2& K5)

CO2: Chooseandusetheappropriatemethodstoisolateandpurify enzymes and check the purity of the enzyme .(K1,K2 , K3,K4 & K5)

CO3: Analyzeenzymekineticdatagraphically,calculatekinetic parameters, determine the mechanismof inhibition bya drug/chemical andanalyzeoptionsforapplyingenzymesandtheirinhibitorsin

medicine(K1,K2,K3&K4)

CO4: Explain allosterism and cooperativity and differentiate Michaelis-Mentenkinetics fromsigmoidalkinetics. Theroleplayedby enzymes in the regulation of vital cellular processes will be appreciated.(K1, K2 ,K5, K6)

CO5: Highlight the use of enzymes in industries and biomedicine (K1,K2 & K3)

UnitsI	Introductionto enzymes and features ofcatalysis:Ashort historyofthe discoveryofenzymesand howtheybecame powerfulbiochemicaltools. Holoenzyme, apoenzyme, cofactors, coenzyme, prosthetic groups, Classification and Nomenclature,Specificity of enzyme action-group specificity, absolute specificity, substrate specificity, stereochemical specificity. Active site, Identification of amino acids at the active site-trapping of ES complex, identification using chemical modification of amino acid side chains and by site-directed mutagenesis.
	Mechanismsofenzymecatalysis:acid-basecatalysis, covalent catalysis, electrostatic catalysis, metal ion catalysis, proximity and orientation effects,LowbarrierH-bonds,StructuralflexibilityMechanismofaction of chymotrypsin
UnitsII	Enzyme techniques:Isolation and purification of enzymes -Importance ofenzyme purification, methods of purification- choice of source , extraction, fractionation methods-based on size or mass (centrifugation, gel filtration); based on polarity (ion-exchange chromatography, electrophoresis, isoelectric focusing, hydrophobic interactionchromatography); based onsolubility(change inpH, change inionicstrength);basedonspecificbindingsites(affinity chromatography),choiceofmethods,Criteriaofpurityofenzymes.

	Enzyme units - Katal, IU. Measurement of enzyme activity - discontinuous,continuous,coupledassays;stoppedflowmethodandits applications.Isoenzymesandtheirseparationbyelectrophoresiswith specialreferencetoLDH
UnitsIII	Enzyme kinetics I: Thermodynamics of enzyme action, Activationenergy, transition-state theory, steady-state kinetics & pre-steady-state kinetics.Single substrate enzyme catalyzed reactions -assumptions, Michaelis-Menten and Briggs-Haldane kinetics, derivation of Michaelis-Menten equation . Double reciprocal (Lineweaver-Burk) and single reciprocal (Eadie -Hofstee) linear plots, their advantages and limitations. Analysis of kinetic data- determination of Km, Vmax, kcat, and their physiological significance, Importance of kcat/Km. Enzyme inhibition: Irreversibleinhibition.Reversibleinhibition-Competitive,uncompetitive ,noncompetitive,mixed and substrate inhibition. Michaelis -Menten equation in the presence of competitive, uncompetitive and non-competitiveinhibitors. Graphical analysis - Diagnostic plots for the determination of inhibition type. Therapeutic use of enzyme inhibitors-Aspirin, statins (irreversible inhibitors), Methotrexate (competitive inhibitor), Etoposide (non-competitive inhibitor), camptothecin (uncompetitive inhibitor). Demonstration:UsingMicrosoftExceltoPlotandAnalyzeKinetic Data
UnitsIV	Enzyme kinetics II: Allosteric enzymes: Cooperativity, MWC and KNF models of allosteric enzymes, Sigmoidal kinetics taking ATCase as an example. Regulation of amount and catalytic activity by - extracellular signal, transcription, stability of mRNA, rate of translation and degradation, compartmentation, pH,temperature, substrateconcentration, allosteric effectors, covalent modification. Regulation of glycogen synthaseandglycogenphosphorylase.Feedbackinhibition-sequential, concerted,cumulative, enzyme-multiplicitywithexamples.

	Bi - Substrate reactions: Single Displacement reactions (SDR) (Ordered and Random bi bi mechanisms), Double Displacement reactions (DDR) (Ping pong mechanism), Examples, Cleland's representation of bisubstrate reactions, Graphicalanalysis (diagnostic plots)to differentiate SDRfrom DDR.
UnitsV	Enzyme technology: Immobilization of enzymes – methods -Reversible immobilization (Adsorption, Affinity binding), Irreversible immobilization (Covalent coupling, Entrapment and Microencapsulation, Crosslinking, Advantages and Disadvantages of each method, Properties of immobilized enzymes,. Designer enzymes-ribozymes and deoxyribozymes, abzymes, synzymes. Enzymes as therapeutic agents-therapeutic use of asparaginase and streptokinase. Applicationofenzymesinindustry-Industrialapplicationofrennin, lipases,lactases,invertase,pectinases,papain.
ReadingList (PrintandOnline)	**Enzymes**|MITOpenCourseWare|FreeOnlineCourseMaterials https://ocw.mit.edu/high-school/biology/exam-prep/chemistry-of-life/enzymes/ **Enzymology** https://onlinecourses.swayam2.ac.in/cec20_bt20/preview https://mooc.es/course/enzymology/ **The activesite ofenzymes** https://dth.ac.in/medical/courses/biochemistry/block-1/1/index.php **EnzymesandEnzymeKinetics** https://www.lecturio.com/medical-courses/enzymes-and-enzyme kinetics.course#/ Mechanisticenzymologyindrugdiscovery:a freshperspective https://www.nature.com/articles/nrd.2017.219 Enzyme Biosensors for Biomedical Applications: Strategies for SafeguardingAnalyticalPerformancesinBiologicalFluids https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4934206/

Self-Study	1. Mechanisticenzymologyindrug discovery 2. EnzymeBiosensorsforBiomedicalApplications
Recommended Texts	1. Enzymes: Biochemistry, Biotechnology and Clinical chemistry, 2nd edition, 2007,Palmer T andBonner P;Affiliated-East West pressprivate Ltd, New Delhi 2. FundamentalsofEnzymology,3rdedition,2003,PriceNCandStevens L; Oxford University Press, New York 3. Voet's Biochemistry, Adapted ed,2011,Voet,D and Voet JG; Wiley, India 4. Lehninger Principles of Biochemistry, 8th edition, 2021, .Nelson DL and Cox MM; WH Freeman & Co, New York 5. Biochemistry, Berg JM, Stryer L, Gatto,G, 8th ed, 2015;WH Freeman & Co., New York. 6. EnzymeKineticsandMechanism;CookPF,ClelandW,;2007; GarlandScience, London

Methodsofassessment:

Recall(K1)-Simpledefinitions,MCQ, Recallsteps,Conceptdefinitions.

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview.

Application(K3)-Suggestidea/conceptwithexamples,Solveproblems,Observe, Explain.

Analyse(K4)-Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiatebetween various ideas

Evaluate(K5)-Longer essay/Evaluationessay,Critiqueorjustifywithprosand cons.

Create(K6)-Checkknowledgeinspecificoroffbeatsituations, Discussion.

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**M**	**S**	**L**	**M**	**S**	**L**	**S**	**S**	**M**
CO2	**S**	**S**	**S**	**S**	**M**	**M**	**L**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**M**	**M**	**M**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**M**	**M**	**M**	**S**	**S**	**S**
CO5	**S**	**S**	**S**	**S**	**M**	**L**	**M**	**S**	**S**	**S**

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215AEC22	CELLULARMETABOLISM	4	1	0	4

Pre-requisites Basicknowledgeonbiochemicalreactionssuchasaddition,deletion, rearrangement,transfer andbreakingofbonds

Course Objectives

1. Familiarizeonbloodglucosehomeostasis
2. Provide an insight into the metabolic path way ofglycogen, glycoprotein, mucopolysaccharide and peptidoglycan with clinical correlation wherever required
3. Inculcate knowledge on nucleotide metabolism and disorders associated with it
4. Provideaplatformtounderstandtheversatilerole ofPLP inamino acid degradation, formation of specialized products and disorders associated with ammonia detoxification
5. Educateonhemeandsulphurmetabolismwithassociatedclinical manifestation

Course Outcomes **Onsuccessfulcompletionofthiscourse,studentsshouldbeableto:**

Aftercompletionofthecourse,thestudentsshouldbeableto:

CO1. Appreciate the modes of synthesis and degradation of glucose and will be able to justify the pros and cons of maintain the bloodsugar level (**K1, K2, K5**)

CO2. Gain knowledge on polysaccharide metabolism and glycogen storage disease **(K1, K2, K5)**

CO3. Acquaintwiththemakingandbrakingofnucleotides **(K1,K2,K4)**

CO4. Differentiatethediversereactionaparticularaminoacidcan

experience**(K1,K2,K3)**

CO5. Correlate the disturbance of metabolic reactions to clinical manifestations with reference to heme and sulphur metabolism (**K1, K2, K4, K5)**

UnitsI	Glycolysis – aerobic and anaerobic, inhibitors, and regulation. Feeder pathway- entry of hexoses into glycolysis, Galactosemia, fructosuria, Pyruvate dehydrogenase complex-mechanism and regulation. Glyoxalate cycle and its regulation. Gluconeogenesis- source, key enzymes, reaction sequence and its regulation. Blood glucose homeostasis and the role of hormones. Pentose phosphate pathway-significance and its regulation. Metabolism of glycogen and its regulation. Biosynthesis of N-linked and O-linked glycoproteins, mucopolysaccharides, Chondroitin sulphate.
UnitsII	Oxidation of fatty acids-oxidation of saturated and unsaturated fatty acids (α, β & ω oxidation) Oxidation of fatty acids with odd and even numbered carbonatoms. Regulationofβoxidation. Ketogenesisand its regulation. Biosynthesis of fatty acid–saturated and unsaturated, chain elongation, regulation. Biosynthesis of prostaglandins, thromboxanes and leukotrienes and hydroxyl eicosanoic acids. Biosynthesis and degradationoftriacylglycerol,phosphoglycero lipids-lecithin,cephalin, plasmalogens and phosphatidyl inositol, Sphingolipid-sphingomyelin, cerebrosides, sulfatides, and gangliosides. Cholesterolbiosynthesis and itsregulation.Lipoproteinmetabolism-chylomicrons,VLDL,HDLand LDL.
UnitsIII	Metabolismofnucleotides- *De novo* synthesis and salvage pathways of purine and pyrimidine nucleotides. Regulation and inhibitors of nucleotidebiosynthesis.Roleofribonucleotidereductaseandits regulation.Degradationofpurineandpyrimidine nucleotides.

Units IV	Biosynthesis of non- essential amino acids.- Role and biological significance of glutamate dehydrogenase, glutamine and asparagine synthetase, lysine, proline and phenylalanine hydroxylase. Interconversion of amino acids - proline to glutamate, methionine to cysteine, serine to glycine. Biosynthesis of spermine and spermidine. Degradation of amino acids –glucogenic and ketogenic amino acids. Formation of acetate from leucine and aromatic amino acid, pyruvate from cysteine, threonine and hydroxy proline, α-keto glutarate from histidine and proline, succinate from methionine, threonine, valine and isoleucine,Oxaloacetatefromaspartate,glycineandserine.
Units V	Biosynthesis and degradation of heme. Jaundice-classification, pathology and Differential diagnosis Oxidation and reduction of inorganic sulphur compounds by microbes and plants. Sulpho transferases and their biological role-rhodanases, sulphatases , 3-mercapto pyruvate sulphur transferases. Mucopolysaccharidoses - Hunter syndrome, Sanfilippo syndrome and Maroteaux-Lamy syndrome.Oxidationofcysteinetosulphateandinterconversionof sulphurcompounds.
Reading List (PrintandOnline)	1. https://www.embopress.org/doi/full/10.1038/msb.2013.19 2. https://people.wou.edu/~guralnl/450Glycogen%20metabolism.pdf 3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3243375/ 4. https://www.researchgate.net/publication/334458898_Urea_Cycle 5. https://www.researchgate.net/publication/51233381_Heme_biosynthesis_and_its_regulation_Towards_understanding_and_improvement_of_heme_biosynthesis_in_filamentous_fungi 6. https://www.researchgate.net/publication/349746691_Microbial_Sulfur_Metabolism_and_Environmental_Implications
Self-study	1. Cori'sCycleandGlucose-Alanine Cycle 2. CoenzymesinvolvedinMethanogenesis
Books Recommended	1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed), W.H.Freeman

2. Voet.DandVoet. J.G(2010)Biochemistry, (4thed),JohnWiley& Sons, Inc.
3. Metzler D.E (2003). The chemical reactions of living cells (2nd ed), Academic Press.
4. ZubayG.L(1999)Biochemistry,(4thed),McGrew-Hill.
5. Textbook of Biochemistry with Clinical Correlations, 7th Edition,Thomas M. Devlin (Editor), Wiley
6. HumanBiochemistry–JamesM.Orten&Otto.W.Neuhan-10th edn-The C.V.Mosby Company

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ, Recallsteps,Conceptdefinitions.

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview.

Application(K3)-Suggestidea/conceptwithexamples,Solveproblems,Observe, Explain.

Analyse(K4)-Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiatebetween various ideas

Evaluate(K5)-Longer essay/Evaluationessay,Critiqueorjustifywithprosand cons.

Create(K6)-Checkknowledgeinspecificoroffbeatsituations, Discussion.

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	M	S	S	S	M
CO2	S	M	S	S	S	M	S	S	S	M
CO3	S	M	S	S	S	M	S	S	S	S
CO4	S	M	S	M	S	M	S	S	S	M
CO5	S	M	S	S	S	M	S	S	S	S

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215AEC23	CLINICALBIOCHEMISTRY	4	1	0	4

Pre-requisites,if any: Thestudentshouldhaveabasicknowledgeofbodyfluidsandtheir compositionandmetabolism;anatomyand physiologyofvitalorgans.

Course Objectives

1. To understand the need and methods of various biological sample collection.
2. To explicitly understand the etiopathogenesis, symptoms and complications of metabolic and hormonal disorders and the relevant diagnostic markers
3. To emphasize the diagnostic significance of serumenzymes indifferent pathologiesandotherLaboratoryinvestigationsof diagnostic importance so as to differentiate normal from disease
4. To conceive the role of inherited genes in inborn errors of metabolism and methodologies pertaining to *in utero* diagnosis and post-natal screening.
5. To get updated about electrolyte and hormonal imbalances and the biochemical tests to diagnose them.

Course Outcomes **CO1.** To appreciate the biological significance of sample collection and awareness of the diagnostic/screening tests to detect common non-communicable diseases so as to understand role of laboratory investigations for biochemical parameters and understand the disorders associated with blood cells

CO2. To understand the etiology of metabolic diseases like diabetes and atherosclerosis and avoid such lifestyle disorders by healthy eating and correlate the symptoms with underlying pathology based on diagnostic and prognostic markers.

CO3. To understand the diagnostic application of serum/plasma enzymes to correlatetheir levelswiththeorganpathologiesassociatedwithspecific diseases.

CO4. To appreciate the role of pre and post-natal diagnosis leading to healthy progeny.

CO5. Tolinktheserumhormonelevelsandclinicalsymptomswith underlying hormonal disturbances. To review the onward transmission of signal via downstream signaling molecules from cell surface to the nucleus by different pathways by comparing and contrasting them and critically evaluate the network between them resulting in the biological outcome.

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UnitI	**Biochemical investigations in diagnosis, prognosis, monitoring, screening:** Specimen collection – blood, (primary/Secondary specimen)., urine and CSF. Preservation ofbiologicalspecimens -blood, urine, CSF and amniotic fluid. ; . Biological reference ranges; **Disordersofbloodcells**:Hemolytic,irondeficiencyandaplasticanemiaand diagnosis, sickle cell anaemia, thalassemia HBA1C variants. Porphyrias, Thrombocytopenia,Causesofleucopenia,leukemiaandleucocytosis.

	Disorders of blood clotting mechanism - Von willebrand's disease, Hemophilia A, B and C, diagnostic test for clotting disorders, D-dimerand itsclinicalsignificance
UnitII	**Diabetesmellitus:pathologyandcomplications:** Acutechanges;Chronic complications: Diabetic nephropathy, neuropathy, retinopathy and Diabetic foot ulcers,Random/Fasting/PP glucose testing, Impaired glucose tolerance (IGT), Impaired fasting glucose (IFT), Diagnosis-by GTT, Pre-diabetes, Gestational DM ,Glycosylated Haemoglobin (HBA1c) ; Glycated albumin., Hypoglycaemia and criticalalert value for glucose.Markers ofcomplications of Diabetes mellitus: Metabolic syndrome, Lipid profile &lipoproteinemia, Atherosclerosis, Diabetic nephropathy, Micralbuminuira, eGFR. Point of care testing for glucose (Glucometers) and continuous glucose monitoring(CGM):principleanditsuse.Majorgroupsofanti-diabeticdrugs. Diet and lifestylemodifications
UnitIII	**Diagnostic Enzymology:**Clinically Important Enzymes and Isoezyme as diagnostic markers: Clinical significance of AST, ALT, ALP, ACP, CK, γ-GT, amylase, pseudocholinesterase and their patternin .Myocardialinfarction;Liver disease, Bone disease, Muscle disease, Cancer (tumor markers), GI tract pancreatitis);Enzymes as therapeutic agents.
	Pre- and post-nataltesting: Amniocentesis, prenataldetectionof inbornerrors of metabolism in developing fetus- Autosomal recessive mode of inheritance-cystic fibrosis, X linked recessive inheritance-Duchenne muscular dystrophy. Newbornscreening(NBS)forInbornerrorsofmetabolism,Tandemmass spectrometryapplication inNBS.

UnitIV	**Liver function tests:** Liver function test panel, Fatty liver . Plasma protein changes in liver diseases. Hepatitis A ,B and C. Cirrhosis and fibrosis. Portal hypertension and hepatic coma.Acute phase proteins -CRP, Haptoglobins, α-fetoprotein, ferritin and transferrin and their clinical significance, Interpreting serumproteinelectrophoresis.Inflammatorymarkers(cytokinessuchasTNF-alphaIL6and others)
UnitV	**Renal function tests** - tests for glomerular and tubular function-Acute and chronic renal failure-Glomerulonephritis, Nephrotic syndrome, uraemia-urinary calculi-Nephrocalcinosis and Nephrolithiasis-causes, pathology and symptoms. Chronic kidney disease. Dialysis-Hemodialysis and peritoneal dialysis. **Electrolytedisorder:**calcium: hypercalcemia andhypocalcemia;Calcium homoestasis in Blood;phosphate:hyperphosphatemia or hypophosphatemia; Clinicalsignificance:Potassium: hyperkalaemia andhypokalaemia,Sodium: hypernatremia and hyponatremia; Chloride: hyperchloremia,hyporchloremia**Hormonaldisordersanddiagnostics:**T3,T4andTSHinthediagnosisof thyroiddisorders;Diagnosticmethodsfordisordersassociatedwithadrenal, pituitary and sex hormones - Addison's disease, Cushing's syndrome, pituitary tumour,Hypopituitarism,Hypogonadism
ReadingList(Print and Online)	1. **Utility ofHILinClinicalChemistry:** https://www.aacc.org/science-and-research/clinical-chemistry-trainee-council/trainee-council-in-english/pearls-of-laboratory-medicine/2018/utility-of-hil-in-clinical-chemistry 2. **Pre,PostandAnalyticalErrorsin ClinicalChemistrylaboratory** DOI: 10.7860/NJLM/2016/22587:2173 https://doi.org/10.2147/JMDH.S286679 3. **StandardsofMedicalCareinDiabetes—2022AbridgedforPrimary Care Providers** https://diabetesjournals.org/clinical/article/40/1/10/139035/Standards-of-Medical-Care-in-Diabetes-2022

https://doi.org/10.2337/diaspect.16.1.32
http://www.ngsp.org/
4. Quality control in clinical laboratory
https://www.researchgate.net/publication/335830829_Quality_Control_in_a_Clinical_Laboratory
https://labpedia.net/quality-control-of-the-clinical-laboratory/
https://journals.sagepub.com/doi/full/10.1016/j.jala.2008.12.001
https://doi.org/10.1016/B978-0-12-407821-5.00004-8
https://www.westgard.com/clia.htm
https://www.labroots.com/webinar/bio-rad-unity-solution-molecular-quality-control-data-management

Self-Study

1. **Potentialsourcesofvariability intheestimationofthe analytes:**

   Pre-analytical phase: acceptance rejection criteria in terms of haemolysis/icteric/lipemia (HIL) interferences

   Analytical phase: Linearity, detection limits precision, accuracy, specificity, sensitivity; Total Allowable Error. (Definitions and examples).

   Post-analyticalphase**:**Unitsofreportingofclinicalchemistryparameters-

2. **Interpretationofresultsinclinicalchemistrybasedonlaboratoryinvestigations and quality control:**

- critical/ alertvalues
- American Diabetes Association (ADA) Standards of Medical Care in Diabetes(yearly update); HBA1C testing :NGSP
- Casestudiesto review
- Qualitycontrolforclinicalchemistryinlaboratory

Recommended Texts

1. ThomasM.Devlin (2014) Textbook of Biochemistry with Clinical Correlations (7th ed). John Wiley & Sons
2. Montgomery R, ConwayTW, Spector AA(1996),Biochemistry: A Case-Oriented Approach (6th ed), Mosby Publishers, USA.
3. TietzFundamentalsofClinicalChemistryandMolecularDiagnostics

(2018) (8th ed),Saunders

4. Dinesh Puri, (2020) Text book of Biochemistry: A clinically oriented approach – 4th Edition, Elsevier.
5. 5. M.N.Chatterjee and Rana Shinde (2012).Textbook of Medical Biochemistry (8th ed), Jaypee Brothers Medical Publishers.
6. Clinical Case Discussion In Biochemistry A Book On Early Clinical Exposure (ECE),PoonamAgrawal, 2021, CBS Publishers &distributors pvt. Ltd

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ, Recallsteps,Conceptdefinitions.

Understand/Comprehend(K2)-MCQ,True/False,Shortessays,Conceptexplanations, Short summary or overview.

Application(K3)-Suggestidea/conceptwithexamples,Observe, Explain.

Analyse(K4)-Finishprocedureinstepwisemanner,Differentiationbetweenvariousideas, Map knowledge

Evaluate(K5)-Longer essay/Evaluationessay,Critiqueorjustifywithprosand cons.

Create(K6)-Checkknowledgeinspecificoroffbeatsituations,Discussion,Debating, Presentation

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	S	M	M	S
CO2	S	M	S	M	S	S	S	M	M	M
CO3	S	S	S	S	S	M	S	S	M	M
CO4	S	M	M	M	S	M	S	S	S	M

CO5	**S**	**M**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215SEC24L	Enzymology,MicrobiologyandCell Biology Lab	0	0	4	4

Pre-requisites Knowledge on basic principles, Instrumentation of Biochemical techniquesandmetabolicreactions

Course Objectives

1. To inculcate skillinstudents enabling themto apprehend the wider knowledge about principles and techniques to be employed for the assayof enzymes under investigation.
2. To inculcate the knowledge ofisolation and purificationtechniques ofenzymes using alkaline phosphatase as an example
3. To perform experiments to study the factors affecting enzyme activity
4. Toachievetraininginassayofenzymes
5. To achieve training inbasic microbiologicaltechniques – preparation ofculture, sterilization and staining methods.
6. To perform the blood grouping test and to prepare blood smear to studydifferent types of blood cells
7. To learn molecular biologytechniques like Gel electrophoresis and Blotting techniques
8. Tointroduceindustrialvisitsothatstudentsmaybeawareofactual need oftheindustryandvariousopportunitiesavailable

Course Outcomes **Onsuccessfulcompletionofthiscourse,studentsshouldbeableto:**

Aftercompletionofthecourse,thestudentsshouldbeableto:

CO1. The student will beableto employ therelevant techniques for isolation and purification of enzymes and gain skill in kinetic studies which is essential for research activity (K1,K2, K4)

CO2. Student will acquire ability in performing enzyme assay, and explicate the methods that form the basis of enzyme characterization. (K1,K2,K4)

CO3. LearntheBasicconceptsinmicrobiologyandcellbiologywhich will be helpful for interdisciplinary research work. (K1,K3,K4)

CO4. Studentswillbetrainedinseparationtechniquesusedin molecularBiologywhichwillbesupportiveintheirfutureresearch (K1,K3,K4 & K6)

CO5. Industrial visits will provide the students with an opportunity to learnpracticallythrough interaction, working methodsandemployment practices. Students will have an exposure to Industrial standard and current work practices (K1,K2,K3,K4 & K6)

UnitsI EnzymologyAlkaline Phosphatase

a. IsolationofAlkalinePhophatasefromgoatkidney.
b. Purificationofalkalinephosphatase
c. Checkingthe purityusingSDS-PAGE
d. DeterminationofoptimumpHandtemperatureofalkalinephosphatase.
e. DeterminationofspecificactivityandKmofalkaline phosphatase.
f. Effectofactivatorsandinhibitorsontheactivityofalkaline phosphatase.

	Assayofenzymes a. SalivaryAmylase b. AcidPhosphatase
UnitsII	Microbiology a. SafetymeasuresandGoodLaboratoryPracticesinmicrobiology laboratory b. Sterilization,Cultureandinoculumpreparation c. Staining ofbacteria– GramStaining
UnitsIII	Physiology&CellBiology a. Testforbloodgrouping(Haemagglutination). b. PeripheralBloodsmear–StainingandInterpretation
UnitsIV	GroupExperiments a. Separationofproteins basedonmolecularweightbySDSPAGE b. AgarosegelelectrophoresisofgenomicDNA
Units V	IndustrialvisitcanbeorganisedtostudentsthroughAcademia–Industry collaborativeProgram
Reading List (PrintandOnline)	1. https://www.researchgate.net/publication/337146254_Kinetic_studies_with_alkaline_phosphatase 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4846332/ 3. https://www.ijsr.net/archive/v3i8/MDIwMTU0MDk=.pdf 4. https://www.researchgate.net/publication/349318898_ABC_of_Periheral_smear 5. https://ncdc.gov.in/WriteReadData/l892s/File608.pdf 6. https://www.ncbi.nlm.nih.gov/books/NBK562156/
Self-Study	1. PreparationofBuffersand pHmeasurement 2. Michaelis-MentenequationandLineweaverBurkplot
Books Recommended	1. DavidPlummer(2001)AnIntroductiontoPracticalBiochemistry (3rd ed) McGraw Hill Education (India) Private Ltd 2. Jayaraman,J(2011),laboratory Manual in Biochemistry,Newage publishers 3. FundamentalsofEnzymology;3rdEdn.Nicholas C.PriceandLewis

Stevens,OxfordUniversityPress(2012).

4. Enzymes:APracticalIntroductiontoStructure,Mechanism,and Data Analysis; Robert A. Copeland , Wiley-VCH Publishers (2000).
5. CappuccinoJG&ShermanN(2005).Microbiology-ALaboratory Manual, Pearson Education Inc
6. PracticalEnzymology,SecondRevisedEdtion:HansBisswanger, Wiley – Blackwell; 2 edition (2011)

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ, Recallsteps,Conceptdefinitions.

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview.

Application (K3) - Suggest idea/concept with examples,Solve problems, Observe, Explain.

Analyse(K4)-Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiatebetween various ideas

Evaluate(K5)-Longer essay/Evaluationessay,Critiqueorjustifywithprosand cons.

Create(K6)-Checkknowledgeinspecificoroffbeatsituations, Discussion.

MappingwithProgrammeOutcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**S**	**S**	**M**	**S**	**L**	**S**	**M**	**S**
CO2	**S**	**S**	**S**	**S**	**M**	**S**	**L**	**S**	**M**	**S**
CO3	**S**	**S**	**S**	**S**	**M**	**S**	**M**	**S**	**M**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215DSC25A	Energyanddrugmetabolism	4	1	0	3

Pre-requisites Basicknowledgeonbiochemicalreactionssuchasaddition,deletion, rearrangement,transfer andbreakingofbonds

Course Objectives

1. Familiarize onconcepts of enthalpy, entropy, free energy, redox system, biological oxidation and high energy compounds
2. Provide an insight into the relationship between electron flow and phosphorylation
3. Inculcate knowledge on processes involved in converting light energy to chemical energy and associated food production by autotrophs
4. Provide a platform to understand the versatile role of Krebs cycle, transport of NADH across mitochondrialmembrane andenergetics
5. Educateonthevariousphasesxenobioticmetabolism

Course Outcomes **Onsuccessfulcompletionofthiscourse,studentsshouldbeableto:**

Aftercompletionofthecourse,thestudentsshouldbeableto:

CO1. Appreciate the relationship between free energy and redox potentialand will be able to justifythe role ofbiologicaloxidationand energy rich compounds in maintaining the energylevel of the system (**K1,K2,K3,K4**)

CO2. Gainknowledgeonroleofmitochondriaintheproductionof energy currency of the cell **(K1, K2, K5, K6)**

CO3. Acquaintwiththeprocessofphotosynthesis**(K1,K2,K5)**

CO4. Comprehend on thediverserole of TCA cycle and the energy obtained on complete oxidation of glucose and fatty acid

(K1,K2,K4,K5)

CO5. Correlate the avenues available to metabolize thexenobiotics (**K1, K2,K4,K5)**

UnitsI	Thermodynamic- principles in biology- Concept of entropy, enthalpy and freeenergychange.Redoxsystems.Redoxpotentialandcalculation of free energy. Biological oxidation – Oxidases, dehydrogenases, hydroperoxidases,oxygenases.Energyrichcompounds– phosphorylatedandnon-phosphorylated.Highenergylinkages.
UnitsII	Electrontransport chain-various complexes ofETC, Q-cycle. Inhibitors of ETC. Oxidative phosphorylation-P/O ratio, chemiosmotic theory. MechanismofATP synthesis - role ofF0-F1 ATPase, ATP-ADP cycle. Inhibitorsofoxidativephosphorylationionophores,protonophores .Regulationofoxidative phosphorylation
UnitsIII	Light reaction-Hills reaction, absorption of light, photochemical event. Photo ETC-cyclic and non-cyclic electron flow. Photophosphorylation-role of CF0-CF1 ATPase. Dark reaction- Calvin cycle, control of C3 pathway,andHatch-Slackpathway(C4pathway),Photorespiration. Synthesisand degradationofstarch
UnitsIV	Interconversion of major food stuffs. Energy sources of brain, muscle, liver, kidneyand adipose tissue. Amphibolic nature ofCitric acid cycle. Anaplerotic reaction. Krebs cycle, Inhibitors and regulation of TCA cycle. Transport of extra mitochondrial NADH – Glycerophosphate shuttle,malateaspartateshuttle.Energeticsofmetabolicpathways– glycolysis,(aerobicandanaerobic),citricacidcycle,betaoxidation
UnitsV	Activation of sulphate ions – PAPS, APS, SAM and their biological role. Metabolism of xenobiotics – Phase I reactions – hydroxylation, oxidation and reduction. Phase II reactions – glucuronidation, sulphation,glutathioneconjugation,acetylationandmethylation.Mode ofactionandfactorsaffectingtheactivitiesofxenobiotic enzymes.

Reading List (PrintandOnline)

1. https://chemed.chem.purdue.edu/genchem/topicreview/bp/ch21/gibbs.php
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7767752/#:~:text=The%20mitochondrial%20electron%20transport%20chain,cellular%20ATP%20through%20oxidative%20phosphorylation.
3. https://www.researchgate.net/figure/Oxidative-phosphorylation-in-mitochondrial-electron-transport-chain-ETC-and-proton_fig1_230798915
4. https://www.lyndhurstschools.net/userfiles/84/Classes/851/photosynthesis%20light%20&%20dark%20reactions%20ppt.pdf?id=560837
5. https://bajan.files.wordpress.com/2010/05/amphibolic-nature-of-krebs-cycle.pdf
6. https://www.sciencedirect.com/topics/medicine-and-dentistry/xenobiotic-metabolism#:~:text=Xenobiotic%20metabolism%20can%20be%20defined,more%20readily%20excreted%20hydrophilic%20metabolites

Self-Study

1. CalculationofKeqand △ G
2. Interrelationshipof carbohydrate, protein, and fat metabolism-role of acetyl CoA

Recommended Texts

1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed), W.H.Freeman
2. RobertK.Murray,DarrylK.Granner,PeterA.Mayes,andVictor W.Rodwell(2012),Harper'sIllustratedBiochemistry,(29thed),McGraw-Hill Medical
3. Metzler D.E (2003). The chemical reactions of living cells (2nd ed), Academic Press.
4. ZubayG.L(1999)Biochemistry,(4thed),McGrew-Hill.
5. DevlinRM(1983)PlantPhysiology(4thed),PWS publishers
6. TaizL, ZeigerE(2010),PlantPhysiology(5thed),SinauerAssociates, Inc

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ, Recallsteps,Conceptdefinitions.

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview.

Application (K3) - Suggest idea/concept with examples,Solve problems, Observe, Explain.

Analyse(K4)-Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiatebetween various ideas

Evaluate(K5)-Longer essay/Evaluationessay,Critiqueorjustifywithprosand cons.

Create(K6)-Checkknowledgeinspecificoroffbeatsituations, Discussion.

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	S	S	S	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	M	S	M	S	M	S	S	S	L
CO5	S	M	S	S	S	M	S	S	S	S

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215DSC25B	**NeuroBiochemistry**	4	1	0	3

Aim:

Thecourseaimstoprovidestudentswithabasicunderstandingof:

- the principles and major mechanisms of metabolic control and of molecularsignalling by hormones;
- thecontrolofcell proliferation

Course Objective:

Bythe end ofthecourse,studentsshouldbeable to:

- demonstrateknowledgeandunderstandingofthemolecularmachineryoflivingcells;
- demonstrate knowledge and understanding of the principles that govern the structures of macromolecules and their participation in molecular recognition;
- usebasiclaboratory skillsandapparatus toobtain reproducibledatafrom biochemical experiments.

Course outcomes:

- CO1Tounderstandvariousneurologicalsystem
- CO2Recognizetheneedfor,andengageinlife-longlearninginneurologicalsystem
- CO3TounderstandvariousExocytosisofneurotransmitter
- CO4To abletounderstandDNAmicroarrays,Methodology,typesand applications
- CO5ToacquireknowledgerelatedtoLEARNING ANDMEMORY
- CO6 Gainknowledgeofcontemporaryissues
- CO7tounderstand biochemistryofvisionandmusclecontraction

UNITI:

NERVOUS SYSTEM

Structure and function of the brain. Central Nervous System, Peripheral and Autonomic Nervous system. Cells of Nervous System – Neurons, Astrocytes, Glial cells, Oligodendrocytes and Schwan cells. Chemical composition of brain – utilization and uptake of glucose and amino acids, Blood – Brain barrier.

UNITII: NEUROTRANSMISSION

Membrane potentials, Resting potential – Depolarization, repolarization and hyperpolarization, Action potential. Mechanism of axonal neurotransmission. Membrane channels – Types of channels, ion gated, voltage gated, chemically gated, mechanically gatedand responsive to intracellular messengers. DISEASES OF NERVOUS SYSTEM Molecular basis of Parkinson's disease, Alzheimer's disease, Schizophrenia, Myasthenia gravis and Multiple sclerosis.

UNITIII:NEUROTRANSMITTERS

Synthesis, storage, release, uptake, degradation and action of neurotransmitters. Acetyl choline, GABA, Serotonin, Dopamine, Glutamate, Aspartate, Nitrousoxide, etc. Neuropeptides. Synaptic transmission – Cholinergic receptors – Nicotinic and Muscarinic receptors, Agonists and Antagonists – their mode of action and effects. Adrenergic receptors, serpentine receptors and intracellular signaling. Fast and slow receptors. Exocytosis of neurotransmitter – Role of synapsins, synaptogamins, SNAP, SNARE and other proteins in docking, exocyotosis and recycling of vesicles.

UNITIV: LEARNINGAND MEMORY

Mechanism of short term memory and Long Term Potentiation. NMDA and AMPA glutamate receptors. Retrograde messengers in synaptic transmission. Role of CAM kinase II, Calcium, protein kinases, cAMP, NO, Calpain and other proteins in memory and learning process. Synaptic plasticity INTERACTION OF DRUGS WITH CNS Mechanism of action of anesthetics, analgesics, hallucinogens, depressants, stimulants and toxins on the nervous system. Addiction and drugs of abuse.

UNITV:BIOCHEMISTRYOFVISION ANDMUSCLE CONTRACTION:

Rod and cone cells, visualcycle, mechanismand regulationofvision, color vision. Thick and thin filaments, interaction of actin and myosin muscle contraction, role of calcium and regulation of muscle contraction. Smooth muscle contraction and its regulation

REFERENCE

1. NeurochemistrybyFerdinandHucho,VCHPublication, 1986

2. MolecularcellBiology,byLodish, Baltimore, etalW.H.Freeman&Co.!996

3. BasicNeurochemistrybyM.P.Spiegel

CourseCode	CourseTitle	L	T	P	C
23215SEC26	NutritionalBiochemistry	4	0	0	3

Pre-requisites, if any: **BASICKNOWLEDGEONFOOD, NUTRITION& DIETETICS, AND METABOLISM OF NUTRIENTS.**

Course Objectives

1. To understand basic concepts involved in growth , health, nutrition, physiology and metabolism
2. To discuss the conceptsand applications of nutrition in correlation with biochemistry
3. Todefinenutritionalneeds inhealthyindividualsand modificationof diet during illness.

Course Outcomes

After completionofthecourse,thestudentsshouldbeableto:

CO1. Planabalanceddiet basedonanindividual'senergy requirement, Assess nutritional status of an individual(K3, K4, K5)

CO2. Describethebiochemical,physiologicalandnutritionalfunctions of macronutrients and their integrated role.Understand the role played by antinutritional factors(k! to K6)

CO3. Evaluate the functions of vitamins and minerals ,and fluids and electrolyte balance in different physiological states and in sports persons(K1 to K6)

CO4. Identify nutritional deficiency conditions , its prevention and dietary management((K3,K4)

CO5. Acquire knowledge about the importance of balanced diet and diet therapy (k5,K6)

UnitsI

Basic concepts - Nutrition - Food groups and balanced diet. NovelFoods.Calorificvalueoffoods:Directandindirectcalorimetry.

	Empty calories. Basal metabolic rate: Factors affecting BMR. SDA and physical activity. Calculation of day's energy requirement. Assessment of nutritional status. Lactose intolerance. Nutritional requirement and biochemical changes in different physiological states -infancy, childhood, pregnancy, lactation, and ageing. Sports nutrition.
Units II	Elements of nutrition - Plant and animal sources of simple and complex carbohydrates, fats and proteins and their requirement. Biological significance, deficiencyand toxicityofmacronutrients and micronutrients. Role of dietary fibre. Protein sparing action of carbohydrates and fats. Essential amino acids. Essential fatty acids. Effects of naturally occurring food toxins, preservatives, additives, alcohol and tobacco on health.
Units III	Vitamins and Minerals- Dietary sources, classification, biochemical functions, requirements, absorption, metabolism and excretion. Vitamin B complex as coenzyme. Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper.
Units IV	Malnutrition - Diseases arising due to Protein - Calorie Malnutrition and undernutrition (Kwashiorkor and Marasmus), Prevention of malnutrition. Deficiencydiseases associated withvitaminB complex, vitamin C and A, D, E & K vitamins - Mineral deficiency diseases - aetiology, sign and symptoms and dietary supplementation. Enrichment and fortification (vitamins and minerals)
Units V	Nutrition indiseases - Aetiology, signs and symptoms , treatment and dietary management during fever(Typhoid and Malaria) andinfectious diseases(COVID-19), Jaundice, hyper acidity (Ulcer), Atherosclerosis,Hypertension,kidneydiseasesanddiabetesin adults. StarvationandObesity.Inter-relationshipofnutrition,infection,

	immunityand poverty
ReadingList(Print and Online)	1. https://www.jmedscindmc.com/article.asp?issn=1011-4564;year=2014;volume=34;issue=5;spage=211;epage=213;aulast=Shrivastava 2. https://www.researchgate.net/figure/Relationship-between-malnutrition-infection-and-immunity-Malnutrition-is-considered-the_fig1_280722727 3. https://en.wikipedia.org/wiki/Novel_food 4. https://www.chemicalsafetyfacts.org/preservatives/ 5. https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/food-enrichment
Self-Study	1. Antabusedrugsandfood 2. Selection of foodsandmarketvisit,readingandunderstandingthe food labels
RecommendedTexts	1. Srilakshmi.E.(2016)NutritionScience,NewAgeInternational Publishers. 2. Mahan,KathleenL.(2004)Krause'sFood,NutritionandDietTherapy, W.B.Saunder's 11th Edition 3. AndreasM.Papas(1998).AntioxidantStatus,Diet,Nutrition,and Health (1st ed) CRC Press. 4. M.Swaminathan(1995)PrinciplesofNutritionandDietetics. Bappco 5. MargaretMcWilliams(2012).FoodFundamentals(10thed) Prentice Hall 6. TomBrody(1998)NutritionalBiochemistry(2nded).Academic Press,USA

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ,Recallsteps, Conceptdefinitions.

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview.

Application (K3) - Suggest idea/concept withexamples,Solve problems, Observe, Explain.

Analyse(K4)–Problem-savingquestions,Finishaprocedureinmanysteps,Differentiate between various ideas.

Evaluate(K5)-Longeressay/Evaluationessay, Critiqueorjustifywithprosandcons

Create(K6)–Checkknowledgeinspecificoroffbeatsituations.Discussion.

MappingwithProgrammeOutcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**M**
CO2	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**M**
CO3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**M**
CO4	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**L**
CO5	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**M**

S-Strong M-Medium L-Low

SEMESTERIII

CourseCode	CourseTitle	L	T	P	C
23215AEC31	Industrial Microbiology	5	1	0	4

Pre-requisites,ifany: BasicKnowledgeofMicrobiologyandmicrobialtechniques

CourseObjectives

Togainknowledgeofthestructure,classificationanduseofmicroorganisms in various industries.

Toknowvariousfermenterdesigns,culturesystemsandtheapplicationof fermentation process in industry.

Tounderstandtheproductionandpurificationoffermentedproductsandtheir industrial applications.

Understandthebasicconceptsoffood and agriculturalmicrobiology.

CourseOutcomes

CO1.Studentswillbeableto understandthestructureandclassificationof microorganisms (K2 , K4)

CO2.Gainknowledgeoftheusesofmicroorganismsinvariousindustrial applications (K3 , K4)

CO3.Understandtheconceptsoffermentationprocess,harvestandrecovery. (K1 , K5)

CO4.Studentswillknowthetypesofmicrobialfermentationprocessesand their applications in pharmaceutical industry. (K2 , K3)

CO5.Studentswilllearnabouttheuseofmicroorganismsinbeverages,diary and food industries. (K3 , K6)

UnitsI

Structureofbacteria, fungiand virusesandtheirclassification.Typesand characteristics of microorganisms used in Industry (a) Food Industry (b) Chemical Industry (c) Pharmaceutical Industry

UnitsII

Fundamentals and principles of microbial fermentation techniques – applicationinindustryandpharmaceuticalBiochemistry.Fermentation– types,techniques, designandoperationoffermenters includingadditionof

	medium. Types and characteristics of microorganisms, environmental conditions required for the growth and metabolism of industrially and pharmaceutically important microbes. Sterilization methods in fermentation techniques, air, gas, culture medium sterilization. Steam-filtrationandchemicals.Typesandconstituentsoffermentativeculture medium and conditions of fermentations, Antifoaming devices.
Units III	Recovery and estimation of products of fermentation- Production of ethanol, acetic acid, glycerol, acetone, butanol and citric acid by fermentation.ProductionofEnzymes-amylase,protease,lipase,Production ofpharmaceuticals by fermentation– penicillin, streptomycin, tetracycline, riboflavin, vitamin B12.Beverages-wine, beer and malt beverages.
Units IV	Food Microbiology: Production of dairy products-bread, cheese and yoghurt (preparation and their types). Food borne diseases- Bacterial and Non- Bacterial. Food preservation - Principles–Physical methods: temperature(low,high,canning,drying),irradiation,hydrostaticpressure, high voltage pulse, microwave processing and aseptic packaging, Chemical methods - salt, sugar, organic acids, SO_2, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins.
UnitsV	AgriculturalMicrobiology:GeneralPropertiesofsoil, microorganisms in soil – decomposition of organic matter in soil. Biogeochemical cycles, nitrogen fixation, Productionofbio fertilizers and its field applications – Rhizobium, azotobacter, blue green algae, mycorrhizae, azospirilium, Production of biofuels (biogas- methane), soil inoculants.
Self-Study	Micro-organismsinfoodprocessingandpharma industries UpstreamandDownstreamprocessesinBiopharma
ReadingList(Print and Online)	Industrial biotechnology: https://nptel.ac.in/courses/102/105/102105058/ Bioreactors: https://nptel.ac.in/courses/102/106/102106053/ Food Microbiology: https://nptel.ac.in/courses/126/103/126103017/ AgricultureMicrobiology:

https://www.youtube.com/watch?v=f7UXyVImZ_c

RecommendedTexts

FoodMicrobiology: AnIntroduction:4th edition,MatthewsKR,KnielKE, Montville TJ; American Society for Microbiology

Food,FermentationandMicro-Organisms,2nd edition,Charles,BW; Blackwell Science Ltd

Microbiology.5thedition,PelczarMJ,ChanECSand KriegNR;McGraw Hill Book Company.

Text bookofMicrobiology:11th edition,AnanthanarayananRandPaniker CKJ; Universities Press (India) Pvt. Ltd.

Food Microbiology, 3rd edition, FrazierWC andWesthoff DC;Tata McGrawHill Publishing Company Ltd, New Delhi

New Methods of Food Preservation:1st edition, Gould GW; Springer Manual of Industrial Microbiology and Biotechnology: 3rd edition, Baltz

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ, Recallsteps,Conceptdefinitions.

Understand/Comprehend(K2)-MCQ,True/False,Shortessays,Conceptexplanations, Short summary or overview.

Application(K3)-Suggestidea/conceptwithexamples,Solveproblems,Observe, Explain.

Analyse(K4)-Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate between various ideas

Evaluate(K5)-Longer essay/Evaluationessay,Critiqueorjustifywithprosand cons.

Create(K6)-Checkknowledgeinspecificoroffbeatsituations, Discussion.

MappingwithProgrammeOutcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**

CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	M	S	S	M	S	S	M	M	M
CO3	S	M	L	S	M	M	S	S	M	S
CO4	M	S	S	S	L	M	S	M	S	M
CO5	S	S	M	S	S	M	M	S	S	S

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215AEC32	Molecular Biology	4	1	0	4

Pre-requisites, if any: Knowledgeofthebasicsofgenetics,cellbiologyandmolecular biology.

Course Objectives

1. To introduce the students to the process of inheritance, concepts of genes, genome, chromatin and chromosomes.
2. To impart a thorough understanding of the key events of molecular biology, including the mechanismsofDNAreplication, transcription and translation along with DNA repair mechanisms.
3. To provide a detailed understanding of post transcriptional and posttranslationalmodifications and processing of eukaryotic RNA and proteins
4. To give a detailed explanation of transcriptional regulation with lac operon and tryptophan operon as examples
5. To impart adequate information of the types of regulatory RNAs along with key concepts of gene silencing

Course Outcomes Aftercompletionofthecourse,thestudentsshouldbeableto:

CO1: Comprehend the organization of genomes, the molecular basis of DNA replication, recombination and transposition, the significance of these processes, the various ways in which the DNA can be damaged leadingtomutationsand lesionsandthedifferentways inwhichtheyare repaired.(K1,K2,K3,K5)

CO2: Gain knowledge about how genes are transcribed and translated in prokaryotes and eukaryotes and how these processes are regulated, recognize the nature of the genetic code and the various experimental approaches used to crack the code (K1,K2,K3,K4,K5)

CO3: AcquireknowledgeofthemolecularbasisofRNAprocessingand

RNA splicing and the various human pathologies that can result from defects of RNA modification. (K1,K2,K4,K5)

CO4: Comprehend the techniques of gene silencing and its applications.(K1,K2,K3,K4,K5,K6)

CO5: Apply the knowledge they have gained in understanding the above vital life processes to enhancing their analytical and problem- solving skills and develop an interest to pursue high quality research. (K2,K3,K4,K5,K6)

UnitsI	Mendel's laws of inheritance-dominance-complete, incomplete and co-dominance, multiple alleles-gene mapping in haploids and diploids, recombination mapping- restriction mapping- modes of gene information transfer in bacterial- conjugation, transformation and transduction. The bacterial chromosome, the eukaryotic genome- chromosome structure – Histones, Nucleosome, chromatin- heterochromatin, euchromatin, chromatinremodeling, DNAase hypersensitive sites, genome organization – the C-value paradox, reassociation kinetics, repetitive sequences, gene amplification,telomeres,pseudogenes,splitgenes,organellegenomes– mitochondrialandchloroplastgenome.
UnitsII	DNA replication and repair: Enzymes of replication, prokaryotic replication mechanisms, primosome & replisomes, eukaryotic DNA replication, the role of topoisomerases and telomerase, regulation of replication, difference between prokaryotic and eukaryotic replication. Mutations -Types of mutations, mechanisms of mutations, mutagenic agents. DNA repair mechanisms – Direct repair, excision repair, mismatch repair, recombination repair, SOS response, eukaryotic repair systems.Recombinationandmobilegeneticelements-theHolliday model,thegeneralrecombinationin*E.coli*,sitespecificrecombination,

	transposonsand retroposons.
UnitsIII	Transcription–Prokaryotictranscription-subunitsofRNApolymerase, E. coli promoters, sigma factor and promoter recognition, alternative sigma factors, initiation, elongation, Rho-dependent and independent termination of transcription. Eukaryotic transcription- Initiation,promoter elements, RNA polymerases, transcription factors, regulatory sequences in eukaryotic protein – coding genes, CpG islands, enhancers. Translation – organization of the ribosome, the genetic code, evidence for a triplet code, deciphering the genetic code, wobble hypothesis, deviation in the genetic code, unusual codons. activation, initiation, elongationand terminationoftranslation in E. coli. The role oftRNAand rRNA, suppressor tRNAs and inhibitors of protein synthesis.,Comparison of prokaryotic translation with eukaryotic translation.
UnitsIV	Regulationofgeneexpressioninprokaryotes-–Positiveandnegative control,the lac operon, identificationofoperator and regulatorsequences bymutations, inductionandrepression,Foot-printingandgel-shift assays for identificationofprotein-DNA interactions. Catabolite repression. *Trp* operon – Attenuation, alternative secondary structures of *trp* mRNA. Regulation ofgene expression ineukaryotes- Response elements, DNA-bindingmotifs,steroidreceptors,associationofmethylationandhistone acetylationwithgeneexpression.
UnitsV	Post transcriptional modifications in eukaryotes- RNA processing-mRNA 5’ cappingand 3’poly-adenylation, introns and exons, RNA splicing,- spliceosome assembly, alternative splicing, processing oftRNAandrRNA,self-splicing,ribozymes,RNAediting-substitutionand insertion/deletion editing, Genome editing-CRISPR- Cas technology Posttranslationalmodificationofproteins- Proteolyticcleavage, covalent modifications, glycosylation of proteins, disulfide bond formation, Proteinsorting–signalpeptides,transportofsecretoryproteins,Golgi andpost-golgisorting,coatedvesicles,targetingofmitochondrial,

	lysosomal andnuclearproteins,Proteindegradation-Ubiquitinationof proteins, Protein folding-chaperones
Reading List (Print and Online)	1. Molecular Biology Free Online Course by MIT Part 3: RNA Uploaded by edX 2. https://mooc.es/course/molecular-biology/ 3. https://onlinecourses.swayam2.ac.in/cec20_ma13/preview 4. https://learn.genetics.utah.edu/ 5. https://www.cellbio.com/education.html 6. https://lifescienceinteractive.com/category/molecular-biology/
Self-Study	. 1. Multiple roles of noncoding RNAs (long ncRNA ,siRNA, miRNA) in development and differentiation; implication of ncRNAs in pathologies. 2.mRNAdegradation- nonsense-mediated decay.
Recommended Texts	1. Lewin's Genes XII : 12th edition, Krebs JE, Goldstein ES, Kilpatrick ST ;Prentice Hall, Delhi 2. Molecular Biology of the Gene : 6th edition, Watson JD , Baker TA, Bell S, Gann A, Levine M, Losick R; Cold Spring Harbor Laboratory Press, New York 3. Essential Cell Biology :3rd edition, Alberts B, Bray D, Hopkin K, Johnson A, Lewis J, Raff M, Roberts K, Walter P ; Garland Science, New York 4. Molecular Cell Biology : 8th edition , Lodish H, Arnold Berk; W.H.Freeman & Co, New York 5. Karp's Cell and Molecular Biology: Concepts and Experiments, 8th Edition; Wiley, India 6. An Introduction to Genetic Analysis 12th edition,, Griffith A. F, DoebleyJ,PeichelC,DavidA,WassarmanDA;Albion Press.W.H.Freeman&Co,NewYork

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ, Recallsteps,Conceptdefinitions.

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview.

Application(K3)-Suggestidea/conceptwithexamples,Solveproblems,Observe, Explain.

Analyse(K4)-Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiatebetween various ideas

Evaluate(K5)-Longer essay/Evaluationessay,Critiqueorjustifywithprosand cons.

Create(K6)-Checkknowledgeinspecificoroffbeatsituations, Discussion.

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	L	M	L	S	S	S	S
CO2	S	S	S	M	M	L	M	S	S	S
CO3	S	S	S	L	M	L	M	S	S	S
CO4	S	S	S	M	M	L	S	S	S	S
CO5	S	S	S	S	S	M	M	S	S	S

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215AEC33	GeneEditing, CellandGenetherapy	4	1	0	4

Pre-requisites, if any: Tointroducestudentsmolecularbasisofcellgenetherapy;viraland nonviralgenetransfertechniquesandgenetherapyapplicationsin hereditary and acquired diseases.

Course Objectives

1. To train the student in techniques related to the molecular basis of genetic diseases and to incorporate skills essential for various types of sequencing.
2. To inculcate practicalknowledge oncomparing the animal modelsused to model genetic diseases
3. To introduce and also elaborate knowledge about wide varieties of vectors and their features in addition to their applications and to identify the viral and nonviral gene transfer techniques
4. To educate about the characteristics of cell culture, therapeutic strategiesingenetherapywithrelevantsafety/ethicsinvolvedand patentsaswell.

Course Outcomes Aftercompletionofthecourse,thestudentsshouldbeableto:

CO1. Ability to read, and evaluate scientific articles within thesubjectsofimmunetherapy,genetherapyandcell therapy.(K1,& K2)

CO2. To clone gene of their interest for several downstream purposes with a robust comprehension about wide variety of applicable gene deliveryvectors. (K1, K2 & K5)

CO3. Be able to provide examples of diseases that can be treated with immune therapy, gene therapy and cell therapy. (K2, K3 & K4)

CO4. To identify knowledge gaps and need for further research within their chosen topic of immune therapy, gene therapyor celltherapy. (K2, K4 & K5)

CO5. To critically discuss and reflect on ethical and social aspects of using immune, gene or cell therapy.The student will be persuaded to contemplateonupcomingtechnologiesfor futuristic benefits.(K2,K5 &K6)

UnitsI Gene Editing: Basis of gene editing, DNA repair mechanisms, Double strand DNA breaks, Nonhomologous End-Joining (NHEJ), Homology directed repair, Programmable nucleases for gene editing,Meganucleases, Zinc-Finger nucleases, Transcription Activator-Like Effector Nucleases (TALEN), CRISPR-Cas systems, gene editing using CRISPR-Cas,drawbacksandmajorchallengestopresentgeneediting techniques,geneeditingforhumandiseasetherapy

UnitsII Gene and cell therapy: Basics of Gene and cell therapy, types of gene therapy, gene therapy strategies, therapeutic targets for gene therapy, choice of the therapeutic target, administration routes, delivery systems, expression of transgene, persistence of the gene therapy, cell targeting, immunologicalresponsetothetherapy,ethical andlegalissues,concerns aboutgeneandcelltherapy

UnitsIII	Vectors for Gene therapy: Non-viral and viral vectors for gene therapy, Physical methods of gene delivery,Polymer, Lipid and inorganic material based chemical systems for gene delivery, Viral vectors, Lentiviral, Adenoviral, Adeno-associated virus, Herpes Simplex virus, vaccinia, baculoviral vectorsfor gene delivery, choice ofviral vector and oncolyticvirus.Genetherapyapplications,Genetherapyforcancer, suicideandoncolyticgenetherapy.
UnitsIV	Stemcells and tissue regeneration: Adult and fetal stemcells, embryonic stem cells, cell reprogramming, induced pluripotent stem cells (iPSC), Chemically induced pluripotent stem cells (CiPSC), reprogramming factors,iPSCderivedprogenitors'cells,Organoids,threedimensional (3D)bioprinting.
UnitsV	Regulatory and Ethical Considerations of stem cell and Gene Therapy, pluripotent stemcell-based cellreplacement therapies. Assessing Human Stem Cell Safety, Use of Genetically Modified Stem Cells in ExperimentalGeneTherapies.Technologicalchallengestowards developmentofpluripotentstemcell-basedcellreplacementtherapies.
ReadingList(Print and Online)	1. StemCell Biology, Daniel Marshak, Richard L. Gardener and David Gottlieb, Cold Spring Harbour Laboratory Press 2. Stemcellbiologyandgenetherapy,BoothC.,CellBiology International, Academic Press 3. StemCellandGene-BasedTherapy:FrontiersinRegenerative Medicine,AlexanderBattler,
Self-Study	1. Applicationsofgeneediting strategies 2. CARTtherapyforCancer
RecommendedTexts	1. AnIntroductiontoHumanMolecularGenetics(2ndEdition),J.J. Pasternak, 2005 2. An Introduction to Molecular Medicine and Gene Therapy 1st Edition by Thomas F. Kresina Upadhyay, S. K. (Ed.). (2021). 3. HumanMolecularGenetics(4thEdition),TomStrachan&Andrew Read, 2010.

4. Stem Cells Handbook: Stewart Sell, Humana Press; Totowa NJ, USA; Oct. 2003,

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ, Recallsteps,Conceptdefinitions.

Understand/Comprehend(K2)-MCQ,True/False,Shortessays,Conceptexplanations, Short summary or overview.

Application(K3)-Suggestidea/conceptwithexamples,Observe, Explain.

Analyse(K4)-Finishprocedureinstepwisemanner,Differentiationbetweenvariousideas, Map knowledge

Evaluate(K5)-Longer essay/Evaluationessay,Critiqueorjustifywithprosand cons.

Create(K6)-Checkknowledgeinspecificoroffbeatsituations,Discussion,Debating, Presentation

MappingwithProgramme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	L	M	S	M	M	M	M	M	M
CO2	S	S	S	S	M	M	M	M	M	S
CO3	S	M	S	S	M	S	S	S	S	S
CO4	S	L	M	M	M	M	S	M	M	S
CO5	S	S	S	S	S	S	S	S	S	S

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215SEC34L	ClinicalBiochemistryLab	0	0	4	4

Pre-requisites, if any: Knowledge on basic principles, Instrumentation of Biochemical techniquesandmetabolicreactions

Course Objectives

1. To instill skill in students enabling them to apprehend the wider knowledge about principles and techniques to be employed for the investigation ofbiological samples, clinicalapproach, normal values of biochemical constituents and clinical interpretations.
2. To inculcate the knowledge of collection, preservation of blood sample and learning various hematological parameters and their significance.
3. To perform experiments to assess liver functions. And also to study the marker enzymes of liver
4. Toevaluatelipidprofileandassesstheirrelationtocardiacfunction.
5. To perform experiments to estimate blood glucose and glycosylated hemoglobin.
6. Toperformurineanalysis, estimateBUNandclearancetestto assess renal function .
7. Tolearnbasicimmunotechnniquesantigen –antibodyreactions.
8. Toperformdataanalysisinusing MS Excel
9. To introduce visit to hospital so that students may be aware of Phleobotomy ,Collection and storage of specimen, Good laboratory practices,Automationandcurrentmethodsadoptedinthe diagnosticlabs

Course Outcomes Aftercompletionofthecourse,thestudentsshouldbeableto:

CO1. Thestudentwillbeabletoacquireknowledgeandskillin hematologytechniques.Theywillgetfamiliarwithmethodsand knowledge to interpret the electrolyte concentration in serum

(K1,K2,K3,K4,K5)

CO2. Thestudent willbe ableto assesstheLiver Functionandinterpret the biochemical investigation in a given clinical situation (K1,K2,K3,K4,K5)

CO3.Skill to perform the Renal function test to assess the function of Kidney and report the abnormalparameters with reference range will be achieved by the student (K1,K2,K3,K4,K5)

CO4.Toestimatethebloodglucosecontentandlipidprofile,to evaluatethealterationsandrecordtheobservationinaccordanceto reference range will be acquired bythe student (K1,K2,K3,K4,K5,K6)

CO5: TheGroupExperimentswillsupportthem toacquirepractical skillstoworkinhealthcaresectorandassistthem tounderstandthe automation process in clinical labs (K1,K2,K3,K4,K5,K6)

I	Haematology:
	RBC count, WBC count – totaland differential count, ESR, PCV, MCV. Bleeding Time, Clotting Time and Estimation of hemoglobin. DeterminationofElectrolytes:Sodium,PotasiumandCalcium
II	Liverfunctiontest:
	Estimation of bilirubin – direct and indirect.Estimation of plasmaprotein, A/G ratio, Thymol turbidity test, ProthrombinTime (PT),Assay of serum glutamate oxaloacetate transaminase, alkaline phosphatase, Gamma-glutamyltransferase(GGT),isoenzymeseparationofLDHby electrophoresis.
III	Renalfunctiontest: CollectionandPreservationofUrinesample
	Qualitativetestsfornormalandpathologicalcomponentsofurine. BUN: Estimation of blood Urea, creatinine, and uric acid. UreaClearancetest
IV	Estimationofbloodglucosebyorthotoluidineandglucoseoxidase method.DeterminationofglycosylatedHb.Glucosetolerancetest.Kit

	methodLipid profile: Estimation of cholesterol by Zak's method, lipoprotein profile, estimationofketonebodies,estimationoftriglycerides,freefattyacids andphospholipids.
V	GroupExperiments a. Antigen–AntibodyReaction-HCGkitmethod ,RAkitmethod b. Phlebotomy–Venipuncture,Differenttechniquesofvenipuncture c. Collectionofblood,Serumor Plasmaseparationand Storage d. Automation in Clinical Biochemistry -Autoanalyser ,Semiautoanalyser
ReadingList(Printand Online)	1. https://www.researchgate.net/publication/260182512_ Practical_Manual_in_Biochemistry_and_Clinical_Biochemistry 2. https://main.icmr.nic.in/sites/default/files/upload_documents/ GCLP_Guidelines_2020_Final.pdfhttps://www.westgard.com/clia.html 3. https://www.researchgate.net/publication/263929434_Biochemistry 4. https://ucms.ac.in/Lectures-C-2020/Renal%20function%20Tests%20-%20PPT.pdf 5. https://youtu.be/i2PfjEks4GQ 6. https://www.euro.who.int/data/assets/pdf_file/0005/268790/WHO-guidelines-on-drawing-blood-best-practices-in-phlebotomy-Eng.pdf
Self-Study	1. Laboratoryhandling ofhuman biologicalspecimen 2. AutomationinClinicalBiochemistry
RecommendedTexts	1PracticalClinicalBiochemistry-Varley'sbyAlanHGowenlock,publishedbyCBSPublishersanddistributors,IndiaSixthEdition ,1988. 2. ManipalManualofClinicalBiochemistry(ForMed.Lab.AndMsc Stud.) 2013(4 Edition) 3. CaseOrientedApproachinBiochemistry-Dr.RajeshKawaduji

Jambhulkar,Dr.AbhijitD.Ninghot:2019FirstEdition

4. Medical Lab Technology Vol I& II,Kanai L Mukerjee New Delhi:Tata Mcgraw Hill Publishing Company, 1996.
5. PracticalBiochemistry–Plummer,NewDelhi:TataMcgrawHill Publishing Company, 2000.
6. Introductory practical Biochemistry – S.K. Sawhney, Randhir Singh, 2nd ed, 2005.

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ, Recallsteps,Conceptdefinitions.

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview.

Application (K3) - Suggest idea/concept with examples, Solve problems, Observe, Explain.

Analyse(K4)–Problem-savingquestions,Finishaprocedureinmanysteps,Differentiate between various ideas.

Evaluate(K5)-Longer essay/ Evaluationessay,Critiqueorjustifywithprosand cons

Create(K6)–Checkknowledgeinspecificoroffbeatsituations.Discussion.

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	L	S	M	S
CO2	S	S	S	S	M	S	L	S	M	S
CO3	S	S	S	S	M	S	M	S	M	S
CO4	S	S	S	S	M	S	M	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215DSC35**A**	BiostatisticsandDataScience	4	1	0	3

Pre-requisites, if any: BasicknowledgeofStatisticsandComputerApplications

Course Objectives

1. Tosummarizethedataandtoobtainitssalient featuresfromthe vast mass of original data.
2. Tounderstandtheconceptofvariousmeasuresofdispersion.
3. Tounderstandtheconceptsofsamplingand learningtest of significance.
4. Tounderstandtheconceptofvariousattributesandrelateto biological studies.
5. Togainknowledge inSPSS,asoftwarepackagewhichgivesa perfect graphical representation and appropriate result for the datathat hasbeenentered

Course Outcomes Aftercompletionofthecourse,thestudentsshouldbeableto:

CO1: Concepts of statistical population and sample, variables and attributes.Tabular and graphical representation of data based on variables.(K1,K2,K3)

CO2: Conditions for the consistency' and criteria for the independenceof data based on attributes.Measures of central tendency, Dispersion, Skewness and Kurtosis.(K1,K2,K3)

CO3:Learning different sampling methods and analysing statistical significance.(K1,K2,K3,K4)

CO4: Understandingstudentsttest,ANOVA,Chisquaretestto

analysethesignificanceofvariousresearch.(K1,K2,K3,K4)

CO5: Learning on data science, algorithm for machine learning, artificial intelligence and big data, their applications in clinical and pharma domain. (K1,K2,K3,K4.K6)

Units I	Nature of biological and clinical experiments – Collection of data in experiment- Primary and secondary data. Methods of data collection. Classification and tabulation. Different forms of diagrams and graphs relatedtobiologicalstudies.Measuresof Averages-Mean,Median,and mode.Useofthesemeasures inbiologicalstudies.
Units II	Measures of Dispersion for biological characters– Quartile deviation, Mean deviation, Standard deviation and coefficient of variation.Measures of skewness and kurtosis.Correlation and regression – Rank correlation– Regressionequation.Simpleproblemsbasedon biochemicaldata.
Units III	Basic concepts of sampling- Simple random sample stratified sampleand systemic sampling. Sampling distribution and standard error. Test of significance based on large samples. Test for mean, difference of means, proportions and equality of proportions.
Units IV	Small sample tests – Students‘t’ test for mean, difference of two way means, tests for correlation and regression coefficients.Chi-square test for goodness of a non independence of attributes. F test for equality of variances.ANOVA-onewayandtwoway.Basicconceptrelatedto biologicalstudies
UnitsV	Introduction to Data Science, Definition ofdata science, importance, and basic applications, Machine Learning Algorithms, Deep Learning, Artificial Neural Networks and their Application, Reinforcement Learning,NaturalLanguageProcessingArtificialIntelligence(AI),Data Visualization,DataAnalysis,OptimizationTechniques,BigData,

	PredictiveAnalysis.ApplicationofAIinmedical,healthandpharma industries.

ReadingList(Print and Online)	1. https://www.ibm.com/docs/en/SSLVMB_28.0.0/pdf/Accessibility.pdf 2. https://pure.tue.nl/ws/portalfiles/portal/19478370/20160419_CO_Mzolo.pdf 3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5453888/ 4. https://home.ubalt.edu/ntsbarsh/excel/excel.htm 5. https://students.shu.ac.uk/lits/it/documents/pdf/analysing_data_using_spss.pdf 6. https://www.ibm.com/support/pages/ibm-spss-statistics-28-documentation
Self-Study	1. Simpleproblemsonprobability,theoreticaldistributions,hypothesis testing 2. Relationshipbetweenmean,medianandmodeprosandconsofthe measures ofcentraltendencyanddeviation
Recommended Texts	1. Zar, J.H. (1984) "Bio StatisticalMethods",Prentice Hall, International Edition 2. Sundar Rao P. S.S., Jesudian G. & Richard J. (1987), "An Introduction to Biostatistics", 2nd edition,. Prestographik, Vellore, India,. 3. Warren,J; Gregory,E; Grant,R (2004), "Statistical Methods in Bioinformatics",1st edition,Springer 4. Milton,J.S.(1992),."StatisticalmethodsintheBiologicalandHealth Sciences", 2nd edition ,Mc Graw Hill, 5. Rosner,B(2005),"FundamentalsofBiostatistics", DuxburyPress 6. Introducing Data Science, DavyCielen, Anro DBMeysman, Mohamed Ali.

Methodsofassessment:

Recall(K1)-Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions.

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview.

Application(K3)-Suggestidea/conceptwithexamples,Solveproblems,Observe, Explain

Analyse(K4)-Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate between various ideas

Evaluate(K5)-Longer essay/Evaluationessay,Critiqueorjustifywithprosand cons

Create(K6)- Checkknowledgeinspecificoroffbeatsituations,Discussion, Presentations

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	L	S	S	S
CO2	S	S	S	S	M	S	L	S	S	S
CO3	S	S	S	S	S	S	M	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	S	M	S	S	S

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215DSC35B	Immunology	5	0	0	4

Aim:

Tolearntheimmunesystemand reaction

Objectives:

- To exposethestudentswiththeimmune systemofhumanbody

Outcomes:

- CO1Thestudentsmayunderstandtheimmunesystem,itscomponentsandvarious techniques used in bio manipulation.
- CO2Thecoursewillprovidetechnicalknowledge asto howdifferent diseasesarecaused and various responses mediated by living cells to combat pathogen attack.
- CO3 Compare and contrast the origin, maturation process, and general function ofB and T lymphocytes.
- CO4AtThecoursewillprovidesoundknowledgeofhowimmunesystemdealswith various pathogens, different processes and cell types involved in prevention of disease.
- CO5To understandtheprinciplesoftolerance, autoimmunityandtheroleofimmunityin protection against pathogens.
- CO6Along withthisthe studentswillbecome aware about concept, synthesisand action mechanism of vaccines.

UNIT-I

Infection

Types – Factors influencing infection – endotoxins and exotoxins – pathogenicity and virulence – sources of infection agents – carriers – portals of entry. **Immunity:** Innate –Acquired – Active and Passive Immunity – phagocytosis – Inflammation. **Immune system:** Components – Lymphoid organs, Primary, Secondary, Tertiary – Lymphoid Tissues – Cells of the immune system.

UNIT-II

Antigens: Antigenicity – Immunogenicity – Types of antigens – Haptens – specificity – Blood group antigens – Blood grouping. **Immunoglobulins:** Isolation – structure and function – Antibodies – clauses of immunoglobulins – Biosynthesis and antibody diversity. **Complement:** Complement – chemical and alternate pathway – Consequence of activation – Anaphylotoxins.

UNIT-III

Immune response: B and T celldevelopment Cellular interaction – APC – MHC – cytokines – TCR – cluster of differentiation – HI and CMI – Regulation of immune response – Primary and secondary immune response – Immune tolerance - Immune suppression.

UNIT-IV

ImmunologicalTechniques: Antigen– Antibodyreaction–Precipitation– Agglutination–CTI – Torsion neutralization – Immunodiffusion – Immunofluoroscence – Immune adherence – Immunoelectrophoresis – EIA– ELISA– RIA– Immunochemetology– Hybridoma Technology – Merits and Demerits – Production of Vaccines and their uses. Production of antisera – Fractionation of leucocytes – Identification of lymphocytes and their subsets – Experimental animal models – Inbred strains – SCID Mice , Nude mice – mice cellculture system.

REFERENCE:

1. Immunology–Richard.A.GoldshyandKuby.
2. EssentialImmunology–Roittet al.
3. Immunobiology–Janeway. C:PaulTravers.
4. Immunology,ShortCourse–EliBenjaminAV. et al.
5. FundamentalsofImmunologySpringer Verlag– Wier etal.
6. AHandbookofPracticalImmunlogy–G.P.Talwar.
7. FundamentalImmunology–Coleman.
8. Textbookofmicrobiology–Ananthamarayanan&panikar.

CourseCode	CourseTitle	L	T	P	C
23215SEC36	Molecularbasisofdiseaseandtherapeuticstrategies	4	1	0	3

Pre-requisites,ifany: Knowledge of Human Physiology, Metabolism and Clinical Biochemistry

Course Objectives

1. To understand the concepts of the mechanisms involved in regulation of blood sugar and management of diabetes mellitus

2. To gainin-depthknowledgeofthe mechanisms ofcancerandoftumor metastasis

3. The student will review the basic organization of the central and peripheral nervous system that coordinate the sensory and motor functions of the body. In addition, the student will explore impaired features underlying the major neuropathological complications.

4. Togainknowledgeinrenaldiseases

5. Tounderstandthe mechanismsinvolved incardiacdisorders

Course Outcomes

Oncompletion ofthiscoursethestudentwillbeableto understand

CO1. Overall view about the complications of diabetes mellitus andits management.

CO2. Comprehensiveunderstandingof theconceptsofcancerbiology and implicating the theoretical concepts for further research

CO3.Understandandappreciatethepathophysiologyofconditions affecting the nervous system.

CO4.Athoroughknowledgeofrenalandcardiacdiseaseswithemphasis related to mechanistic aspects and therapeutic interventions.

CO5. A thorough knowledge on the experimental models of non-communicablediseasesthat willbeapplied for futureresearchorproject dissertation. An in-depth knowledge on development of drugs against non-communicable diseases.

Units	
I	Mechanism of blood sugar regulation in human body. Pathophysiology of Type I and II diabetes, Diabetes – investigation methods for the diagnosisofdiabetes.Nutritionalcare.Complicationsrelatedtodiabetes – Diabetic cardiovascular disease, retinopathy, neuropathy and nephropathy. Cellular and molecular mechanism of development of diabetes- Management of Type I and Type II diabetes, drugs for the treatment of diabetes.
II	Biology of cancer: Overview of hallmarks of cancer. Tumorigenesis, Tumor progression and mechanism of Metastasis. Proto-oncogene to oncogene. Oncogene- myc and src family. Tumor suppressor gene-Rb and p53 pathway in cancer. Diagnosis- Non-invasive imaging techniques, Tumor diagnosis, Interventional radiology, New imaging technique, Molecular techniques in cancer diagnosis.- treatment of cancer- surgery, radiotherapy, chemotherapy, hormonal treatment, and biological therapy. Introduction to personalized medicine.
III	Brain-neuronalnetwork-memory- Neurogenerativediseases- Parkinson and Alzheimer Disease- molecular understanding of the neurodegenerative diseases- treatment modalities.
IV	Acute and chronic renal failure, glomerular diseases–

	glomerulonephritis, nephritic syndrome, diabetes insipidus, diagnosis of kidney disease.
V	Introduction to cardiovascular diseases, Lipids and lipoproteins in coronary heart disease-cardiac enzymes, Molecular changes during cardiac remodeling – hypertrophy of hearts – heart failure- treatment modalities.

Reading List (Print and Online)

1. TheBiochemicalbasisofdisease:2018,**BarrAJ;**PortlandPress
2. BiochemicalBasis ofDiseases
3. https://www.biologydiscussion.com/diseases-2/biochemical-basis-of-diseases/44276

RecommendedTexts

1. Wills'BiochemicalBasisofMedicine:2nd edition,ThomasH, Gillham B;Elsevier
2. MolecularBiochemistryofHumanDiseases,2021,FeuerG,dela IglesiaF;CRC Press

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ, Recallsteps,Conceptdefinitions

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview

Application(K3)-Suggestidea/conceptwithexamples,Suggestformulae,Solveproblems, Observe, Explain

Analyse(K4)-Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate between various ideas, Map knowledge

Evaluate(K5)-Longer essay/ Evaluationessay,Critiqueorjustifywithprosand cons

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**S**	**S**	**S**	**M**	**M**	**S**	**S**	**S**	**S**	**S**
CO2	**S**	**M**	**S**	**L**	**M**	**M**	**M**	**M**	**M**	**S**
CO3	**S**	**S**	**M**	**L**	**S**	**S**	**M**	**M**	**S**	**M**
CO4	**S**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**M**	**S**
CO5	**S**	**S**	**M**	**M**	**S**	**M**	**M**	**M**	**S**	**S**

S-Strong M-Medium L-Low

SEMESTERIV

CourseCode	CourseTitle	L	T	P	C
23215AEC41	PharmaceuticalBiochemistry	4	1	0	4

Pre-requisites, if any: Thestudentshouldhaveabasicknowledgeofdrugdiscoveryand development.Student should possess basic knowledge bioinformatics to understand and correlate the drug development process.

Course Objectives

1. To understand the different types of bioinformatic tools for drug discovery.
2. To get an overview of how different bioinformatic tools aid in the process of target identification, drug screening and quantitative structure activity relationship.
3. To assimilate the involvement of different metabolic pathways involved in drug metabolism and correlate their involvement in elimination process
4. Tounderstand thebiochemicalbasisofdrug action atthetarget tissue.
5. To understand different phases in drug clinical trials and its assessment.

Course Outcomes

Aftercompletionofthecourse,thestudentsshouldbeableto:

CO1. Tounderstand and explain thebasic concepts of drug discovery and drug development process.

CO2. Toreviewthedifferentsoftwareandcomputational toolswhich aid in the design of drugs and its rationalization.

CO3. To analyze the different stages of the drugdiscoveryprocess with thetarget&hitidentification,assaysfordrugscreeningandpreclinical studies.

CO4. Tounderstandthevariousphasesoftheclinicaltrailsandthe methodofconductofclinicaltrails.

Units	
I	Drug discovery and development, drug target identification and validation,Hit identification, General principles of screening, correlations between various animal models and human situations, Correlation between in-vitro and in-vivo screens; Special emphasis on cell-based assay, biochemical assay, radiological binding assay, Pharmacologicalassay,Invitro,Invivo&Ex-vivoexperiments,lead optimization,preclinicalstudies.
II	Bioinformaticsapproaches fordrug development: Identification of potential molecules, chemical compound library preparation, Identification of target in pathogen, Ligand & protein preparation, Molecular docking, Binding free energy estimation, High throughput virtual screening, Docking protocol validation andenrichment analysis, Single point energy calculation, Pharmacokinetics and Pharmacodynamics, ADME & toxicity prediction, Molecular dynamic simulation, Rule of three and five, Lipinsky rule, Pharmacophore development, Quantitative structure activityrelationship, 3D-QSAR,Techniquesofdevelopingapharmacophoremapcovering bothligandbasedandreceptorbasedapproaches.
III	Drugmetabolism&interactions: Drug-receptor interactions, receptortheoriesand drug action, Xenobiotics, xenobiotics phases (Phase-I, Phase-II and Phase-III), role of cytochrome P450 oxidases and glutathione S-transferases in drug metabolism, factors affecting drug metabolism, Enzymes as a drug target, Kinase inhibitors, ATPase inhibitors, drug protein interaction, DrugDNA interaction. Basic ligand concepts-agonist, antagonist, partial agonist, inverse agonist, efficiencyandpotency.Forcesinvolvedindrug-receptorcomplexes. Receptorclassification–thefoursuperfamilies.Receptorbinding

	assays-measurementofKd, BmaxandIC$_{50}$.
IV	Biochemical mode of action of antibiotics- penicillin and chloramphenicol, actions of alkaloids, antiviral and antimalarial substances. Biochemical mechanism of drug resistance- sulphonamides. Drug potency and drug efficacy. General principles of chemotherapy: chemotherapyofparasiticinfections,fungalinfections,viraldiseases. Introductionto immunomodulatorsand chemotherapyofcancer.
V	Clinical trials (Phase-I, Phase-II, Phase-III and Phase-IV clinical trial). Main features of clinical trials, including methodological and organizational considerations and the principles of trial conduct and reporting.Keydesignssurroundingdesign,samplesize,deliveryand assessmentofclinicaltrials.
Self-Study	1. Examplesofpharmaceuticaldevelopmentofadrug 2. Basicpharmacologyofdrugactionandkinetics
ReadingList(Printand Online)	1. Textbook of Drug Design. Krogsgaard-Larsen, Liljefors and Madsen (Editors), Taylor and Francis, London UK, 2002. 2. DrugDiscoveryHandbookS.C.Gad(Editor)Wiley-Interscience Hoboken USA, 2005
RecommendedTexts	1. Practical Application ofComputer-Aided Drug Design, Ed. Charifson P., Marcel Dekker Inc. 2. 3D QSAR in Drug Design: Theory, Methods and Applications, Ed. Kubinyi H., Ledien 3. Pharmaceutical Profiling in Drug Discovery for Lead Selection, Borchardt RT, Kerns, EH, Lipinski CA, Thakker DR and Wang B, AAPS Press, 2004 4. DrugDiscoveryandDevelopment;TechnologyinTransition.HP Rang.ElsevierLtd1st edition2006.

5.Pharmacology in Drug Discovery. T. P. Kenakin. Elsevier, 1st Edition 2012.

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ,Recallsteps, Conceptdefinitions.

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview.

Application(K3)-Suggestidea/conceptwithexamples,Solveproblems, Observe, Explain.

Analyse(K4)–Problem-savingquestions,Finishaprocedureinmanysteps,Differentiate between various ideas.

Evaluate(K5)-Longeressay/Evaluationessay, Critiqueorjustifywithprosandcons

Create(K6)–Checkknowledgeinspecificoroffbeatsituations.Discussion.

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	M	M	S	S	S
CO2	S	S	S	M	M	S	S	S	S	S
CO3	S	S	S	L	S	M	M	S	S	M
CO4	S	M	S	L	S	L	M	S	S	M
CO5	S	S	S	L	S	M	M	S	S	S

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215AEC42	BiochemicalToxicology	4	1	0	4

Pre-requisites, if any: Thestudentshouldhaveabasicknowledgeof pharmacology of drug action and understanding on their biochemical pathways.

Course Objectives

1. Tounderstandthedetailedstudyofbiochemicalbasisofdrugs and its toxicity, particularly their actions on living systems.
2. Tounderstandtherelevanceandmethodstoidentifythe chemotherapeutic value of drug.
3. To understand the fundamentals of toxicology and dose- response relationships.
4. To understand the toxicological drug testing procedures based onin vitro and animal studies
5. Tounderstandbiochemicalpathwaysofdrugtoxicityandits manifestation on vital organs.

Course Outcomes Oncompletionofthiscourse,thestudentwillbe able

CO1: To appreciate and understand the role oftoxicological biomarkers to assess drug toxicities.

CO2: To conceive the role of disposition of drug in human system and their metabolism and methodologies pertaining to toxicological studies.

CO3: To understand and evaluate the functions of different organs on drug disposition and associated drug toxicities.

CO4 : To understand the toxicologicalresponse to foreign compounds and their pharmacological, physiological and biochemical effects.

CO5: Tolinkthemechanismoftoxicityandclinicalsymptomswith underlying physiological disturbances.

	Units
I	Fundamentals of Toxicology and dose-Response Relationships: Introduction Biomarkers Criteria ofToxicity New Technologies EvaluationofToxicityInteractions;DoseResponse;Measurementof Dose-Response; Relationships Linear Dose Response Hormesis; Hazard and Risk Assessment Duration and Frequency of Exposure and Effect
II	Factors Affecting Toxic Responses: Disposition: Absorption ,Sites of absorption, distribution, Excretion; Metabolism: types of Metabolic changephaseIreactions;Phase2reactions;controlofMetabolism, Toxicationvs.Detoxication
III	Toxicity testing; Test protocol, Genetic toxicity testing & Mutagenesis assay: Invitrotest systems: bacterialmutationtests-Reversiontest,Ames test, Fluctuation test, and Eukaryotic mutation test. In vivo test system Mammalian mutation test-Host mediated assay and Dominant Lethal test. Biochemical basis of toxicity: Mechanism of toxicity: Disturbance ofexcitable membrane function, AlteredCalciumhomeostasis, Covalent bindingtocellularmacromolecules&genotoxicity,Tissuespecific toxicity
IV	Toxic Responses to Foreign Compounds: Direct Toxic Action: Tissue Lesions; Mechanism and response in cellular toxicity, pharmacological, physiological and Biochemical effects; Developmental Toxicology-Teratogenesis;ImmunotoxicityGeneticToxicity;Chemical Carcinogenesis
V	BiochemicalMechanismsofToxicity:TissueLesions:LiverNecrosis; kidneyDamage;LungDamage,Liverdamage,Cardiacdamage;

	Neurotoxicity; Exaggerated and Unwanted pharmacological effects; Physiological effects; Biochemical Effects: Lethal Synthesis and Incorporation,InteractionwithspecificProteinReceptors; Teratogenesis;Immunotoxicity;multi-OrganToxicity
Self-Study	• Casestudiesto review
Reading List (PrintandOnline)	1. PreclinicalSafetyEvaluationofBiopharmaceuticals:AScience- Based Approach to Facilitating Clinical Trials by Joy A. Cavagnaro 2. AComprehensiveGuidetoToxicologyinNonclinicalDrug Development2ndEditionbyAliS.Faqi
Recommended Texts	1. PrinciplesOfToxicologyby:KarenEStine,ThomasMBrown2006 Publisher. Crc Press 2. PrinciplesofBiochemicalToxicologybyJohnA.TimbrellPublisher: Informa Healthcare 3. EnvironmentalToxicologybySigmundF.Zakrzewski, (2002) Publisher:OxfordUniversityPress,USA

MethodofEvaluation:

TestI	TestII	Assignment	End Semester Examination	Total	Grade
10	10	5	75	100	

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ,Recallsteps, Conceptdefinitions.

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview.

Application(K3)-Suggestidea/conceptwithexamples,Solveproblems, Observe, Explain.

Analyse(K4)–Problem-savingquestions,Finishaprocedureinmanysteps,Differentiate between various ideas.

Evaluate(K5)-Longeressay/ Evaluationessay, Critiqueorjustifywithprosandcons

Create(K6)–Checkknowledgeinspecificoroffbeatsituations.Discussion.

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	L	S	L	M	M	M	M
CO2	M	M	S	M	M	L	M	S	S	S
CO3	S	S	S	M	M	L	S	S	M	M
CO4	S	M	S	M	M	M	S	S	M	M
CO5	M	S	S	S	S	M	M	M	S	S

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215DSC44A	Biosafety,LabSafetyandIPR	4	1	0	3

Pre-requisites, if any: Thestudentshouldhaveabasicknowledgeof hazardsassociatedwith thehandlingofbiologicalagentsandimportanceofintellectualproperty fromscientificresearch.

Course Objectives

1. To assimilate the hazards associated with the handling of biological and chemical agents.
2. To understand howto protect fromthe hazardsbythe implementation ofvarious safety measures in biochemical laboratories.
3. To implicate the importance of protecting the scientific intellect by filingpatent and understand the various offices for filing and maintaining patents
4. Tounderstandthescopeofpatentinginbiologicalresearch.
5. To create an awareness of ethics associated with used of genetically modifiedorganisms/cellsand itsrationale foruseinlivingorganisms.

Course Outcomes Aftercompletionofthecourse,thestudentsshouldbeableto:

CO1. Tounderstandandimplementvariousaspectsofbiosafetyand carry out risk assessment of products in biological research

CO2. Understand the basic concepts of ethics and safety that are essentialfordifferent disciplinesofscienceandproceduresinvolvedand protection of intellectual property and related rights.

CO3. To appreciate the intellectual property rights and its implementation of on the invention related to biological research.

CO4. Tounderstandthestatutorybodiesthat regulatethepropertyrights and its validity in various countries.

CO5. Critique the ethical concerns associated with modern

biotechnologyprocessesandplanaccordingly.

Units	
I	Biosafety: Historical background; introduction to biological safety cabinets; primary containment for biohazards; biosafety levels; recommended biosafetylevels for infectiousagentsand infectedanimals; biosafety guidelines - government of India, roles of IBSC, RCGM,GEAC etc. for GMO applications in food and agriculture; environmental releaseofGMOs;riskassessment;risk management andcommunication; national regulations and international agreements.
II	Laboratory safety - Chemical, electrical and fire hazards; handling and manipulating human or animal cells and tissues, toxic, corrosive or mutagenic solvents and reagents; mouth pipetting, and inhalation exposures to infectious aerosols, Safe handling of syringe needles orother contaminated sharps, spills and splashes onto skin and mucous membranes. Health aspects; toxicology, allergenicity, antibiotic resistance. History of biosafety microbiology and molecular biology, Risk assessment, Personal protective equipment, Laboratory facilities and safety equipment, Disinfection, decontamination, and sterilization, Regulatorycompliance,Laboratorysecurityandemergencyresponseand administrativecontrols.
III	Intellectual Property Rights (IPR):Introduction to patents, types of patents, process involved in patenting in India, trademarks, copyright, industrial design, trade secrets, traditional knowledge, geographical indications, historyof national and international treaties and conventions on patents, WTO, GATT, WIPO, Budapest Treaty, Patent Cooperation Treaty(PCT)andTRIPS.Patentdatabases:Searchinginternational databases;analysisandreportformation.IndianPatentAct1970;recent

	amendments; filing of a patent application; precautions before patenting disclosure/non-disclosure; procedure for filing a PCT application. The patentability of microorganisms-claims, Characterization and repeatability disposition in the culture collections, legal protection for plantsandotherhigherorganisms,newplantvarietiesbyrights,tissue culture protocols
IV	Patent filing and infringement: Patent application- forms and guidelines, fee structure, time frames; types of patent applications: provisional and complete specifications; PCT and convention patent applications, International patenting-requirement, financial assistance for patenting-introduction to existing schemes; Publication of patents-gazette of India, status in Europe and US. Research Patenting: Patenting by researchers and scientists-University/organizational rules in India and abroad. Detailedinformationonpatentingbiologicalproducts,Casestudieson patents(basmatirice,turmeric,neemetc.),andpatentinfringement.
V	Bioethics:
	Introduction to bioethics, human genome project and its ethical issues, genetic manipulations and their ethical issues, ethical issues in GMOs, foods and crops in developed and developing countries, environmental release of GMOs, ethical issues involved in stem cell research and use, useofanimalsinresearchexperiments,animalcloning,humancloning andtheirethicalaspects,testingofdrugsonhumanvolunteers.
Self-Study	1. Review ofdrugpatentdocuments 2. Safetyin biologicalresearchlaboratories
Reading List (Print and Online)	1. V. Shree Krishna, (2007). Bioethics and Biosafety in Biotechnology, New Age International Pvt. Ltd. Publishers. (Unit III, Unit IV andUnit V) 2. Deepa Goel, Shomini Parashar, (2013). IPR, Biosafety and Bioethics, Pearson. (Unit II) 3. R.IanFreshney,2016.CultureofAnimalCells:AManualofBasic

TechniqueandSpecializedApplications,6thEd,JohnWiley&Blackwell.

4.BAREACT,IndianPatentAct1970Acts&Rules,UniversalLaw PublishingCo.Pvt.Ltd.,2007.(UnitI)

Recommended Texts

1. Biosafety in Microbiological and Biomedical Laboratories, (2020) 6th Ed. (https://www.cdc.gov/labs/pdf/SF19_308133-A_BMBL6_00-BOOK-WEB-final3.pdf)
2. KankanalaC.,(2007),GeneticPatentLaw&Strategy,1stEdition, ManupatraInformationSolutionPvt.Ltd.,

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ,Recallsteps, Conceptdefinitions.

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview.

Application (K3) - Suggest idea/concept withexamples,Solve problems, Observe, Explain.

Analyse(K4)–Problem-savingquestions,Finishaprocedureinmanysteps,Differentiate between various ideas.

Evaluate(K5)-Longeressay/Evaluationessay, Critiqueorjustifywithprosandcons

Create(K6)–Checkknowledge inspecificoroffbeatsituations.Discussion.

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	S	S	S	S
CO2	S	S	S	L	M	M	S	S	S	S
CO3	S	M	M	M	S	M	S	S	S	M
CO4	S	M	M	L	S	L	S	S	S	M
CO5	S	S	S	L	S	M	S	S	S	S

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215DSC44B	Plant Biochemistry	4	1	0	3

Course Prerequisites or Co-requisites A background in plant biology, general biochemistryor chemistry is expected. Note that concurrent registration in any of these courses will NOT meet this requirement. Students must have completed both semesters of O-chem and a biochemistry course that covers general metabolism prior to taking this course.

Course Objectives :

This course covers biochemical processes specific to plants and is aimed to allow students togain an understanding and appreciation of how biochemical components are synthesized and utilized by plants during growth and development and in their interactions with their environment, as well as how these processes can be manipulated. This course includes topics in photosynthesis, carbohydrates, nitrogen and lipid metabolism, specialized metabolism and plant metabolicengineering.Fluxandgenomics-basedtechniques,suchasproteomics,transcriptomics and metabolomics are discussed in relation to metabolism.

Unit-I Plant cell: Structure, function and mechanisms ofaction ofphytochromes, cryptochromes and phototropins, stomatal movement,transpiration, photoperiodismand biological clocks, plant movement. Photosynthesis: Photosynthetic apparatus, pigments of photosynthesis, Calvin cycle (C3 plants), Hatch slack (C4 plants) & CAM pathways of carbon reduction and its regulation, Structure, function and regulation of RUBISCO, Crassulacean acid metabolism in plants. Photorespiration: photorespiration pathway and significance, cyanide resistance, relationship between photosynthesis, photorespiration.

Unit-II

Phytohormones: Biosynthesis, transport, physiological effects, mode of action and signal transduction of auxins, gibberlic acid, abscisic acid, ethylene and cytokinins in germination, embryogenesis, growth and development of plant.

UnitIII

Nitrogen metabolism: Nitrogen fixation, nitrogenise complex, biochemistry and genetics of nitrogen fixation and ammonium assimilation, structure of 'NIF' genes and its regulation, structural features of nitrate reductase and nitrite reductase, regulation of nitrate and sulphate assimilation.

Unit III: Secondary plant metabolites: Nature, distribution, biosynthesis and function of plant metabolites, biosynthesis of nicotine. Biochemistry of plant toxins, phytohemagglutinins, lathyrogens, nitriles, protease inhibitors, protein toxins, role of secondary metabolites inchemical defence.

Unit-IV Revised M.Sc. Biochemistry from 2019 12 Plant stress physiology: Plant stress, plant responsesto abiotic and biotic stresses, salinity, water, heat,chilling, anaerobiosis, heavymetals, radiations and their impact on plant growth and metabolism, mechanisms of resistance to biotic stress and abiotic stress, antioxidative defence mechanism. Plant defence:

Unit V: Genetic basisofplant-pathogen interactions, antio R-Avr gene interactionsand isolation of R genes, hypersensitive response (HR), systemic acquired resistance (SAR) and induced systemic resistance (ISR).

Books recommended

- IntroductionofPlantBiochemistry,byGoodwinT.W.andE.I.Mercer,PergamonPress, Oxford, 1983.
- PlantPhysiology, 5thEdition,byLincolnTaizandEduardoZeiger, Amazonpress, 2012
- IntroductionofPlantBiochemistry,byGoodwinT.W.andE.I.Mercer,PergamonPress, Oxford.
- BuchananBB,GruissemW&JonesRL.2000.BiochemistryandMolecularBiologyof Plants. 2nd Ed. John Wiley.
- Dey PM &Harborne JB. 1997. Plant Biochemistry. Academic Press. • Heldt HS. 1997. PlantBiochemistry and Molecular Biology. Oxford Univ.Press.

CourseCode	CourseTitle	L	T	P	C
23215DSC45A	DevelopmentalBiology	4	1	0	3

Pre-requisites,if any: ComprehensiveKnowledgeofCellBiology

Course Objectives Thecandidatesundertakingthiscoursewillunderstandtheconceptsof developmental biology.

1. Tounderstandthebackgroundofdevelopmentalbiology
2. Togainin-depthknowledgeofvariousmodelorganisms
3. To gaininsightintoaspectsofstemcelltechnology
4. Togaininsightsinto morphogenesisandoranogenesis
5. Toacquirein-depth understandingofcell deathmechanismsand cell fate decision

Course Outcomes

CO1.Graspknowledgeabout thebackgroundofdevelopmentalbiology

CO2.Gain abundant knowledge about model oraganisms and gametogenesis

CO3.Gain knowledge about stem cells and their applications in regenerative therapy

CO4.Goodknowledge aboutorganogenesis

CO5.Learnthebasicsofcelldeath mechanismsand cellfatedecision.

Units

I Overview of Developmental biology: Background of Developmental biology - Principles of developmental biology –Potency, commitment, specification, induction, competence, determination and differentiation; morphogeneticgradients;cellfateandcelllineages;stemcells;genomic equivalenceandthecytoplasmicdeterminants;imprinting;mutantsand

	transgenicsinanalysisofdevelopment.
II	Modelorganisms
	Gametogenesis – production of gametes, Formation of zygote, fertilization and earlydevelopment: molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants;cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination. Drosophila Developmentalbiology-Axis formation, Genes &mutation.*C.elegans*– Vulvaformation,Axisformation.
III	RegenerationDevelopmentalBiology
	Stem cells – Definition, Classification, Embryonic and adult stem cells, properties, identification, Culture of stem cells, Differentiation and dedifferentiation, Stem cellmarkers, techniques and their applications in modernclinicalsciences.Three-dimensionalcultureandtransplantation ofengineeredcells. Tissueengineering- skin, boneandneuronaltissues.
IV	Morphogenesis & Organogenesis:Cell aggregation and differentiation in Dictyostelium; axes and pattern formation in Drosophila, amphibia and chick; organogenesis – vulva formation in Caenorhabditis elegans, eye lens formation, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development-larvalformation,metamorphosis;environmentalregulationofnormal development;sexdetermination.
V	CellularsenescenceandCellfatedecision
	Cellular senescence – concepts & Frizzled receptor in Development and disease.Diabetesanddevelopmentalbiology,Celldeathpathwaysin developments.Markersofimportantdiseases.
ReadingList(Print and Online)	DevelopmentalBiology–GilbertScott http://bgc.org.in/pdf/study-material/developmental-biology-7th-ed-sf-gilbert.pdf

Recommended Texts Developmentalbiology:VIIIedition,**Gilbert,S**F;SinauerAssociates,Inc

Methodsofassessment:

Recall(K1)-Simpledefinitions, MCQ,Recallsteps, Conceptdefinitions.

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview.

Application(K3)-Suggestidea/conceptwithexamples,Solveproblems, Observe, Explain.

Analyse(K4)–Problem-savingquestions,Finishaprocedureinmanysteps,Differentiate between various ideas.

Evaluate(K5)-Longeressay/Evaluationessay, Critiqueorjustifywithprosandcons

Create(K6)–Checkknowledgeinspecificoroffbeatsituations.Discussion.

MappingwithProgrammeOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	M	L	S	S	M
CO2	M	M	M	M	M	S	M	S	M	M
CO3	M	M	L	M	M	S	L	S	L	L
CO4	S	M	L	S	S	M	S	S	M	M
CO5	S	S	M	S	L	M	M	S	M	M

S-Strong M-Medium L-Low

CourseCode	CourseTitle	L	T	P	C
23215DSC45B	CancerBiology	4	1	0	3

OBJECTIVES:

To enable the students to understand • Basic biology of cancer • Impact of antibodies against cancer in the human body leading to more effective treatments • Enhanced immunology based detection methods and imaging techniques • Development of cell based and cytokine based immunotherapy against cancer.

UNITI FUNDAMENTALSOFCANCERBIOLOGY

Regulation of cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, modulation of cell cycle in cancer, different forms of cancers, diet and cancer. Cancer screening and early detection, Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer.

UNITII PRINCIPLESOFCARCINOGENESIS

Theory of carcinogenesis, Chemical carcinogenesis, metabolism of carcinogenesis, principles of physical carcinogenesis, x-ray radiation-mechanisms of radiation carcinogenesis.

UNITIII PRINCIPLESOFMOLECULARCELLBIOLOGYOF CANCER

Signal targets and cancer, activation of kinases; Oncogenes, identification of oncogenes, retrovirusesand oncogenes, detectionofoncogenes. Oncogenes/protooncogene activity. Growth factors related to transformation. Telomerases.

UNITIV PRINCIPLESOFCANCERMETASTASIS

Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement membrane disruption, three step theory of invasion, proteinases and tumour cell invasion.

UNITV NEWMOLECULESFORCANCER THERAPY

Different forms of therapy, chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection. Use of signal targets towards therapy of cancer; Gene therapy.

TOTAL:45PERIODS

OUTCOMES:The coursewouldfacilitatethe students

• Toappreciatetheroleofimmunesystemincancer•To describe self –tolerance machineryand immune surveillance • To understand the cancer microenvironment and its influence on immune cells • To have awareness on medicalapplications ofcytokines and immune cells against cancer

TEXTBOOKS:

1. Weinberg, R.A. "The Biology of Cancer" Garland Science, 2007
2. McDonald,Fetal., "MolecularBiologyofCancer"IIndEdition. Taylor&Francis, 2004.

REFERENCES:

1. King,RogerJ.B."CancerBiology"AddisonWesleyLongman,1996.2.Ruddon,Raymond W. "CancerBiology"IIIrdEdition.OxfordUniversityPress,1995.

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF ENGLISH

2023 – 2024

1.1.3 Total number of courses having focus on employability/ entrepreneurship/ skill development offered by the University during the year

1.2.1 Number of new courses introduced of the total number of courses across all programs offered during the year

EMPLOYABLITY
SKILL DEVELOPMENT
ENTREPRENEURSHIP
EMPLOYABLITY/ SKILLDEVELOPMENT

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)
Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF ENGLISH

2023-2024

EMPLOYABLITY

SKILL DEVELOPMENT

ENTREPRENEURSHIP

EMPLOYABLITY/ SKILL DEVELOPMENT

B.A ENGLISH- REGULATION 2023

COURSE STRUCTURE

SEMESTER – I

Course Code	Course Title	L	T	P	C
THEORY					
23110AEC11/ 23111AEC11/ 23132AEC11/ 23135AEC11	Tami – I/Advanced English-I/Hindi-I/ French - I	3	1	0	3
23111AEC12	English-I	3	1	0	3
23111AEC13	Introduction to English literature	4	1	0	3
23111AEC14	Indian writing in English	4	1	0	3
23111GEC15	Social history of England	3	0	0	3
23111GEC16	Myth and Literature	3	0	0	3
Skill Enhancement Course					
23111SEC17	Green literature	2	0	0	2
23111SEC18	Foundation Course (FC)	2	0	0	2
Ability Enhancement Compulsory course (AECC)					
231AECCINC	Indian Constitution	2	0	0	2
231LSCUV	Universal Human Values	0	0	0	1
	Total	**26**	**4**	**0**	**25**

SEMESTER – II

Course Code	Course Title	L	T	P	C
THEORY					
23110AEC21/ 23111AEC21/ 23132AEC21/ 23135AEC21	Tami – II/Advanced English-II/Hindi-II/ French - II	3	1	0	3
23111AEC22	English-II	3	1	0	3
23111AEC23	British literature – I	4	1	0	3
23111AEC24	American literature – I	4	1	0	3

23111GEC25	History of English literature	3	0	0	3
23111GEC26	Film and Literature	3	0	0	3
Skill Enhancement Course					
23111SEC27	Philosophy for literature	2	0	0	2
23111SEC28	Spoken and Presentation Skills	2	0	0	2
Ability Enhancement Compulsory course (AECC)					
231AECCCMS	Communication Skills	2	0	0	2
231SSCBE	Basic Behavioural Etiquette	0	0	0	1
	Total	**26**	**4**	**0**	**25**

SEMESTER – III

Course Code	Course Title	L	T	P	C
THEORY					
23110AEC31/ 23132AEC31/ 23111AEC31/ 23135AEC31	Tamil – III/Hindi-III/Advanced English-III/ French – III	3	1	0	3
23111AEC32	English-III	3	1	0	3
23111AEC33	British literature - II	4	1	0	3
23111AEC34	Biographies, auto-biographies & memoirs	4	1	0	3
23111GEC35	Literary Genres and Terms	3	0	0	3
23111GEC36	ELT and Computer Assisted Language Learning	3	0	0	3
Skill Enhancement Course					
23111SEC37	Functional English	2	0	0	1
23111SEC38	Public speaking skills	2	0	0	2
Ability Enhancement Compulsory course (AECC1)					
23111RMC39	Research Methodology	2	0	0	2
231ACLSOAN	Office Automation	0	0	0	1
	Total	**26**	**4**	**0**	**24**

SEMESTER – IV

Course Code	Course Title	L	T	P	C
THEORY					
23110AEC41/ 23111AEC41/ 23132AEC41/ 23135AEC41	Tamil-IV/Advanced English-IV /Hindi-IV/ French – IV	3	0	0	3
23111AEC42	English-IV	3	0	0	3
23111AEC43	American literature - II	4	1	0	3
23111AEC44	World literature intranslation	4	1	0	3
23111GEC45	Film Studies	3	0	0	3
23111GEC46	Translation: Basic Concepts and Practice	3	0	0	3
Skill Enhancement Course					
23111SEC47	English for business	2	0	0	2
23111SEC48	English for careers	2	0	0	2

Ability Enhancement Compulsory course (AECC1)					
23111BRC49	Participation in Bounded Research	2	0	0	2
231AECCEVS	Environmental Studies-II	2	0	0	2
231LSCLS	Leadership and Management Skills	0	0	0	1
	Total	**28**	**2**	**0**	**27**

SEMESTER – V

Course Code	Course Title	L	T	P	C
THEORY					
23111AEC51	Aspects of languageand linguistics	4	1	0	4
23111AEC52	Authors in focus	4	1	0	4
23111AEC53	Women's writing inEnglish and in translation	4	1	0	4
23111AEC54	Indian writing intranslation	4	1	0	3
23111DSC55_	Discipline Specific Elective – I	3	1	0	3
23111DSC56_	Discipline Specific Elective – II	3	1	0	3
Skill Enhancement Course					
231AECCVED	Value Education	2	0	0	2
23111SEC57	Internship/Industrial Visit/Field Visit	**0**	**0**	**0**	**2**
AUDIT COURSE					
231ACLSPSL	Professional Skills	0	0	0	1
	Total	**24**	**6**	**0**	**26**

SEMESTER – VI

Course Code	Course Title	L	T	P	C
THEORY					
23111AEC61	Shakespeare studies	4	2	0	4
23111AEC62	Literary Criticism	4	2	0	4
23111DSC63_	Discipline Specific Elective – III	4	2	0	3
23111PRW64	Project	0	0	6	4
23111SEC65	Professional Competency Skill- General awareness for competitive examination	4	2	0	2
231EXACT	Extension activity	0	0	0	1
AUDIT COURSE					
231ACSIKWS	Indian Knowledge System	0	0	0	2
	Total	**16**	**8**	**6**	**20**
				Total Credits -Programme	**140**
				Total Credits - Audit Courses	**07**
				Total Credits	**147**

Credit Distribution

Sem	AEC	SEC	GEC	DSC	AECC	Research	Others	Total
I	12	4	6	-	2	-	-	24
II	12	4	6	-	2	-	-	24
III	12	3	6	-	-	2	-	23
IV	12	4	6	-	2	2	-	26
V	15	2	-	6	2	-	-	25
VI	8	2	-	3	-	4	1	18
Total	**71**	**19**	**24**	**9**	**8**	**8**	**1**	**140**

AUDIT COURSE CREDIT DISTRIBUTION

Sem	Audit
I	1
II	1
III	1
IV	1
V	1
VI	2
Total	**7**

Discipline Specific Electives

Semester	Discipline Specific Elective Courses
V	23111DSC55A- Disaster management
	23111DSC55B- Writing for media
V	*23111DSC56A*- Art and literary aesthetics
	23111DSC56B- Introduction to Comparative Literature
VI	23111DSC63A -Fundamentals of Academic Writing
	23111DSC63B -Mass communication and journalism

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)
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SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF ENGLISH

B.A ENGLISH- REGULATION 2023

EMPLOYABLITY

SEMESTER – I

CORE I – INTRODUCTION TO ENGLISH LITERATURE

Subject Code	Course Title	L	T	P	S	Credits	Inst. Hours
23111AEC13	INTRODUCTION TO LITERATURE	4	1	-	-	4	5

Learning Objectives	
LO1	To introduce the different forms of literature
LO2	To provide learners with the background knowledge of literature
LO3	To enable leaners to understand the different genres of writing
LO4	To examine the various themes and methodologies present in literature
LO5	To create the ability of critically examining a text

UNIT	Details
I	Introduction: Poetry-Different forms of poetry- Sonnet, Ode, Elegy, Lyric Ballad. Prose-Short Story, Novella, Novel. Drama- Comedy, Tragedy, Tragi-Comedy.
II	William Shakespeare - Sonnet 18, Sonnet 116. John Keats - Ode to Nightingale. Thomas Gray - Elegy Written in a Country Churchyard.
III	J.M. Barrie - The Admirable Crichton. Lady Gregory - The Rising of the Moon.
IV	Manohar Malgonkar - Spy in Amber. Don Quixote - Tilting at the Windmills.
V	Katherine Mansfield - Bliss and other stories. Robert Frost - Mending Wall

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Appreciate and analyse and the basic elements ofpoetry, including meter, rhyme, and theme.	PO1

CO2	Gain knowledge of the elements of fiction including narrative structure, character analysis and comparison between different but related texts.	PO1, PO2
CO3	Explore the dramatic storytelling including play structure, monologues, dialogue, and scene setting.	PO4, PO6
CO4	Use library resources to research and develop arguments about literary works.	PO4, PO5, PO6
CO5	Work skillfully within a team, respect coworkers, delegate work and contribute to a group project.	PO3, PO8

Text Books (Latest Editions)	
1.	Backpack Literature: An Introduction to Fiction, Poetry, Drama, and Writing- X. J. Kennedy, by Pearson, 2016.
2.	Portable Literature: Reading, Reacting, Writing - 9th edition–LaurieKirszner, by Cengage Learning, 2016
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Henny Herawati et al., Introduction to Literature, Sanata DharmaUniversity Press, October 2021.
2.	Michael Meyer, D. Quentin Miller,The Compact Bedford Introduction toLiterature with 2021 MLA Update, Bedford/St. Martin's, August 2021.
3.	Janice Campbell., Introduction to Literature: Excellence in Literature English1, 4th Ed, Everyday Education, LLC, January 2021.
4	Subhendu Mund., The Making of Indian English Literature, Taylor & Francis Ltd., 2021.
5	Adamson H. D. Linguistics and English Literature: An Introduction,Cambridge University Press, 2019.
6	Felicity Titjen et al.(ed), Teaching English Language and Literature, Taylor& Francis,2020
Web Resources	
1.	ASIATIC: IITUM Journal of English Language & Literature
2.	The English Historical Review (EHR)

CORE II - INDIAN WRITING IN ENGLISH

Subject Code	Course Title	L	T	P	S	Credits	Inst. Hours
23111AEC14	**INDIAN WRITING IN ENGLISH**	Y	Y	-	-	4	5

Learning Objectives	
LO1	To familiarize the students with the emergence and growth of Indian Writingin English in the context of colonial experience.
LO2	To help in understanding issues concerning Indian Writing in English such asthe representation of culture, identity, history, constructions of nation, (post)national and gender politics, cross-cultural transformations.
LO3	To enable leaners to appreciate Nation-Nationalism; Counter Discourse; Subalternity; Identity Movements.
LO4	To closely examine the various themes and methodologies existing in Contemporary Indian Writing in English.
LO5	To help learners apply the ideas encapsulated in Indian Aesthetics to literarytexts
UNIT	**Details**
I	Ruskin Bond - Handful of Nuts, Night Train to Deoli K.A. Abbas - Sparrows
II	Rabindranath Tagore - Khabhuliwala. Ruskin Bond - School Days
III	Poetry- Toru Dutt - The Lotus Sri Aurobindo - The Tiger and the Deer.
IV	Sarojini Naidu- The Village Song Shiv K Kumar - Indian Women Mirza Ghalib - It is not Love, it is Madness
V	Rabindranath Tagore - Mukhthadhara. Nissim Ezeikel - Nalini: A Comedy in Three Acts Joginder Paul - Sleepwalkers.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Appreciate the historical trajectory of various genres of Indian Writing in English from colonial times to till the present	PO1
CO2	Analyze Indian literary texts written in English in terms of colonialism, postcolonialism, regionalism, and nationalism	PO1, PO2

CO3	Understand the role of English as a medium for	PO4, PO6
	political awakening and the use of English in India for creative writing	
CO4	Analyze how the sociological, historical, cultural and political context impacted the texts selected for study	PO4, PO5, PO6
CO5	Evaluate critically the contributions of major Indian English poets and dramatists	PO3, PO8
Text Books (Latest Editions)		
1.	Rexroth, Kenneth. The New British Poets: An Anthology. Granger Books, 1976.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Bacon, Francis, and Michel Leiris. Francis Bacon. Ediciones Poligrafa, 2008.	
2.	MARLOWE, Christopher. Dr. Faustus. BOOK ON DEMAND LTD, 2021.	
3.	Shelley, Mary Wollstonecraft. Frankenstein. CreateSpace, 2015.	
4.	Swift, Jonathan, et al. Gulliver's Travels. Oxford University Press, 2019.	
Web Resources		
1.	**Ranger, Paul. "Technical Features." She Stoops to Conquer by Oliver Goldsmith, 1985, pp. 51–68., https://doi.org/10.1007/978-1-349-07664-2_5.**	
2.	Dickens, Charles. "Fifty-Two." A Tale of Two Cities, 2008, https://doi.org/10.1093/owc/9780199536238.003.0047.	

MYTH AND LITERATURE

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111GEC16	Myth and literature	3	1	-	-	4	4	25	75	100

Learning Objectives	
LO1	To help students at the origin and sources of myths in literature.
LO2	Provide them with a unique approach of interpreting critical analysis that hasgiven rise to a need of understanding the concept 'Myth' in relation to man's life
LO3	Get an In-depth study of the theoretical approaches
LO4	Help them gain insight to myth, ritual, philosophy, methods and contemporaryissues in religious studies from ancient times to modern times
LO5	Help them to understand the definition of symbolism with its different typesand dimensions.
UNIT	**Details**
I	Introduction to Myth/ Mythology- Sources of Indian mythology – Types of story and its relation to myth
II	Ted Hughes Selections from Tales from Ovid i) Creation; Four Ages; Flood;Lycaon ii)The Rape of Proserpina iii) Birth of Hercules iii) Echo and Narcissus iv) Pyramus and Thisbe
III	General idea of Vedic, Epic and Puranic Mythology
IV	Symbolism: Role of Symbols in myths, Symbols relatedto Sacrifice and other Iconography, Understanding totems and taboos in tribal myths
V	Indian Mythology by (DevduttPattanaik)- in-depth psychological devotion to the perspectives of Indian Mythology in Literature,

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the origin and sources of myths inliterature	PO1
CO2	Develop an in-depth knowledge of the theoretical approaches of myth, ritual, philosophy, methods andcontemporary issues in religious studies from ancienttimes to modern times.	PO1, PO2
CO3	Gain insight to the basic idea of Vedic Epic and Puranic Mythology and also the connection amongFire, Rain, Stars, Holy Drink, Supernatural	PO4, PO6

	birth, Mountains & Rivers, Holy places & Festivals	
CO4	Understand symbolism with its different types and dimensions.	PO4, PO5, PO6
CO5	Develop in-depth psychological devotion to the perspectives of Indian Mythology in Literature, Art, and Music	PO3, PO8
Text Books (Latest Editions)		
1.	Bauman, Richard. A Genre@ in Folklore, Cultural Performance, and PopularEntertainments: A Communications-Centered Handbook. Oxford: Oxford University Press, 1991.	
2.	Boas, Franz. A Introduction to James Teit,@ Traditions of the Thompson River Indians of British Columbia. Memoirs of the American FolkloreSociety, VI, 1898.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Eller, Cynthia. The Myth of the Matriarchal Prehistory: Why an Invented PastWon't Give Women a Future. Boston: Beacon Press, 2000.	
2.	Grimm, Jakob and Wilhelm Grimm. A Prefaces to the First and Second Editions@ of the Nursery and Household Tales, in Maria Tatar, The HardFacts of the Grimms= Fairy Tales. Princeton: Princeton University Press, 1987(originally published 1812-1819): 203-222.	
Web Resources		
1.	*Bascom, William. AThe Forms of Folklore: Prose Narratives@ in Journal ofAmerican Folklore 78, 1965: 3-20.*	

GREEN LITERATURE

Subject Code	Course Title	L	T	P	S	Credits	Inst. Hours
23111SEC16	GREEN LITERATURE	2	-	-	-	2	2

Learning Objectives	
LO1	To broaden the idea of literature and the concept of texts.
LO2	To learn the difference between genre fiction and literary fiction.
LO3	To make students gain an understanding of the folk roots of literature.
LO4	To make students find a perspective into the debate between high and low cultures.
LO5	To analyze the fantasy work that gains popularity.
UNIT	**Details**
I	William words worth – My haert leaps up A.K Ramanujan- "Flowering Tree"
II	Humboldt, Alexander von, Views of Nature Rachel Carson -"A Fable for Tomorrow'
III	Henry David Thoreau- LIFE IN WOODS D.H. Lawrence -"Snake"
IV	Jack London -To Build a Fire William Faulkner-A Rose for Emily John Green -Paper Towns
V	Annie dillard – Teaching A Stone Talk Amitav Ghosh -The Hungry Tide

The course outcome is based on the Learning Objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Learning Objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

	Course Outcomes	
Course Outcomes	On completion of this course, students will;	
CO1	acquire awareness about one of the oldest forms of ecocriticism- respect world views and the discrimination in society as failure to comply with egalitarian values of Nature.	PO1
CO2	become familiar with the opposing viewpoints in Man's relationship with the physical environment from literary texts.	PO1, PO2
CO3	understand and identify Ecological concepts-Symbiosis, Mutation, , Parasitism Biodiversity from the literary texts prescribed.	PO4, PO6

CO4	become familiar with ecological, deep ecological and oiko poetic principles	PO4, PO5, PO6
CO5	apply these critical tools to analyse and understand environmental messages from literary texts and other mediums	PO3, PO8
Text Books (Latest Editions)		
1	Chute, Hillary. –Comics as Literature .Reading Graphic Narrative‖.PMLA – Publications of The Modern Language Association of America. 123. 452-465. 2008.	
2	Herge. Tintin in Tibet.Baker and Taylor, 2009.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Chauhan, Anuja. The Zoya Factor Harper Collins, 2008.	
2.	Gill, Rosalind & Herdieckerhoff, Elena. –Rewriting the romance: new femininities in chick lit? .Feminist Media Studies 6(4). 2006.	

SEMESTER II

BRITISH LITERATURE-I

Subject Code	Course Title	L	T	P	S	Credits	Inst. Hours
23111AEC23	BRITISH LITERATURE-I	4	1	-	-	4	5

Learning Objectives	
LO1	To introduce British Identity, Periods and other related forms.
LO2	To increase the ability for students to intellectually assess the world and theirplace in it.
LO3	To enable leaners to understand that British literature is at the foundation of English-speaking peoples' culture.
LO4	To closely examine the various themes and methodologies present in British literature
LO5	To create an aptitude of critically probing through the text
UNIT	**Details**
I	Francis Bacon - Of Truth, Of Adversity Joseph Addison and Sir Richard Steele - The Spectator Club, On Gratitude, On Giving Advice.
II	Robert Jamieson - Robinhood & The Monk Robert Edgar Burns - The Potter William Blake - The Chimney SweeperJohn
III	P.B.Shelly - Arethusa, Hymn to Intellectual Beauty. William Wordsworth - Ode: To Intimation & Immorality Lord Byron - She Walks In Beauty John Milton - Paradise Lost Book 4.
IV	Christopher Marlowe - Dr. Faustus Oliver Goldsmith - She Stoops to Conquer
V	Mary Shelly - Captain Walton's Conclusion-Frankenstein Jonathan Swift - Voyage to Lilliput/Houyhnhnms-Gulliver's Travels Charles

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Demonstrate knowledge of the major social, political, philosophical, and scientific events forming the backdrop for the development of early British Literature.	PO1
CO2	Synthesize, integrate, and connect information by writing essays using techniques of criticism and evaluation.	PO1, PO2

CO3	Read and discuss the themes, approaches, styles, andcontributions to the development of British literaturefrom the Medieval Period to the end of the eighteenth-century	PO4, PO6
CO4	Distinguish between the characteristics of British literary movements in discussing and writing about British literature.	PO4, PO5, PO6
CO5	Write about literature using standard literaryterminology and other literary conventions.	PO3, PO8
Text Books (Latest Editions)		
1.	Rexroth, Kenneth. The New British Poets: An Anthology. Granger Books, 1976.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Bacon, Francis, and Michel Leiris. Francis Bacon. Ediciones Poligrafa, 2008.	
2.	MARLOWE, Christopher. Dr. Faustus. BOOK ON DEMAND LTD, 2021.	
3.	Shelley, Mary Wollstonecraft. Frankenstein. Create Space, 2015.	
4.	Swift, Jonathan, et al. Gulliver's Travels. Oxford University Press, 2019.	
Web Resources		
1.	Ranger, Paul. “Technical Features.” She Stoops to Conquer by Oliver Goldsmith, 1985, pp. 51–68., https://doi.org/10.1007/978-1-349-07664-2_5.	
2.	Dickens, Charles. “Fifty-Two.” A Tale of Two Cities,2008, https://doi.org/10.1093/owc/9780199536238.003.0047.	

AMERICAN LITERATURE-I

Subject Code	Course Title	L	T	P	S	Credits	Inst. Hours
23111AEC24	AMERICAN LITERATURE-I	4	1	-	-	4	5

Learning Objectives	
LO1	To Understand the growth and development of American literature.
LO2	To critically examine how various genres developed and progressed.
LO3	Learn about prominent writers and famous works in American literature.
LO4	To closely examine the various themes and methodologies present in British literature
LO5	To create an aptitude of critically probing through the text
UNIT	**Details**
I	E.M.Foster - The Prologue-Passage to India (Lines 1-68). Walt Whitman - O Captain, My Captain!
II	Edgar Allan Poe - The Raven Emily Dickinson - Because I Could Not Stop for Death.
III	Edgar Allan Poe - The Philosophy of Composition Martin Luther King Jr- I have a Dream
IV	Tennessee Williams- The Glass Menagerie Eugene O' Neill - Emperor Jones
V	Harriet Beecher Stowe - Uncle Tom's Cabin Herman Melville- Billy Budd Washington Irving- The Legend of the Sleepy Hollow

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Analyze and discuss works of American literature from a range of genres (e.g. poetry, nonfiction, slave narrative, captivity narrative, literary fiction, genre fiction, sermon, public proclamations, letters, etc.).	PO1
CO2	Identify relationships between moments in American history, colonialism, and culture and their representationin works of American literature.	PO1, PO2
CO3	Articulate ways that American literature reflects complexhistorical and cultural experiences.	PO4, PO6
CO4	Produce a mix of critical, creative, and/or reflectiveworks about American literature to 1865.	PO4, PO5, PO6

CO5	Analyze and describe about American literature using standard literary terminology and other literary conventions.	PO3, PO8
Text Books (Latest Editions)		
1.	Levine, Robert S., et al. The Norton Anthology of American Literature. W.W.Norton & Company, 2022.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Dickinson, Emily, and Johanna Brownell. Emily Dickinson: Poems. Chartwell Books, 2015.	
2.	Gould, Jean. American Women Poets: Pioneers of Modern Poetry. DODD, MEAD, 1980.	
3.	Poe, Edgar Allan, et al. Poetry for Young People: Edgar Allen Poe. Sterling Pub. Co., 1995.	
4.	Kallen, Stuart A., and Terry Boles. The Gettysburg Address. Abdo & Daughters, 1994.	
Web Resources		
1.	"Harriet Beecher Stowe's Uncle Tom's Cabin." 2003, https://doi.org/10.4324/9781315812113.	
2.	Mason, Ronald. "Herman Melville and 'Billy Budd.'" Tempo, no. 21, 1951, pp. 6–8., https://doi.org/10.1017/s0040298200054863	

FILM AND LITERATURE

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111GEC26	FILM AND LITERATURE	2	-	-	-	3	2	25	75	100

Learning Objectives	
LO1	To help students look closely into the relation between film and literature.
LO2	Introduce learners to the various ways in which literature and the moving imagediverge.
LO3	Help the learners understand how each form makes their own claims to thenarrative.
LO4	Help learners to interpret elementary concepts of cinema, cinema history andpractice and the basics of adaptation theory.
LO5	**Help learners gain perspective on literature's relationship with cinema**

UNIT	Details
I	**Theories, practices, forms, adaptations, migrations**-William Shakespeare's KingLear [1606] Akira Kurasawa, Ran (1985)Gregory Kozintsev, King Lear (1971)
II	Arthur C Clark, The Sentinel (1948)/ Encounter in the Dawn(1953) StanleyKubrick, 2001: A Space Odyssey(1968)
III	**Cinema from novella and dramatic literature-**
IV	Boris Pasternak, DrZhivago (1957)David Lean, DrZhivago(1965)
V	Joseph Conrad, Heart of Darkness (1902) Francis Ford Coppola, Apocalyse Now(1979)

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Gain insight to the various ways in which literature and the moving image diverge as well as correspond through the theory of narrative while being a source of long conflict through much of the history of film studies.	PO1
CO2	Familiarize with the inter-dependence of the two artforms that collectively and individually re-present,effectively ensuring that the fruition of the collaboration is often far from simple.	PO1, PO2
CO3	Understand the politics and process of adaptation of literary forms into cinematic forms, how the process of signification in them vary and collide.	PO4, PO6
CO4	Gain insight on how each form makes their own claims to the narrative and the major debates thathave been provoked in world cinema around the problems of adaptation.	PO4, PO5, PO6

CO5	Get an understanding of elementary concepts of cinema, cinema history and practice and the basics of adaptation theory.	PO3, PO8
Text Books (Latest Editions)		
1.	Mast, Gerald &Marshall Cohen, Film Theory and Criticism: IntroductoryReadings. New York: Oxford University Press, 1994.	
2.	Nichols Bill (ed), Movies and Methods: Vol. I: An Anthology. Calcutta: Seagull Books, 1985.	
3.	**Bill Nichols (ed), Movies and Methods: Vol. II: An Anthology. Calcutta: Seagull Books, 1985.**	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Roberge Gaston, The Subject of Cinema. Calcutta: Seagull Books. 1990. Print.	
2.	Horton Andrew, 'Film and Literature', Encyclopedia of World Literature in the 20th Century Vol 2, Leonard S Klein (ed), New York: Frederik Ungar, 1982, 93-99. Print	
Web Resources		
1.	*(PDF) Film and Literature (researchgate.net)*	

Subject Code	Course Title	L	T	P	S	Credits	Inst. Hours
23111SEC27	PHILOSOPHY FOR LITEERATURE	Y	Y	-	-	2	2

Learning Objectives	
LO1	Engage with the philosophy of literary representations.
LO2	Give the students a historical overview of the major figures in philosophy
LO3	Introduce to them some of the significant schools of thought that hasinfluenced human perception.
LO4	Inform students how an understanding of philosophy is vital to thereading of literature
LO5	Analyze the philosophical thought
UNIT	**Details**
I	The World of Greeks-Heraclitus—Nature of Poet—Plato—Concept of Forms—Ideal vs Physical—Aristotle—Concept of Soul—Beauty—Art—Nature
II	Robert Frost. –West- Running Brook- S T Coleridge. –Kubla Khan -P B Shelley.–Ozymandias,
III	Enlightenment and After-Rene Descartes—Rationalism—Dualism—Spinoza—idea of Nature and God— Pantheism—concept of substance and modes— Cartesiandualism vs Spinoza‘s monism—John Locke— Liberalism— Empiricism—Immanuel Kant— Transcendental Idealism
IV	Emily Dickinson. –The Brain—is wider than the Sky‖ (Debate the Cartesian mind body or material immaterial dualism),Walt Whitman. –On the Beach at Night Alone.‖ (Spinoza‘s pantheism), William D. H. Lawrence.–How Beastly the Bourgeois Is?‖ (Marx‘s idea of social44class)
V	W H Auden. –Who‘s Who?‖ (Heidegger‘s idea of Dasein and Geworfenheit, –Being- thrown- in-the-world), Ted Hughes. –Hawk Roosting,‖ (ego that mediates the instinctual id and the critical super-ego), Maya Angelou.–When I think of myself,‖ (de Beauvoir‘s concept of becoming),

The course outcome is based on the Learning Objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Learning Objectives and Course outcomes. The blooms taxonomy verbs will be given as a separate annexure for your reference.Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Have a diachronic understanding of the evolution ofphilosophy from the time of Greek masters to 20th century.	PO1
CO2	Have an awareness of the major schools of thought inwestern philosophy.	PO1, PO2
CO3	Have a healthy epistemological foundation atundergraduate level that ensures scholarship at advanced levels of learning	PO4, PO6
CO4	Talk about some of the key figures in Philosophy.	PO4, PO5,

		PO6
CO5	Analyze and appreciate texts critically, from different philosophical perspectives.	PO3, PO8
Text Books (Latest Editions)		
1	Durrant, Will. The Story of Philosophy, Simon &Schuster, 1991.	
2	Gaarder, Jostein. Sophie's World: 20th Anniversary Edition. Orion, 2015.	
References Books **(Latest editions, and the style as given below must be strictly adhered to)**		
1.	Russell, Bertrand. History of Western Philosophy. Routledge, 2016.	
2.	Gibson, John. The Philosophy of Poetry.Oxford UP, 2015.	
Web Resources		
1.	https://www.philosophybasics.com/general_whatis.html	
2.	https://archive.org/details/SophiesWorld_989/page/n5/mode/2up	

SEMESTER III

BRITISH LITERATURE-II

Subject Code	Course Title	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111AEC33	**British literature-II**	3	2	-	-	4	5	25	75	100

Learning Objectives	
LO1	To help learners analyze British Literature written from the late 18th Century to the present.
LO2	To guide them in interpreting literature as it relates to its historical, cultural, and/or political context.
LO3	To provide them with understanding of relationships between various movements (such as Romanticism, Victorianism, Modernism, and/or Postmodernism) and the literature of the period.
LO4	To closely examine literary works using critical perspectives.
LO5	To help them with applying appropriate formal conventions when writingabout literature.
UNIT	**Details**
I	Christina Rossetti- The Goblin Market T.S.Eliot - The Wasteland W.H.Auden - The Unknown Citizen
II	G. K. Chesterton - Piece of Chalk Charles Lamb- Dream Children William Hazlitt- Indian Jugglers
III	Joseph Addison - Sir Roger in London G.B.Shaw - Arms and The Man
IV	John Osborne - Look Back in Anger Jane Austen - Persuasion,
V	Wilkie Collins - The Moonstone David Green - Winged Words

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Exhibit an understanding of and appreciation for key works in British literature, as evidenced in daily workand course discussions.	PO1
CO2	Demonstrate an understanding of periodization, theme,genre, motif, and so on, in British literature.	PO1, PO2
CO3	Establish an understanding that historical, cultural, spiritual, and ethical issues, among others, shape humanexperiences and impact	PO4, PO6

	motivations.	
CO4	Respond to literature with facility, both orally and on paper, on important thematic considerations having to do with literary and historical milieu, culture, human responsibility, morality, ethics, and the manner and causes by which humans interact with one another.	PO4, PO5, PO6
CO5	Analyze and express about British literature usingstandard literary lexicon and other literary conventions.	PO3, PO8
Text Books (Latest Editions)		
1.	Renard, Virginie. The Great War and Postmodern Memory: The First World Warin Late 20 Th -Century British Fiction (1985-2000). Peter Lang AG, Internationaler Verlag Der Wissenschaften, 2013.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Brontë Charlotte, et al. Jane Eyre. Oxford University Press, 2019.	
2.	Lamb, Charles. Dream Children: A Reverie. Reed Pale Press, 1928.	
3.	Look Back in Anger, by John Osborne: Theatre Program, 1974, La MamaTheatre. 1974.	
Web Resources		
1.	Makinen, Merja. "Representing Women of Violence Agatha Christie and HerContemporary Culture." Agatha Christie, 2006, pp. 135–157., https://doi.org/10.1057/9780230598270_6.	

FUNCTIONAL ENGLISH

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111SEC37	Functional English	2	0	-	-	2	2	25	75	100

Learning Objectives	
LO1	To enable learners use appropriate phrases for performing language functions
LO2	To help them to edit, select and present information in a format/ perspective
LO3	To enable them to listen and reduce information to a point form
LO4	To help them read and to expand from points to paragraph
LO5	To enable them to predict, comprehend, infer and synthesize information

UNIT	Details
I	Definition of Functional English-Significance of Functional English
II	Four essentials of functional English: LSRW
III	Grammar
IV	Strategies to use functional English
V	Provide a dramatic play to perform which gives the students to apply functional language

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Learn to form words properly using prefixes/ suffixesand make correct use of Concord or Subject-Verb Agreement	PO1
CO2	Familiarize themselves in writing leave application, apology and request letters and points/ideas to writeparagraphs	PO1, PO2
CO3	Learn to introduce themselves and describe person, placeor situation and also gain knowledge of using prepositions of place, time and direction correctly.	PO4, PO6
CO4	Get practiced to skim and scan through a passage andread to get an overall idea, and comprehend the Passage	PO4, PO5, PO6
CO5	Cultivate the habit of newspaper reading	PO3, PO8

Text Books (Latest Editions)

1.	Susan Thurman, The Only Grammar Book You'll Ever Need: A One-Stop Sourcefor Every Writing Assignment.2011
2.	Grant Barrett, Perfect English Grammar: The Indispensable Guide to ExcellentWriting and Speaking,2013

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Jane Straus, Lester Kaufman, and Tom Stern, The Blue Book of Grammar and Punctuation: An Easy-to-Use Guide with Clear Rules, Real-World Examples, andReproducible Quizzes,2015
Web Resources	
1.	**BBC World Service. (2011) Learning English: Ø http://www.bbc.co.uk/worldservice/learningenglish/language/askaboutenglish/2 009/03/090210_aae_punc_apostrophe.shtm**

PUBLIC SPEAKING SKILLS

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111SEC37	**Public speaking skills**	2	-	-	-	2	2	25	75	100

Learning Objectives	
LO1	To help students understand the goals and benefits of public speaking
LO2	To help them recognize communication apprehension and guide them on how to reduce it
LO3	To familiarize them on how public speaking can be used to advocate or createchange
LO4	To enable learners recognize the social and historical contexts of speech, oratory,and rhetoric
LO5	To help them think and speak imaginatively and critically
UNIT	**Details**
I	What is Public Speaking?
II	Need for Public Speaking.
III	Significance and essentials of public speaking skills
IV	Techniques in acquiring the skill
V	Speaking any common topic in front of the class

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Demonstrate an understanding of the principles of publicspeaking	PO1
CO2	Recognize barriers to public speaking and identify howto avoid them	PO1, PO2
CO3	Understand how to give effective verbal and nonverbalfeedback	PO4, PO6
CO4	Learn about planning speech organization for theintended audience	PO4, PO5, PO6
	Practice effective group delivery and speech informal context.	PO3, PO8

CO5		
Text Books (Latest Editions)		
1.	Beebe, S. A., & Beebe, S. J. (2006). Public Speaking: An audience - centred approach (6th ed.). New York: Pearson	
2.	Fraleigh, D.M., &Tuman, J.S.(2009). Speak up! An illustrated guide to publicspeaking. New York: Bedford/St. Martins.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Apple, W.Streeter, L.A. & Krauss, R. M (1979). Effects of pitch and speech rate on personal attributions. Journal of Personality and Social Psychology, 37, 715-727.	
Web Resources		
1.	**Learning Outcomes | Public Speaking (lumenlearning.com) lu03_public_speaking.pdf (indianhills.edu)**	

SEMESTER IV

AMERICAN LITERATURE-II

Subject Code	Course Title	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111AEC43	American Literature-II	3	2	-	-	4	5	25	75	100

Learning Objectives	
LO1	To help learners examine the roots of American literature by focusingmultiple genres—poetry, drama, stories and novel.
LO2	To guide to explore literature that reveals and emerges from multiple perspectives such as race, gender, ethnicity, socioeconomic class and historical period.
LO3	To create an awareness of the social, historical, literary and cultural elements of the changes in American literature.
LO4	To help them explore distinct literary characteristics of American literature and analyze literary works of eminent American writers.
LO5	To inculcate a rhetorical approach to the literary study of American texts and also the conceptions, generalizations, myths and beliefs about American cultural history.
UNIT	**Details**
I	Theodore Roethke - The Meadow Mouse . Emily Dickinson - The Bird Came Down the Walk Maya Angelou – Phenomenal Women
II	Neil Simon - Barefoot in the Park Henry David Thoreau - Winter Animals
III	Ralph Waldo Emerson - The American ScholarEdgar Allan Poe - Philosophy of Composition
IV	Nathaniel Hawthorne -Young Goodman Brown. Toni Morrison – Beloved
V	Mark Twain - The Adventures of Tom Sawyer. Angeline Boulley - Firekeeper's Daughter

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the depth and diversity of American literature, keeping in mind the history and culture of the United States of America from the colonial period to the present.	PO1
CO2	Understand the social-cultural-ecological-political, historical, religious and philosophical contexts of theAmerican spirit in literature.	PO1, PO2

CO3	Evaluate the thoughts, beliefs, customs, struggles, andvisions of African American writers	PO4, PO6
CO4	Understand the American style of writing and ideologieslike Transcendentalism, corruption, pride, power and obsession along with spiritualism and Christian values.	PO4, PO5, PO6
CO5	Critically analyze American literary texts in the light of several movements in literature and understand the changing faces of texts with developments in culture. Students can compare/contrast literary works through an analysis of genre, theme, character, and other literary devices.	PO3, PO8

Text Books (Latest Editions)	
1.	Angelou, Maya. The Complete Poetry. Random House, 2015.

References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Dickinson, Emily. A Bird Came Down the Walk - Selected Bird Poems of Emily Dickinson. Read Books Ltd, 2021.
2.	Gray, Richard. A Brief History of American Literature. John Wiley & Sons, 2010. Hansberry, Lorraine. A Raisin in the Sun. Modern Library, 1995.
3.	Morrison, Toni. Beloved. Everyman's Library, 2006.
4.	Twain, Mark. The Adventures of Tom Sawyer. The Floating Press, 2009.

Web Resources	
1.	Cramer, Jeffrey S., editor. "Thoreau Describes His Contemporaries." TheQuotable Thoreau, Princeton University Press, 2011, pp. 430–38, http://dx.doi.org/10.1515/9781400838004.430.
2.	Hawthorne, Nathaniel. "The Revelation of the Scarlet Letter." The Scarlet Letter,Oxford University Press,2008, http://dx.doi.org/10.1093/owc/9780199537808.003.0025.

FILM STUDIES

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111GEC45	Film Studies	2	1	-	-	3	3	25	75	100

Learning Objectives	
LO1	Aims to train students to decode the visual messages imparted by movies.
LO2	To amplify their impacts.
LO3	To train the students to read the films they watch, both as an aesthetic work and as politically motivated.
LO4	To enabling the learners to use a various methods.
LO5	To learn touchstone method in evaluating contemporary Indian main streamcinema with World Cinema as well as Indian Classics.
UNIT	**Details**
I	Introduction, Filmic Visual: Mise-en-Sceneism.
II	Screen writing, One-line, plot, characterization, one-linescene order & treatment.
III	Film history and film genres
IV	Critical understanding of films Auteurist, Formalist, Marxist, Feminist and Post-colonialPerspectives
V	Writing film reviews and critic

The course outcome is based on the Learning Objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Learning Objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

	Course Outcomes	
Course Outcomes	On completion of this course, students will;	
CO1	Students discuss the aspects of Cinema.	PO1
CO2	Students analyze the aesthetics as well as the politics in films.	PO1, PO2
CO3	Students read and review films,	PO4, PO6
CO4	Students develop an understanding of contemporaryaesthetic trends in political, social,cultural and philosophical context	PO4, PO5, PO6
CO5	Write film scripts and reviews.	PO3, PO8

Text Books (Latest Editions)

1	Monaco, James How to Read a Film 5th ed. OUP, 2005.
2.	Bordwell, David and Thompson, Kristin, Film Art: an Introduction, 7th ed. McGraw-HillCo., 2004.
3	Cook, David A., A History of Narrative Film, 4th ed. W.W.Norton, 2004.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Kawin, Bruce, How Movies Work. University of CaliforniaPress, 1992.
2.	Nelken, Jill, Introduction to Film Studies, 5th ed. Routledge,2011.
3.	Feild, Syd, Screenplay: The Foundations of Screenwriting. RHUS, 2005.

TRANSLATION: BASIC CONCEPTS AND PRACTICE

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111GEC46	**Translation: basic concepts and practice**	2	1	-	-	3	3	25	75	100

Learning Objectives	
LO1	To enable learners get an overview of translation concepts
LO2	To gain insight into the evolution of Translation in global perspective and itsdevelopment in the domain of language and literature.
LO3	Gain exposure to some basic concepts related to Translation.
LO4	Familiarize with some Important Institutions of Translation and their contributions
LO5	Help learners get a knowledge on Translation Studies
UNIT	**Details**
I	Origin and Development of Translation in Global perspective
II	Origin and Development of Translation and its Present Scenario.
III	Important Institutions of Translation (some important Translators and their works)
IV	Basics of Translation and Translation Studies – An Introduction
V	Objectives and Importance of Translation

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Be able to explain the growth and development ofTranslation and some basic concepts related to it.	PO1

CO2	Be ready to discuss and define Translation Studies.	PO1, PO2
CO3	Familiarize and learn about the different types ofbooks and the need for their translation.	PO4, PO6
CO4	**Gain exposure to the field of translation studiesand explore the dynamics of the field.**	PO4, PO5, PO6
CO5	Learn about the use of translation and the methods ofassessing the written concepts of translation.	PO3, PO8
Text Books (Latest Editions)		
1.	Mona Baker, Kirsten Malmkjær, Routledge Encyclopedia of Translation Studies,(1998), Routledge Taylor and Francis Group, London and New York	
2.	Yves Gambier, Luc van Doorslaer, Handbook of Translation Studies, (2011), JohnBenjamins Publishing, Amesterdam and Philadelfia	
3.	Susan Bassnett , Translation Studies, (2013), Routledge Taylor and Francis Group,London and New York.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Carmen Millán, Francesca Bartrina, The Routledge Handbook of TranslationStudies, (2013), Routledge Taylor and Francis Group, London and New York	
Web Resources		
1.	*https://mu.ac.in/wp-content/uploads/2022/06/PDF-of-Translation-Studies.pdf*	

SEMESTER V

ASPECTS OF LANGUAGE &LINGUISTICS

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111AEC51	**Aspects Of Language & Linguistics**	3	2	-	-	4	5	25	75	100

Learning Objectives	
LO1	To help learners gain knowledge of linguistic research methods and of different theories of language
LO2	To enable them gain specialized knowledge related to other areas of linguistic research and applications
LO3	To help them gain detailed knowledge of the history, traditions and distinctive character of the academic field of English linguistics.
LO4	To familiarize them with the ability to use this knowledge to analyze problems in both other academic settings and work contexts.
LO5	To enhance competence in humanities that includes the ability to think historically and analytically about language, literature, culture and society.
UNIT	**Details**
I	Introduction to study of language
II	Theory of Communication-General Semiotics- Linguistics, Sign, Language & Culture- Language & Writing.
III	Introduction to Saussurian Structuralism-Introduction to Phonology & Morphology- Syntax & Semantics
IV	Computing in Linguistics & Phonetics-Introductory Reading.
V	Linguistic Changes-English Language Varieties- Idiolect, Dialect, Pidgin & Creole- Bilingualism/Multilingualism- Psychology of Language-Natural Learning Process-Linguistics: An Introduction of Language & Communication-Structural Aspects of Language Change-Course in General Linguistics-The Study of New Linguistic Varieties.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Be able to analyze a wide range of problems relatingto linguistic scholarship and research ethics.	PO1
CO2	Apply the acquired skills in both academic and work contexts to plan and complete extensive research projects involving the gathering and systematizing of a substantial amount of information	PO1, PO2

CO3	Communicate the results of independent research and gain mastery of advanced linguistic terminology	PO4, PO6
CO4	Communicate about academic issues related to languagesand linguistics, both with specialists and the general public.	PO4, PO5, PO6
CO5	Contribute to new thinking and innovation processes within the area of linguistic specialization.	PO3, PO8
Text Books (Latest Editions)		
1.	Eco, Umberto. A Theory of Semiotics. Indiana University Press, 1979.	
2.	**Harley, Trevor A. The Psychology of Language. Psychology Press, 2013.**	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	McLuhan, Eric, and Marshall McLuhan. Theories of Communication. Peter Lang Pub Incorporated, 2011.	
2.	Sakoda, Kent, and Jeff Siegel. Pidgin Grammar. Bess Press, 2003.	
3.	**Bloomfield, Leonard. Language. University of Chicago Press, 1984.**	
4.	Saussure, Ferdinand. Course in General Linguistics. Open Court Publishing, 1986. Yule, George. The Study of Language. Cambridge University Press, 2010.	

WOMEN'S WRITING IN ENGLISH AND IN TRANSLATION

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111AEC53	**Women's Writing In English And In Translation**	4	1	-	-	4	5	25	75	100

Learning Objectives	
LO1	To familiarize learners with how unique experiences of women influence theirwritings
LO2	To help them analyze representations of women in literature.
LO3	To enable learners to be familiar with various contexts that influence the representation of women in literature.
LO4	To enable them apply appropriate formal conventions when writing aboutliterature
LO5	To help them in understanding how and on what grounds women's writing canbe considered as a separate genre.
UNIT	**Details**
I	Toru Dutt - Our Casuarina Tree. Elizabeth Browning - How do I love thee? Judith Wright – Eve to the Daughter
II	Gwendolyn Brooks - Boy Breaking Glass. Avvaiyar - Worth Four Crores (Give, Eat &Live) On Reading Haiku
III	Virginia Woolf - A Room Of One's Own. Clarissa Pinkola Estés - Women Who Runs With Wolves
IV	Kate Chopin –Awakening Carol Churchill – Top Girls
V	Margaret Atwood - Surfacing- Ambai - In a forest, A deer. N. Kalyan Vaasanthi - Breaking Free.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Examine and appreciate the role played by sociocultural-economic contexts in defining women.	PO1
CO2	Be enlightened about the issues and concerns of thewomen writers of the developed and developing countries.	PO1, PO2
CO3	Understand and appreciate the representation of femaleexperience in literature	PO4, PO6

CO4	Gain awareness of class, race and gender as socialconstructs and how they influence women's lives.	PO4, PO5, PO6
CO5	Be equipped with analytical, critical and creative skills tointerrogate the biases in the construction of gender and patriarchal norms.	PO3, PO8

Text Books (Latest Editions)	
1.	Gilbert, Sandra M., and Susan Gubar. The Norton Anthology of Literature byWomen. W. W. Norton, 2007.
2.	Olson, S. Douglas. The "Homeric Hymn to Aphrodite" and Related Texts. Walterde Gruyter, 2012.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Estés, Clarissa Pinkola. Women Who Run with the Wolves. 1995.
2.	Holmström, Lakshmi. In A Forest, A Deer. OUP India, 2012.
3.	Jain, Jasbir, and Avadhesh K. Singh. Indian Feminisms. 2001.
4.	Woolf, Virginia. A Room of One's Own. Renard Press Ltd, 2020.
Web Resources	
1.	"Ambai (C. S. Lakshmi) b. 1944." Name Me a Word, Yale University Press, 2019,pp. 259–67, http://dx.doi.org/10.12987/9780300235654-032.

INDIAN WRITING INTRANSLATION

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111AEC54	Indian Writing In Translation	3	2	-	-	4	5	25	75	100

Learning Objectives	
LO1	To introduce the students to the polyphony of modern Indian writing intranslation.
LO2	To make them understand the multifaceted nature of cultural identities in thevarious Indian literatures through indigenous literary traditions.
LO3	To compare literary texts produced across Indian regional landscapes to seeksimilarities and differences in thematic and cultural perspectives.
LO4	To explore images in literary productions that express the writers sense of theirsociety.
LO5	To encourage the students to explore texts outside of the suggested reading liststo realize the immense treasure trove of translated Indian literary works.
UNIT	**Details**
I	Ilango Adigal - The book of Vanci. Silappathikaaram Kurunthogai (Five verses for oneTinai
II	Rabindranath Tagore - Where the mind is without fear Sarojini Naidu - The Soul's Prayer. Nissim Ezeikel - The Railway Clerk. Arun Kolatkar - An Old Woman
III	Theory of Value A collection of Readings-(33-40) Chapter 6-Bharata Natya Shastra (100-118)-Hindu Viewof Life-Vanishing Landmarks
IV	Anon E. Mouse - How the Raja's son won the Princess Labam. Sunil Gangopadhyay - Arjun
V	Badal Sircar - Evam IndrajitGirish Karnad – Tughlaq

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	**Understand the multifaceted nature of cultural identities in the various Indian literatures through indigenous literary traditions.**	PO1
CO2	**Compare literary texts produced across Indian regional landscapes to seek similarities and differences in thematic and cultural perspectives.**	PO1, PO2
CO3	**Learn to explore images in literary productions that express the writers' sense of their society.**	PO4, PO6

CO4	**Explore texts outside of the suggested reading lists to realize the immense treasure trove of translated Indian literary works.**	PO4, PO5, PO6
CO5	**Be familiar with concepts such as modernism, regionalism, the contemporary, and representations of history, class, and gender in modern Indian writingin translation.**	PO3, PO8

Text Books (Latest Editions)	
1.	Modern Indian Writing in Translation, Edited by Dhananjay Kapse, 2016
2.	Short Fiction from South India, Edited by Subashree Krishnaswamy and K. Srilata, 2007
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	A Clutch of Indian Masterpieces, Edited by David Davidar, 2016.
2.	Changing the Terms: Translating in the Postcolonial Era, Edited by Sherry Simon and Paul St. Pierre, 2000
3.	100 Great Indian Poems by Abhay K. Bloomsbury, 2019
Web Resources	
1.	Modern Indian Writing in Translation - Course (nptel.ac.in).

NON- MANDATORY ELECTIVE PAPER – VIII - WRITING FOR MEDIA

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111DSC55	**Writing For Media**	3	2	-	-	3	5	25	75	100

Learning Objectives	
LO1	To learn the basics of journalistic reporting, writing, and editing.
LO2	To acquire basic skills in other forms ofwritten communication.
LO3	To learn how to use technology
LO4	To reach, communicate with and increase your audience.
LO5	To explore various branches of journalism.

UNIT	Details
I	Introduction to types of media, print electronic , digital writing, significanceof media and social benefits.
II	Writing for the media-the basic principles-Style of media writing.
III	Types of media writing-1 News Reports-Interviews-Commentaries.
IV	Types of media writing-2 Reviews of Art, Literature, Film-Reporting Cultural Events.
V	Dia writing- journalism in education, tabloid, investigative,developmental and photography.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Recall the basics of reporting and writing for printmedia.	PO1
CO2	Report news keeping values and qualities of a goodreporter.	PO1, PO2
CO3	Apply theoretical knowledge in writing reports, commentaries, reviews.	PO4, PO6
CO4	Distinguish between the different styles of Journalismand compose specific articles.	PO4, PO5, PO6
CO5	Apply various knowledge in regard to variousbranches of journalism.	PO3, PO8

	Text Books (Latest Editions)
1.	Pickering, Ian. Writing for News Media: The Story Teller's Craft. Routledge, 2018.
2.	Flak, Vincent F. Dynamics of Media Writing: Adapt and Connect. Sage, 2018.
3.	Batty, Craig and Cain, Sandra. Media Writing: A Practical Introduction. Red GlobePress, 2016.

ART AND LITERARY AESTHETICS

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111AEC56A	**Art And Literary Aesthetics**	4	2	-	-	4	6	25	75	100

Learning Objectives	
LO1	To introduce the multi disciplinarity of Art and Literary Studies.
LO2	To gain an understanding of various movements in art history.
LO3	To help students find relevant and associative ideas.
LO4	To engage with works of art that directly refer to literary works and alsodraw inspiration from from it.
LO5	To recognize how all forms of art is part of a continuum.
UNIT	**Details**
I	Literature and visual arts - essays.
II	Romanticism through coleridge and delacroix
III	Pre-Raphaelite movement - D.G. Rosetti's Prosperine (painting and Poem)
IV	Post-Impressionism - Amritya shergill's Ancient story Teller painting andvirginia woolf's The Waves (novel)
V	Expressionism - Munch- Scream(painting)and Kafka- Metaphorphosis (Novella)

The course outcome is based on the Learning Objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Learning Objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.
Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

	Course Outcomes	
Course Outcomes	On completion of this course, students will;	
CO1	The student will be able to engage with literature in abroader, educated perspective.	PO1
CO2	The student will be able to think with greateroriginality and independence about the complex	PO1, PO2

	Inter relationship between different art forms.	
CO3	The student will be trained to engage sensitivelyand intelligently in new readings of literature.	PO4, PO6
CO4	The course develops an understanding of the co- relation between literature, film, music and paintingand encourages ways of reading and seeing which deliver insights into literary texts.	PO4, PO5, PO6
CO5	Initiate students to implement the multidisciplinary scopeof art and literary studies.	PO3, PO8

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1. Herbert Read – extract from The Meaning of Art (pg 17-48) Pelican Books,1959.

Web Resources

1. Astor, Dave. Music in Literature.2 Apr. 2013, www.huffpost.com/entry/music-in-literature_b_2590404 .
2. Benjamin, Elizabeth and Sophie Corser. ‑INTRODUCTION Literature and Art: Conversations and Collaborations‖ MHRA Working Papers in the Humanities, 9 (2015) http://www.mhra.org.uk/pdf/wph-9-1.pdf
3. Berger, John. Ways of Seeing. Penguin 1972.http://waysofseeingwaysofseeing.com/ways-of- seeing-john-berger- 5.7.pdf

INTRODUCTION TO COMPARITIVE LITERATURE

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111DSC56B	**INTRODUCTION TO COMPARITIVE LITERATURE**	3	0	0	0	3	5	25	75	100

Learning Objectives	
LO1	To attain a broad knowledge of various literary traditions bothin their specificity and interrelation.
LO2	To interpret a literary text or other cultural artifact in a non-native target language and to develop advanced skills in order to compare texts from variety of different traditions, genres, periods and areas.
LO3	To cultivate a complex, trans disciplinary understanding and appreciation of literary texts from a variety of different traditions, geners, periods, and areas.
LO4	To develop the skills to move among and between diverse cultures, including on-site research and travel abroad as meansof participation in cultural.
LO5	To enable the students to produce sophisticated oral andwritten argumentations on literary and cultural topics in comparative contexts.
UNIT	**Details**
I	Definition and Scope, National Literature, Comparative Literature, General Literature, World Literature, The Frenchand American Schools of Comparative Literature.
II	Influence and Imitation- Periodization Movement, GenreStudies, Thematology
III	Literature and other disciplines, Literature and other Arts
IV	Comparative Study of Shelley and Bharathi, Selectedpoems of Shelley- *Ode toLibert ,Queen Mab, Love's Philosophy.* Selected poems of Subramaniya Bharathi-*Bharath Country, Worship of Sun, KannanMyServant.*
V	Comparative study of Vairamuthu's *KallikattuIthikasam* and Ernest Hemingway's' *The Old Man and the Sea'*

The course outcome is based on the Learning Objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Learning Objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Read critically literary and cultural textsin a range of genres and media (novels,poetry, drama, film, monuments, political discourse, popular culture, audio, etc.)	PO1
CO2	Demonstrate knowledge of historical, linguistic, and cultural contexts of textsas they are produced and received across national boundaries and in response to the dynamics of global movements and crises creating dyamic intersections of power, peoples, and aesthetic practices.	O1, PO2
CO3	Use critical terminology and interpretive methods drawn from specific 20th –and 21stcentury comparative and critical theoriesfrom multiple disciplines.	PO4, PO6
CO4	Recognize the different aims, formal constraints, rhetorical strategies, and ideological underpinnings at stake in different literary genres through texts intwo or more foreign languages.	PO4, PO5, PO6
CO5	Master a variety of theoretical and methodological approaches to textsand adopt them for comparative textual studies able to go beyond simply mechanical applications.	PO3, PO8

Text Books (Latest Editions)

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Ulrich Weisstein: Comparative Literature and other
2.	Arts Wellek& Warren: Theory of Literature
3.	Part II S.S.Prawar :Comparative Literatures

Course Code	Course Title	L	T	P	C
231—DSC54-	**Disaster Management**	**4**	**0**	**0**	**3**

AIM: Disaster management aims to reduce, or avoid the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery.

Course Objectives:

1. To provide students an understanding the need for studying the disaster management
2. Develop an understanding about the various types of disasters.
3. To expose students to the risk and vulnerability analysis
4. To create awareness about disaster prevention and risk reduction
5. To establish relationship between disasters and developments.
6. To understand Rehabilitation, Reconstruction and Recovery in the event of Disaster
7. To gain knowledge on Climate Change Adaptation and IPCC Scenario and Scenarios in the context of India.

Course Outcomes:

CO1: Understand the need and significance of studying disaster management

CO2: Understand the different types of disasters and causes for disasters.

CO3: Gain knowledge on the impacts Disasters on environment and society

CO4: Study and assess vulnerability of a geographical area.

CO5: Students will be equipped with various methods of risk reduction measures and risk mitigation.

CO6: Understand the role of Information Technology in Disaster Management

CO7: Understand Geographical Information System applications in Disaster Management

Content of Course
UnitI: Introduction to Disasters
ChapterNo.1 Disaster:Concept,Meaning,andDefinition **ChapterNo.2**HistoryofMajorDisasterEventsinIndia **ChapterNo.3**TypesofDisasters–NaturalDisasters:Famine,Drought,Flood,Cyclone, Tsunami, Earthquake
UnitII: Disaster Mitigation and Disaster Management
ChapterNo.4 Man-madeDisasters:Riots,Blasts,Industrial,Militancy **ChapterNo.5**Profile,FormsandReductionofVulnerability **Chapter No. 6** Disaster Mitigation: Concept and Principles
UnitIII: Impact of Disaster
ChapterNo.7 DisasterManagement:ConceptandPrinciples **ChapterNo.8**Pre-disaster-PreventionandPreparedness **ChapterNo.9**Physical,Economic,Social,Psycho-socioAspects,EnvironmentalImpacts
UnitIV: Disaster Process and Intervention
ChapterNo.10 DuringDisaster-RescueandRelief **ChapterNo.11**Post-disaster-RehabilitationandReconstruction **ChapterNo.12**VictimsofDisaster-Children,Elderly,andWomen **ChapterNo.13**Displacement-Causes,Effectsand Impact
UnitV: Disaster Intervention
ChapterNo.14 MajorIssuesandDynamicsintheAdministrationofRescue,Relief, Reconstruction and Rehabilitation **ChapterNo.15**ComponentsofRescue,Relief,Reconstruction; Rehabilitation **ChapterNo.16**DisasterPolicyinIndia;DisasterManagementAuthority-NDMA, SDMA, DDMA; Disaster Management Act, 2005

Key*Words:*Disaster,DisasterMitigation,DisasterManagementandDisasterProcess

References:

AnilSinha(2001),DisasterManagement-

LessonsDrawnandStrategiesforFuture.New Delhi, Jain Publications.

Backer,C.W.andChapman,W.(ed.).(1969),ManandSocietyinDisasters,New Delhi,

Clarke,J.I.,PeterCurson,et.al.(ed.)(1991),PopulationandDisaster,Oxford,Basil Blackwell Ltd.

Cuny,Frederick(1984),DisastersandDevelopment,Oxford,OxfordUniversityPre ss. Disaster Management Act 2005

Garb,S.and Eng. E(1969),Disasters HandBook, NewYork, Springer.

Gupta, M.C, L.C. Gupta, B. K. Tamini and Vinod K. Sharma (2000), Manual on Natural Disaster Management in India, New Delhi, National Institute of Disaster Management. Hoff,A. (1978), Peoplein Crisis-Understanding and Helping, California, AddisonWesley.

Maskrey, Andrew (1989),Disaster Mitigation: A Community Based Approach, Oxford, Oxfarm.

Narayan, Sachindra (ed.) (2000), Anthropology of Disaster Management, New Delhi, Gyan Publishing House.

Nidhi G Dhawan (2014), Disaster Management and Preparedness, NewDelhi, Jain Publications.

Parasuraman,S.and Unnikrishnan,P.V.(2000),India Disasters Report:Towards Policy Initiative, New Delhi, Oxford University Press.Satendra, K.J.AnandhaKumarandV.K.Naik(2013),India'sDisasterReport,NewDelhi, National Institute of Disaster Management.

Singh,R.B.(ed.)(2000),DisasterManagement,NewDelhi,RawatPublications.

Sinha,P.C.(ed.)(1998),Encyclopedia of Disaster Management (Vol.1-10),NewDelhi, Anmol Publications.

Tata Institute of Social Sciences(2002).Special Volume on Disaster Management, Indian Journal of Social Work, Vol.63, Issue 2, April.

SEMESTER VI

Literary critcism

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111AEC62	Literary critcism	4	2	-	-	4	6	25	75	100

Learning Objectives		
LO1	To Introduce learners to the basics of Literary Criticism	
LO2	To enable learners to widen their knowledge of literary texts and focus on their importance	
LO3	To empower learners to write a critical appreciation	
LO4	To ingrain the minds towards creative writing, appreciation, critical thinking and critical analysis	
LO5	To help them accentuate expression of thoughts and views for critical appreciation and judgmental reviews	
UNIT	**Details**	
I	Poetics-Mimesis, Catharsis, Hamartia, Parts of Tragedy, Plot, TragicHero.	
II	Preface to Lyrical Ballads-The romantic creed, Definition of Poetry, Diction &Language. Fancy and Imagination, Poetic Genius.	
III	The Concept of Poetry-Defence of Poetry -Classicism, Touchstone Theory, GrandStyle, High Seriousness etc	
IV	Indian Aesthetics, Movements and Concepts, Tinai, Rasa, Dhwani, Alankara, All ISMS, Object Correlative, Negative Capability,Seven Types of Ambiguity	
V	William Blake - Tyger . G K.Chesterton - Running After one's Hat Katherine Mansfield - A Cup of Tea	
Course Outcomes	On completion of this course, students will;	
CO1	Articulate and discuss the latest developments in the specific field of practice; Communicate effectively in oral and in written English; and recognize the need for, and prepare to engage in lifelong learning.	PO 1
CO2	Apply knowledge of contemporary issues and principlesof ethics relevant to professional practice;	PO1, PO2
CO3	Function effectively as an individual, and as a member orleader in diverse teams and in multidisciplinary settings;	PO4, PO6
CO4	Recognize the need for, and prepare to engage in lifelong learning.	PO4, PO5, PO6
CO5	Demonstrate a service orientation in one's profession;	PO3, PO8
Text Books (Latest Editions)		
1.	Dobie, Ann B. (2009). Theory into Practice: An Intro to Literary Criticism.Australia: Wadsworth Cengage Learning.	
2.	Fry, Paul H. (2013). Theory of Literature. New Haven: Yale University Press.	

FUNDAMENTALS OF ACADEMIC WRITING

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111DSC64B	**FUNDAMENTALS OF ACADEMIC WRITING**	3	0	-	-	3	5	25	75	100

Learning Objectives	
LO1	To attain broad knowledge.
LO2	To understand various styles of sentence pattern.
LO3	To cultivate a coherent and associative thinking ability to exhibitwriting skills.
LO4	To develop the ability to structure Essays.
LO5	To enable the students to learn copy- editing.
UNIT	**Details**
I	Writing as a Process -Pre-writing strategies, while- writing strategies, post-writing strategies ;developing writing through extended practices; developingreflective abilities & meta-awareness about writing.
II	Sentence Skills -Sentence structure; S-V agreement; modifiers; sentence fragments; commas coordination; subordination; parallelism; making complete, logical comparisons; avoiding wordy phrasing;V-T sequence.
III	Structuring Paragraphs -Topic sentence; supporting details; unity & coherence; Methods of development (Examples, comparison & contrast, process, definition,cause& effect, division & classification)
IV	Structuring Essays - Introduction; development of body; conclusion; description,narration, exposition; argumentation.
V	Content editing and substantive editing: Proofreading, copy-editing (involves anintensive check of word choice, style & sentence structure, comprehension and terminologies) & substantive editing (to resolve content ambiguity, to eliminate language errors, to improve structure, and to enhance the overall comprehension of the paper); features of written English

The course outcome is based on the Learning Objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Learning Objectives and Course outcomes.

The blooms taxonomy verbs will be given as a separate annexure for your reference.Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	To design the process writing	PO1
CO2	To express sentence skills.	PO1, PO2
CO3	To structure and develop paragraphs through techniques	PO4, PO6
CO4	To compose academic essays	PO4, PO5, PO6

CO5	To distinguish between content editing and substantiveediting.	PO3, PO8
Text Books (Latest Editions)		
1.	Zemach, Dorothy E. & Rumisek, Lisa A. *Academic Writing from Paragraph toEssay*. London: Macmillan	
2.	Langan, John. 2001. *Sentence Skills with Readings*. Boston: McGrawHill.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Hartley, James. 2008. *Academic Writing and Publishing: A Practical Handbook*. London: Routledge.	
2.	Bailey, Stephen. 2003. *Academic Writing: A Practical Guide for Students*. London: Routledge Falmer.	

MASS COMMUNICATIONAND JOURNALISM

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111DSC56	**Mass Communication And Journalism**	3	2	-	-	3	5	25	75	100

Learning Objectives	
LO1	To impart the basic knowledge of Mass communication & Journalism and relatedareas of studies.
LO2	To develop the learner into competent and efficient Media & EntertainmentIndustry ready professionals.
LO3	To empower learners by communication, professional and life skills.
LO4	To develop the ability to structure Essays.
LO5	To enable the students to learn copy- editing.
UNIT	**Details**
I	Mass Communication in India, Print Medium, Audio-Visual Media, Other Media, Ethics, press laws
II	News Agencies, News and its Dissemination, Featureand Column Writing, Editorials, reporting
III	Advertising, Illustrations.
IV	House and Trade Journals, Starting of Newspapers andPeriodicals.
V	Preparation for a Career, Research in Journalism,Planning and Publicity Campaigns.

The course outcome is based on the Learning Objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Learning Objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Students would be able to enhance understanding of the origin and of the print, electronic and web media. Electronic and web media.	PO1
CO2	Students would be able to inculcate the knowledge of growth of print, electronic and web	PO1, PO2
CO3	Students would be able to understand the significance of speech communication.	PO4, PO6
CO4	Students explore journals.	PO4, PO5, PO6
CO5	Students would find research gaps.	PO3, PO8

ENGLISH FOR COMPETITIVE EXAMINATIONS

Subject Code	Course Title	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23111SEC65	**English For Competitive Examinations**	4	2	-	-	3	6	25	75	100

Learning Objectives	
LO1	To develop the students intellectual, personal and professional abilities.
LO2	To acquire basic language skills listening, speaking, readingand writing for effective communication.
LO3	To develop confidence in getting job opportunities.
LO4	To provide awareness to the students about the various types of jobs offered in both in the Central and State Government.
LO5	To develop competitive skills through various types of objective tests.
UNIT	**Details**
I	Parts of Speech, Direct and Indirect Speech, Reading Comprehension, Letter Writing.
II	Tenses, Active and Passive Voice, Expansion of Proverbs, Essay Writing.
III	Gerund, Infinitives, Idioms and Phrases, Degrees of Comparison, HintsDevelopment, Email Writing, Report Writing.
IV	Homonyms, Question Tags, Simple, Complex, Compound, Jumbled Sentences, Dialogue Writing.
V	Determiners, Kinds of Sentences (Assertive, Imperative, Interrogative and Exclamatory), Capitalization, Punctuation, Spotting Errors, CV Writing andCover letter.

The course outcome is based on the Learning Objectives. Each course objective will have a course outcome. This will elucidate what the student will acquaint once he completes that particular unit. There will be equal number of Learning Objectives and Course outcomes.
The blooms taxonomy verbs will be given as a separate annexure for your reference.Each course outcome should be mapped with the POs.
The mapping of each CO can be done with any number of POs.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Gain knowledge of English language to face thechallenges in Competitive Examinations.	PO1
CO2	Acquire skills in vocabulary usage and grammar.	PO1, PO2
CO3	Acquire skills in logical reasoning, question erroranalysis and correct usage of words.	PO4, PO6
CO4	Build confidence in getting job opportunities.	PO4, PO5, PO6
CO5	Aware of the various types of jobs offered in both inthe Central and State Government.	PO3, PO8
Text Books (Latest Editions)		
1.	English for Competitive examinations-.P.Bhatnagar & Rajal Bhargava	
2.	Remedial Grammar-F.T.Wood	

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

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SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF ENGLISH

2023-2024

EMPLOYABLITY

SKILL DEVELOPMENT

ENTREPRENEURSHIP

EMPLOYABLITY/ SKILL DEVELOPMENT

MA ENGLISH – REGULATION 2023

COURSE STRUCTURE

First YearSemester-I

COURSE CODE	LIST OF COURSES	L	T	P	C
23211AEC11	English Poetry	5	1	0	4
23211AEC12	English Drama	5	1	0	4
23211AEC13	English Fiction	5	1	0	4
23211GEC14	Indian Writing in English	5	0	0	4
23211DSC15_	Discipline specific Elective-I	5	0	0	3
23211RMC16	Research Methodology	2	0	0	2
		27	**3**	**0**	**21**

Semester-II

	List of Courses	L	T	P	C
23211AEC21	American Literature	4	1	0	4
23211AEC22	Shakespeare Studies	4	1	0	4
23211AEC23	Post-colonial Theory and Literature	4	1	0	4
23211GEC24	Approaches to English Language Teaching	4	0	0	4
23211DSC25_	Discipline specific Elective-II	4	0	0	3
23211SEC26	Industry Training & Expectations	3	0	0	3
23211SEC28	Internship* / Tourism	2	0	0	2
23211BRC27	Participation In Bounded Research	2	0	0	2
		27	3	**0**	**26**

Semester-III

COURSE CODE	**LIST OF COURSES**	L	T	**P**	**C**
23211AEC31	Contemporary Literary Criticism	4	1	0	4
23211AEC32	Canadian Studies	4	1	0	4
23211AEC33	Literature of the Marginalized in India	4	1	0	4
23211SEC34	Translation Studies	3	1	0	3
23211DSC35_	Discipline specific Elective-III	4	1	0	3
23211SEC36	Leadership Skills	3	0	0	3
23211SEC37	Internship / Industrial Activity	3	0	0	3
		25	5		**24**

Semester-IV

COURSE CODE	**LIST OF COURSES**	L	T	**P**	**C**
23211AEC41	Twenty First Century Millennial Literature and Culture	4	1	0	4
23211AEC42	Subaltern Studies	4	1	0	4
23211AEC43	Film and Media Studies	4	1	0	3
23211GEC44	English for Careers	4	1	0	3
23211PRW45	Project	0	0	5	4
23211SEC46	English Teaching methods, Aptitude, Attitude for competitive examination	4	1	0	2
		20	5	**5**	**20**
	Total credit				**91**

Credit distribution

SEM	**AEC**	**SEC**	**GEC**	**DSC**	**Research**	**Total Credits**
I	12	-	4	3	2	21
II	12	5	4	3	2	26
III	12	9	-	3	-	24
IV	11	2	3	-	4	20
Total	47	16	11	09	**08**	**91**

Discipline Specific Electives

Semester	Discipline Specific Elective Courses
I	23211DSC15A- Theatre Art
	23111DSC15B- Technical Writing
II	*23111DSC25A*- A Glimpse Of Nobel Laureates
	23111DSC25B- Technology In Teaching English
III	23111DSC35A - Functional English
	23111DSC35B - Employability skills

SEMESTER I

CORE -1 ENGLISH POETRY – From Chaucer to 20th Century

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23211AEC11	**English poetry**	5	1	-	-	4	6	25	75	100

Learning Objectives	
LO1	To familiarize students with English Poetry starting from Medieval England to 17th Century.
LO2	To focus on the evolution of Poetic forms such as Sonnet, Ballad, Lyric, Satire, Epic etc.
LO3	Good comprehension of History of English literature is enhanced
LO4	Differentiation among the various stages of English could be identified by students.
LO5	Critical approaches towards various literary forms can be learnt.

Details

UNIT I Middle English Poetry-Chaucer: "The General Prologue": Pardoner, The Nun: Doctor, Friar

UNIT II Elizabethan Poetry- Spenser: "Epithalamion"
Donne: "A Valediction: Forbidding Mourning""The Canonization"

UNIT III Seventeenth Century Poetry- John Milton “Paradise Lost” Book IX
Marvell: "To His Coy Mistress"

UNIT IV
Gray "Elegy"
Wordsworth: Tintern Abbey

UNIT V Dylan Thomas: "Do Not Go Gentle Into That Good Night"
Seamus Heaney:"Digging"
Carol Ann Duffy: "Standing Female Nude"

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Gain ideas about the old English writing style.	PO1, PO2
2	Acquire knowledge about various forms of poetry during different centuries.	PO5,PO6
3	Evaluate various poets as representatives of their periods	PO7
4	Trace the evolution of various literary movements	PO8

5	Justify British Poetry as an aesthetic record of the societies concerned	PO9, PO10
Text Book		
1	1973, The Oxford Anthology of English Literature Vol. I. The Middle Ages Through the 18th century. OUP, London	
2	Standard editions of texts	
Reference Books		
1.	T.S. Eliot, 1932, "The Metaphysical Poets" from Selected Essay; Faber and Faber limited, London.	
2.	H.S. Bennett, 1970, Chaucer and the Fifteenth Century, Clarendon Press, London.	
3.	Malcolm Bradbury and David Palmer, ed., 1970 Metaphysical Poetry, Stratford - upon – Avon Studies Vol. II, Edward Arnold, London.	
4.	William R. Keats, ed., 1971, Seventeenth Century English Poetry: Modern Essays in Criticism, Oxford University Press, London.	
5.	A.G. George, 1971, Studies in Poetry, Heinemann Education Books Ltd., London.	
6	David Daiches, 1981, A Critical History of English Literature Vols. I &II., Secker &Warburg, London.	
7	Thomas N. Corns, ed., 1993, The Cambridge Companion to English Poetry: Donne toMarvell, Cambridge University Press, Cambridge.	
	Web Resources	
1.	http://www.english/.org.uk/chaucer/htm	
2.	https://www.britannica.com/topic/The-Canonization	
3.	https://www.worldhistory.org/Elizabethan_Theatre/https://www.britannica.com/topic/Paradise-Lost-epic-poem-by-Milton	
4.	https://www.britannica.com/topic/Absalom-and-Achitophel	
5.	https://www.cs.mcgill.ca/~rwest/wikispeedia/wpcd/wp/m/Modernist_poetry_in_English.htm	

CORE III - ENGLISH FICTION

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23211AEC13	English Fiction	5	1	-	-	4	4	25	75	100

Learning Objectives	
LO1	To familiarize the students with the origin and development of the British Novelup to the 20th Century.
LO2	The contents of the paper are meant to throw light on various concepts andtheories of the novel.
LO3	To understand the social background base on the prescribed novels.
LO4	Identifying and differentiating various forms of novels.
LO5	Trying hands in writing a piece of work on their own.

Details

UNIT I - Allegorical Novel and Satire John Bunyan The Pilgrim's Progress
Jonathan Swift Gulliver's Travels

UNIT II - The New World Novel : RobinsonCrusoe: Tristram Shandy.

UNIT III - Middle Class Novel of Manners **:**Jane Austen-Emma

UNIT IV - Women's Issues **:** Charlotte Bronte- Jane Eyre

UNIT V - D.H.Lawrence :The Rainbow

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Gain wide knowledge about different types of novels.	PO1, PO10
CO2	Learn the art of writing different forms ofnovel with the learned notions.	PO2, PO3
CO3	Explore Social, domestic and gothic novels.	PO4, PO5
CO4	Assess philosophical and political underpinnings of Victorian morality, anti Victorian realities and the aesthetic movement.	PO4, PO5, PO6
CO5	Infer themes relating to the turn of the century events through close reading of text.	PO7, PO8,PO10

Text Books (Latest Editions)	
1.	Wayne C. Booth, 1961, The Rhetoric of Fiction, Chicago University Press, London.
2.	F.R. Leavis, 1973, The Great Tradition, Chatto&Windus, London.
References Books **(Latest editions, and the style as given below must be strictly adhered to)**	
1.	Ian Watt, 1974, Rise of the English Novel, Chatto&Windus, London.
2.	Frederick R Karl, 1977, Reader's Guide to the Development of the English Novel till the 18th Century, The Camelot Press Ltd. Southampton.
3.	Arnold Kettle, 1967, An Introduction to English Novel Vol. II, Universal BookStall, New Delhi.
4.	Raymond Williams, 1973, The English Novel: From Dickens to Lawrence, Chatto&Windus, London.
5.	Ian Milligan, 1983, The Novel in English: An Introduction, Macmillan, HongKong.
Web Resources	
1.	http://en.wikipedia.org/wiki/English_literature
2.	http://en.wikipedia.org/wiki/novel
3.	https://www.britannica.com/art/picaresque-novel
4.	https://www.britannica.com/art/novel-of-manners
5.	https://www.britannica.com/topic/Jane-Eyre-novel-by-Bronte

ELECTIVE I -THEATRE ART

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23211DSC15A	Theatre art	5	0	0	-	3	4	25	75	100

Learning Objectives	
LO1	To introduce the learners to the literary aspect of dramas.
LO2	To familiarize Theatre as an art form.
LO3	To introduce the concepts of directing and stage management.
LO4	To inculcate in the students the role of Theatre in society.
LO5	To familiarize the students with the components of acting.

Details

UNIT I - Drama as a performing art, Relation between drama and theatre, The role of theatre,The need for permanent theatres.

UNIT II - Greek theatre, Shakespearean theatre, The Absurd theatre, The Epic theatre, The Multipurpose theatre, Designing for a particular theatre, The Eastern theatre - Folk theatre, urban theatre, third theatre, other theatres in vogue.

UNIT III - Fundamentals of Play directing: Concept, technique, physical balance, demonstration The director and the stage

UNIT IV - Components of acting: Gesture, voice, costume, make-up, mask and different styles inacting as an art form, violence in the theatre, need for censorship, managing time and space.

UNIT V - Theatre of illusion, Expressionism and dramatic symbolism, Stage design in the modern world, Lighting in the modern world, Word versus spectacles.

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand a broad range of theatrical disciplinesand Experiences	PO2
CO2	Identify the diversity of theatrical experiences andthe role of theatre in society	PO1, PO2
CO3	Discover the relationships among the various facetsof Theatre	PO4, PO5
CO4	Estimate drama as a performing art and the aspectsof Stagecraft	PO4, PO5, PO6

CO5	Gain exposure to diverse components of actingand techniques	PO8, PO9
Text Books (Latest Editions)		
1.	Sangeetha, K and A.Selvalakshmi. An Introduction to Theatre Art. New CenturyBook House (P) Ltd.,2015.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Balme, Christopher B. *The Cambridge Introduction to Theatre Studies*. Cambridge University Press,2008.	
2.	Leach, Robert. *Theatre Studies: The Basics*. Routledge, 2013.	
Web sources		
1.	https://paradisevalley.libguides.com/the111/theatre_history_websites	
2.	https://www.britannica.com/place/England/Performing-arts	
3.	https://www.worldhistory.org/Greek_Theatre/	
4.	https://archive.org/details/fundamentalsofpl0000dean_y3x3	
5.	http://scriptclickcreate.weebly.com/acting.html	
6.	https://www.britannica.com/art/theater-building/Production-aspects-of-Expressionist-theatre	

TECHNICAL WRITING

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23211DSC15B	TECHNICAL WRITING	5	0	0	-	3	3	25	75	100

Learning Objectives	
LO1	Technical Writing is ultimately important as it provides information on a company'sproducts and services
LO2	Good documentation forms a major part of the sales and marketing strategies,services and training and other related administrative inputs.
LO3	The course in technical writing focuses on the discoursal features and functions oftechnical writing including the technical reports, project reports and related documents.
LO4	The knowledge of computing appropriate to the discipline.
LO5	The ability to use current technologies, skills, and tools necessary for computingpractices.

Details
UNIT I- Technical Writing: A Curtain Raiser,P-W-R and BPS, From Sentences to paragraphs **UNIT II –** The Know-How of Technical Description, Document Design ,Graphics: EnhancingContent **UNIT III –** Data Interpretation, Presentation, News Reports, Proposals, Brochures, User Manuals. **UNIT IV –** Blogging, Vlogging, Posting on Social Media **UNIT V -** White Paper, CVs: Drafting the Blueprint of Your Future, On the Track: You aTech-Writer!

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand and know how to follow the stages of thewriting process and applythem to technical and workplace writing tasks.	PO1
CO2	Be able to produce a set ofdocuments related to technology and writing in theworkplace and will have improved their ability to write clearly and accurately.	PO1, PO2

CO3	Understand the basiccomponents of definitions, descriptions, process explanations, and other common forms of technicalwriting.	PO4, PO6
CO4	Be Familiar with basic technicalwriting concepts and terms, such as audience analysis, jargon, format, visuals, and presentation.	PO4, PO5, PO6
CO5	Be able to read, understand, and interpret material on technology.	PO3, PO8

Text Books (Latest Editions)	
1.	Baker, Mona, In Other Words: A Coursebook on Translation. London: Routledge
2.	Bassnet, Susan. Translation Studies. London & New York: Routledge, 1991.

References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Catford, J.C. A Linguistic Theory of Translation: An Essay in Applied Linguistics
2.	Duff, Alan, Translations. Oxford: OUP, 1989. London: OUP, 1965.
Web Resources	
1.	https://www.tech-tav.com/technical-writing-resources
2.	https://guides.library.unt.edu/c.php?g=528500&p=6841451
3.	https://pressbooks.bccampus.ca/technicalwriting/part/documentdesign/
4.	https://en.m.wikipedia.org/wiki/Technical_writing
5.	https://www.utleystrategies.com/blog/proposal-writing?format=amp

SEMESTER II

AMERICAN LITERATURE

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23211AEC21	**American literature**	4	1	-	-	4	6	25	75	100

Learning Objectives

LO1	To introduce the learners to the development of American literature.
LO2	To familiarize social and political events that have a bearing on American writing
LO3	To introduce the concepts and emerging themes in American literature
LO4	To inculcate the movements and trends that shaped American literature,
LO5	To familiarize the students with the relation between aesthetics and racism inFiction

UNIT I

POETRY

Emily Dickinson "The Last Night That She Lived",
Wallace Stevens "Anecdote of the Jar"
Anne Lexton "Wanting to Die"

UNIT II - Prose

Emerson - The American Scholar,
Amy Tan- Mother Tongue,

UNIT III Drama

Arthur Miller - Death of a Salesman,
NtozakeShange – For Colored Girls.

UNIT IV Fiction/Short Story

Edgar Allan Poe - "The Cask of Amontillado"
Kate Chopin - The Awakening

UNIT V Autobiography - Excerpts from – MalcolmX,
Cherrie Moraga - Getting Home Alive

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Analyze the movements and trends that shapedAmerican literature	PO2
CO2	Estimate various speeches and concepts of livingwhich changed American history	PO1, PO3
CO3	Evaluate the relation between aesthetics and racismin	PO4, PO5

	fiction	
CO4	Validate representative socio-political, cultural, racial and gender perspectives in theatrical works	PO4, PO5, PO6
CO5	Gain exposure to the different literary genres andits evolution in American Literature	PO8, PO10
Text Books(Latest Editions)		
1.	Willis Wagner : American Literature - A World View	
References Books (Latest editions, and the style as given below must be strictlyadhered to)		
1.	, Marcus Cunliffe : Sphere History of Literature - American Literature to 1900.	
2.	Boris Ford : The New Pelican Guide to EnglishLiterature - Vol.9. American Literature.	
	Web Sources	
1.	https://www.thoughtco.com/american-literary-periods-741872	
2.	https://www.poetryfoundation.org/poets/walt-whitman	
3.	https://blog.eyewire.org/emerson-vs-thoreau-transcendentalist-battle/	

ELECTIVE - IV A GLIMPSE OF NOBEL LAUREATES

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23211DSC25A	Glimpse of nobel laureates	4	0	-	-	3	4	25	75	100

Learning Objectives	
LO1	To introduce the learners to the Nobel Laureates of various genres of Literature
LO2	To familiarize students on various Nobel Laureates
LO3	To focus on interpreting the works of various Nobel Laureates
LO4	Focus on evaluate critically and aesthetically the prescribed texts
LO5	Understanding the Nobel Laureates contribution to the society

Details

UNIT I -Detailed Poetry

Pablo Neruda- If You Forget

Non-Detailed Poetry

As One Listens to the Rain - Octavio Paz

Oracle - Seamus Heaney

UNIT II Detailed Prose

Loot - Nadine Gordimer

Disorder and Early Sorrow - Thomas Mann

UNIT III

Detailed Drama

The Caretaker - Harold Pinter

Man and Superman - George Bernard Shaw

UNIT IV

Short Stories

Alice Munro

The Turkey Season Differently Runaway

The Bear Came Over the Mountain Boys and Girls

UNIT V

Novels

The Pearl - John Steinbeck

One Hundred Years of Solitude - Gabriel Garcia Marquez

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Relate the outstanding works of Nobel Laureates in anidealistic direction that adds the greatest	PO1

	benefit to humankind	
CO2	Interpret the works of various Nobel Laureates	PO1, PO2,PO3
CO3	Analyse the different themes with regard to social, political and cultural aspects.	PO4, PO6
CO4	Evaluate critically and aesthetically the prescribed texts.	PO3, PO8
CO5	Perceive the influence of Nobel Laureates in Literature	PO9, PO10

Text Books(Latest Editions)	
1.	Nine Nobel Laureates in English Literature. Omega Publications, 2012.
References Books **(Latest editions, and the style as given below must be strictly adhered to)**	
1.	Nine Nobel Laureates in English Literature. Omega Publications, 2012.
Web Resources	
1	https://en.wikipedia.org/wiki/List_of_Nobel_laureates_in_Literature
2	https://www.britannica.com/biography/Pablo-Neruda
3	https://www.britannica.com/topic/Nobel-Prize
4	https://interestingliterature.com/2021/07/harold-pinter-the-caretaker-summary-analysis/amp/
5	https://www.britannica.com/biography/Alice-Munro

TECHNOLOGY IN TEACHING ENGLISH

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23211DSC25B	Technology In Teaching English	4	0	-	-	3	2	25	75	100

Learning Objectives

LO1	Acquaint participants with technology tools, learn to implement network-related programs with concepts of Web Developing.
LO2	Integrate these tools into their English language teaching.
LO3	Enhance English language teaching professionals around the world acquire and maintain basic knowledge and skills in technology for professional purposes.
LO4	Help participants utilize technology in lesson planning, materials development, feedback, and assessment. Practice different phases of software/system development.
LO5	Facilitate professional communication, collaboration, and efficiency improvement by participating in online discussions .Students will be able to demonstrate adequate skills in oral and written communication for technical English language, actively participate in group discussions and interviews and exhibit evidence of vocabulary building

Details

UNIT I

Definition -Virtual- Learning Environment: 1.Meaning- Web-Based Learning Environment 2.Virtual- Learning Environment 3. Web Tools 4. Effective Web Tools in Teaching 5.Classroom Tools.

UNIT II

Webpage Development:

How to develop a webpage, Hosting A Web page, Meta Data Development. Content Writing, Creating Ads, Wikipedia Development: How to develop and edit Wikipedia.

UNIT III

Computational Linguistics: Introduction to speech recognition (SR) systems, text-to-speech(TTS) synthesizers, Interactive voice response (IVR) systems, search engines, text editors andlanguage instruction materials.

UNIT IV

Lexicography

Introduction to Lexicography, Dictionary Development (e- Dictionary), WorldNet, Thesaurus.Language Teaching: First Language and Second Language Teaching, Various methods of Language Teaching.

UNIT V

E-Learning

Asynchronous E-Learning Vs Synchronous E-Learning of Language E-Learning Challenges and Solutions. Application: Machine Translation.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand thedigital system, its organization and architecture	PO2, PO3
CO2	Identify needs and aspirations on a broader spectrum, Able to recognize the evolving role of Digital Technologies.	PO, P04
CO3	Discuss how technology affects language learning and teaching today	PO5, PO6
CO4	Use strategies to teach vocabulary growth through social media.	PO7, PO8, PO9
CO5	Identify appropriate grammar activities that include opportunities for learners to discover, analyze, and produce English grammar during language interactions.	PO10
Text Books (Latest Editions)		
1.	Anderson, T. (ed.) The Theory and Practice of Online Learning Athabasca AB: AthabascaUniversity Press, 2008.	
2.	Bates, A. and Sangrà, A. Managing Technology in Higher Education San Francisco: Jossey–Bass/John Wiley and Co, 2011.	
References Books (Latest editions, and the style as given below must be strictly adheredto)		
1.	Butcher, N. and Wilson-Strydom, M.) A Guide to Quality in Online LearningDallas TX: Academic Partnerships, 2013	
2.	Batson, T., & Bass, R. Teaching and learning in the computerage.Change, Mar-Apr., 1996.	
Web sources		
1.	https://englishpost.org/tools-teach-english-technology/	
2.	https://www.britishcouncil.in/teach/resources-for-teachers/technology-teachers - series	
3.	https://www.techtarget.com/whatis/definition/virtual-learning-environment-V LE-or-managed-learning-environment-MLE?amp=1	
4.	https://en.m.wikipedia.org/wiki/Web_development	
5.	https://plato.stanford.edu/entries/computational-linguistics/	

FIRST YEAR - SEMESTER II

ENTREPRENEURSHIP DEVELOPMENT

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23211SEC26	**Entrepreneurship development**	2	2	-	-	4	4	25	75	100

Learning Objectives	
LO1	To help students acquire necessary knowledge and skills required for organizingand carrying out entrepreneurial activities.
LO2	To develop the ability of analysing and understanding business situations in which entrepreneurs act.
LO3	To aid them in analysing various aspects of entrepreneurship – especially oftaking over the risk, and the specificities as well as the pattern of entrepreneurship development
LO4	To bring in them the ability to contribute to their entrepreneurial and managerial potentials.
LO5	To help them master the knowledge necessary to plan entrepreneurial activities.

Details

UNIT I

Introduction-Meaning and Importance- Evolution of term 'Entrepreneurship'-Factors influencingEntrepreneurship-Psychological factors-Social factors-Economic factors-Environmental factors.

UNIT II

Characteristics of an entrepreneur-Types of entrepreneur: business, use of technology, motivation,growth, stages- New generations of entrepreneurship vs social entrepreneurship.

UNIT III

Entrepneurship -health entrepreneurship-tourism entrepreneurship- women entrepreneurship- barriersto entrepreneurship.

UNIT IV

Motivation-Maslow's theory, Herjburg's theory, McGragor's theory- Culture and society-Risk takingbehavior.

UNIT V

Creativity and entrepreneurship- Steps in creativity- Decision making and problem solving-assistance to an entrepreneur-Incentives and facilities-New ventures.

Course Outcomes

Course	On completion of this course, students will;

Outcomes		
CO1	Define basic terms and understand basic concepts inthe area of entrepreneurship	PO1
CO2	Analyse the business environment in order to identify business opportunities	PO1, PO2
CO3	Identify the elements of success of entrepreneurial ventures	PO4, PO6
CO4	Consider the legal and financial conditions for starting a business venture	PO4, PO5, PO6
CO5	Evaluate the effectiveness of different entrepreneurial strategies and specify the basic performance indicators of entrepreneurial activity	PO3, PO8

Text Books (Latest Editions)	
1.	C J Cornell .The Age of Metapreneurship: A journey into the future of Entrepreneurship. Venture Point Press (11 April 2017)
2.	Joe Carlen. A Brief History of Entrepreneurship. Columbia Business School Publishing (1 October 2016)
3.	Harpreet S. Grover.Let's build a company, Vibhore Goyal, Penguin Books, 2020.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	Kashyap, Karan. Go Startup. Fingerprint Publishing, 2021.
Web Resources	
1.	https://www.cmu.edu/swartz-center-for-entrepreneurship/education-and-resources/project-olympus/pdf/entrepreneurship-101.pdf
2.	https://byjus.com/commerce/what-is-entrepreneurship/
3.	https://in.indeed.com/career-advice/career-development/types-of-entrepreneurship
4	https://www.modernhealthcare.com/article/20150221/MAGAZINE/302219978/health-entrepreneurship-on-the-rise

SEMESTER III

CORE VII -CONTEMPORARY LITERARY CRITICISM

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23211AEC31	Contemporary literary criticism	4	1	-	-	4	5	25	75	100

Learning Objectives	
LO1	To enable the students to comprehend that criticism is not merely an understanding of literary text but also a rapidly increasing body of knowledge
LO2	To provide knowledge about the different schools in contemporary literary Criticism
LO3	To focus on interpreting the works of various literary critics
LO4	Focus on evaluate critically and aesthetically the prescribed texts
LO5	Understanding the principles of criticism

Details

UNIT I

Structure, Sign and Play in the Discourse of HumanSciences : Derrida

UNIT II

The Deconstructive Angel : M.H. Abrams

UNIT III

Against Interpretation : Susan Sontag Crisis (In Orientalism) : Edward Said

UNIT IV

Irony as Principle of Structure :Cleanth Brooks

Creative Writers and Day Dreaming : Sigmund Freud

UNIT V

From Work to Text: Roland Barthes

Capitalism, Modernism and Post Modernism: Terry Eagleton

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand a literary text by applying various critical theories.	PO2, PO3
CO2	Develop analytical understanding of the subject matter	PO4
CO3	Analyze a literary text with reference to socio-political issues	PO5

CO4	Evaluate critically and aesthetically the prescribed texts.	PO6, PO8
CO5	Appreciate a text at emotional, intellectual and aesthetic levels	PO9
Text Books(Latest Editions)		
1.	Eagleton, T. (2008). Literary theory: An introduction. U of Minnesota Press.	
References Books (Latest editions, and the style as given below must be strictly adheredto)		
1.	Wood, Nigel, and David Lodge. Modern Criticism and Theory. Taylor and Francis, 2014.	
2.	Lodge, David. Twentieth Century Literary Criticism: A Reader. Routledge, 2016.	
Web Resources		
1	https://courses.lumenlearning.com/suny-britlit1/chapter/literary-criticism/	
2	https://www.atlassociety.org/post/deconstructing-derrida-review-of-structure-sign-and-discourse-in-the-human-sciences	
3	https://fs.blog/susan-sontag-against-interpretation/	
4	https://www.studocu.com/in/document/madurai-kamaraj-university/ma-englis h/the-deconstructive-angel/4517560	
5	https://www.britannica.com/biography/Roland-Gerard-Barthes	

TRANSLATION STUDIES

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23211GEC34	Translation studies	3	1	-	-	3	4	25	75	100

Learning Objectives

LO1	To enable students to get a glimpse of the rich diversity of Indian culture and literature
LO2	To provide knowledge about the regional languages through representative texts in English translation
LO3	To equip the students in the skills as well as the politics of translation.
LO4	Focus on important dimensions of culture through the prescribed texts
LO5	Understanding the nuances of translations

Details

UNIT I

Translation- definition, nature, scope
Translator and his qualities

UNIT II

Types of Translation

UNIT III

Problems in Translation

UNIT IV

History of translation

UNIT V

Workshops on Translation

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the systematic study of translation	PO1, PO3
CO2	Appreciate better the dimensions of language and its nuances essential for translation	PO2, PO5
CO3	Gain exposure to effective translation	PO4
CO4	Be equipped in the skills as well as the politics of translation.	PO6, PO8
CO5	Gain knowledge in the regional languages through representative texts in English	PO9

	translation	
Text Books(Latest Editions)		
1.	Lalita and Susie Tharu. Introduction to Women Writing in India. Penguin	
References Books (Latest editions, and the style as given below must be strictly adheredto)		
1.	Bassnett, Susan and Harish Trivedi. eds. 1999.Post-colonial Translation. London. Routledge	
2.	Amit Choudhury, 2001, The Picador Book of Modern Indian Lietrature, Macmillan, London	
3	R. Azhagarasan&Ravikumar Anthology of Tamil Dalit Writing (OUP)	
Web sources		
1	https://en.wikipedia.org/wiki/Translation_studies#:~:text=Translation%20studies%20is%20an%20academic,of%20study%20that%20upport%20translation.	
2	https://www.tandfonline.com/toc/rtrs20/current	
3	https://complit.fas.harvard.edu/translation-studies	
4	https://www.seagullbooks.org/our-authors/p/indira-parthasarathy/	
5	https://www.lit-across-frontiers.org/about-translation-workshops/	

EXTRA DISCIPLINARY COURSE: FUNCTIONAL ENGLISH

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23211DSC35A	Functional English	3	1	-	-	3	4	25	75	100

Learning Objectives	
LO1	To expose the learners towards the organizing and delivery of speech
LO2	To train the learners in various language skill in Public Speaking
LO3	Creating awareness about using language according to the situation
LO4	Helping learners overcome common problems of Indian speakers of English
LO5	Introducing major features of spoken English

Details

UNIT I

Public Speaking

1.Characteristics of a good speaker
2.Methods of Speaking
3.Preparation and Delivery of Speech

UNIT II

Speech for Situations

1. Speech to inform
2.Speech to Persuade
3.Speeches for Special occasions

UNIT III

Occupational Skills

1. Email
2. Resume
3.Official memo

UNIT IV

Interview Skills

1.Prepare and practice for Interviews
2.Some General Questions in an Interview
3.Profile Writing for a Job
4.Presentation Skills

UNIT V

Interpersonal Skills

1.Team Development 2.Relationship and Communication 3.Negotiation

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Define communicative skills	PO2
CO2	Utilize the nuances of English language in publicspeaking	PO1, PO2
CO3	Evaluate language skills in day to day life	PO3, PO4
CO4	Develop different styles of occupational skills	PO5, PO6
CO5	Learn to analyze the usage of English words in different contexts and acquire considerable flair inusing broad range of vocabulary	PO8
Text Books(Latest Editions)		
1.	Mohan, Krishna, et al. *Developing Communication Skills*. MacmillanPublishers India Ltd., 2009.	
2.	Mitra, Barun K. *Effective Technical Communication: a Guide for Scientists and Engineers*. Oxford University Press, 2006.	
References Books (Latest editions, and the style as given below must be strictly adheredto)		
1.	Sudha,S. *Job Fair Keys*, Jayalakshmi Publications, 2017.	
2.	Functional English Grammar: An Introduction for Second Language Teachers (Cambridge Language Education)	
	Web sources	
1.	Team Development- https://blog.vantagecircle.com/team- development/5. Relationship and Communication- https://2012books.lardbucket.org/books/a-primer-on communication-	
2.	Negotiation-https://www.pon.harvard.edu/daily/negotiation-skills- daily/what-is negotiation/	
3.	https://in.indeed.com/career-advice/interviewing/interviewing-skills	
4.	https://careerwise.minnstate.edu/careers/occupatio nal- skills.html	

SEMESTER IV

EMPLOYABILITY SKILLS

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23211DSC35B	**Employability skills**	3	1	-	-	3	4	25	75	100

Learning Objectives	
LO1	To help students identify the knowledge and skills required for obtainingemployment.
LO2	To emphasize on individual skill assessments and interpersonalcommunication skills.
LO3	To help them understand workplace responsibilities, teamwork skills, safetyissues and personal management skills required for the workplace.
LO4	To assist them in understanding long term and short-term goals
LO5	To aid them in understanding decision making strategies and setting priorities inwork and personal life.

Details
UNIT I Behavioural Skills- Personal Strength Analysis-Ethics,Values & Etiquette- Social Etiquette- Role Modeling. **UNIT II** English Literacy- Functional English-Reading-Written English- Communication skills- SelfIntroduction-Verbal and Non-Verbal Communication-Campus to work. **UNIT III** IT Literacy- Basics of Computers-Operating System- Ms Word-Ms Excel-Web browsers and searchengines-email-mobile application. **UNIT IV** Entrepreneurship Skills- Maintaining Efficiency at Workplace-Occupational Safety, Health andEnvironment Education. **UNIT V** Career plan-basic professional skills-resume preparation- mock interview- career pathways-searchand apply for job.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Get to know their personal strengths and weaknesses.	PO1
CO2	Understand factors that contribute to confidenceand self-esteem	PO1, PO2
CO3	Gain knowledge on the skill of communicating effectively with employers, supervisors and co-workers.	PO4, PO6
CO4	Understand teamwork approach to completing tasks.	PO4, PO5, PO6
CO5	Be aware on the strategies for handling stress and work pressure.	PO3, PO8
Text Books (Latest Editions)		
1.	Arvind M Nawale, Mahesh M Nivargi, An Introduction to Employability Skills-A text book for College Students. Macmillan Publications.	
2.	A. K. Xavier and S. Radhakrishnan, A Textbook of Employability Skills, JKPPublications.	
3.	Manojkumar C Shimpi, Employability Skills. Neelam Publications.	
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1.	Soft Skills & Employability Skills by Sabina Pillai & Agna Fernadez. CambridgeUniversity Press.	
Web sources		
1.	https://cbseacademic.nic.in/web_material/Curriculum21/publication/secondary/Em ployability_Skills10.pdf	
2.	https://leverageedu.com/blog/behavioural-skills/	
3.	https://in.indeed.com/career-advice/career-development/professional-skills	
4.	https://www.countryliving.com/life/g15915245/social-etiquette/	

SOFT SKILL III - LEADERSHIP SKILLS

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
	Elective	Y	Y	-	-	2	2	25	75	100

Learning Objectives

LO1	To introduce the students to all aspects of leadership and organizations.
LO2	Enable them to master Soft Skills.
LO3	Help them improve their body language and Non - Verbal Communication skills.
LO4	To make them become good leaders.
LO5	Teach them organizational behavior,Conflict management, strategy and entrepreneurship.

UNIT I INTRODUCTION

1. Role of a Leader
2. Leadership Development and Behavior
3. Trust, Integrity and Ethics Personality and Leadership

UNIT II

SELF-ASSESSMENT

1. Work/Life Balance
2. Leader/Follower RelationshipMaking /Leading change

UNIT III

LEADERSHIP SKILLS

Time Management (The Priority Matrix – Minimizing Distractions - Avoiding Procrastination – Action Planning)

Delegation Skills (Successful Delegation – Barriers to delegation – The who and howof delegating – The SMART acronym)

UNIT IV

NEGOTIATION SKILLS

1.Definition of negotiation 2.Types of negotiation3.Stages of negotiation

UNIT V

CONFLICT RESOLUTION

1.Reasons for conflict 2.Consequences of conflict 3.Resolution Strategies

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Demonstrate an understandingof leadership qualities	PO2, PO10
CO2	Identify the different aspectsof leadership.	PO1, PO3
CO3	Exhibit their mastery in body language and Non Verbal Communication	PO4, PO6
CO4	Master negotiation skills	PO5, PO6, PO7
CO5	Be able to analyse organizational behavior, conflicts and entrepreneurshipskills	PO8, PO9
Text Books (Latest Editions)		
1.	Maxwell, John. Developing the Leader Within You. New Delhi, Three ESS Publication	
2.	Maxwell , John. The 21 Irrefutable Laws of Leadership Dana Daniel. Conflict Resolution	
References Books (Latest editions, and the style as given below must be strictly adheredto)		
1.	Schiffman, Stephen. Negotiation Techniques (That Really Work)	
2.	*Open Journal of Leadership - SCIRP* **ISSN Print:** 2167-7743 **ISSN Online:** 2167-7751 Journalof Leadership & Organizational Studies (JLOS).	
Web Resources		
1.	https://www.skillsyouneed.com› leadership-skills	
2.	https://www.mindtools.com› Leadership Skills	
3.	https://www.techtarget.com/searchcio/definition/leadership-skills?amp=1	
4.	https://www.skillsyouneed.com/leadership-skills.html	
5.	https://haiilo.com/blog/what-are-the-top-leadership-skills-that-make-a-great-leader/	

SEMESTER IV

TWENTY-FIRST CENTURY MILLENNIAL LITERATURE ANDCULTURE

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23211AEC41	**Twenty-first century millennial literature and culture**	4	1	-	-	4	5	25	75	100

Learning Objectives

CO1	To sensitize the students to various aspects of new studies in twenty first century millennial literature.
CO2	Understanding important ideas, movements and systems of thought that effectively contributes to the rich diversity of 21st century life of people atthe global level.
CO3	Identify the possibilities for multidisciplinary analysis of literary texts.
CO4	Analyze literary texts by employing appropriate interdisciplinary theories.
CO5	Evaluate the viability of interdisciplinary analyses of literary and cultural forms.

Details

UNIT I

Blue Studies

The Hungry Tide - Amitav Ghosh

The Life of Pi - Yann Martel

UNIT II

Animal Studies

Margo DeMello "Human Animal Studies" from *Animals and*

"What is it like to be a trope?" from *Literature and Animal Studies*

UNIT III

Medical Humanities

Thomas R. Cole et al "Introducing Medical Humanities"from *Medical Humanities: An Introduction-*

Dan Millman Way of the Peaceful Warrior

UNIT IV

Climate Studies

Introduction to Climate Change and Studies Barbara KingsolverFlight behavior

UNIT V
Disability Studies

Lennard J. Davis "Introduction: Disability, Power and Culture" From the Disability StudiesReader.
Clarke Barker and Stuart Murray "Introduction: On Reading Disability in Literature" from The Cambridge Companion to Disability Studies

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Analyse contemporary issues and its immediate requirement	PO3
CO2	Effectively understand their social responsibility	PO2, PO6
CO3	Gain exposure to the emerging trends in 21st century millennial literature.	PO4. PO5
CO4	Be equipped in the interdisciplinary theories.	PO6
CO5	Appreciate the viability of interdisciplinary analyses of literary andcultural forms.	PO10

Text Books (Latest Editions)

1.	Bates, Victoria, et al. Medicine, Health and the Arts: Approaches to the MedicalHumanities.1st ed., Routledge, 2015.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1.	Bleakley, Alan. Medical Humanities and Medical Education: How the MedicalHumanities Can Shape Better Doctors. Routledge, 2016.
2.	DeMello, Margo. Body Studies: An Introduction. 1st ed., Routledge, 2013
3	Nocella II J, Antony., Sorenson, John. Socha, Kim., and Atsuko Matsuoka. *Defining Critical Animal Studies: An Intersectional Social Justice Approach forLiberation.* Peter Lang Publishing Inc., 2014.

Web sources

1.	http://www.criticalanimalstudies.org/students-for-cas/journal-for-critical-animal-studies/archives/
2.	http://www.jstor.org/stable/25614299.
3.	https://www.timeshighereducation.com/student/student-services/blue-studies-ii nternational
4.	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2746847/
5.	https://en.m.wikipedia.org/wiki/Medical_humanities

English Teaching methods, Aptitude, Attitude for competitive examination

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
23211SEC46	**English Teaching methods, Aptitude, Attitude for competitive examination**	3	1	-	-	3	4	25	75	100

Learning Objectives	
LO1	Comprehending the nuances and question pattern to get through NET, SET and Gate Exams.
LO2	Evaluating the knowledge of literature.
LO3	Repeated practice to attend MCQs
LO4	Profound understanding about the various movements in English Literature
LO5	Tracing the growth of English literature and literary forms

Details

UNIT I

Teaching and Research Aptitude

UNIT II

Comprehension

UNIT III

communication

UNIT IV

Logical reasoning

UNIT V

Mathematical research and aptitude

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Succeed with ease in competitive exams.	PO2, PO3
CO2	Effectively attempt MCQs	PO1
CO3	Gain profound understanding about the various movements in English Literature	PO6
CO4	Understand the nuances of competitive exams	PO7
CO5	Relate to theory and literature	PO6, PO10

Text Books(Latest Editions)	
1.	Harpreet Kaur. Oxford NTA –UGC Paper I FOR NET/SET/JRF: Teaching and Research Aptitude. Oxford, 2020
2.	Ronald Carter and John McRae. The Routledge History of English Literature: Britain and Ireland. Routledge
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1.	SrinivasaIyengar, Kodaganallur Ramaswami. Indian Writing in English. Sterling Publ., 2019
2.	Maryemma Graham and Jerry Washington Ward. The Cambridge History of African American Literature. Cambridge University Press, 2015.
3.	Henry Beers A. Brief History of English and American Literature. OUTLOOK VERLAG, 2020.
4.	Peter Barey. An Introduction to Literary and Cultural Theory by Peter Barry.
5.	M.H. Abrams – A Glossary of Literary Terms.
Web Resources	
1.	**https://ugcnetpaper1.com/books-recommended-nta-ugc-net-english/**
2.	**https://byjusexamprep.com/ugc-net-english-books-i**
3.	**https://journalism.uoregon.edu/directory/faculty-and-staff/all/jwasko**
4.	**https://m.economictimes.com/opinion/interviews/there-is-a-lot-of-power-in- tamil-cinema-because-of-its-closeness-to-everyday-life-anand-pandian-author- reel-world/amp_articleshow/51169927.cms**
5.	**https://guides.library.yale.edu/c.php?g=295800&p=1975065**

1.1.2 Total number of courses having focus on employability/ entrepreneurship/ skill development offered by the University during the year

SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF BIOTECHNOLOGY

B.Sc. BIOTECHNOLOGY CURRICULUM

REGULATION 2023

B. Sc., Graduate Attributes

- Research, inquiry and analytical thinking abilities.
- Capability and motivation for intellectual development.
- Ethical, social and professional understanding.
- Communication in intra and inter disciplinary
- Teamwork, collaborative and management skills in scientific research
- Information literacy in respective discipline

B. Sc., Program Educational Objectives PEO

- **PEO 1**: Graduates will learn and apply knowledge of Biotechnology, Science and Engineering concepts to solve problems related to field of Biotechnology.
- **PEO 2**: Demonstrate professional and ethical attitude with awareness of current issues and think about the social entailment of their work, especially its impact on safety, health and environment for sustainable development.
- **PEO 3**: To empower the students with analytical and research skills, enable them to critically analyze existing literature in an area of specialization and to nurture entrepreneurial endeavors.
- **PEO 4**: Graduates will be able to design and innovate solutions to Biotechnological problems by applying appropriate tools while keeping in mind safety and ethical factors for environmental & society.
- **PEO 5:** Graduates will be able to undertake any responsibility as an individual and as a team in a multidisciplinary environment.

B. Sc., Programme Specific Outcome (PSO)

- **PSO1 -** Graduates will exhibit contemporary knowledge in Biotechnology and students will be eligible for jobs in pharmaceutical and biotechnological Industry.
- **PSO2 -** An expert in biotechnology and allied fields (medical, microbial, agricultural, environmental, plant and animal) for utilizing the practical skill to address biotechnological challenges.
- **PSO3 -** Graduates will be able to work individually as well as in a team to survive in a multidisciplinary environment.
- **PSO4 -** If students will engage themselves in the process of effective learning, it will give opportunities to utilize acquired knowledge for catering the needs of science and technology as well as for the betterment of human mankind.
- **PSO5 -** Graduates will be able to understand the potentials, and impact of biotechnological innovations on the environment and their implementation for finding sustainable solutions to issues pertaining to the environment, health sector, agriculture, etc.

B.Sc., Program Outcome PO

- **PO1-**Understand the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevance in the day-to-day life
- **PO2-**Understanding and better knowledge of the causes, types and control methods for environmental pollution by the students.
- **PO3-**The student will be able to discuss the mechanisms associated with gene expression systems in prokaryotes and eukaryotes.
- **PO4-**Developed various communication skills such as reading, listening, speaking etc.,
- **PO5-**Acquired the skills in handling scientific instruments, planning and performing in laboratory experiments
- **PO6-**Ethics: Convey and practice social, environmental and biological ethics.
- **PO7-**To get knowledge about research tools and learn to review literature. Ability to carry out independent literature survey corresponding to the specific publications type and asses basic research tool

SCHOOL OF ARTS AND SCIENCE

B.Sc., BIOTECHNOLOGY - REGULATION 2023

EMPLOYABLITY

SKILL DEVELOPMENT

ENTREPRENEURSHIP

EMPLOYABLITY/ SKILL DEVELOPMENT

EMPLOYABLITY/ ENTREPRENEURSHIP/ SKILL DEVELOPMENT

COURSE STRUCTURE

SEMESTER – I					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
23110AEC11/ 23111AEC11/ 23132AEC11/ 23135AEC11	Tamil – I/Advanced English-I/Hindi-I/ French - I	3	1	0	3
23111AEC12	English-I	3	1	0	3
23117AEC13	Cell and Molecular Developmental Biology	4	1	0	3
23115GEC14	Biological Chemistry	4	1	0	3
PRACTICAL					
23117SEC15L	Cell and Molecular Developmental Biology	0	0	3	3
23115SEC16L	Biological Chemistry	0	0	3	3
Skill Enhancement Course					
23117SEC17	Food and Nutrition (Non Major Elective)	2	0	0	2
23117SEC18	Foundation Course	2	0	0	2
Ability Enhancement Compulsory course					
231AECCINC	Indian Constitution	2	0	0	2
AUDIT COURSE					
231LSCUV	Universal Human Values	-	-	-	1
	Total	**20**	**4**	**6**	**25**
SEMESTER – II					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
23110AEC21/ 23111AEC21/ 23132AEC21/ 23135AEC21	Tami – II/Advanced English-II/Hindi-II/ French - II	3	1	0	3
23111AEC22	English-II	3	1	0	3
23117AEC23	Genetics	4	1	0	3
23116GEC24	Fundamentals of Microbiology	4	1	0	3
PRACTICAL					
23117SEC25L	Genetics	0	0	3	3

23116SEC26L	Fundamentals of Microbiology	0	0	3	3
Skill Enhancement Course					
23117SEC27	Public health and Hygiene(Non Major Elective)	2	0	0	2
23117SEC28	Food and Bioprocess technology	2	0	0	2
Ability Enhancement Compulsory course					
231AECCCMS	Communication Skills	2	0	0	2
AUDIT COURSE					
231SSCBE	Basic Behavioural Etiquette	-	-	-	1
	Total	**20**	**4**	**6**	**25**
SECOND YEAR					
SEMESTER – III					
23110AEC31/ 23132AEC31/ 23111AEC31/ 23135AEC31	Tamil – III/Hindi-III/Advanced English-III/ French – III	3	1	0	3
23111AEC32	English-III	3	1	0	3
23117AEC33	Immunology and Immunotechnology	4	1	0	3
23115GEC34	Bioinstrumentation	4	1	0	3
	PRACTICAL				
23117SEC35L	Immunology and Immunotechnology	0	0	3	3
23115SEC36L	Bioinstrumentation	0	0	3	3
Skill Enhancement Course					
23117SEC37	Environment Management In Industries	2	0	0	1
23117SEC38	Good Laboratory Practices	2	0	0	2
Ability Enhancement Compulsory course					
23115RMC39	Research Methodology	2	0	0	2
AUDIT COURSE					
231ACLSOAN	Office Automation	-	-	-	1
	Total	**20**	4	**6**	**24**
SEMESTER – IV					
23110AEC41/ 23111AEC41/ 23132AEC41/ 23135AEC41	Tamil-IV/Advanced English-IV /Hindi-IV/ French – IV	3	0	0	3
23111AEC42	English-IV	3	0	0	3
23117AEC43	Genetic Engineering and rDNA technology	4	1	0	3
23117GEC44	Bioinformatics and Biostatistics	4	1	0	3
PRACTICAL					
23117 SEC45L	Genetic Engineering and rDNA technology	0	0	3	3
23117SEC46L	Bioinformatics and Biostatistics	0	0	3	3
Skill Enhancement Course					
23117SEC47	Organic Farming and Health Management	2	0	0	2
23117SEC48	Biotechnology for Society	2	0	0	2
Ability Enhancement Compulsory course					
23115BRC49	Participation in Bounded Research	2	0	0	2
231AECCEVS	Environmental Studies	2	0	0	2

AUDIT COURSE					
231LSCLS	Leadership and Management Skills	0	0	0	1
	Total	**22**	**2**	**6**	**27**
SEMESTER – V					
23117AEC51	Plant Biotechnology	5	1	0	4
23117AEC52	Animal Biotechnology	5	1	0	4
23117AEC53	Environmental and Industrial Biotechnology	5	1	0	4
23117DSC54__	Discipline Specific Elective –I	4	0	0	3
Skill Enhancement Course					
23117SEC55L	Plant Biotechnology and Animal Biotechnology Lab	0	0	3	3
23117SEC56L	Environmental and Industrial Biotechnology Lab	0	0	3	3
23117SEC57	Internship/Industrial Visit/Field Visit	**0**	**0**	**0**	**2**
AUDIT COURSE					
231ACLSPSL	Professional Skills	-	-	-	1
231AECCVED	Value Education	2	0	0	2
	Total	**21**	**3**	**6**	**26**
Third year					
SEMESTER – VI					
22117AEC61	Bioentrepreneurship	5	0	0	4
22117AEC62	Pharmaceutical Biotechnology	5	0	0	4
23117DSC63	Discipline specific Elective II	5	0	0	3
23117PRW64	Project	0	0	13	4
23117SEC65	General awareness for competitive examination	2	0	0	2
231EXACT	Extension activity	-	-	-	1
AUDIT COURSE					
231ACSIKWS	Indian Knowledge System	-	-	-	2
	Total	**17**	**0**	**13**	**20**
Total Credits -Programme					**140**
Total Credits - Audit Courses					**07**
Total Credits					**147**

Semester	**Discipline specific Elective courses -I**
I	23117DSC54A - Nano technology 23117DSC54B - Enzymology 23117DSC54C - Bioethics and Biosafety 23117DSC54D - Cancer biology 23117DSC54E - Biochemical Pharmacology 23117DSC54F - Disaster Management
	Discipline specific Elective courses -II
II	23117DSC63A - Marine Biotechnology 23117DSC63B - Food Technology

SEMESTER I

Course Code	Course Title	L	T	P	C
23110AEC11	Tamil-I **இக்கால இலக்கியம்**	3	1	0	3

முதல் பருவம்

பாடநோக்கம் :

இக்கால தமிழ் இலக்கிய வகைகளின் மாதிரிகளைக் கற்பித்து அவற்றில் ஈடுபாட்டையும், சுவைக்கும் திறனையும் ஏற்படுத்துதல்.

பயன்கள் :

CO1: மொழி ஆளுமைத் திறன் பெறுதல்.

CO2: சமூக சிந்தனையை வளர்த்துக் கொள்ளுதல்.

CO3: படைப்பாளர்களாக உருவாகும் திறனைப் பெறுதல்.

CO4:இலக்கியங்களின் அறிவை மேம்படுத்துதல்.

CO5: கவிதை எழுதும் முறையை புரிந்துக்கொள்ளுதல்

அலகு -1 மரபுக்கவிதை

1.பாரதியார்--விடுதலை, வந்தே மாதரம் ,காற்று
2.பாரதிதாசன் - அழகின் சிரிப்பு ,தமிழனுக்கு வீழ்ச்சி இல்லை
3.கவிமணி தேசியவிநாயகம் பிள்ளை-- தொழிலாளியின் முறையீடு
4.நாமக்கல் கவிஞர்-- தருணம் இதுவே ,
5.கண்ணதாசன்-- அனுபவம்

அலகு - 2 புதுக்கவிதைகள்

1.அப்துல் ரகுமான் -வெற்றி
2.அறிவுமதி-நட்புக் காலம்
3.வைரமுத்து- ருசி, சிற்பி- ஓடு ஓடு சங்கிலி
4.மு.மேத்தா- வெளிச்சம் வெளியே இல்லை

அலகு - 3 நாட்டுப்புறவியல்

1.பழமொழிகள்
2.விடுகதைகள்
3.தொழில் பாடல்

அலகு- 4 சிறுகதை

1.தடயம்- மா. ஜெயபிரகாசம்
2.எதார்த்தம் - சு. தமிழ்ச்செல்வி
3.நீதி - பூமணி

அலகு- 5 இலக்கியவரலாறு

கவிதை, சிறுகதை நாட்டுப்புறப்பாடல்

பொதுக்கட்டுரை : மனித நேயம், வாழ்வியல் அறங்கள்

மனப்பாடப் பகுதி : பாரதியார் கவிதை- வேண்டும்,
பாரதிதாசன் கவிதை-செந்தாமரை

பார்வை நூல்கள் :

1.பாரதியார் கவிதைகள் - மணிவாசகர் பதிப்பகம் சென்னை
2.பாரதிதாசன் கவிதைகள் - பாரி நிலையம், சென்னை
3.தமிழ் இலக்கிய வரலாறு - மு வரதராஜன் சாகித்திய அகாதெமி,சென்னை
4.நாட்டுப்புறவியல் - முனைவர். ஆறு. ராமநாதன் ,மணிவாசகர் பதிப்பகம், சென்னை
5.தமிழ் சிறுகதையும் தோற்றம் வளர்ச்சி - தமிழ் புத்தக நிலையம், சென்னை

இணையதளம் - www.tamilvu.org

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

Course Code	Course Title	L	T	P	C
23111AEC11	Advanced English-I	3	1	0	3

Aim:

To improve the knowledge of English

Course Objective:

CO1: To familiarize the students with the glossary terms, figures of speech
CO2: To enhance vocabulary
CO3: To learn how to edit and proofread
CO4: To know the comparison and contrast and cause and effect forms
CO5: To understand the impact of the speeches of famous people

Course Outcome:

CO1: Development of vocabulary
CO2: Learning to edit and do proof reading
CO3: Reading and comprehending literature
CO4: Comparison and contrast and cause and effect forms
CO5: The impact of the speeches of famous people

UNIT–I:

The Origin of Language - Development of Gesture, Sign, Words, Sounds, Speech and Writing Language History and the Process of Language Change Core Features of Human Language, Animals and Human Language

UNIT–II:

Nature of LanguagePure Vowels, Diphthongs and Consonants Language Varieties: Dialects, Idiolect, Pidgin and Creole Language and Gender, Language and Disadvantage

UNIT–III:

Linguistic Form Morphology, Grammar, Syntax Saussurean Dichotomies: Synchronic and Diachronic Linguistics Semantics, Pragmatics

UNIT–IV:

Branches of Linguistics Structural Linguistics, Sociolinguistics, Psycholinguistics, Neurolinguistics, Applied Linguistics

UNIT–V:

Stylistics and Discourse Analysis: Relationship between Language and Literature, Style and Function, Poetic Discourse, Narrative Discourse and Dramatic Discourse

Author	Title of the book	Edition/Year	Publisher
Wren and Martin	English Grammar	2009	S.Chand & Company Ltd
Meenakshi Raman & amp; Sangeetha Sharma	Technical Communication	Second Edition/2011	Oxford University Press
Sudhir Kumar Sharma	The World's Great Speeches	-	Galaxy Publishers

Course Code	Course Title	L	T	P	C
23111AEC12	English-I	3	1	0	3

Course Objectives

CO1: To enable learners to acquire the linguistic competence necessarily required in various life situations.

CO2: To help them understand the written text and able to use skimming, scanning skills

CO3: To assist them in creative thinking abilities

CO4: To enable them become better readers and writers

CO5: To assist them in developing correct reading habits, silently, extensively and intensively

Course Content:

UNIT I: Poetry

1.1 A Patch of Land - Subramania Bharati

1.3 A Nation's Strength – Ralph Waldo Emerson

1.4 Love Cycle - Chinua Achebe

UNIT II: Prose

2.1 JRD - Harish Bhat

2.2 Us and Them - David Sedaris From Dress Your Family in Corduroy and Denim

UNIT III: Short Stories

3.1 The Faltering Pendulum - Bhabani Bhattacharya

3.2 How I Taught my Grandmother to Read - Sudha Murthy

3.3 The Gold Frame- R.K. Laxman

UNIT IV: Language Competency

4.1 Vocabulary : Synonyms, Antonyms, Word Formation

4.2 Appropriate use of Articles and Parts of Speech

4.3 Error correction

UNIT V: English for Workplace

5.1 Self - introduction, Greetings

5.2 Introducing others

5.3 Listening for General and Specific Information

5.1 Listening to and Giving Instructions / Directions

Course Outcomes

Course Outcomes	On completion of this course students will;	Programme Outcomes
CO1	Develop and integrate the use of the four language skills i.e. Reading, Listening, Speaking and Writing	**PO1**
CO2	Understand the total content and underlying meaning in the context.	**PO1, PO2**
CO3	Form the habit of reading for pleasure and for information	**PO4,PO6**
CO4	Comprehend material other than the prescribed text	**PO4, PO5, PO6**
CO5	Develop the linguistic competence that nables them, in the future, to present the culture and civilization of their nation.	**PO3, PO8**

Text books (Latest Editions)	
1.	Steel Hawk and other stories by Bhattacharya, Bhabani, New Delhi: Sahitya Akademi, 1967
2.	How I taught my Grandmother to Read and other Stories, Murthy, Sudha,Penguin Books, India, 2004

Reference Books (Latest Editions, and the style given must be strictly adhered to)	
1.	English in use - A textbook for College Students (English ,Paper back, - T.Vijay Kumar, K Durga Bhavani, YL Srinivas
2.	Practical English Usage - 4th Edition By Michael Swan
3.	The Art of Civilized Conversation: A Guide to Expressing Yourself with Style and Grace -Margaret Shepherd,Penny Carter, (Illustrator), Sharon Hogan, 2005.

Web Resources	
1.	A patch of land by Subramania Bharati translated by Usha Rajagoplan : https://books.google.co.in/books?id=iSHvOmXuvLMC&printsec=frontcover&dq=subramania+bharati+poems&hl=en&newbks=1&newbks_redir=0&source=gb_mobile_search&sa=X&redir_esc=y#v=onepage&q=subramania%20bharati%20poems&f=false
2.	The Sparrow by Paul Laurence Dunbar https://poets.org/poem/sparrow-0
3.	A Nation's Strength by Emerson https://poets.org/poem/nations-strength
4.	Love cycle by Chinua Achebe : https://www.best-poems.net/chinua-achebe/love-cycle.html
5.	JRD by Harish Bhat https://www.tata.com/newsroom/heritage/coffee-tea-jrd-tata-stories
6.	Us and Them by David Sedaris From Dress Your Family in Corduroy and Denim https://legacy.npr.org/programs/morning/features/2004/jun/sedaris/usandthem. html
7.	Uncle Podger Hangs a Picture: http://rosyhunt.blogspot.com/2013/01/uncle-podger-hangs-picture.html

8.	The Gold Frame: https://fybaenglish.blogspot.com/2018/12/the-gold-frame-r-k-laxman.html

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**2**
CO2	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**
CO5	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**

Mapping with Programme Specific Outcomes:

CO/PO	PSO 1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15

Weighted percentage of Course Contribution to POS	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**

3 – Strong, 2 – Medium, 1 - Low

Course Code	Course Title	L	T	P	C
23117AEC13	CELL AND MOLECULAR DEVELOPMENTAL BIOLOGY	4	1	0	3

Aim: To understand the various techniques in biotechnology and their applications.

Course Objectives:

- Have an insight of the cell as the fundamental unit of life and to compare the structure of the Eukaryotic cell with the primitive prokaryotic cell
- Analyze the structure and obtain a strong foundation about the functional aspects of cell organelles and cell membrane.
- Study the structure and functions of Nucleic acid and discuss the molecular mechanism of Replication, Transcription and Translation and post translational modifications of proteins.
- Predict the response of cells to the intra and extracellular environment by studying about the intracellular signaling pathways.
- Understand the principles and molecular mechanisms involved in cellular differentiation, morphogenesis, growth and Potency of the cell.

Course Outcomes:

- The students do understand the importance of plant and animal diversity and their conservation through *in-vitro* propagation and maintenance.
- Exploited techniques in molecular biology like isolation of animal and plant genomic DNA, their separation by gel electrophoresis, and amplification of separated DNA by polymerase chain reaction.
- To gain knowledge in Concept of Biology, Bio-molecules, Genetics, DNA Technology, Bioinformatics, Nanotechnology, Genetic Manipulations etc.,
- To understand the principles of the mechanism of some biotechnologically derived diagnostic aids/tests

UNIT-I

Discovery and diversity of cells - Cell theory - Structure of prokaryotic (bacteria) and eukaryotic cells (plant and animal cells).

UNIT–II

Bio-macromolecules and Bio-micromolecules (Primary functions in the cell). Structure and Functions of Cell Organelles: Cell wall - Cell membrane - Cytoplasm - Nucleus - chromosomes -Endoplasmic reticulum - Ribosomes - Golgi bodies - Plastids - Vacuoles - Lysosomes - Mitochondria - Microbodies - Flagella - Cilia - Centrosome and Centrioles - Cytoskeleton.

UNIT–III

Structure and functions of DNA and RNA -Central Dogma of the cell. DNA-Replication in prokaryotes - Transcription in Prokaryotes and Eukaryotes - RNA Processing – Genetic code- Translation - Similarities and differences in prokaryotic and eukaryotic translation - Post Translational Modifications - Protein Sorting - Protein degradation.

UNIT-IV

Cell cycle - Cell cycle checkpoints - Cell division - Mitosis and Meiosis - Cellular differentiation - Cell junctions - Cell Adhesion - ExtraCellular Matrix - Cell to cell communications - Signal transduction - G - Protein Coupled Receptors Signal transduction pathways

UNIT-V

Gametogenesis - Spermatogenesis and Oogenesis in mammals. Fertilization- Types of cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals- Organogenesis.

TEXTBOOKS:

1. T. Devasena (2012), Cell Biology, Oxford University Press.
2. Gupta, Renu & Makhija, Seema & Toteja, Ravi. (2018). Cell Biology: Practical Manual.
3. Gilbert, S.F. 2016.Developmental Biology, 11th edition. Sinauer Associates Inc. Publishers, MA. USA.
4. Bruce Alberts, 6th Edition (2014). Molecular Biology of the cell, W. W. Norton & Company.
5. James D. Watson (2001), The Double Helix: A personal account of the Discovery of the Structure of DNA, Touchstone Publishers.

REFERENCE BOOKS:

1. Karp's Cell and Molecular Biology: Concepts and Experiments. 8th Edition (2015). Wiley Publications.

2. James D. Watson, 7th Edition (2014), Molecular Biology of the Gene, Pearson Publications.

3. Geoffrey M. Cooper, 7th Edition (2015). The Cell: A Molecular Approach, Sinauer Associates, Qxford University Press.

4. Lodish Harwey, 6th Edition (2016), Molecular Cell Biology, W. H. Freeman Publications

5. Wolpert L, Tickle C, 2015. Principles of Development, 5th edition, Oxford University Press.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	2	1	3	-	3	3	2	3
CLO2	3	3	3	3	-	3	3	2	3
CLO3	3	3	3	2	-	3	3	2	2
CLO4	3	2	3	2	-	3	3	2	3
CLO5	3	3	2	2	-	3	3	2	3
TOTAL	15	14	12	12	0	15	15	10	15
AVERAGE	3	2.8	2.4	2.4	0	3	3	2	3

BIOCHEMISTRY I

Course Code	Course Name	L	T	P	S
23115GEC14A	BIOLOGICAL CHEMISTRY	4	1	0	3

Course objectives

The objectives of this course are to

- Introduce the structure and classification of carbohydrates
- Comprehend the metabolism of carbohydrates
- Study the classification and properties of amino acids
- Elucidate the various levels of organization of Proteins
- Study functions and deficiency diseases of vitamins

Unit I:

Definition and classification of carbohydrates, linear and cyclic forms (Haworth projection) for glucose, fructose and mannose and disaccharides (maltose, lactose, sucrose). General properties of monosaccharide's and disaccharides. Occurrence and significance of polysaccharides.

Unit II: Metabolism- Catabolism and Anabolism. Carbohydrate metabolism- Glycolysis, TCA cycle, HMP shunt and glycogen metabolism and energetic

Unit III: Amino acids -Classifications, physical properties -amphoteric nature, isoelectric point and chemical reactions of carboxyl amino and both groups. Amino acid metabolism - transamination, deamination and decarboxylation.

Unit IV : Proteins- classification - biological functions ,physical properties- ampholytes, iso electric point, salting in and salting out, denaturation, nature of peptide bond. Secondary structure, α-helix and β-pleated sheet, tertiary structure, various forces involved- quaternary structure.

Unit V: Vitamins- Fat (A, D, E and K) and water soluble vitamins (B complex and C)- sources, RDA, biological functions and deficiency diseases

Course Outcome

CO	On completion of this course, students will be able to	Programme Outcome
CO1	Classify the structure of carbohydrates and its properties	PO1
CO2	Explain the metabolism of carbohydrates and its significance	PO1
CO3	Classify amino acids and its properties	PO1
CO4	Explain the classification and elucidate the different levels of structural organization of proteins	PO1
CO5	Identify the disease caused by the deficiency of vitamins	PO1

Text Books

- Satyanarayan,U (2014) Biochemistry (4th ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.
- Jain J.L.(2007) Fundamentals of Biochemistry,S.Chand publishers 311

Reference books

- David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed) W.H. Freeman.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	1	3	2	2	3	3	3
CLO2	3	2	1	3	2	2	3	3	3
CLO3	3	1	2	3	2	2	3	3	3
CLO4	3	2	3	3	2	1	3	3	3
CLO5	3	2	3	2	2	2	3	2	3
TOTAL	**15**	**10**	**10**	**14**	**10**	**9**	**15**	**14**	**15**
AVERAGE	**3**	**2**	**2**	**2.8**	**2**	**1.8**	**3**	**2.8**	**3**

Course Code	Course Title	L	T	P	C
23117SEC15L	CELL AND MOLECULAR DEVELOPMENTAL BIOLOGY	0	0	3	3

Course objectives

CO1: Demonstrate the operation of Light Microscope
CO2: Identify blood cells and its components
CO3: Isolate and identify plant, and animal cells.
CO4: Summarizes the concept of gametes
CO5: Develop skill to perform cell fractionations.

EXPERIMENTS

1. Components of a Compound / Light Microscope.
2. Blood smear preparation and Identification of Blood cells
3. Buccal smear preparation and Identification of squamous epithelial cells.
4. Isolation and Identification of plant cells.
5. Observation of sperm & Egg
6. Mounting of chick Embryo - 24 hrs, 48 hrs, 72 hrs, 96 hrs.
7. Types of placenta in mammals.
8. Cell fractionation and Identification of cell organelles (Demo)

REFERENCE:

- K.V. Chaitanya, (2013), *Cell and molecular biology*: Lab manual, PHI publishers,. ISBN 978-81-203-800-4

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CLO1	3	3	3	3	2	3	3	2	2
CLO2	3	3	3	3	3	3	3	2	2
CLO3	3	3	3	3	3	3	3	3	3
CLO4	3	2	3	3	3	3	3	3	3
CLO5	3	3	2	3	2	2	2	3	3
TOTAL	15	14	14	15	13	14	14	13	13
AVERAGE	3	2.8	2.8	3	2.6	2.8	2.8	2.6	2.6

Course Code	Course Title	L	T	P	C
23115SEC16L	BIOLOGICAL CHEMISTRY	0	0	3	3

Learning objectives

- Identify carbohydrates by qualitative test
- Estimate biomolecules volumetrically
- Estimate protein quantitatively

I Qualitative analysis of carbohydrates

a) Monosaccharides-Glucose, Fructose

b) Disaccharides- Lactose, Maltose, Sucrose

c) Polysaccharides-Starch

II Volumetric analysis

a) Estimation of ascorbic acid using 2,6dichlorophenolindophenol as link solution

b) Estimation of Glucose by Benedict's method

c) Estimation of Glycine by Sorenson Formal titration

III Quantitative analysis (Demonstration Experiment)

a) Colorimetric estimation of protein by Biuret method

Course Outcome

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Qualitatively analyze and report the type of carbohydrate based on specific tests	PO1, PO2, PO3
CO2	Quantitatively estimate the carbohydrates, amino acids and ascorbic acid	PO1, PO2, PO3
CO3	Estimate protein by colorimetric method	PO1, PO2, PO3

Text books

1. Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, New Age International Publishers, 2011.
2. An Introduction to Practical Biochemistry, David T. Plummer, 3 rd edition, Tata McGraw-Hill Publishing Company Limited, 2001.
3. Biochemical Methods, Sadasivam S and Manickam A, 4h edition, New Age International Publishers, 2016

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO 3	PSO4
CO 1	2	3	3				3	3	3	3
CO 2	2	3	3				3	3	3	3
CO 3	2	3	3				3	3	3	3

S - Strong (3) M – Medium (2) L –Low (1)

Non Major Elective Semester-I

Course Code	Course Title	L	T	P	C
23117SEC17	FOOD AND NUTRITION	2	0	0	2

Course Objectives

CO1: The student can determine the relationship between food, health and immunity
CO2: Able to explain the classification of foods and their deficiency
CO3: Can analyse the importance of BMR
CO4: Can outline the basic food groups and their adulteration
CO5: Apply the concepts of food to prepare different food plans

Unit I:

Definition of food, Nutrition, Nutrient, Nutritional status, Dietetics, Balance diet, Malnutrition, Energy (Unit of energy-Joule, Kilocalorie). Health, Immunity by food and function of food.

Unit II:

Carbohydrate, Protein, Fat, Vitamin and Minerals (Calcium, Phosphorous, Sodium, Potassium, Iron, Iodine, Fluorine) -Sources, Classification, Function, Deficiencies of these nutrients. Function of water and dietary fiber.

Unit III:

BMR: Definition, factors affecting BMR and total energy requirements (Calculation of energy of individuals)

Unit IV:

Basic five food groups, nutritional significance of cereals, pulses, milk, meat, fish, vegetables, egg, nuts, oils and sugars. Food toxins, Food additives, Food quality, Safe food handling, Food adulteration, Preservatives and Packaging

Unit V:

Principles and Objectives of meal planning. Diet for an infant, preschool child, School child, normal male and female of different occupations.

Text Books

1. Vidya & D.B. Rao, 2010. A textbook of nutrition by, Discovery Publishing house,
2. Handbook of Nutrition & Food, third edition, CRC Press (Taylor and Francis group) by Carolyn D.Berdanier
3. Food science and Nutrition, Oxford publication by Sunetra Roday
4. Janet D Ward & Larry T Ward, Principles of food science by, Good heart-Wilcox publishing.
5. Dr. M. Swaminathan, 2018. Hand Book of Food & Nutrition, Second edition Bangalore press.

Reference Books

1. Joshi, V.K. and Singh, R.S., A. (2013), *Food Biotechnology- Principles and practices,* I.K.International Publishing House Pvt. Ltd., New Delhi,.
2. RavishankarRai, V,(2015), *Advances in Food Biotechnology,* (First edition), John Wiley & Sons, Inc, ISBN 9781118864555
3. Foster, G.N., (2020), *Food Biotechnology*, (First edition), CBS Publishers & Distributors Pvt Ltd, ISBN 9789389396348
4. Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath, Robert E. Levin (2005), *Food Biotechnology*, (2nd edition), *CRC Press*, ISBN 9780824753290
5. Perry Johnson-Green (2018), *Introduction to Food Biotechnology*, Special Indian Edition, *CRC Press*, ISBN 9781315275703

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	2	1	1	3	2	3	3	3
CLO2	3	2	1	1	3	3	3	3	3
CLO3	3	2	1	1	3	3	3	3	3
CLO4	3	2	1	1	3	3	3	3	3
CLO5	3	2	1	1	3	3	3	3	3
TOTAL	15	10	5	5	15	14	15	15	15
Average	3	2	1	1	3	2.8	3	3	3

Course Code	Course Title	L	T	P	C
23117SEC18	FOUNDATION COURSE	2	0	0	2

Unit 1:

Biotechnological Advances in Plant Seed Development and Germination Cellular and Molecular Biology of embryogenesis in dicotyledonous plants, hormonal regulation of seed development; control of seed maturation and germination, biotechnological approaches for altering seed composition.

Unit II:

DNA replication, Repair and Recombination: Replication initiation, elongation and termination in prokaryotes & eukaryotes, enzymes and accessory proteins involved in DNA replication, Fidelity; DNA repair- photoreactivation, nucleotide and base excision repair, mismatch repair, SOS response, gene amplification, mobile genetic elements.

Unit III:

Cellular therapy; Stem cells: definition, properties and potency of stem cells; Sources: embryonic and adult stem cells; Concept of tissue engineering; Histotypic and Organotypic culture for tissue engineering; Immunotherapy: Cancer immunotherapy; Role of cytokine therapy in cancers; Genetically engineered stem cells in cancer treatment

Unit IV:

Introduction to Fermentation processes, Types of fermentation processes, batch fermentation processes and its kinetics, plug flow fermentation process and its kinetics, continuous fermentation processes and its kinetics, Fed batch fermentation processes and its kinetics, factors affecting fermentation processes.

Unit V:

Molecular pharming (farming): edible vaccines, therapeutic proteins, Nutritional quality: golden rice, protein, vitamins. T-DNA & transposon tagging, promoter trapping, activation tagging. Chloroplast transformation: advantages, vectors, success with tobacco and potato.

Course Code	Course Title	L	T	P	C
231AECCINC	INDIAN CONSTITUTION	2	0	0	2

Objectives:

- To make the students understand about the democratic rule and parliamentarian administration
- To appreciate the salient features of the Indian constitution 3.To know the fundamental rights and constitutional remedies
- To make familiar with powers and positions of the union executive ,union parliament and the supreme court
- To exercise the adult franchise of voting and appreciate the electoral system of Indian democracy.

Learning Out comes:

- Democratic values and citizenship training are gained
- Awareness on fundamental rights are established
- The function of union government and state government are learnt
- The power and functions of the judiciary are learnt thoroughly
- Appreciation of democratic parliamentary rule is learnt

Unit I: The making of Indian constitution

The constitution assembly organization –character -work salient features of the constitution- written and detailed constitution -socialism –secularism-democracy and republic.

Unit II: Fundamental rights and fundamental duties of the citizens.

Right of equality - right of freedom- right against exploitation -right to freedom of religion- cultural and educational rights -right to constitutional remedies -fundamental duties .

Unit III: Directive principles of state policy.

Socialistic principles-Gandhi an principles-liberal and general principles -differences between fundamental rights and directive principles

Unit IV: The union executive, union parliament and Supreme Court.

Powers and positions of the president -qualification _method of election of president and vice president -prime minister -Rajya Sabah -Lok Sabah .the supreme court -high court -functions and position of supreme court and high court

Unit V: State council -election system and parliamentary democracy in India.

State council of ministers -chief minister -election system in India-main features election commission-features of Indian democracy.

References:

1) Palekar.s.a. Indian constitution government and politics, ABD publications, India
2) Aiyer, alladi krishnaswami, Constitution and fundamental rights 1955.
3) Markandan. k.c.directive Principles in the Indian constitution 1966.
4) Kashyap. Subash c, Our parliament ,National book trust , New Delhi 1989

Course Code	Course Title	L	T	P	C
231LSCUV	UNIVERSAL HUMAN VALUES	0	0	0	1

Aim:

This course aims at making learners conscious about universal human values in an integral manner, without ignoring other aspects that are needed for learner's personality development.

Course Objectives:

The present course deals with meaning, purpose and relevance of universal human values and how to inculcate and practice them consciously to be a good human being and realiseone's potentials.

Course Outcomes:

By the end of the course the learners will be able to:

- Know about universal human values and understand the importance of values in individual, social circles, career path, and national life.
- Learn from case studies of lives of great and successful people who followed and practised human values and achieved self-actualisation.
- Become conscious practitioners of human values.
- Realise their potential as human beings and conduct themselves properly in the ways of the world.

Unit I

- Introduction: What is love? Forms of love – for self, parents, family, friend, spouse, community, nation, humanity and other beings, both for living and non-living
- Love and compassion and inter-relatedness
- Love, compassion, empathy, sympathy and non-violence
- Individuals who are remembered in history for practicing compassion and love.
- Narratives and anecdotes from history, literature including local folklore
- Practicing love and compassion: What will learners learn gain if they practice love and compassion? What will learners lose if they don't practice love and compassion?
- Sharing learner's individual and/or group experience(s)
- Simulated Situations

- Case studies

UNIT II

- Introduction: What is truth? Universal truth, truth as value, truth as fact (veracity, sincerity, honesty among others)
- Individuals who are remembered in history for practicing this value
- Narratives and anecdotes from history, literature including local folklore
- Practicing Truth: What will learners learn/gain if they practice truth? What will learners lose if they don't practice it?
- Learners' individual and/or group experience(s)
- Simulated situations
- Case studies

Unit III

- Introduction: What is non-violence? Its need. Love, compassion, empathy sympathy for others as pre-requisites for non-violence
- Ahimsa as non-violence and non-killing
- Individuals and organisations that are known for their commitment to non-violence
- Narratives and anecdotes about non-violence from history, and literature including local folklore
- Practicing non-violence: What will learners learn/gain if they practice non- violence? What will learners lose if they don't practice it?
- Sharing learner's individual and/or group experience(s) about non-violence
- Simulated situations
- Case studies

Unit IV

- Introduction: What is righteousness?

- Righteousness and dharma, Righteousness and Propriety
- Individuals who are remembered in history for practicing righteousness
- Narratives and anecdotes from history, literature including local folklore
- Practicing righteousness: What will learners learn/gain if they practice righteousness? What will learners lose if they don't practice it?
- Sharing learners' individual and/or group experience(s)
- Simulated situations
- Case studies

Unit V

- Introduction: What is peace? Its need, relation with harmony and balance
- Individuals and organisations that are known for their commitment to peace
- Narratives and Anecdotes about peace from history, and literature including local
- folklore
- Practicing peace: What will learners learn/gain if they practice peace? What will learners lose if they don't practice it?
- Sharing learner's individual and/or group experience(s) about peace
- Simulated situations
- Case studies

Unit VI

- Introduction: What is service? Forms of service for self, parents, family, friend, spouse, community, nation, humanity and other beings—living and non-living, persons in distress or disaster.
- Individuals who are remembered in history for practicing this value.
- Narratives and anecdotes dealing with instances of service from history, literature
- including local folklore
- Practicing service: What will learners learn/gain gain if they practice service? What will learners lose if they don't practice it?
- Sharing learners' individual and/or group experience(s) regarding service
- Simulated situations
- Case studies

Unit VI

- Introduction: What is service? Forms of service for self, parents, family, friend, spouse, community, nation, humanity and other beings—living and non-living, persons in distress or disaster.
- Individuals who are remembered in history for practicing this value.
- Narratives and anecdotes dealing with instances of service from history, literature including local folklore
- Practicing service: What will learners learn/gain gain if they practice service? What will learners lose if they don't practice it?
- Sharing learners' individual and/or group experience(s) regarding service
- Simulated situations
- Case studies

Unit VII

- Introduction: What is renunciation? Renunciation and sacrifice. Self-restrain and Ways of overcoming greed. Renunciation with action as true renunciation
- Individuals who are remembered in history for practicing this value.
- Narratives and anecdotes from history and literature including local folklore about individuals who are remembered for their sacrifice and renunciation.
- Practicing renunciation and sacrifice: What will learners learn/gain if they practice Renunciation and sacrifice? What will learners lose if they don't practice it?
- Sharing learners' individual and/or group experience(s)
- Simulated situations
- Case studies

SEMESTER II

Course Code	Course Title	L	T	P	C
23110AEC21	**Tamil-II - பக்தி இலக்கியம்**	3	1	0	3

இரண்டாம் பருவம்

நோக்கம் :

- காலந்தோறும் பக்தி இலக்கியம் வளர்ந்துள்ள தன்மையைக் கற்பித்தல்.
- நாயன்மார்கள், ஆழ்வார்களின் பக்திச் சிறப்பை அறிய செய்தல்.

பயன்கள்:

CO1: நாயன்மார்கள் பக்திச் சிறப்பை அறிதல்.

CO2: ஆழ்வார்களின் பக்தி நெறியை உணர்தல்.

CO3: பக்தி இலக்கியம் காலம் தோறும் வளர்ந்ததே அறிதல்.

CO4: பாடல்களில் இசை இன்பம், ஓசை நயம் அறிதல்.

அலகு - 1 பன்னிரு திருமுறைகள்

1. திருஞானசம்பந்தர்- திருத்தில்லைப் பதிகம்
2. திருநாவுக்கரசர் - திருநீற்றுப் பதிகம்
3. சுந்தரர் - திருவெண்ணைநல்லூர்
4. திருமூலர்- திருமந்திரம்(இளமை நிலையாமை)

அலகு - 2 பன்னிரு ஆழ்வார்கள்

1. ஆண்டாள் - திருப்பாவை
2. பெரியாழ்வார்- மூன்றாம் திருமுறை(பத்து பாடல்கள்)
3. மதுரகவியாழ்வார் - கண்ணின் நுண் சிறு தாம்பு

அலகு - 3 சிற்றிலக்கியங்கள்

1. மீனாட்சியம்மைப் பிள்ளைத்தமிழ்- செங்கீரை பருவம், அம்புலி பருவம்
2. நந்திக்கலம்பகம்
3. குற்றால குறவஞ்சி- குறத்தி நகர்வளம் கூறுதல்
4. காளமேகப்புலவர் பாடல்கள்

அலகு - 4 புதினம்

1. நா .பார்த்தசாரதியின்- குறிஞ்சி மலர்

அலகு-5 தமிழ் இலக்கிய வரலாறு

1. பக்தி இலக்கியங்கள்
2. சைவமும் தமிழும்
3. வைணவ சமயம் போற்றி வளர்த்த தமிழ்
4. சிற்றிலக்கியங்கள்
5. நாவல் இலக்கியம்

பார்வை நூல்கள் :

1. தேவாரம் - மணிவாசகர் பதிப்பகம் சென்னை
2. நாலாயிர திவ்ய பிரபந்தம் - வர்த்தமான பதிப்பகம் சென்னை
3. தமிழ் இலக்கிய வரலாறு - முனைவர் ச சுபாஷ் சந்திர போஸ், இயல் வெளியீடு ,தஞ்சாவூர
4. தமிழ் நாவல் இலக்கியம் -கா கைலாசபதி- தமிழ் புத்தக நிலையம், சென்னை

இணையதளம் - www.tamilvu.org,
www.noolulagam.com

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

Course Code	Course Title	L	T	P	C
23111AEC21	Advanced English-II	3	1	0	3

Aim:

To improve communication skills in English

Course Objective:

- To understand the format of e-mail, fax and memos
- To write itinerary, checklist, invitation, circular, instruction, recommendations
- To understand the impact of the biographies of famous people

Course Content:

Unit I

Introduction Test of vocabulary range; test of verbal speed; test of verbal responsiveness; affixation-prefix, suffix; synonyms.

Unit II

Homonyms and homographs Words of foreign origin; antonyms; redundant words; phrases; acronyms; words commonly confused; slang and new words.

Unit III

Technical terms Personality types; relationships; medicines; science; business, education, law, technology, and the humanities.

Unit IV

Vocabulary for professional exams TOEFL; IELTS; SAT; GRE; CAT; MAT; TANCET; BEC; GMAT

Unit V

Vocabulary games synonyms; antonyms; compound word; homophone; idioms; literature; oxymoron; parts of speech; prefix; suffix; root word; spelling; word play.

Outcome:

- Developing technological skill
- Able to write in a variety of formats
- Read biographies and develop personality

Author	Title of the book	Edition / Year Publisher	Edition / Year Publisher
Meenakshi Raman & Sangeetha Sharma	Technical Communication	2011	Oxford University Press
Rajendra Pal & J.S.Korlahalli	Business Communication	2015	Sultan

Course Code	Course Title	L	T	P	C

23111AEC22	**Paper II - General English**	3	1	0	3

Course Objectives

CO1: To introduce learners to the essential skills of communication in English

CO2: To enable them use these skills effectively in academic and non-academic contexts

CO3: To enable them use these skills effectively in academic and non-academic contexts

CO4: To enable them use various business communication strategies and to use advanced vocabulary

CO5: To familiarize them in writing descriptive essays and respond to arguments orally and in writing

Course Content

UNIT I : Poetry

1.1 Very Indian Poem in Indian English - Nissim Ezekiel

1.2 Still I Rise - Maya Angelou

1.3 On Killing a Tree - Gieve Patel

UNIT II : Prose

2.1 If You Are Wrong Admit it- Dale Carnegie

2.2 Kindly Adjust Please - Shashi Tharoor

2.3 The Spoon-fed Age- W.R. Inge

UNIT III: Fiction

Alchemist - Paulo Coelho

UNIT IV: Language Competency

4.1 Homonyms, Homophones, HomographsPortmanteau words

4.2 Subject Verb Agreement

UNIT V: English in the Workplace

5.1 Reading for General and Specific information [Charts, tables, schedules, graphs etc]
5.2 Reading news and weather reports
5.3 Writing paragraphs
5.4 Taking and making notes

Course Outcome s	On completion of this course, students will;	POS
CO1	Learn to introduce themselves and talk about everyday activities confidently	PO1
CO2	Be able to write short paragraphs on people, places and events	PO1, PO2
CO3	Identify the purpose of using various tenses and effectively employ them in speaking and writing	PO4, PO6
CO4	Gain knowledge to write subjective and objective descriptions	PO4, PO5, PO6
CO5	Identify and use their skills effectively in formal contexts.	PO3, PO8

Text Books (Latest Editions)	
1.	**The Alchemist - Paulo CoelhoHarper – 2005**

References Books (Latest editions and the style as given below must be strictly adhered to)	
1.	Advanced English Grammar. Martin Hewings. Cambridge University Press, 2000
2.	Descriptive English. SP Bakshi, Richa Sharma · 2019, Arihant Publications (India) Ltd.
3.	The Reading Book: A Complete Guide to Teaching Reading. Sheena Cameron, Louise Dempsey, S & L. Publishing, 2019.
4.	Skimming and Scanning Techniques, Barbara Sherman, Liberty University Press, 2014
5.	Brilliant Speed Reading: Whatever you need to read, however ...Phil Chambers, Pearson, 2013.
6.	The Archer, Paulo Coelho. Penguin Viking, 2020.

Web Resources

1.	Very Indian poem by Nissim Ezekiel http://econtent.in/pacc.in/admin/contents/40_%20_2020103001102714.pdf
2.	Still I Rise by Maya Angelou https://www.poetryfoundation.org/poems/46446/still-i-rise
3.	The Flower by Tennyson: https://www.poemhunter.com/poem/the-flower-2/
4.	On Killing a tree by Gieve Patel: https://www.poemhunter.com/poem/on-killing-a-tree/
5.	If you are wrong, admit it: https://www.tbr.fun/if-youre-wrong-admit-it/
6.	Kindly Adjust please - Shashi Tharoor https://www.theweek.in/columns/shashi-tharoor/2018/05/25/kindly-adjust-to-our-english.html?fbclid=IwAR3IhtdXqvuV4ySECn9S7SA6HmCEYISyd1QHd3BlwKgiNKKwdkeSg3qWp-U/
7.	The Spoon Fed Age: https://www.nrkacademy.com/2016/04/spoon-feeding-by-wringe.html
8.	The Alchemist: https://www.youtube.com/watch?v=lxBYpmxjeDU

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

3 – Strong, 2 – Medium , 1 -

Low Mapping with Programme Specific Outcomes:

CO /PO	PSO 1	PS O2	PS O3	PS O4	PS O5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POS	3.0	3.0	3.0	3.0	3.0

Course Code	Course Title	L	T	P	C
23117AEC23	GENETICS	4	1	0	3

Aim:

- Students will understand the cellular components underlying mitotic cell division.

Objectives:

- Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
- Students will understand how these cellular components are used to generate and utilize energy in cells

Outcomes:

- This paper will enable the students to learn the basics and lay strong foundation in understanding the composition of cells, how cells works is fundamental to living systems.

UNIT I

Genetics- History, Genetics in Society and Biology, Fundamental Concepts of Genetics- Mendelian genetics: Monohybrid cross, Dihybrid cross, Test Cross, Back cross, Sex determination and Sex-Linked Chromosomes, genetic vs environmental effect-multiple alleles. Deviations from Mendelian Genetic Principles.

UNIT II

Prokaryotic and Eukaryotic Chromosomes – organization and structure-Transposable elements, Cellular Repoduction in Prokaryotic and Eukaryotic cells - mitosis and meiosis- significance- cell cycle-Linkage, mechanism of crossing over-genetic variability

UNIT III

Gene concept: modern concept of gene- DNA as a genetic material- Watson and Crick model of DNA- DNA replication- repair- Telomeres-Linkage-Recombination-Gene Mapping- DNA Senescence.

UNIT IV

Prokaryotic and Eukaryotic Transcription and Translation-RNA and its types-Genetic code. Control of Gene Expression:– Operon concept- Lac and Trp operon

UNIT V

Gene Mutation and Chromosome variations-Genetic disorders- in borne errors of metabolism, Banding techniques, chromosomal aberrations.

Cell Junctions and the Extracellular Matrix- Cell–Cell junctions-the Extracellular Matrix Cancer and oncogenes.

REFERENCES

- Genetics-A Conceptual Approach by Benjamin A. Pierce, 4th Edn, 2012 W. H. Freeman and Company.
- Molecular Biology of the Cell by Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter, 6th Edn, 2015, Garland Science
- iGenetics: A Molecular Approach by Peter J. Russell. 3rd Edn, 2010, Pearson Education, Inc.,
- Genetics by Verma and Agarwal. Chand publications.
- Genetics by Gardner, Simmons and Snustad. 2004. John Wiley & sons.

MAPPING WITH PROGRAMME OUTCOME AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	3	2	3	3	2	2
CLO2	3	3	3	3	3	3	3	2	2
CLO3	3	3	3	3	3	3	3	3	3
CLO4	3	2	3	3	3	3	3	3	3
CLO5	3	3	2	3	2	2	2	3	3
TOTAL	15	14	14	15	13	14	14	13	13
AVERAGE	3	2.8	2.8	3	2.6	2.8	2,8	2.6	2.6

Course Code	Course Title	L	T	P	C
23116AEC34	FUNDAMENTALS OF MICROBIOLOGY	4	1	0	3

Aim:

Students should have knowledge about the history and development of Microbiology

Objectives:

The contents of this course will help students understand history, biology of microorganisms, growth and control of microbes. Thus the beginners are rightly exposed to foundation of Microbiology which would lead them towards progressive advancement of the subject

Unit I History of microbiology

Historical development of Microbiology- Theories of spontaneous generation – The scope of Microbiology - prokaryotic and eukaryotic microorganisms. General principles and nomenclature – Haeckel's three kingdom concept, Whittaker's five kingdom concept- Carl Woese three domain classification.

Unit II Microscopy

Microscopy: Principles and applications of bright field, dark field, phase contrast, fluorescent SEM and TEM. Principles and types of staining– Simple, differential (Gram, Spore, AFB) Capsule staining (Negative), Sterilization: Principles and methods – physical moist heat, dry heat, filtration (Membrane and HEPA).

Unit III General Characteristics of microbes

General characteristics and nature of Archaebacteria, Cyanobacteria, Mycoplasma, Rickettsiae, Chlamydia, Spirochaetes, Actinobacteria, Protozoa, Algae, Fungi and Viruses. Basic understanding of classification of viruses, algae, fungi and protozoa.

Unit IV Classification of bacteria

Outline classification for bacteria as per the Bergey's Manual of Systematic Bacteriology -Structural organization of bacteria – Size, shape and arrangement of bacterial cells -Ultrastructure of a bacterial cell - cell wall, cell membrane, ribosomes, nucleoid, slime, capsule, flagella, fimbriae, spores, cysts, plasmid, mesosomes and cytoplasmic inclusions.

Unit V Cultivation of microbes

Cultivation of microbes- Types of culture media with specific examples for each type. Aerobic and Anaerobic culture techniques-Pure culture techniques (Tube dilution, Pour plate, Spread plate and Streak plate).

Outcomes:

On the successful completion of the course, student will be able to:

1. Understand the history of microbiology
2. Analyze the types of microscope
3. Understand the general characteristics of microbes
4. Evaluate the success of understanding the characterization and cultivation of microbes.

REFERENCES

1. Alcamo IE. Fundamentals of Microbiology, sixth edition, Addison wesley Longman, Inc. California. 2001.
2. Alexopoulos CJ, Mims CW and Blackwell M. Introductory Mycology. Fifth edition John Wiley and Sons. Chichester. 2000.
3. Atlas RA and Bartha R. Microbial Ecology. Fundamentals and Application, Benjamin Cummings, New York. 2000.
4. Black JG. Microbiology-principles and explorations, 6th edition. John Wiley and Sons, Inc. New York. 2005.
5. Cappuccino and Sherman. Microbiology – A Laboratory Manual. 7th edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi. 2012.
6. Dubey RC and Maheswari DK. A Text Book of Microbiology. S Chand, New Delhi. 2010
7. Johri RM, Snehlatha, Sandhya Shrama. A Textbook of Algae. Wisdom Press, New Delhi. 2010.

7. Kanika Sharma. Textbook of Microbiology – Tools and Techniques. 1st edition, Ane Books Pvt. Ltd., New Delhi. 2011.
8. Madigan MT, Martinko JM, and Parker J. Biology of Microorganisms, 12th Edition, MacMillan Press, England. 2009.
9. Moselio Schaechter and Joshua Leaderberg. The Desk encyclopedia of Microbiology. Elseiver Academic press, California. 2004.
10. Pelczar MJ, Chan ECS and Kreig NR. Microbiology, fifth edition. McGrawHill. Book Co. Singapore. 2009.
11. Prescott LM, Harley JP, and Klein DA. Microbiology (7th edition) McGraw Hill, Newyork. 2008.
12. Schlegel HG. General Microbiology, Cambridge University Press, U.K. 2008.
13. Tortora GJ, Funke BR and Case CL. Microbiology: An Introduction. 9th Edition, Pearson Education, Singapore. 2009.
14. Rajan S and Selvi Christy R. Essentials of Microbiology, Anjanaa Book House, Chennai, 2015.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	2	3	3	3	3
CLO4	3	3	3	2	3	2	3	3	2
CLO5	3	3	2	3	3	3	3	2	3
TOTAL	15	15	14	14	14	14	15	14	14
AVERAGE	3	3	2.8	2.8	2.8	2.8	3	2.8	2.8

Course Code	Course Title	L	T	P	C
23117SEC25L	GENETICS LAB	0	0	3	3

Course Objectives:

- Demonstrate the basic principles of important techniques in Molecular biology and Genetics.
- Analyze the Polytene chromosome of the organisms
- Identify Barr bodies from Buccal smear
- Demonstrate the Preparations and maintenance of culture medium
- Demonstrate Human karyotyping

Outcomes:

- It will provide an understanding of the unique features of plant cells and animal cell.
- Gain understanding on the interaction between cells and the environment

Experiments:

1. Mitotic stages of onion (Allium cepa) root tip
2. Meiotic stages of cockroach testes/ Flower bud
3. Giant chromosomes from Chironomus larvae/ Drosophila salivary glands
4. Identification of Barr bodies from Buccal smear
5. Preparations of culture medium and culture of Drosophila – methods of maintenance
6. Identifications of mutants of Drosophila
7. Human karyotyping (Demo)

REFERENCE:

1. Practical Manual on "Fundamentals of Genetics" (PBG-121). 2019, Edition: First Publisher: Odisha University of Agriculture & Technology. Editor: Kaushik Kumar Panigrahi

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	2	3	3	3	3
CLO4	3	3	3	2	3	2	3	3	2
CLO5	3	3	2	3	3	3	3	2	3
TOTAL	15	15	14	14	14	14	15	14	14
AVERAGE	3	3	2.8	2.8	2.8	2.8	3	2.8	2.8

Course Code	Course Title	L	T	P	C
23116SEC26L	MICROBIOLOGY LAB	0	0	3	3

Course objectives

1. Describe the general Laboratory safety & Sterilization Techniques
2. Develop Skills in Media Preparation, Isolation & Serial Dilution Techniques and Pure Culture Techniques
3. Microscopically analyze the morphological features of Bacteria and fungi and define various Staining Techniques.
4. Perform the Motility of organisms.
5. Able to characterize and identify bacteria using Biochemical tests.

Experiments:

1. Safety practices in Microbiological laboratory
2. Microscope and its operation
3. Principles and operations – Autoclave, Hot Air Oven, Filtration, Laminar Air Flow, Incubators, colony counter, Centrifuge, pH meter, Colorimeter and SpectrophotometerPreparation of culture media, cleaning of glassware and sterilization methods
4. Demonstration of ubiquitous nature of microorganisms.
5. Measurement of size of microbes – micrometry.
6. Observation of permanent slides to study the structural characteristics of algae (Anabena, Nostoc, Spirulina, Oscillotoria), fungi (Pythium, Rhizopus, Saccharomyces, Penicillium, Aspergillus, Agaricus) and protozoa (Entamoeba histolytica and Plasmodium spp.).
7. Enumeration of bacterial numbers by Viable count (Plate count) and Total count (Haemocytometer count)
   - Pure culture techniques - Streak plate, Pour plate and Spread plate.
   - Test for motility of bacteria – Hanging drop method.
   - Staining techniques – Simple staining, Gram's staining, Spore-staining, Capsular staining.
   - Isolation of bacteria, actinobacteria, fungi and cyanobacteria.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	2	2	2	1	2	3	3	3
CLO2	3	2	2	2	1	1	3	3	3
CLO3	3	2	1	1	-	1	3	3	3
CLO4	3	2	1	2	3	2	3	3	2
CLO5	3	3	2	3	3	2	3	2	3
TOTAL	15	11	8	10	8	8	15	14	14
AVERAGE	3	2.2	1.6	2	1.6	1.6	3	2.8	2.8

Course Code	Course Title	L	T	P	C
23117SEC27	PUBLIC HEALTH AND HYGIENE	2	0	0	2

Course objectives

1. Can explain the importance of health and hygiene
2. Can analyze the importance of food and malnutrition
3. Can understand the cause of diseases
4. Will get know about lifestyle diseases
5. Will get awareness about various Health Services Organizations

Unit I

Scope health and hygiene – Concept of health and disease - Pollution and health hazards; water and airborne diseases. Radiation hazards: Mobile Cell tower and electronic. Role of health education in environment improvement and prevention of diseases. Personal hygiene, oral hygiene and sex hygiene.

Unit II

Classification of food into micro and macro nutrients. Balanced diet, Importance of dietary fibres.Significance of breast feeding. Malnutrition anomalies – Anaemia, Kwashiorkar, Marasmus, Rickets, Goiter (cause, symptoms, precaution and cure).

Unit III

Communicable viral diseases- measles, chicken pox, poliomyelitis, swine flu, dengue, chickungunya, rabies, leprosy and hepatitis. Communicable bacterial diseases- tuberculosis, typhoid, cholera, tetanus, plague, whooping cough, diphtheria, leprosy. Sexually transmitted diseases- AIDS, syphilis and gonorrhoea. Health education and preventive measures for communicable diseases.

Unit IV

Non-communicable diseases such as hypertension, stroke, coronary heart disease, myocardial infarction.Osteoporosis, osteoarthritis and rheumatoid arthritis-cause, symptom, precautions. Diabetes- types and their effect on human health. Gastrointestinal disorders- acidity, peptic ulcer, constipation, piles. (cause, symptoms, precaution and remedy) Obesity (Definition and consequences). Mental illness(depression and anxiety). Oral and lung cancer and their preventive measures.

Unit V

Health Services Organizations: World Health Organization (WHO), United Nations International Children's Emergency Fund (UNICEF) and Indian Red Cross (IRC).

Text Books

1. Mary Jane Schneider (2011) Introduction to Public Health.
2. Muthu, V.K. (2014) A Short Book of Public Health.
3. Detels, R. (2017) Oxford Textbook of Public Health (6th edition).
4. Gibney, M.J. (2013) Public Health Nutrition.
5. Wong, K.V. (2017) Nutrition, Health and Disease.

Reference Books

1. S. Lal, (2018), Vikas. *Public Health Management Principles And Practice*, 2nd Edition, CBS Publishers and Distributors Pvt Ltd, ISBN: 978-93-87742-93-2.
2. Mary-Jane Schneider (2016), *Introduction to Public Health*,(5th Edition), Jones & Bartlett Learning,. ISBN-13: 978-1284197594
3. Carolyn D. Berdanier, Johanna T. Dwyer, David Heber (2013), *Handbook of Nutrition and Food*, (3rd Edition), CRC Press,. ISBN 9781466505711
4. Sue Reed, Dino Pisaniello, GezaBenke, Kerrie Burton. (2013), *Principles of*
5. *Occupational Health and Hygiene: An Introduction, (* 2nd Revised ed. Edition), Allen &Unwin,
6. V. Kumaresan, R. Sorna Raj, *(*2012) *Public Health and Hygiene*,(1st Edition), Saras Publication

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	-	2	3	3	3	3	3
CLO2	3	3	-	2	3	3	3	3	3
CLO3	3	3	1	2	3	3	3	3	3
CLO4	3	3	1	2	3	3	3	3	3
CLO5	2	3	2	3	3	3	2	2	3
TOTAL	14	15	4	11	15	15	14	14	15
Average	2.8	3	0.8	2.2	3	3	2.8	2.8	3

Course Code	Course Title	L	T	P	C
23117SEC28	FOOD AND BIOPROCESS TECHNOLOGY	2	0	0	2

Course Outcome

Students will be able to assess nutritional status and apply the knowledge in understanding the metabolism and nutrient functions.

UNIT I

Introduction to Bioprocess Technology: History and Scope- Bioreactor: Design, parts and accessories, functions- Modes of Operation of fermenter – Batch & continuous - Types of reactors - Bubble column, Fluidized bed reactor, plug flow reactor.

UNIT II

Fermentation media design, sterilization and media requirement for industrial fermentation, Main parameters to be monitored and controlled in fermentation processes, aerobic and anaerobic fermentation processes. Development and scale up of bioreactors for production of biological products. Immobilization – Types of immobilization, various methods - Applications of immobilized enzyme technology.

UNIT III

Downstream processing: Cell disruption methods for intracellular products, removal of insolubles, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods. Enrichment operations: Membrane – based separations. Product finishing: precipitation/crystallization, mixing, dialysis, distillation and drying

UNIT IV

Production of microbial enzymes (Amylase, Protease and Pectinase) applications, production of organic solvents (Ethanol, Methanol) – production of organic acids (Citric acid, Acetic acid) - Single cell protein production – Spirulina, Yeast, Actinomycetes protein. Beverages production – Beer and Wine.

UNIT V

Processing of Milk – Pasteurization and homogenization - Modifying milk composition – Production of milk products – Curd, cheese, yogurt, and flavoured milk. Bakery products – Bread making. Probiotics and Role of Food technology in bio-defense programs.

References:

1. Shuler, M.L. and Kargi, F. 2008. Bioprocess engineering – Basic concepts. Pearson Education.
2. M.L. Srivastava., 2010. Fermentation Technology, Narosa Publications.
3. Pauline M. Doran., 2009.Bioprocess Engineering Principles. Academic Press Inc.,
4. El-Mansi& Bryce C.F.A., 2007. Fermentation Microbiology and Biotechnology., 2nd edition, Taylor and Francis Publishing

Course Code	Course Title	L	T	P	C
231AECCCMS	COMMUNICATION SKILLS	2	0	0	2

Aim:

Course Objectives:

This course has been developed with the following objectives:

1. Identify common communication problems that may be holding learners back
2. Identify what their non-verbal messages are communicating to others
3. Understand role of communication in teaching-learning process
4. Learning to communicate through the digital media
5. Understand the importance of empathetic listening
6. Explore communication beyond language.

Course Outcome:

By the end of this program participants should have a clear understanding of what good communication skills are and what they can do to improve their abilities.

Unit I

- Techniques of effective listening
- Listening and comprehension
- Probing questions
- Barriers to listening

Unit II

- Pronunciation
- Enunciation
- Vocabulary
- Fluency
- Common Errors

Unit III

- Techniques of effective reading
- Gathering ideas and information from a given text
    - i. Identify the main claim of the text
    - ii. Identify the purpose of the text
    - iii. Identify the context of the text
    - iv. Identify the concepts mentioned

- Evaluating these ideas and information
    i. Identify the arguments employed in the text
    ii. Identify the theories employed or assumed in the text
- Interpret the text
    i. To understand what a text says
    ii. To understand what a text does
    iii. To understand what a text means

Unit IV

- Clearly state the claims
- Avoid ambiguity, vagueness, unwanted generalisations and over simplification of issues
- Provide background information
- Effectively argue the claim
- Provide evidence for the claims
- Use examples to explain concepts
- Follow convention
- Be properly sequenced
- Use proper sign posting techniques
- Be well structured
    i. Well-knit logical sequence
    ii. Narrative sequence
    iii. Category groupings

- Different modes of Writing -
    i. E-mails
    ii. Proposal writing for Higher Studies
    iii. Recording the proceedings of meetings
    iv. Any other mode of writing relevant for learners

Unit V

- Role of Digital literacy in professional life
- Trends and opportunities in using digital technology in workplace
- Internet Basics
- Introduction to MS Office tools
    i. Paint
    ii. Office

iii. Excel

iv. Power point

Unit VI

- Introduction to social media websites
- Advantages of social media
- Ethics and etiquettes of social media
- How to use Google search better
- Effective ways of using Social Media
- Introduction to Digital Marketing

Unit VII

- Meaning of non-verbal communication
- Introduction to modes of non-verbal communication
- Breaking the misbeliefs
- Open and Closed Body language
- Eye Contact and Facial Expression
- Hand Gestures
- Do's and Don'ts
- Learning from experts
- Activities-Based Learning

Reference:

1. SenMadhucchanda (2010), *An Introduction to Critical Thinking*,Pearson,Delhi
2. Silvia P. J. (2007), *How to Read a Lot*, American Psychological Association, Washington DC

Course Code	Course Title	L	T	P	C
231SSCBE	Basic Behavioral Etiquette	-	-	-	2

Objectives:

Training is mainly focused on discipline, grooming, career planning and building personality. As it is the first year of university, students are given awareness about the job market right from the start so that they prepare accordingly at their own pace and potential.

Eliminating negative thought, developing enriching habits, unlocking individual potentials and well-versed communication is the aim of this program.

The module consists of

a) Communication Skills
b) Goal Setting
c) Career Planning
d) Reaching your Potential
e) Time Management
f) Stress Management
g) Grooming and Discipline
h) Learning skills
i) Listening Skills
j) Team Building

Reference Book:

1. Barbara Pachter, Marjorie Brody. Complete Business Etiquette Handbook. Prentice Hall, 2015.
2. Dhanavel, S.P. English and Soft Skills. Hyderabad: Orient BlackSwan, 2021.
3. Koneru, Aruna. Professional Communication. Delhi: McGraw, 2008.
4. Mahanand, Anand. English for Academic and Professional Skills. Delhi: McGraw, 2013. Print.
5. Nancy Mitchell. Etiquette Rules : A Field Guide to Modern Manners. Wellfleet Press, 2015.
6. Rani, D Sudha, TVS Reddy, D Ravi, and AS Jyotsna. A Workbook on English Grammar and Composition. Delhi: McGraw, 2016.

SEMESTER III

Course Code	Course Title	L	T	P	C
23110AEC31	Tamil-III - **காப்பிய இலக்கியம்**	3	1	0	3

மூன்றாம் பருவம்

பாடநோக்கம் :

- தமிழ்க் காப்பியங்களை அறிமுகப்படுத்துதல்.
- காப்பியங்கள் கூறும் வாழ்வியல் அறங்களை உணர்த்துதல்.
- காப்பிய இலக்கியங்களில் இலக்கியச் சுவையை பயிற்றுவித்தல்.
- நாடக இலக்கியத்தின் தனித்துவத்தைக் கற்பித்தல்.

பயன்கள் :

CO1 : இலக்கியங்களின் சிறப்புகளை அறிவர்.
CO2 : காப்பியக் கதைகள் வழி அறச் சிந்தனை பெறுவர்
CO3 : பல்வேறு காப்பிய வடிவங்களை பற்றிய அறிவு பெறுவர்.
CO4 : நாடக படைப்பாக்கத்திற்கான தூண்டுதலைப் பெறுவர்.

அலகு -1 காப்பியங்கள்

1. சிலப்பதிகாரம் - மதுரை காண்டம் (வழக்குரை காதை)
2. மணிமேகலை - விழாவறை காதை
3. சீவக சிந்தாமணி - குணமாலையார் இலம்பகம்

அலகு -2 காவியங்கள்

1. கம்பராமாயணம்- மந்தரை சூழ்ச்சி படலம்
2. மகாபாரதம் - ஆரண்ய பருவம்

அலகு -3 புராணங்கள்

1. பெரியபுராணம்- இளையான்குடி மாற நாயனார் புராணம்
2. சீறாப்புராணம் - ஈத்தங்குழை வரவழைத்தப் படலம்
3. தேம்பாவணி- பிரிந்த மகனை காண்படலம்

அலகு-4 - நாடகம்

1. சாபம்? விமோசனம்

அலகு-5 இலக்கிய வரலாறு

1. காப்பியங்கள்
2. இரட்டைக் காப்பியங்கள்
3. நாடக இலக்கியம்

பார்வை நூல்கள் :

1. காப்பியத்திறன்- மணிவாசகர் நூலகம், சிதம்பரம்.
2. தமிழ் காப்பியங்கள் - கி. வா .ஜெகன் ஜெகநாதன் , அமுத நிலையம், சென்னை .
3 .நவீன நாடக உருவாக்கம் - கோ பழனி , தமிழ் பல்கலைக்கழகம், தஞ்சாவூர்.
4. மு.இராமசுவாமி, செண்பகம் இராமசுவாமி, பாவை பதிப்பகம்,ஜானிஜான் சாலை,சென்னை - 14

இணையதளம் -www.tamilvu.org , www.noolulagam.com

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

Course Code	Course Title	L	T	P	C
23111AEC31	Advanced English-III	3	1	0	3

Course Objective:

- To familiarize with the organs of speech and the description and classification of speech sounds
- To understand consonant clusters, syllables, word accent and intonation. To know how to interpret graphics
- To write slogans and advertisements

Course Content:

UNIT-I

The Origins of Language - The natural sound source - The social interaction source The physical adaptation source: teeth and lips, mouth and tongue, larynx and pharynx

UNIT-II

The Sounds of Language – Phonetics Voiced and voiceless sounds Place of articulation Manner of articulation - Consonants, Vowels, Diphthongs

UNIT-III

The Sound Patterns of Language Phonology Phonemes: Natural classes Syllables: Consonant clusters Coarticulation effects: Assimilation, Nasalization, Elision , Normal

UNIT-IV

Word formation - Coinage, Acronyms, Derivation, Prefixes and suffixes, Infixes, Multiple

UNIT-V

Syntax

Course Outcome:

- Understand phonetics
- Develop writing skill
- Able to develop creative writing

Author	**Title of the book**	**Edition / Year**	**Publisher**
T.B. Balasubramaniyan	A textbook of phonetics for Indian Students	Reprint 2208	Macmillian
Meenakshi Sharma & amp; Sangeetha Sharma	Technical Communication	2011	Oxford University Press

Course Code	Course Title	L	T	P	C
23111AEC32	English-III - **(GENERAL ENGLISH)**	3	1	0	3

Course Objectives:

CO1: To enhance the level of literary and aesthetic experience of students and to help them respond creatively.

CO2: To sensitize them to the major issues in the society and the world.

CO3: To sensitize them to the major issues in the society and the world.

CO4: To equip them to utilize the digital knowledge resources effectively for their chosen fields of study.

CO5: To help them think and write imaginatively and critically.

Course Content:

UNIT I:

Poetry:

1.1 The Voice of the Mountains - Mamang Dai

1.2 A Song of Hope - Oodgeroo Noonuccal

1.3 In an Artist's Studio - Christina Rossetti

UNIT II:

Scenes From Shakespeare:

2.1 Romeo & Juliet -The Balcony Scene

2.2 Macbeth -Banquet Scene

2.3 Julius Caesar - Murder Scene

UNIT III:

Speeches of Famous personalities

3.1 Yes, We Can -Barack Obama

3.2 You've Got to Find What You Love -Steve Jobs

UNIT IV:

Language Competency

4.1 Writing letters and emails

4.2 Writing and messaging in social media

platforms [blogs, twitter,

instagram.facebook]

4.3 Learning netiquette, email etiquette

UNIT V:

English for Workplace

5.1 Data Interpretation and Reporting

5.2 Data Presentation and analysis

5.3 Meeting Etiquettes - language, dress code, voice modulation.

Online Meetings - Terms and expressions used

5.4 Conducting and participating in a meeting

Course Outcomes		
Course Outcomes	**On completion of this course, students will;**	
CO1	Broaden their outlook and sensibility and be acquainted with cultural diversity and divergence in perspectives.	PO1
CO2	Be updated with basic informatics skills and attitudes relevant to the emerging knowledge society	PO1,PO2
CO3	Produce grammatically and idiomatically correct language.	PO4,PO6
CO4	Gain knowledge in writing techniques to meet academic and professional needs.	PO4,PO5,P O6
CO5	Be equipped with sufficient practice in Vocabulary, Grammar, Comprehension and Remedial English from the perspective of career oriented tests.	PO3,PO8

Text Books (Latest Editions)	
1.	Arden Shakespeare Complete works by Shakespeare (Author), William (Author), Bloomsbury, 2011)
References Books:(Latest Editions,and the style as given below must be strictly adhered to)	
2.	Shakespeare Book: Big Ideas Simply Explained, Stanley Wells et al. DK Publishing, 2015
3.	Famous Speeches by Mahatma Gandhi, Createspace Independent Publishing Platform, 2016
4.	How to Build a Professional Digital Profile Kindle Edition by Jeanne Kelly Bernish, Bernish Communications Associates, LLC; 1st edition (May 29, 2012)
5.	Keys to Teaching Grammar to English Language Learners, Second Ed.: A Practical Handbook by Keith S Folse, Michigan Teacher Training, 2016.
6.	Role Play-Theory and Practice.Krysia M Yardley-Matwiejczuk, SAGE publications ltd, 1997

Web Resources	
1.	The Voice of the Mountains by Mamang Dai: https://www.scribd.com/document/558838656/The-Voice-of-the-Mountain-By-Mamang-Dai-Adivasi-Resurgence
2.	A song of Hope by Kath Walker: http://www.wordslikethis.com.au/a-song-of-hope/
3.	In an artist's studio by Christina Rossetti: https://www.poetryfoundation.org/poems/146804/in-an-artist39s-studio
4.	Sita by Toru Dutt: https://www.poetrynook.com/poem/s%E2%94%9C%C2%ABta

5.	Tryst with Destiny: https://www.cam.ac.uk/files/a-tryst-with-destiny/index.html#:~:text=Jawaharlal%20Nehru%2C%20delivering%20his%20Tryst%20with%20Destiny%20speech.&text=%22Long%20years%20ago%20we%20made,awake%20to%20life%20and%20freedom.
6.	Yes, We Can: https://www.englishspeecheschannel.com/english-speeches/barack-obama-sp eech/
7.	You've got to find what you love: https://www.businessbusinessbusiness.com.au/steve-jobs-youve-got-to-find-w hat-you-love/#:~:text=Steve%20Jobs%2C%20in%20his%20commencement, emphasizes%20on%20believing%20in%20oneself.

Mapping with Programme Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

3 – Strong, 2 – Medium, 1 – Low Mapping with

Programme Specific Outcomes:

CO /PO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POS	3.0	3.0	3.0	3.0	3.0

Course Code	Course Title	L	T	P	C
23117AEC33	Immunology and Immunotechnology	4	1	0	3

Aim:

- To learn the immune system and reaction

Objectives:

- Explain the role of immune cells and their mechanism in body defense mechanism.
- Demonstrate the antigen –antibody reactions in various immune techniques.
- Gain new insights into Antigen -Antibody interactions and to demonstrate immunological techniques.
- Gain knowledge of production of vaccines.
- Apply the knowledge of immune associated disease, hypersensitivity reactions.

Outcomes:

- The students may understanding the immune system, its components and various techniques used in bio manipulation.

Unit I

Introduction to Immunology. Cells involved in immune response. Primary and Secondary lymphoid organs – Thymus, Bone marrow, Lymph nodes and Spleen. Hematopoiesis – development of B and T lymphocytes. Types of immunity – Innate and acquired.

Unit II

Antigen: Characteristics and types. Antibody – Structure, Types, Properties and their Biological Function. Production of antibodies- Hybridoma technology: Applications of Monoclonal antibodies in biomedical research

Unit III

Antigen – Antibody interactions, Immunodiffusion and Immuno electrophoresis. Principle and application of ELISA and RIA and Flourescent antibody technique and Western Blotting. Purification of antibodies.

Unit IV

The complement system and activation and regulation. Types – Classical,

alternative and Lectin pathway. Biological function of C' proteins. Cytokines- Structure and Function. Vaccines – Types, Production and application

Unit V

Hypersensitivity Reactions and Types. Major Histocompatability Complex – MHC genes, MHC in immune responsiveness, Structure and function of Class I and Class II MHC molecules. HLA tissue typing.

Text Books

1. Thomas J. Kindt, Barbara A. Osborne and Richard A Goldsby, 2006. Kuby Immunology. 6th edition, W. H . Freeman and Company.
2. Kannan, I., 2010. Immunology. MJP Publishers, Chennai
3. Abbas, A.K., A.H.L., Lihtman and S. Pillai, 2010. Cellular and Molecular Immunology, 6th Edition. Saunders Elsevier Publications, Philadelphia
4. NandiniShetty, 1996, Immunology : introductory textbook – I. New Age International, New Delhi.
5. Fahim Halim K.,2009. The Elements of Immunology. Pearson Education.

REFERENCES:

- Immunology by I.J. Kubey .1991 Freseman and company.
- Essential immunology Ivan Roitt , 1994. Blackwell Scientific publisher, Oxford.
- Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt, 2011. Roitt.s Essential Immunology, 12th edition, Wiley- Blackwell. USA.
- Janeway Travers. (1997). Immunobiology- the immune system in health and disease. Current Biology Ltd. London, New York. 3rd Edition.
- Frank C. Hay, Olwyn M. R. Westwood. (2002). Practical Immunology, 4thEdition., Wiley-Blackwell.
- Noel R. Rose, Herman Friedman, John L. Fahey. (1986). Manual of Clinical Laboratory Immunology. ASM.3rd Edition

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PSO 1	PSO 2	PSO 3
CLO1	3	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	2	3	3	3	3
CLO4	3	3	3	2	3	2	3	3	2
CLO5	3	3	2	3	3	3	3	2	3
TOTAL	15	15	14	14	14	14	15	14	14
AVERAGE	3	3	2.8	2.8	2.8	2.8	3	2.8	2.8

Course Code	Course Title	L	T	P	C
23115GEC34	BIOINSTRUMENTATION	4	1	0	3

Course Objectives

1. Practice, experiment with and apply the basic instruments in the laboratory.
2. Predict the functionality of Beer – Lambert's law in identifying and quantifying a biomolecule.
3. Employ the separation techniques for separating biomolecules based on chromatography and electrophoretic techniques
4. Understand the clinical important isotopes and detection of isotopes.
5. Employ the separation techniques for separating biomolecules based on centrifugal force by centrifugation

Unit I

pH – Definition – pH meter. Measurement of pH and calibration of pH meter - Buffers – Preparation of Buffers. Microscopy: Principle and applications of Compound, Bright field, Phase contrast and Fluorescence Microscope.

Unit II

Spectra – Absorption and Emission Spectra – Beer Lambert's law – Colorimeter, UV-Visible Spectrophotometer. Mass spectroscopy - Atomic absorption spectrometer (AAS) - Nuclear magnetic resonance spectrometer (NMR).

Unit III

Chromatography - Principles – Paper Chromatography, TLC, Gel filtration, Ion-Exchange, Affinity Chromatography Gas Liquid Chromatography and HPLC. Electrophoresis: Principle, Paper Electrophoresis – Cellulose Acetate Electrophoresis - Agarose Gel Electrophoresis – SDS- PAGE and Iso-electric focusing

Unit IV

Radioactivity – Isotopes – Clinically important isotopes – Measurement of Radioactivity – GM Counters, Scintillation Counters – Autoradiography – Applications. SOPs for Radioactive materials.

Unit V

Centrifugation – Principles - RCF, Sedimentation concept - - Different types of centrifuge – Types of rotors – Centrifugation types: Differential and Density gradient centrifugation – Ultra

Centrifuge.

Text Books

1. Upadhyay and UpadhyayNath. (2009). "Biophysical Chemistry", Principles and Techniques. Himalaya Publishing House.

2. Upadhyay and UpadhyayNath. (2009). "Biophysical Chemistry", Principles and Techniques. Himalaya Publishing House.
3. SkoogD.A.F.James Holler and Stanky,R.Crouch, (2007) "Instrumental Methods of Analysis" Cengage Learning

4. Palanivelu P, 2000. Analytical Biochemistry & Separation Techniques, 4th edition, Twenty first century publications.
5. Prakash M, 2009. Understanding Bioinstrumentation, 1st edition, Discovery Publishing House Pvt Ltd

Reference Books

1. Keith Wilson,John Walker,(2010).Principles and techniques of Biochemistry and Molecular Biology"(7th edition).Cambridge University Press.
2. David L.Nelson, Michael M Cox.Lehninger(2008)."Principles of Biochemistry",Fifth edition W.H.Freeman,Newyork.

3. Khandpur R S, 2014. Handbook of Biomedical Instrumentation, 3rd edition, McGraw Hill Education (India).

4. L.A Geddes and L.E.Baker (2008) "Principles of Applied Biomedical Instrumentation"WileyIndia Third Edition.

5. Sharma B K, 2005. Instrumental Methods of Chemical Analysis, 24th Edition, GOEL Publishing House.

Course Code	Course Title	L	T	P	C
23117SEC35L	IMMUNOLOGY AND IMMUNOTECHNOLOGY	0	0	3	3

Course Objective

- Perform blood grouping and determine blood type.
- Able to count WBC and RBC.
- Conduct serological diagnostic tests such as ASO, CRP, RA and Widal test.
- Acquire technical skills required for immunodiffusion and know the principle behind the techniques.
- Able to Demonstrate ELISA, Handling of Laboratory animals.

Experiments:

- Separation of Serum and Plasma.
- Blood grouping and Rh typing.
- WBC counting
- RBC counting
- Differential blood count
- WIDAL Slide test
- ASO test
- Double Immunodiffusion
- Single Radial Immunodifusion

Text Books

- Talwar. (2006). Hand Book of Practical and Clinical Immunology, Vol. I, 2nd edition, CBS.
- Asim Kumar Roy. (2019). Immunology Theory and Practical, Kalyani Publications.

Reference Books

1. Frank C. Hay, Olwyn M. R. Westwood. (2008).Practical Immunology, 4th Edition, Wiley-Blackwell.
1. Rose. (1992). Manual of Clinical Lab Immunology, ASM.
2. Wilmore Webley. (2016). Immunology Lab Manual, LAD Custom Publishing.
3. Janeway Travers. (1997). Immunobiology- the immune system in health and disease. Current Biology Ltd. London, New York. 3rd Edition.
4. Peter J. Delves, Seamus Martin, Dennis R. Burton, Ivan M. Roitt. (2006). Roitt's
5. Essential Immunology, 11thEdition., Wiley-Blackwell.

Course Code	Course Title	L	T	P	C
23115AEC36L	BIOINSTRUMENTATION	0	0	3	3

Course Objective

- Practice, experiment with and apply the basic instruments in the laboratory such as weighing balance, pH meter, shaker, incubator etc. in various research processes.
- Predict the functionality of Beer – Lambert's law in identifying and quantifying biomolecules.
- Employ the separation techniques for separating biomolecules based on paper chromatography
- Employ the separation techniques for separating biomolecules based on paper chromatography
- Employ the separation techniques for separating biomolecules based on centrifugal force by centrifugation.

Experiments:

1. Preparation of Buffer (Phosphate Buffer)
2. Determination of pH of biological samples using pH meter
3. UV spectra of Nucleic acids and proteins.
4. Chromatography analysis of sugar, amino acids, lipids by paper chromatography.
5. Chromatography analysis of sugar, amino acids, lipids by Thin layer chromatography.
6. Fractionation of biological material into its various components by Centrifuge.

Text Books

- Sharda University Abstract Laboratory Manual for Bio-instrumentation, Biochemistry, Microbiology, Cell Biology and Enzyme Technology
- Bhomwik (2011),Analytical techniques in Biotechnology – A complete laboratory manual, MGH Publisher, ISBN-13 : 978-007070013

Reference Books

- P. Palanivelu (2017), Analytical Biochemistry and Separation techniques – A laboratory manual, (5th Edition), Twentyfirst century publishers, ISBN: 978-81-908489-0-9

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	2	3	3	3	3
CLO4	3	3	3	2	3	2	3	3	2
CLO5	3	3	3	3	3	3	3	2	3
TOTAL	15	15	15	15	14	14	15	14	14
AVERAGE	3	3	3	3	2.8	2.8	3	2.8	2.8

Course Code	Course Title	L	T	P	C
23117SEC37	ENVIRONMENT MANAGEMENT IN INDUSTRIES	2	0	0	1

Course Objective

1. The student understands the need of Instruments for Medical field
2. Can examine the setup of Diary Industry
3. learn the Management skills for Agri Industry
4. Understanding of hazards in Workplace
5. Gains knowledge about Industrial hazards and its prevention

Unit I

Introduction to life science, computer in life science-Medical imaging, Genomics and phylogenetics, Drug design and discovering, Assistive robotics, Brain-computer interfaces, Simulation of biological systems and Medical treatment optimization.

Unit II

Introduction to Dairy industries, The Structure of Dairying in Developing Countries, Application of Computer in Dairy Industry, Milk Procurement & Billing, Plant Automation, Computerized Accounting System, Applications of Management Information System (MIS), Packaging, Supply Chain Integration and Traceability.

Unit III

Agribusiness - Application of marketing and decision making in contemporary agribusiness firms. Marketing strategies, marketing research and information, segmentation and targeting, Professional selling skills and knowledge – Rural Development – NABARD.

Unit IV

Hazards in the workplace: Pressure, Biological, Chemical, Electricity, Fire, Heat & Cold, Indoor Air Quality, Lighting, Noise, ergonomics, Radiation (ionizing & non ionizing), Vibrations, hours of work, violence in work place, Understanding of Material Safety Data Sheets, Accidents and Safety Management: Accident Prevention methods, Safety Management and audit, Personal Protection Approaches

Unit V

Occupational Health & Industrial Hygiene: Scientific and engineering basis for occupational health, biological monitoring (e.g. BEI), Occupational Hygiene, Concept of First Aid, Preventive Measures, and Occupational Health & Safety Management System: OHSAS – 18000.

Text Books

- Multi-Criteria Decision Analysis for Risk Assessment and Management, Editors Jingzheng Ren, Series Title Industrial Ecology and Environmental Management PublisherSpringer Cham,
- DOIhttps://doi.org/10.1007/978-3-030-78152-1
- Environmental Management, Butterworth-Heinemann,Editor(s): Iyyanki V. Muralikrishna, Valli Manickam, 2017, Page iv, ISBN 9780128119891, https://doi.org/10.1016/B978-0-12-811989-1.12001-9.
- (https://www.sciencedirect.com/science/article/pii/B9780128119891120019)
- Life Cycle Sustainability Assessment for Decision-Making Methodologies and Case Studies Book • 2020 Editors Jingzheng Ren & Sara Toniolo

Reference Books

- Lalat Chander, 2010. Text book of Dairy Plant Layout and Design, ICAR, New Delhi.
- Larry R. Collins, 2001.Physical Hazards of the Workplace, CRC Press, Taylor&Francis group.
- Andrew Barkley, 2013, Principles of Agricultural Economics, Taylor&Francis group.
- Mishra R.K., 2015. Occupational health management, Aitbs Publishers and Distributors- Delhi.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	3	3	2	3	3	3
CLO2	3	3	3	3	3	2	3	3	3
CLO3	3	3	3	3	3	3	3	3	3
CLO4	3	3	3	3	3	3	3	3	3
CLO5	3	3	3	3	3	3	3	3	3
TOTAL	15	15	15	15	15	13	15	15	15
Average	3	3	3	3	3	2.6	3	3	3

Course Code	Course Title	L	T	P	C
23117SEC38	GOOD LABORATORY PRACTICES	2	0	0	2

Course Objective

1. The student obtains adequate information to setup Biotechnology Laboratory
2. Learn to prepare solutions and maintenance of lab
3. Can demonstrate the working of lab equipment's
4. Learns about Biotechnology lab standards
5. Gains knowledge about Safety measures

Unit I **15 Hours**

Biotechnology lab organization - Types of labs associated with Biotechnology (General lab, microbial culture lab, plant tissue culture lab, Fermentation lab, computational stimulation lab), Types of Chemical (Analytical grade, molecular grade) and its various arrangement (Arrangement of basic chemicals, solvent, acid and base, fine chemicals like dyes, protein and enzyme storage units), Physical chemical characteristics: hygroscopic, corrosive, volatile properties; Fire and explosion hazard data, Health hazards (how to use UV-illuminator), Fumigation technique.

Unit II **15 Hours**

Lab ethics - Regulatory affairs: Methods and types of documentation (pre-lab writes, result recording and post lab report: interpretation of result), Dilution factor calculation, Molarity, percentage, dilution of concentrated solution, metric units (kg to gms and vice -versa).

Unit III **15 Hours**

Instrument calibration and importance - Principles, use and maintenance of laboratory instruments like Autoclave, hot air oven, Incubators, Water bath,

Refrigerator, Centrifuge, Calorimeter, pH meter, Haemocytometer, Microtome, Electronic balances, Bio safety cabinets. SOP preparation for instrumentation.

Unit IV **15 Hours**

GLP & Biotechnology Industry standards - Good Laboratory guidelines, Elements of GLP, Standard Operating Procedures and its importance, Quality Assurance & Quality control, Internal audit basics, ISO, BIS and HACCP standards.

Unit V **15 Hours**

Types of wastes and safe disposal methods - Definition of waste, types of waste: Biological and chemical waste, methods of Safe Disposal of biological and chemical waste: treatment methods of Ethidium Bromide solutions, Electrophoresis Gels, Contaminated Gloves, debris, Wastes containing sodium azide, Silver staining solutions, Perchloric acid, Nanoparticle wastes, Spill management, Awareness and training for personnel.

Text Books

- Milton A. Anderson GLP Essentials: A Concise Guide to Good Laboratory Practice, Second Edition 2nd Edition, Published by CRC press.
- 2nd Edition GLP Essentials A Concise Guide to Good Laboratory Practice, Second Edition By Milton A. Anderson Copyright Year 2002
- Principles of Good Laboratory Practice Paperback – 1 January 2020 by Pradeep Deshmukh (Author)

Reference Books

- Good Laboratory Practice: Nonclinical Laboratory Studies Concise Reference Paperback – Import, 18 October 2010 by Mindy J Allport-Settle (Author)
- Good Laboratory Practice Standards: Applications for Field and Laboratory Studies (ACS Professional Reference Book) 1st Edition by Willa Y. Garner (Editor), Maureen S. Barge (Editor), James P. Ussary (Editor)

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	1	3	2	3	3	3
CLO2	3	3	3	2	3	1	3	3	3
CLO3	3	3	3	2	3	1	3	3	3
CLO4	3	3	2	2	2	3	3	3	3
CLO5	3	3	2	2	2	3	3	3	3
TOTAL	15	15	13	9	13	10	15	15	15
Average	3	3	2.6	1.8	2.6	2	3	3	3

Course Code	Course Title	L	T	P	C
23117RMC39	Research Methodology	2	0	0	2

AIM:

To create a basic appreciation towards research process and awareness of various research publication

OBJECTIVES:

- To understand the steps in the research process and the suitable methods.
- To identify various research communications and their salient features
- To carry out basic literature survey using the common data-bases
- To give exposure to MATLAB platform for effective computational and graphic works required for quality research

OUTCOME:

Ability to carry out independent literature survey corresponding to the specific publication type and assess basic computational frameworks used in mathematical researches.

PREREQUISITES:

Basic computer literacy & skills for working in window-environment

UNIT I: Introduction to Research Methodology

Meaning of research – Objectives of research – Types of research – Significance of research – Research approaches

UNIT II: Research Methods

Research methods versus methodology – Research and scientific method – Criteria of good research – Problems encountered by researchers in India.

UNIT III: Literature Survey

Articles – Thesis – Journals – Patents – Primary sources of journals and patents – Secondary sources – Listing of titles – Abstracts – Reviews – General treaises – Monographs.

UNIT IV: Database Surve

Database search – NIST – MSDS – PubMed – Scopus – Science citation index – Information about a specific search.

UNIT V:

Basic Principles of Laboratory Safety and Waste management

Introduction - Access to Laboratory and Emergency Exits - Personal Protective Clothing and Equipment - Good Working Practices-Maintenance of Laboratory Equipment - Working with Hazardous Substances - Storage of Chemicals - Working with Flammable Solvents - Gas Cylinders-Fire Precautions - Emergency Procedures - First Aid - Accident Follow-Up - Safety Manual - Safety Training - Management of Laboratory Safety and Responsibilities - Waste Management.

Course Code	Course Title	L	T	P	C
231ACLSOAN	OFFICE AUTOMATION	-	-	-	1

Aim:

Course Objectives:

To provide an in-depth training in use of office automation, internet and internet tools. The course also helps the candidates to get acquainted.

Course Outcomes:

After completion of the course, students would be able to documents, spreadsheets, make small presentations and would be acquainted with internet.

UNIT I
Knowing the basics of Computers

UNIT II
Word Processing (MS word)

UNIT III
Spread Sheet (MS XL)

UNIT IV
Presentation (MS Power Point)

UNIT V
Communicating with Internet

Reference:

1. Fundamentals of computers - V.Rajaraman - Prentice- Hall of india
2. Microsoft Office 2007 Bible - John Walkenbach,Herb Tyson,Faithe Wempen,cary N.Prague,Michael R.groh,Peter G.Aitken, and Lisa a.Bucki -Wiley India pvt.ltd.
3. Introduction to Information Technology - Alexis Leon, Mathews Leon, and Leena Leon, Vijay Nicole Imprints Pvt. Ltd., 2013.
4. Computer Fundamentals - P. K. Sinha Publisher: BPB Publications
5. https://en.wikipedia.org
6. https://wiki.openoffice.org/wiki/Documentation
7. http://windows.microsoft.com/en-in/windows/windows-basics-all-topics

SEMESTER IV

Course Code	Course Title	L	T	P	C
23110AEC41	Tamil-IV **சங்க இலக்கியம்**	3	0	0	3

நான்காம் பருவம்

பாடநோக்கம் :

- பழந்தமிழ் இலக்கிய வளத்தை உணர்த்துதல்.
- சங்க அக, புற பாடல் மரபுகளைப் பயிற்றுவித்தல்.
- புற இலக்கியங்கள் காட்டும் வாழ்வியல் அறங்களை உணர்த்துதல்.

பயன்கள்:

CO1:பழந்தமிழ் இலக்கிய மரபை அறிவர்.

CO2 :சங்க இலக்கியங்களில் உள்ள அழகியல் கூறுகளை உணர்வர்.

CO3 : வாழ்வியல் அறங்கள் மற்றும் வரலாற்றுச் செய்திகளை அறிவர்.

அலகு-1

1. குறுந்தொகை- பாடல் எண்: 28 & 38
2. நற்றிணை- பாடல் எண்: 1, 27, 28,167 & 168
3. ஐங்குறுநூறு- பாடல் எண்: இளவேனில் பத்து

அலகு-2

1. கலித்தொகை- பாடல் எண்: 3 & 7
2. அகநானூறு- பாடல் எண்: 5, 42 & 100
3. புறநானூறு- பாடல் எண்: 182, 204, 41 & 121

அலகு-3

1. சிறுபாணாற்றுப்படை முழுவதும்

அலகு-4

1. திருக்குறள்- செய்நன்றி அறிதல், கூடா நட்பு ,நலம்புனைந்துரைத்தல்
2. நாலடியார் - பாடல் எண்: 1,172,215 & 253

அலகு-5 இலக்கிய வரலாறு

1. சங்க இலக்கியம்
2. எட்டுத்தொகை
3. பத்துப்பாட்டு
4. பதினெண் கீழ்க்கணக்கு நூல்கள்

பார்வை நூல்கள்

1.குறுந்தொகை - கழக வெளியீடு ,சென்னை
2.நற்றிணை - கழக வெளியீடு ,சென்னை
3.ஐங்குறுநூறு - கழக வெளியீடு ,சென்னை
4.கலித்தொகை - கழக வெளியீடு ,சென்னை
5.அகநானூறு - கழக வெளியீடு ,சென்னை
6.புறநானூறு - கழக வெளியீடு ,சென்னை
7.திருக்குறள் - பரிமேலழகர் உரை ,கழக வெளியீடு ,சென்னை

இணையதளம் -www.tamilvu.org , www.noolulagam.com

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

Course Code	Course Title	L	T	P	C
23111AEC41	Advanced English-IV	3	0	0	3

Aim:

To improve the knowledge of English

Objective:

- To familiarize with the objectives and types of interview To know the types of questions and answering techniques To prepare reviews and proposals
- To learn the grammatical forms

- To understand the meaning of a poem and write the content To write for and against a topic
- To draw a flowchart To write definitions Course Content:

UNIT 1

Parts of speech –Noun –Pronoun-Adjective-Verb-Adverb-Conjunction- PrepositionInterjection-Definition-Types-Examples

UNIT 2

Types Of Sentences-Statement-Interrogative-Exclamatory-Imperative

UNIT 3

Sentence Pattern-Types-SV-SVO-SVC-SVA-SVOO-SVOC-SVOA

UNIT 4

Tenses- Subject -Verb-Concord

UNIT 5

Phrases and Clauses-Definition And Types Outcome: Develop writing skill

Comprehend and describe poems

Learn interviewing skills

ReferencesBooks

uthor	Title of the book	Edition / Year	Publisher
Rajendra Pal & J.S Korlahalli	Essentials of Business Communication	2015	Sultan Chand & Sons

Course Code	Course Title	L	T	P	C
23111AEC42	English-IV	3	1	0	3

Course Objectives:

CO1: To help learners imbibe the rules of language unconsciously and tune to deduce language structure and usage.

CO2: To enable them use receptive skills through reading and listening to acquire good exposure to language and literature

CO3: To help them develop style in speech and writing and manipulate the tools of language for effective communication.

CO4: To provide exposure to plays, autobiographies and expose them to value based ideas.

CO5: To enhance their language skills especially in the areas of grammar and pronunciation.

Course Content:

UNIT I:

Life Writing

1.1 I am Malala-Malala Yousafzai - Chapter 1

1.2 My Inventions - Nikola Tesla - Chapter 2

UNIT II:

One Act Plays

2.1 The Zoo Story- Edward Albee

2.2 The Proposal- Anton Chekhov

UNIT III:

Interviews

3.1 Nelson Mandela's Interview with Larry King.

3.2 Rakesh Sharma's Interview with Indira Gandhi from Space

3.3 Lionel Messi with Sid Lowe (Print)

UNIT IV:

Language Competency

4.1 Refuting, Arguing & Debating

4.2 Making Suggestions & Responding to Suggestions, Asking for and Giving Advice or Help 4.3 Interviews (face to face, telephone and video conferencing)

UNIT V:

English for Workplace

5.1 Job Applications: Covering letters, CV and Resume

5.2 Creating a digital profile - Linkedin

5.3 Filling Forms (Online & Manual): creation of account, railway reservation, ATM, Credit/debit card

5.4 Body Language -Practical Skills for Interviews

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Learn to communicate effectively and appropriately in real life situation.	PO1
CO2	Use English effectively for study purpose across the curriculum	PO1,PO2
CO3	Develop interest in and appreciation of Literature	PO4,PO6
CO4	Develop and integrate the use of the four language skills	PO4,PO5,PO6
CO5	Enhance their language skills especially in the areas of grammar and pronunciation.	PO3,PO8

TextBooks(LatestEditions)	
1	I Am Malala The Girl Who Stood Up for Education and Was Shot by the Taliban by Malala Yousafzai, Christina Lamb , Little Brown, 2013.
2	My Inventions by Nikola Tesla Ingram Short title, 2011 Edition
ReferencesBooks **(Latest editions,and the style as given below must be strictly adhered to)**	

1	**Writing Your Life: A Guide to Writing Autobiographies,Mary Borg, Taylor & Francis, 2021**
2	**One-act Plays for Acting Students: An Anthology of Short** Norman A. Bert · 1987 ·
3	**The One-Act Play Companion: A Guide to plays, playwrights ...** Colin Dolley, Rex Walford · 2015
4	How to Build a Professional Digital Profile Kindle Edition by Jeanne Kelly Bernish, Bernish Communications Associates, LLC; 1st edition (May 29, 2012)
5	Role Play-Theory and Practice.Krysia M Yardley-Matwiejczuk, SAGE publications ltd, 1997

Web Resources	
	or Readers' Theatre: ttps://www.youtube.com/watch?v=JaLQJt8orSw&t=469s(the link to the erformance; refer scripts by Aaron Sheperd)
	ttp://BBC learn English.com
	ttp://onestopenglish.com
	ttp://hearn-english-today.com
	ttp://talkenglish.com

	he Zoo Story: ttp://www.lem.seed.pr.gov.br/arquivos/File/livrosliteraturaingles/zoostory.p f
	he Proposal: https://www.one-act-plays.com/comedies/proposal.html
	elson Mandela with Larry King nterviews: http://edition.cnn.com/TRANSCRIPTS/0005/16/lkl.00.html
	akesh Sharma with Indira Gandhi nterview : ttps://www.ndtv.com/offbeat/what-first-indian-astronaut-rakesh-sharma-tol -indira-gandhi-about-india-from-space-2204839

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

CO /PO	PSO 1	PS O2	PS O3	PS O4	PS O5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weight age	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Course Code	Course Title	L	T	P	C
23117AEC43	GENETIC ENGINEERING AND rDNA TECHNOLOGY	4	1	0	3

Aim:

- To be able to read, interpret and discuss scientific journal articles in physiology.

Objectives:

- To provide advanced undergraduate and introductory graduate students with a comprehensive overview of animal physiology from molecular, cellular and whole animal systems approaches.
- To critically evaluate clinical and research case problems relating to endocrinology and cell biology.

Outcomes:

- Understand the physiological processes that regulate body functions and the regulation of an organ system from the molecular all the way to the whole animal level
- Understand how changes in one system may impact a different system

UNIT I

Respiration: Availability of oxygen- respiratory organs in aminals- properties and functions of respiratory pigments- regulation of respiration

UNIT II

Circulation: types of hearts- composition and functions of blood- cardiac rhythm- cardiac output- ECG- blood pressure- electrical activity and properties of heart- regulation of cardiovascular function.

UNIT III

Coordination (neuromuscular and neuroendocrine): Nerveimpulse conduction-ultrastructure of muscle – theories of muscle contraction

UNIT IV

Excretion: structure and functions of different excretory organs in animals-mechanism of urine formation in man

UNIT V

Homeostasis: Significance- mechanism of osmo-ion regulation in fresh water, estuarine and marine fishes.

REFERENCES:

- Human Physiology, Stuart Fox, 11th ed., McGraw Hill
- Linda Costanzo's "Physiology- Board Review Series (5th ed.)" Lippincott Williams & Wilkins.

Course Code	Course Title	L	T	P	C
23117GEC44	BIOINFORMATICS AND BIOSTATISTICS	4	1	0	3

Course Objective

- Acquire knowledge about the Developments and Applications of Bioinformatics.
- Gain knowledge about the importance of the bioinformatics, databases, tools and software of bioinformatics and explain different types of Biological Databases.
- Understand the basics of sequence alignment, sequence analysis and Protein structure prediction method.
- Demonstrate the basic methods of data collection, graph construction and sampling techniques and Calculate measures of central tendency
- Correlate and analyze biological data through various statistical methods and interpret biological data via various probabilistic distribution methods.

Outcomes:

- To Understand the regulation of protein and nucleic acids function
- To know the structure-function relationships and macromolecular interactions.
- To find out newer methods to implement rDNA Technology for various organisms.
- To understand several modern molecular methods to elucidate molecular and genetic questions.

UNIT I:

Introduction to Bioinformatics – Genome, Transcriptome and Proteome, Gene prediction rules and software. Nucleic acid Databases – Primary and Secondary Databases – Structure Database – CATH, SCOP – Data base Searching – BLAST and FASTA, BLOSSUM

UNIT II:

Sequence analysis (Proteins and Nucleic acids), Protein Database: Comparison of Protein sequences and Database searching – methods for protein structure prediction

- Homology modeling of proteins, visualization tools (RASMOL).

UNIT III:

Multiple Sequences alignment – method of multiple sequences alignment- Evolutionary analysis, clustering methods Phylogenic trees - Methods to generate phylogenetic tree- Tools for multiple sequences alignment and phylogenetic analysis - History of Drug Discovery, Steps in Drug design - Chemical libraries – Role of molecular docking in drug design.

UNIT IV:

Statistics – collection, classification, tabulations of Statistical Data – Diagrammatic representation – Graphs – Sampling method and standard error. Measures of central tendency – measures of dispersion.

UNIT V:

Correlations and regression. Probability distribution-Binomial, Negative binomial, multinomial distribution, Poisson distribution. Tests of significance – t tests – F tests – Chi square test. Analysis of variance – Statistical Soft wares.

Text Books

1. Pennington, S.R. and Punn, M.J. 2002. Proteomics: from protein sequence to function. Viva books Pvt. Ltd.
2. Shuba G., 2010. Bioinformatics., Tata McGraw Hill publishing.India.
3. Rastogi, S.C, Mendiratta, N,Rastogi, P., 2004. Bioinformatics methods and application. Prentice-Hall of India private limited, New Delhi.
4. N. Gurumani (2011) "An Introduction to Biostastistics" MJP Publishers
5. Verbala Rastogi (2011).”Fundamentals of Biostatistics”, Ane books Pvt Ltd Publishers, Chennai.

Reference Books

1. Attwood, T.K. and Parry-Smith, D.J.2008. Introduction to Bioinformatics. Pearson Education.
2. David Mount., Bioinformatics: sequence and genome analysis, second edition., Taylor & Francis, UK; 2009.
3. D.R.Westhead. Instant Notes in Bioinformatics., second edition., Taylor & Francis, UK; 2009.
4. Zar,(J.H.2010).”Biostatistical Analysis” Fifth Edition, Pearson Education Pvt Ltd, Indian Branch,NewDelhi.
5. P.N.Arora and P.K. Malhan.(2013)"Biostatistics"Himalaya publishing House.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	2	3	3	3	3
CLO4	3	3	3	2	3	2	3	3	2
CLO5	3	3	3	3	3	3	3	2	3
TOTAL	15	15	15	14	14	15	15	14	14
AVERAGE	3	3	3	2.8	2.8	3	3	2.8	2.8

Course Code	Course Title	L	T	P	C
23117SEC45L	GENETIC ENGINEERING AND RDNA TECHNOLOGY	0	0	3	3

Course Objective

- Isolate the Plasmid DNA and Genomic DNA. and predict the molecular weight of DNA by agarose gel electrophoresis.
- Demonstrate working principles of PCR, RFLP and other important Genetic Engineering techniques.
- Prepare the competent cells and perform bacterial transformation.
- Determine the restriction digestion of DNA
- Determine the restriction fragment length polymorphism.

Experiments

1. Isolation of genomic DNA Isolation of plasmid DNA Isolation of RNA
2. Production of competent cells for transformation Bacterial transformation
3. Restriction Digestion of DNA
4. Restriction Fragment Length Polymorphism(DEMO) PCR(Demonstration)

Text Books

Laboratory Manual for GENETIC ENGINEERING 1st Edition, Kindle Edition by S. JOHN VENNISON (Author) 2009.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	2	3	3	3	3
CLO4	3	3	3	2	3	2	3	3	2
CLO5	3	3	3	3	3	3	3	2	3
TOTAL	15	15	15	14	14	14	15	14	14
AVERAGE	3	3	3	2.8	2.8	2.8	3	2.8	2.8

Course Code	Course Title	L	T	P	C
23117SEC46L	BIOINFORMATICS AND BIOSTATISTICS	0	0	3	3

Course Objective

1. Analyse the Biological databases
2. Able to perform BLAST and FASTA
3. Represent data in to graphical form
4. Test the level of significance of biological data and interpret the results.
5. Determine averages of the biological data

Experiments

1. Biological databases (NCBI, Swissprot and PDB)
2. BLAST FASTA
3. Identification of functional domains in nucleotide binding proteins using a domain analysis server like SMART
4. Preparation of bar diagram, line diagram and pie diagram using MS EXCEL.
5. Calculation of Central tendency- mean, geometric mean, median using MS EXCEL
6. Calculation of dispersion – Mean deviation, quartile deviation and standard deviation using MS EXCEL
7. Calculation of student's t test using MS EXCEL

Text Books

1. Pennington, S.R. and Punn, M.J. 2002.Proteomics: from protein sequence to function. Viva books Pri. Ltd.
2. Maleolm and Goosfship. J. 2001. Genotype to phenotype, 2ndedition. Bios Scientific Publishers Ltd

3. Misener, S. and Krawetz. S.A. 2000. Bioinformatics: Methods and Protocols. Humana press.
4. Attwood, T.K. and Parry-Smith, D.J.1999. Introduction to Bioinformatics. Pearson Education Asia.
5. Primrose, S.B. 1998. Principle of genome analysis. 2ndedition. Blackwell Science.

Reference Books

6. Durbin, R., Eddy, S., Krogh, A. and Mitchison, G. 1998. Biological sequence analysis. Cambridge University Press.
7. Friedman, C.P. and Wyatt. J.C. 1997. Computers and Machine: Evaluation methods in medicinal information. Springer-verlag, New York.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	2	3	3	3	3
CLO4	3	3	3	2	3	2	3	3	2
CLO5	3	3	3	3	3	3	3	2	3
TOTAL	15	15	15	14	14	14	15	14	14
AVERAGE	3	3	3	3	2.8	2.8	3	2.8	2.8

Course Code	Course Title	L	T	P	C
23117SEC47	ORGANIC FARMING AND HEALTH MANAGEMENT	2	0	0	2

Course Objective

- The student will value the concepts of ecology and environment
- To know the techniques of Vermicomposting and enjoying the cultivation of common Medicinal Herbs
- To gain the knowledge about Principles and Policies in Organic forming and Certification agencies
- To realize the Concept of Health and importance of well being
- To appreciate the Role of exercise and nutrition in Health related fitness

Unit I

Ecology and Environment – Principles of ecology – Ecosystem - Biotic and abiotic components and interaction – Energy flow –Nutrient cycle – Biodiversity – Endemic – Exotic - Interrelationships.

Unit II

Composting – Microbial Compost – Vermicompost – Setup for vermicompost unit - Nutrition garden – Ring garden – Double digging – Cultivating vegetables – Common medicinal herbs – Identification and Cultivation.

Unit III

Organic farming – Principles and Policies – Certification agencies – AGMARK, fssai, Halal certification – Participatory grading system (PGS) – Storage – Packing – Transportation – Marketing. Micro-enterprises – Self Help Groups – Economics of cultivations – Sustainability

Unit IV

Health: Concept of Health, changing concepts definitions of health, dimensions of health, concept of well being, spectrum of health, determinants of health, ecology of health, right to health, responsibility for health, indicators of health

Unit V

Exercise and Health related fitness: Health related fitness, health promotion, physical activity for health benefits. Sports related fitness: Role of nutrition in sports, nutrition to athletic performance

Text Books

1. G.K. Veeresh, 2006. Organic farming , First edition, New Delhi, India Foundation Books in association with Centre for Environment Education.
2. Mangala rai, 2012.Hand Book of Agriculture, Sixth Edition, ICAR New Delhi.

3. B.B. Sharma , 2007. A Guide to Home Gardening, Second Edition, MIB India, New Delhi.
4. Adrianne E. Hardman, 2009. Physical Activity and Health – The evidence explained, Second edition, Taylor and Francis Group.

Reference Books

1. Farmers of Forty Centuries: Permanent Organic Farming in China, Korea, and Japan Hardcover – 10 June 2011by F. H. King (Author)

2. Organic Farming: Components And Management Edition: 1 Author/s:Gehlot D , Publisher: M/s AGROBIOS (INDIA) ISBN: 9788177544008.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	3	3	3	3	3
CLO4	3	3	3	3	3	3	3	3	3
CLO5	3	3	3	3	3	3	3	3	3
TOTAL	15	15	15	15	15	15	15	15	15
Average	3	3	3	3	3	3	3	3	3

Course Code	Course Title	L	T	P	C
23117SEC48	BIOTECHNOLOGY FOR SOCIETY	2	0	0	2

Course Objective

1. Will understand the role of Biotechnology in Sericulture, Apiculture and Mushroom Cultivation
2. Will gain knowledge about the production of Bio fertilizer and advantages of Biopestisides
3. Will understand the significance of microorganisms in Biodegradation
4. Will get know about History of Antibiotics
5. Will able to comprehend about Transgenic Plants

Unit I **15 Hours**

Introduction to Biotechnology- Role of Biotechnology in sericulture- Rearing of silkworms- Importance and applications- Role of Biotechnology in apiculture- Bee hive hierarchy- Bee keeping process- Products obtained- Mushroom farming stages- Cultivation of paddy straw mushroom- Importance of mushroom cultivation.

Unit II **15 Hours**

Biofertilizer- Definition- Mass production of *Rhizobium*-Advantages and disadvantages- Biopesticides- Definition- Microbial biopesticides- *Bacillus thuringiensis*- Single cell protein- Introduction- history- production of *Spirulina* SCP- Applications- Advantages & disadvantages

Unit III **15 Hours**

Biodegradation- Definition- Process-role of microorganisms in biodegradation - biodegradable plastics-advantages- Bio weapons- introduction- history- potential agents- delivery methods- harmful effects.

Unit III **15 Hours**

Biodegradation- Definition- Process-role of microorganisms in biodegradation - biodegradable plastics-advantages- Bio weapons- introduction- history- potential agents- delivery methods- harmful effects.

Unit IV **15 Hours**

Antibiotics- Definition- Introduction and history of antibiotics- sources- classification- spectrum- production of penicillin- definition of antibiotic resistance.

Unit V **15 Hours**

Transgenic plants – Definition of transgene and transgenesis - BT Cotton, Flavr-Savr tomato and Golden rice- history – importance, applications, advantages and disadvantages.

Text Books

1. Sathyanarayana, U., Chakrapani, U., (2008). Biotechnology, First edition, Books and allied (P) Ltd, Kolkata.
2. A.K. Chatterji, (2011).Introduction to Environmental Biotechnology, Third edition, PHI Learning Pvt Ltd. New Delhi. ISBN-978-81-203-4298-9
3. R.C. Dubey, (2014). A text book of Biotechnology, S.Chand& Company, New Delhi. ISBN 9788121926089
4. H. Patel, (2011).Industrial Microbiology,(2nd edition), MacMillan Publishers
5. Thakur, I.S., (2019).Environmental Biotechnology- Basic principles and applications- (2nd edition)- Dreamtech Press, ISBN 978-93-89307-55-9

Reference Books

1. Basics of Biotechnology Paperback – 1 January 2004 by A.J. Nair (Author) Publisher Laxmi Publications
2. Basic Biotechnology Paperback – 2 February 2008 by Ratledge Colin (Author) Publisher Cambridge University Press

Course Code	Course Title	L	T	P	C
231AECCEVS	Environmental Studies	2	0	0	2

Aim:

- To motivate participation in environment protection and improvement.

Objectives:

1. Creating awareness about environmental problems among people.
2. Imparting basic knowledge about the environment and its allied problems.
3. Developing an attitude of concern for the environment.
4. Motivating the public to participate in environment protection and environment improvement.
5. Acquiring skills to help the concerned individuals in identifying and solving environmental problems.
6. Striving to attain harmony with Nature.

Outcomes:

1. Students will gain knowledge about environmental pollutions, preventive measures.
2. Students will gain information related to societal issues in concern with the environment.
3. Students should have outline knowledge on natural resources and effective management of resources.
4. Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale;
5. Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment;
6. Demonstrate ecology knowledge of a complex relationship between predators, prey, and the plant community; Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues; and Understand how politics and management have ecological consequences.

1. **Nature of Environmental Studies**

Definition, scope and importance. Multidisciplinary nature of environmental studies Need for public awareness.

2. **Natural Resources and Associated Problems.**

a) Forest resources: Use and over — exploitation, deforestation, dams and

their effects on forests and tribal people.

b) Water resources: Use and over — utilization Of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.

c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources.

d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer — pesticide problems.

e) Energy resources: Growing energy needs, renewable and non — renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy.

f) Land resources: Solar energy, Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification,

Role of an individuals in conservation of natural resources.

3. Ecosystems

Concept of an ecosystem.

Structure and function of an ecosystem. Producers, consumers and decomposers.

Energy flow in the ecosystem.

Ecological succession.

Food chains, food webs and ecological pyramids.

Introduction, types, characteristics features, structure and function of the following ecosystem:

g) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem, d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

4. Biodiversity and its conservation

Introduction — Definition: genetic, species and ecosystem diversity. Bio — geographical classification of India.

Value of biodiversity: consumptive use, productive use, social, ethical,

aesthetic and option values.

India as a mega — diversity nation. Western Ghat as a biodiversity region. Hot— spot of biodiversity.

Threats to biodiversity habitat loss, poaching of wildlife, man — wildlife conflicts.

Endangered and endemic species of India.

Conservation of biodiversity: In — situ and Ex — situ conservation of biodiversity.

5. Environmental Pollution

Definition: Causes, effects and control measures of: Air pollution, Water pollution, soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards.

Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of a individual in prevention of pollution.

6. Social Issues and the Environment

Disaster management: floods, earthquake, cyclone, tsunami and landslides. Urban problems related to energy Water conservation, rain water harvesting, watershed management

Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issue and possible solutions.

Global wanTling, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Wasteland reclamation. Consumerism and waste products.

7. Environmental Protection

From Unsustainable to Sustainable development. Environmental Protection Act.

Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act.

Forest Conservation Act.

Population Growth and Human Health, Human Rights.

8. Field Work

Visit to a local area to document environmental assets — River / Forest / Grassland / Hill / Mountain. Or Visit to a local polluted site — Urban / Rural I lad Listrial / Agricultural. Study of common plants, --nsects, birds. Or Study of simple ecosystems -— ponds, river, hill slopes, etc.

References:

1. Agarwal, K.C,200l, Environmental Biology, Nidi Pub. Ltd., Bikaner.
2. Bharucha Erach, The l3iodiversity of India, Mapin Publishing Pvt, Ltd., Ahmedabad 380013, India, Email: rn4pin@icenet.net (R)
3. Brunner R.C., 1989, 1-lazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clank R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E. & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Pub. Mumbai, Il96p
6. De A.K., Environmental Chemistry, Wiley Wastern Ltd.
7. Down to Earth, Centre for Science and Environment, New Delhi. (R)]
8. Gleick, H., 1993, Water in crisis, Pacific Institute for studies in Dcv., Environment & Security. Stockholm Env Institute. Oxford Univ. Press 473p
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bompay (R)
10. Heywood, V.K. & Watson, R.T.1995, Global Biodiversity Assessment, Crnbridge Univ. Press 1140 p.
11. Jadhav, H. and Bhosale, VJvI. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.
12. Mickinney, M.L. and School. R.M. 1196, Environmental Science Systems and Solutions, Web enhanced edition, 639p.
13. Miller T.G. Jr. Environmental Science. Wadsworth Publications Co. (TB).
14. Odum, E.P. 1971, Fundamentals of Ecology, W.B. Saunders Co. USA,574zp.
15. Rao M.N. and Dana, A.K. 1987, Waste Water Treatment, Wxford & IBH Publ. Co. Pvt. Ltd., 345p
16. Sharma B.K., 2001, Environmental Chemistry, Gokel PubI. Hkouse, Meerut
17. Survey of the Environment, The Hindu (M)
18. Townsend C., Harper, J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
19. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, vol. 1 and II, Environmental Media (R)
20. Trivedi R.K. and P.K. Goel, Introduction to air pollution, Techno— Science Publications (TB)
21. Wagner K.D., 1998, Environmental management, W.B. Saunders Co. Philadelphia, USA 499p,
22. Paryavaran shastra — Gholap T.N,

1. Paryavaran Sahastra — Gharapure
2. (M) Magazine
3. (R) Reference (TB) Textbook

Course Code	Course Title	L	T	P	C
231LSCLS	Leadership and Management Skills	-	-	-	2

Aim:

The aim of the course is cultivating and nurturing the innate leadership skills of the youth so that they may transform these challenges into opportunities and become torch bearers of the future by developing creative solutions.

Course Objective:

The Module is designed to**:**

- Help students to develop essential skills to influence and motivate others
- Inculcate emotional and social intelligence and integrative thinking for effective leadership
- Create and maintain an effective and motivated team to work for the society
- Nurture a creative and entrepreneurial mindset
- Make students understand the personal values and apply ethical principles in professional
  and social contexts.

Course Outcomes :

Upon completion of the course students will be able to:

1. Examine various leadership models and understand/assess their skills, strengths and
   abilities that affect their own leadership style and can create their leadership vision
2. Learn and demonstrate a set of practical skills such as time management, self management,
   handling conflicts, team leadership, etc.
3. Understand the basics of entrepreneurship and develop business plans
4. Apply the design thinking approach for leadership
5. Appreciate the importance of ethics and moral values for making of a balanced personality.

UNIT I- Leadership Skills

a. **Understanding Leadership and its Importance**
   - What is leadership?
   - Why Leadership required?
   - Whom do you consider as an ideal leader?

b. Traits and Models of Leadership
   - Are leaders born or made?
   - Key characteristics of an effective leader
   - Leadership styles
   - Perspectives of different leaders

c. Basic Leadership Skills

- Motivation
- Team work
- Negotiation
- Networking

UNIT II - Managerial Skills

a. **Basic Managerial Skills**

- Planning for effective management
- How to organise teams?
- Recruiting and retaining talent
- Delegation of tasks
- Learn to coordinate
- Conflict management

b. Self Management Skills

- Understanding self concept
- Developing self-awareness
- Self-examination
- Self-regulation

UNIT III - Entrepreneurial Skills

a. **Basics of Entrepreneurship**

- Meaning of entrepreneurship
- Classification and types of entrepreneurship
- Traits and competencies of entrepreneur

b. Creating Business Plan

- Problem identification and idea generation
- Idea validation
- Pitch making

UNIT IV - Innovative Leadership and Design Thinking

a. **Innovative Leadership**

- Concept of emotional and social intelligence
- Synthesis of human and artificial intelligence
- Why does culture matter for today's global leaders

b. Design Thinking

- What is design thinking?
- Key elements of design thinking:
  - Discovery
  - Interpretation
  - Ideation
  - Experimentation
  - Evolution.
- How to transform challenges into opportunities?
- How to develop human-centric solutions for creating social good?

UNIT V- Ethics and Integrity

a. **Learning through Biographies**

- What makes an individual great?
- Understanding the persona of a leader for deriving holistic inspiration

- Drawing insights for leadership
- How leaders sail through difficult situations?

b. Ethics and Conduct

- Importance of ethics
- Ethical decision making
- Personal and professional moral codes of conduct
- Creating a harmonious life

Bibliography and Suggested Readings :

Books

- Ashokan, M. S. (2015). *Karmayogi: A Bbiography of E. Sreedharan*. Penguin, UK.
- Brown, T. (2012). *Change by Design*. Harper Business
- Elkington, J., & Hartigan, P. (2008). *The Power of Unreasonable People: How Social Entrepreneurs Create Markets that Change the World*. Harvard Business Press.
- Goleman D. (1995). *Emotional Intelligence*. Bloomsbury Publishing India Private Limited
- Kalam A. A. (2003). *Ignited Minds: Unleashing the Power within India*. Penguin Books India
- Kelly T., Kelly D. (2014). *Creative Confidence: Unleashing the Creative Potential Within Us All.* William Collins
- Kurien V., & Salve G. (2012). *I Too Had a Dream*. Roli Books Private Limited
- Livermore D. A. (2010). *Leading with cultural intelligence: The New Secret to Success*. New York: American Management Association
- McCormack M. H. (1986). *What They Don't Teach You at Harvard Business School: Notes From A Street-Smart Executive*. RHUS
- O'Toole J. (2019) *The Enlightened Capitalists: Cautionary Tales of Business Pioneers Who Tried to Do Well by Doing Good.* Harpercollins
- Sinek S. (2009). *Start with Why: How Great Leaders Inspire Everyone to Take Action*. Penguin
- Sternberg R. J., Sternberg R. J., & Baltes P. B. (Eds.). (2004). *International Handbook of Intelligence*. Cambridge University Press.

E-Resources

- Fries, K. (2019). 8 Essential Qualities That Define Great Leadership. *Forbes*. Retrieved 2019- 02-15 from https://www.forbes.com/sites/kimberlyfries/2018/02/08/8-essential-qualities-that-define-great-leadership/#452ecc963b63.
- How to Build Your Creative Confidence, Ted Talk by David Kelly - https://www.ted. com/talks/david_kelley_how_to_build_your_creative_confidence
- India's Hidden Hot Beds of Invention Ted Talk by Anil Gupta - https://www.ted.com/ talks/anil_gupta_india_s_hidden_hotbeds_of_invention

- Knowledge@Wharton Interviews Former Indian President APJ Abdul Kalam - . "A Leader Should Know How to Manage Failure" https://www.youtube.com/ watch?v=laGZaS4sdeU
- Martin, R. (2007). How Successful Leaders Think. *Harvard Business Review, 85*(6): 60.
- NPTEL Course on Leadership - https://nptel.ac.in/courses/122105021/9

SEMESTER V

Course Code	Course Title	L	T	P	C
23117AEC51	PLANT BIOTECHNOLOGY	5	1	0	4

Course Objective:

- Explore the history of Biotechnology and state the importance of organization of plant genome
- Be acquainted with the molecular basis of action of plant hormones and gene expression
- Illustrate about various culture medium preparations, haploid, triploid plant production and its applications
- Exploit symbiotic organisms as a vector for gene transfer to produce transgenic plants
- Develop molecular technique skills for crop improvement.

Unit I 15 Marks

History of plant biotechnology, Conservation of Plant using Biotechnology. Plant genome organization: structural features of a representative plant gene, gene families in plants. Organization of chloroplast genome and mitochondrial genome

Unit II 15 Marks

Auxins, cytokinins and gibberlins – molecular basis of action – phytochrome – role in photomorphogeneisis – abscisic acid – and stress – induced promoter switches in the control of gene expression – Ethylene and fruit ripening.

Unit III 15 Marks

Media composition (MS media) - Micropropagation techniques - direct and indirect organogenesis - somoclonal variation - somatic embryogenesis - haploid and triploid - Protoplast isolation, fusion and culture - hybrid and cybrid production, Synthetic seed production. Secondary metabolite production.

Unit IV 15 Marks

Agroacterium and crown gall tumors – Mechanism of T-DNA transfer to plants, Tiand Ri Plasmid vectors and their utility – Plant viral vectors. Symbiotic nitrogen fixation in Rhizobia, nif gene.

Unit V 15 Marks

Crop improvement, herbicide resistance, insect resistance, virus resistance, plants as bioreactors. Transgenic plants- plant vaccines, genetically modified food - future perspectives & ecological impact of transgenic plants

Text Books

1. Sudhir, M. 2000. Applied Biotechnology and plant Genetics. Dominant publishers and distributors.
2. Trivedi, P.C.2000. Applied Biotechnology: Recent Advances. PANIMA Publishing corporation.
3. Ignacimuthu. 1996. Applied Plant Biotechnology. Tata McGraw – Hill.
4. Narayanaswamy S. 1994. Plant cell and tissue culture. Tata McGraw Hill Publishing Company limited, New Delhi.
5. Chawla, H.S., "Introduction to Plant Biotechnology", 3rd Edition, Science Publishers, 2009.

Reference Books

1. Kojima, Lee, H. and Kun, Y. 2001. Photosynthetic microorganisms in Environmental Biotechnology. Springer – Verlag.
2. Stewart Jr., C.N., "Plant Biotechnology and Genetics: Principles, Techniques and Applications" Wiley-Interscience, 2008.
3. Heldt HW. Plant Biochemistry & Molecular Biology, Oxford University Press. 1997.
4. Trigiano, R.N. and Gray, D.J. 1996. Plant tissue culture concepts and laboratory exercise. CRC Press. BocaRatin, New York.
5. Street, H.E. 1977. Plant tissue culture. Blackwell Scientific Publications, oxford, London.

Course Code	Course Title	L	T	P	C
23117AEC52	ANIMAL BIOTECHNOLOGY	5	1	0	4

Course Objective

1. Understand the basic concepts of Animal cell culture and cell laboratory
2. Describe the media preparation, preservation, trypsinization, counting, maintenance and application of cell lines.
3. Discuss the strategies for gene transfer and gene expressions with their applications.
4. Be acquainted with genetic modification and stem cell technology in production of transgenic animals.
5. Learn the Assisted reproductive technology and its applications.

Unit I **15 Hours**

Animal cell culture – History and development, Pluripotency, Media, balanced salt solutions, Physical, chemical and metabolic functions of constituents of culture media, Role of carbon dioxide, Serum, growth factors and amino acids in media. Serum containing and serum free media. Constitution of a media for cell line. Essential equipments required for animal cell culture.

Unit II **15 Hours**

Types of cell culture- Primary, Secondary, Organ culture and cell lines. Role of feeder layers in cell culture, Cell separation techniques, cell synchronization, Cell counting methods, cryopreservation, Cell banking procedures. Biology of cultured cells- Apoptosis and cell death.

Unit III **15 Hours**

Transfection of cells in culture- Animal viral vectors for transfection, Physical methods of transfection, HAT selection, selectable markers. Micro manipulation of cells, Gene targeting, gene silencing and Gene knockout and their applications.

Unit IV **15 Hours**

Protein production by genetically engineered mammalian cell lines, Stem cells and their applications-; Cell culture as a source of valuable products -Transgenic Animals.

Unit V **15 Hours**

Collection and preservation of embryos, Semen banking, AI, IVF and ICSI. Case Study-any two relevant studies.

Text Books

1. Ramasamy.P. 2002.Trends in Biotechnology, University of Madras of Publications, Pearl Press
2. Ignacimuthu. 1996. Basic Biotechnology. Tata McGraw-Hill.
3. K. Srivastava et al., 2009, Animal Biotechnology, Oxford & IBH Publishing Co. Pvt. Ltd.
4. B.C. Currell et al., 1994, In vitro Cultivation of Animal Cells (Biotol), Butterworth-Heinemann Ltd.
5. Jenkins, N. (ed). 1999 Animal cell Biotechnology: Methods and protocols. Humana press, New Jesey.

Reference Books

1. R. Ian Freshney, Culture of Animal cells – A Manual of Basic Technique Fourth Edition, WILEY LISS & Publications.
2. Glick, B.R. and Pasternark. 2002. Molecular Biotechnology: Principle and applications of recombinant DNA.
3. Kreuzer, H. and Massey, A. 2001. Recombinant DNA and Biotechnology: A guide for teachers, 2nd edition. ASM Press Washington.
4. Traven. 2001. Biotechnology. Tata McGraw – Hill.
5. Walker,J.M. and Gingold, E.B. 1999.Molecular biology and Biotechnology, 3rd edition. Panima Publishing Corporation.

Course Code	Course Title	L	T	P	C
23117AEC53	ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY	**5**	**1**	**0**	**4**

Course objectives

1. Know about the environment, its issues and management of the environment.
2. Explain the process of wastewater treatment, drinking water treatment and solid waste management in various industries.
3. Illustrate the significance of bioreactors in bioprocess engineering and culture methods.
4. Explain Downstream processing, Fermented Products production and advanced methods
5. Speculate the role and importance of microorganisms behind the ore leaching, production of food products and Biofertilizers.

Unit I 15 Hours

Environmental Pollution – Sources and types - Water, Air, Thermal, Industrial and Radiation - Global environmental changes. Global warming, Greenhouse effect, acid rain, ozone depletion, and photochemical smog. Environmental issues, management strategies and safety, Biotechnological approaches for management.

Unit II 15 Hours

Waste water treatment: Aerobic and anaerobic methods (Primary, Secondary and Tertiary) – Use of aquatic plants in waste water treatment. Solid waste management. Bioenergy and SCP from waste. Drinking water treatment. Biotechnological approach to industrial effluent (Paper, Tannery, Textile) Pesticide waste disposal.

Unit III 15 Hours

Bioprocess Engineering-Steps in bioprocess development. Design of bioreactors - Basic objective of fermenter design, aseptic operation & containment, body construction, agitator and sparger design, baffles, stirrer glands and bearings. Bioreactor configurations and types: Bubble column, airlift reactor, packed bed, fluidized bed, trickle bed, Membrane reactor, Photobioreactor, Animal and plant cell bioreactors. Factors affecting broth viscosity, Mixing in Fermenters. Fermentation systems Batch culture, Continuous culture, Fed-batch culture.

Unit IV 15 Hours

Downstream processing Filtration, Centrifugation, Cell disruption, Liquid-liquid extraction, Chromatography, membrane processes, Drying, Crystallization, Whole broth processing. Different types of fermented foods produced from microorganisms- Idli, Sauerkraut - Dairy products- Cheese and Yoghurt. Microbial biomass, Microbial enzymes– Amylase & protease, Immobilization of enzymes: Methods,Properties, Applications, Advantages and Disadvantages of Immobilization, Biosensors and Biochips -Types and applications. Microbial Polysaccharide production: Xanthan, Dextran.

Unit V 15 Hours

Ore leaching (methods and examples), MEOR, Production of antibiotics – Penicillin - streptomycin. Alcoholic beverages: Wine, Beer –Biofertilizers- Rhizobium & Azotobacter. Biopesticides – Bacillus thuringiensis and microbial toxin production and their applications - Biosurfactants, Vitamins- Folic acid & Vitamin B12, Organic acids

Text Books

1. Chatterji, A.K., 2002. Introduction to Environmental Biotechnology, Prentice-Hall of India, New Delhi.
2. Anil Kumar De., 2000. Environmental Chemistry, 4th Edition. New Age International, New Delhi.
3. Murugesan, A G., Rajakumari, C., 2005. Environmental Science and Biotechnology Theory and Techniques., MJP publishers, Chennai.
4. T.Satyanarayana, Bhavdish Narain Johri,Anil Prakash (2012), Microorganisms in Sustainable Agriculture and Biotechnology.
5. Madigan, Michael and Martinko, John, Brock biology of microorganism, 11th edition, (2005).

Reference Books

1. Alan Scragg, 1999. Environmental Biotechnology, Pearson Education Limited, England,
2. Peter F. Stanbury, Allan Whitaker, Stephen J. Hall (2013). Principles of Fermentation Technology Second Edition, Elsevier Science Ltd
3. Michael J. Waites, Neil L. Morgan, John S. Rockey, Gary Higton (2001.), Industrial Microbiology: An Introduction. . Blackwell Science Ltd
4. Nduka Okafor, Modern Industrial Biotechnology & Microbiology (2017), Science Publishers, Edenbridge Ltd.
5. Waites, Morgan, Rockey and Higton, Industrial Microbiology: An Introduction, Blackwell Science (2001).

Course Code	Course Title	L	T	P	C
23117DSC54A	NANOTECHNOLOGY	5	1	0	4

Course objectives

1. The students will get an outline about Nanotechnology and its research in India.
2. To know about nanoparticles and their analysis using Advanced Instrumentation.
3. To get an insight about Nano devices
4. The students will know about the Applications of Nanotechnology
5. The students will know about the Nano Biosensors and their applications.

UNIT	Contents	No. of Hours
1	Glimpse of Nanotechnology based material in ancient India: Wootz steel (iron carbide) and the Delhi iron pillar (anticorrosive nanomaterial), Bhasma (nanomaterial as medicine). Contributions of Indian Research Institutes in the field of nanobiotechnology.	15
II	Metals: Silver nanoparticle synthesis and its analyses by UV-spectroscopy and FTRI. Self-Assembly nanomaterial: Cell membrane and its analyses by SEM	15
III	Nano-thin films: Chitosan thin film, Nanodevices (nanorobots), Nanotubes: Microtubules assembly and its importance, Nano shells- Dendrimers: Liposomes, Nanofibers: Collagen, Fibronectin & elastin, nano fluidics: Extracellular matrix assembly and its importance.	15
IV	Agriculture: Crop production- Nano fertilizers technology, Biomaterial to improve shelf life of vegetables. Medicine: Collagen thin films in wound healing mechanism, Nanoscale devices – DNA microarray for disease diagnosis, Antibodies and Targeted drug delivery system.	15

V	Nano biosensors (Firefly-luciferase) and its applications, Introduction to Biomimetics (Gecko foot effect, Lotus leaf effect: Paint and fabrics, Box fish based Car).	15
Total		**75**

Text Books

1	Vasantha Pattabhi and N. Gautham (2009), Biophysics, Narosa Publishmg House, New Delhi.
2	Narayanan.P (2010), Essentials of Biophysics, New Age International (P) Ltd. Publishers, New Delhi.
3	Rai, Mahendra, and Clemens Posten (2013). *Green biosynthesis of nanoparticles: Mechanisms and applications*, CABI, ISBN: 9781780642246.
4	Shanmugam.S, "Nanotechnology", MJP publishers, 2010.
5	Pradeep T (2012). *Textbook of Nanoscience and Nanotechnology*, McGraw Hill publications, ISBN: 9781259007323.

Reference Books

1	D.Voet & J.G.Voet (2010), Biochemistry, John Wiley &Sons, New York.
2	Biochemistry by Lubert Stryer, 4th Ed., WH.Freeman, 1995.
3	David S. Goodsell, "Bionanotechnology", John Wiley &Sons Inc., publications, 2004.
4	Guozhong Cao (2004). Nanostructures and Nanomaterials, synthesis, properties and applications, Imperial College Press, ISBN: 978-1860944802.
5	C.M.Niemeyer, C.A. Mirkin (2007). *Nanobiotechnology*, WILEY-VCH Verlag GmbH & Co. KG, Weinheim, ISBN: 9783527306589.

Web Resources

1	http://vvm.org.in/study_material/ENG%20-20Indian%20Contributions% 20to% 20 Science.
2	https://www.jabonline.in/admin/php/uploads/16_pdf.pdf
3	https://www.youtube.com/watch?v=gSpHINVmgoE
4	https://www.youtube.com/watch?v=ITtGJUGXFKc
5	https://www.youtube.com/watch?v=4cGROrskvLM

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	2	2	2	2	2	3	3	3
CLO2	3	3	3	2	3	3	3	3	3
CLO3	3	3	3	3	2	3	3	3	3
CLO4	3	2	2	-	-	2	3	2	3
CLO5	3	3	3	2	3	3	3	3	3
TOTAL	15	13	13	9	10	13	15	15	15
AVERAGE	3	2.6	2.6	1.8	2	2.6	3	3	3

Course Code	Course Title	L	T	P	C
23117DSC54B	ENZYMOLOGY	5	1	0	4

Course objectives

1. The students will learn the Fundamentals of Enzymology.
2. The students will study about the characteristic features of Enzymes.
3. The student will know about the details of Enzyme Kinetics.
4. The student will apply the biochemical techniques for enzyme isolation
5. The Student will understand the process of Immobilization of enzymes , Enzyme engineering and Designer enzymes in various Industrial purposes.

UNIT	Contents	No. of Hours
1	Nomenclature and classification of enzymes according to the International Union of Biochemistry and Molecular Biologists Convention. Properties of enzymes and factors that influence rate of enzyme action (pH, temperature, substrate concentration, enzyme concentration, activators and inhibitors). Definitions - Apoenzyme, holoenzyme, zymogens. Coenzymes – (Vitamin and Non vitamin origin). Transition state theory, standard free energy, activation energy.	15
II	Active site (definition, characteristic features), Enzyme specificity. Bisubstrate and multisubstrate reactions. ES complex formation, lock and key model and induced fit model. Enzyme units - IU & Katal. Turnover number. Isoenzymes (LDH & CPK), Definition – Ribozymes & Abzymes.	15
III	Enzyme Kinetics – Michaelis-Menten equation and its derivation, significance of Km and Vmax, Lineweaver- Burk plot and Eadie-Hofstee plot, Hanes-Woolf plot. Enzyme inhibition - competitive, Non- competitive, Uncompetitive – (Derivations not included). Allosteric inhibition - sequential model, concerted model, feedback inhibition.	15

IV	Membrane bound proteins – Fluid mosaic model. Extraction of enzymes – Chemical agents and Physical methods of extraction, French pressure cell and ultrasonication. Nature of the extraction medium. Technique for enzyme isolation, separation of cellular organelles by differential centrifugation, purification of enzymes-dialysis, chromatography, electrophoresis. Intracellular localization of enzymes and marker enzymes.	15
V	Immobilization of enzymes- Chemical and Physical methods. Clinical and industrial applications of immobilized enzymes. Enzyme engineering and Designer enzymes. Pharmaceutical, Clinical and Industrial uses of enzymes.	15
Total		75

Text Books

1	Satyanarayana. U. 2013. Biochemistry.4th edition, Elsevier India.
2	Jain J L, 2014, Fundamentals of Biochemistry, 7th edition, S.Chand publishing.
3	Rodwell, V.W, Bender D.A, Botham K.M. 2015, Harper's Illustrated Biochemistry, 30th edition. McGraw-Hill Education.
4	Fundamentals of Enzymology - Nicholas C. Price and Lewis Stevens., Oxford University Press, New Delhi.
5	Voet, D. and Voet, J.G. 2016. Biochemistry, 5th edition. John Wiley and Sons, Inc.,

Reference Books

1	Enzyme – Palmer, 18th edition, 2004.London: Portland Press
2	Biochemistry- Jeremy M Berg, John L Tymoczko, and LubertStryer,6th Edition, Freeman Publications, 2006.
3	Ralph A. Messing (2012) Immobilised Enzymes Academic Press, NY.

4	Nelson D.L., and Cox, M.M. 2013. Lehninger Principles of Biochemistry. 6th edition.W.H. Freeman & Company.
5	Jeremy M Berg, Stryer, L. 2015. Biochemistry, 8th edition. Macmillan Learning.
Web Resources	
1	https://www.youtube.com/watch?v=AD3-v1oKjSk
2	https://www.youtube.com/watch?v=tPCOEUo6J8s
3	https://www.youtube.com/watch?v=ALwziZSRiqM
4	https://www.youtube.com/watch?v=0ZiCqwtFMTs

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	**3**	**3**	**3**	**2**	**1**	**3**	**3**	**3**	**3**
CLO2	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**
CLO3	**3**	**3**	**3**	**2**	**1**	**2**	**3**	**3**	**3**
CLO4	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**3**	**3**
CLO5	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**
TOTAL	**15**	**14**	**14**	**10**	**10**	**13**	**15**	**15**	**15**
AVERAGE	**3**	**2.8**	**2.8**	**2**	**2**	**2.6**	**3**	**3**	**3**

Course Code	Course Title	L	T	P	C
23117DSC54C	BIOETHICS & BIOSAFETY	5	1	0	4

Course objectives

1. The students will understand the concepts of Bioethics and Biosafety.
2. The students will realize the impact of Gene cloning in societal problems and also understand the need of the Bioethics
3. The students will know about the importance of Ethical Clearance.
4. The students will get knowledge about Patents Rights in the field of Research.
5. The students will know about Biosafety and GLP.

UNIT	Contents	No. of Hours
1	Human Rights: Definition, Classification and Scope of Human Rights. United Nations Commission for Human Rights, National and State Human Rights Commission. Article 21 of Indian Constitution – UDHR. Social issues of Human rights.	15
II	Impact of gene cloning & Bioethics-Issues concerning reproduction, Birth, life and Death (Artificial insemination, egg donation, IVF, embryo transplants, Prenatal diagnosis and sex selection & Abortion).	15
III	Bioethics of IPR - ethical criteria in biotechnology- animal ethics; Licensing of animal house - Human cloning - Ethical issues - Ethical clearance norms for conducting studies on human subjects.	15
IV	Patents - Introduction -Treaties and Conventions of Patents, Patent Cooperation Treaty - TRIPS Basis of Patentability – Non Patentable Inventions - Patent Application Procedure in India. Other Forms of IP: Copyright - Trade Mark – Industrial designs – Farmer's Rights. Patenting of Biotechnology products and processes.	15
V	Biosafety - General guidelines - DBT guidelines on biosafety in conducting research in biology / biotechnology - Risk assessment studies- Hazardous materials used in Biotechnology- Handling and Disposal - Good manufacturing practices & Good Laboratory practices, Containment facilities and Biosafety practices - Regulation on field experiments and release of GMO's - Labelling of GM foods - Guidelines for research in transgenic plants and Animals.	15
Total		**75**

Text Books	
1	Ignacimuthu, S (2009), *Bioethics*, Narosa Publication house, ISBN: 978-81-7319-966-0
2	V. Sree Krishna . V (2007), *Bioethics and Biosafety in Biotechnology*, (1st ed.), New Age International Private Limited.
3	Rhona Smith. (2003), *International Human rights*, Blackstone Press.
4	Manual of patent practice and procedure. IPR India, 2005.
5	Ministry of commerce and industry, New Delhi, pp.163.
Reference Books	
1	Trayer, P.C, Fredrick.R., and Koch, M. (2002), *Biosafety*. Michigan State University
2	Biosafety, Traylor, Fredric & Koch, 2002. Michigan state University pub., USA.
3	Contemporary issues in Bioethics, Beauchamp & Leroy, 1999. Wardsworth Pub. Co. Belmont, California.
4	Biotechnology and safety assessment, John.A.Thomas, 2004. pp.333
Web Resources	
1	www.ipr-helpdesk.org/
2	www.patentoffice.nic.in/ipr/patent/patents.htm
3	www.bangalorebio.com/GovtInfo/ipr.htm

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	3	3	3	3	3
CLO4	3	3	3	3	3	3	3	3	3
CLO5	3	3	3	3	3	3	3	3	3
TOTAL	15	15	15	15	15	15	15	15	15
AVERAGE	3	3	3	3	3	3	3	3	3

Course Code	Course Title	L	T	P	C
23117DSC54D	CANCER BIOLOGY	5	1	0	4

Course objectives

1. The students will understand the Basics of Cancer Biology.
2. The students will comprehend the Cancer at the Molecular level.
3. The students will learn about the types of Cancer.
4. The students will realize the different techniques of Detection and Treatment of Cancer.
5. The students will know about the Prevention of Cancer.

UNIT	Contents	No.of Hours
1	Cancer: Introduction; Origin of Cancer- The Mutation Concept, The Epigenetic Concept, Viral Concept, Unified genetic concept of cancer; Difference between Normal and Cancer cells; Signs and symptoms.	15
II	Cancer as a genetic disease; Genetic Alterations in Cancer cells, Point mutation, splice mutation, alternate splicing; Mutation in regulatory sequences, deletions, Insertion, Chromosome abnormalities, Genetic defects and the time course of hereditary cancer.	15
III	Types of Cancer: - Blood & Lymph – Leukemia, Malignant lymphoma, Bone- Soft tissue Sarcoma, Thorax- Breast cancer, Male genitalia- Prostate cancer, Female genitalia- Cervical cancer; Tumor suppressor genes; Classification of Tumor suppressor genes.	15
IV	Detection and Treatment:- Early detection, Molecular detection of Carcinomas, Cancer warning signals; Markers in blood urine; Therapies- Chemotherapy, Gene therapy, Radiotherapy, Biological therapy(Immuno therapy).	15
V	Prevention:- Tobacco smoking, sunlight, diet, ionizing radiation, alcohol drugs, promiscuity, lifestyle and cancer prevention, Environmental factors and cancer, potentially carcinogenic substances for humans.	15
Total		75
Text Books		
1	A. Sarkar, 2011, Biology of Cancer, Discovery Publishing House, New Delhi.	
2	Ranajit Sen,2004, Principles and Management of Cancer, B.I. Publications Pvt Ltd, New Delhi.	

3	Dr M.R.Ahuja, 1997, Cancer- Causes and Prevention, UBS Publishers Distributors Pvt. Ltd.
4	A. Sarkar, 2011, Biology of Cancer, Discovery Publishing House, New Delhi.
5	Ranajit Sen,2004, Principles and Management of Cancer, B.I. Publications Pvt Ltd, New Delhi.
Reference Books	
1	Francesco Pezzella, Mahvash Tavassoli, David J. Kerr, 2019, Oxford Textbook of Cancer Biology, Oxford University Press
2	Albert DeNittis, MD, Joel W. Goldwein, MD, and Thomas J. Dilling, MD, 2002, The Biology of Cancer.
3	Robin Hesketh, 2012, Introduction to Cancer Biology, Cambridge University Press
4	Francesco Pezzella, Mahvash Tavassoli, David J. Kerr, 2019, Oxford Textbook of Cancer Biology, Oxford University Press
5	Albert DeNittis, MD, Joel W. Goldwein, MD, and Thomas J. Dilling, MD, 2002, The Biology of Cancer.
Web Resources	
1	http://csbl.bmb.uga.edu/mirrors/JLU/DragonStar2017/download/introduction-to-cancer-biology.pdf
2	http://webserver1.oneonta.edu/faculty/bachman/cancer/207lectures.htm

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	3	3	3	3	3
CLO4	3	3	3	3	2	3	3	3	3
CLO5	3	3	3	3	3	3	3	3	3
TOTAL	15	15	15	15	14	15	15	15	15
AVERAGE	3	3	3	3	2.8	3	3	3	3

Course Code	Course Title	L	T	P	C
23117DSC54E	BIOCHEMICAL PHARMACOLOGY	5	1	0	4

Course Objectives

1. Understand basic general principles of pharmacokinetics and pharmacodynamics.
2. Understand the major categories of drug targets.
3. Understand mechanism of actions of major drugs related to cardiovascular diseases, diabetes, infectious diseases, cancer, and neurological disorders.
4. Use problem solving skills to learn basic pharmacological concepts.
5. Be familiar with the techniques and approaches used for the study of pharmacology

UNIT I

Basic Concepts in Pharmacology, Pharmacokinetics and Pharmacodynamics, Drug absorption, distribution, elimination, drug metabolism, drug interactions, Drug-receptor interaction, Doseresponse relationships and related topics.

UNIT II

General Principals of Drug therapy: Overview of Drug resistance; Mechanisms of action and cellular resistance to Antibacterial Drugs (a) Inhibitors of Bacterial Cell wall synthesis (Penicillin, Cephalosporin, Carbapenam, Vancomycin); Differences in cell wall Structure between Gram-positive and Gram-negative bacteria (b) Inhibitors of protein synthesis (tetracycline, streptomycin, erythromycin, chloramphenicol etc.).

UNIT III

General principles of cancer chemotherapy; Mechanisms of action and cellular resistance to several classes of anticancer drugs (purine and pyrimidine analogs, antimitotic drugs, DNA intercalating agents, alkylating agents, methotrexate, etc.).

UNIT IV

Replication cycles of certain viruses including Corona, Influenza, HIV; Mechanism of action of some antiviral drugs.

UNIT V

Drugs that affect the nervous system, cardiovascular system, respiratory system, Bacterial infections-antibiotics, Chemotherapy-anticancer drugs

REFERENCES:

- Goodman & Gilman's The Pharmacological Basis of Therapeutics, J.Hardman (editor), L. Limbird (editor) and A. Gilman (editor), 10th edition, MacGraw-Hill, 2001.
- Pharmacology, Page C.P., Curtis, M.J. Sutter, M.C. et al, Medical Edition Paschalidi, 2000.
- Pharmacology, Harvey, R.A. and Champe P.C. Edition Parisianou, 1995.
- Color Atlas of Pharmacology, Thieme Medical Publishers, Authors: Luellmann, Mohr, Hein, Bieger. 3rd edition, 2005

TEXT BOOKS:

1. Biochemical Pharmacology (2012), by Michael Palmer, Alice Chan, Thorsten Dieckmann and John Honek. This book is available for free download using the following link. https://www.nwcbooks.com/get/ebook.php?id=NhE6-BgFVvQC
2. Pharmacology 7th edition (Lippincott Illustrated Reviews) by Karen Whalen, Published by Lippincot Williams & Wilkins, (4th to 6th edition of this book may also be adequate).
3. "Basic and Clinical Pharmacology" by B. G. Katzung and A.J. Trevors (13th edition, 2014).

Course Code	Course Title	L	T	P	C
23117DSC54F	DISASTER MANAGEMENT	5	1	0	4

AIM:
Disaster management aims to reduce, or avoid the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery.

Course Objectives:
CO1: To provide students an understanding the need for studying the disaster management
CO2: Develop an understanding about the various types of disasters.
CO3: To expose students to the risk and vulnerability analysis
CO4: To create awareness about disaster prevention and risk reduction
CO5: To establish a relationship between disasters and developments.
CO6: To understand Rehabilitation, Reconstruction and Recovery in the event of Disaster
CO7: To gain knowledge on Climate Change Adaptation and IPCC Scenario and Scenarios in the context of India.

Course Content
Unit I: Introduction to Disasters
Chapter No. 1 Disaster: Concept, Meaning, and Definition
Chapter No. 2 History of Major Disaster Events in India
Chapter No. 3 Types of Disasters – Natural Disasters: Famine, Drought, Flood, Cyclone, Tsunami, Earthquake
Unit II: Disaster Mitigation and Disaster Management
Chapter No. 4 Man-made Disasters: Riots, Blasts, Industrial, Militancy
Chapter No. 5 Profile, Forms and Reduction of Vulnerability
Chapter No. 6 Disaster Mitigation: Concept and Principles
Unit III: Impact of Disaster
Chapter No. 7 Disaster Management: Concept and Principles
Chapter No. 8 Pre-disaster- Prevention and Preparedness
Chapter No. 9 Physical, Economic, Social, Psycho-socio Aspects, Environmental Impacts
Unit IV: Disaster Process and Intervention
Chapter No. 10 During Disaster- Rescue and Relief
Chapter No. 11 Post-disaster- Rehabilitation and Reconstruction
Chapter No. 12 Victims of Disaster- Children, Elderly, and Women
Chapter No. 13 Displacement- Causes, Effects and Impact
Unit V: Disaster Intervention
Chapter No. 14 Major Issues and Dynamics in the Administration of Rescue, Relief, Reconstruction and Rehabilitation
Chapter No. 15 Components of Rescue, Relief, Reconstruction; Rehabilitation
Chapter No. 16 Disaster Policy in India; Disaster Management Authority- NDMA, SDMA, DDMA; Disaster Management Act, 2005
Key Words: Disaster, Disaster Mitigation, Disaster Management and Disaster Process

Course Code	Course Title	L	T	P	C
23117SEC55L	PLANT BIOTECHNOLOGY AND ANIMAL BIOTECHNOLOGY LAB	0	0	3	3

Course Objectives

1. Explain plant tissue culture and Illustrate Callus development.
2. Develop technical skills in Protoplast isolation and Nucleus localization.
3. Make use of the techniques used in preparing tissue culture medium and membrane filtration in culturing animal cells and prepare single cell suspension and evaluate cell counting and viability.
4. Develop technical skills in isolation of DNA and RNA from plants and microorganisms.
5. Examine the importance of trypsinization in monolayer and subculture and cryopreservation.

Experiments

1. Plant tissue culture media preparation & sterilization techniques.
2. Callus induction
3. Isolation of plant protoplast & viability test.
4. Localization of nucleus using nuclear stain.
5. Preparation of Animal Tissue culture medium and membrane filtration
6. Preparation of Single Cell Suspension & Cell counting
7. Cell viability Test
8. Isolation of plant DNA and plant RNA(Demo)
9. Isolation of Agrobacterium plasmid DNA (Demo)
10. Trypsinization of monolayer and subculturing (Demo)
11. Measurement of phagocytic activity (Demo)
12. MTT Assay (Demo)
13. Cryopreservation and thawing (Demo)

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	2	-	2	3	3	3
CLO2	3	2	2	2	-	2	3	3	3
CLO3	3	3	2	2	-	2	3	3	3
CLO4	3	2	3	2	-	2	3	3	3
CLO5	3	3	2	1	-	2	3	3	3
TOTAL	15	13	12	9	-	10	15	15	15
AVERAGE	3	2.6	2.5	1.9	-	2	3	3	3

Course Code	Course Title	L	T	P	C
23117SEC56L	ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY	0	0	3	3

Course objectives

1. Students can able to isolate the microorganisms and determine their growth curve, generation time.
2. To analyze the water samples, perform immobilization and production of Wine, Biogas and compost.
3. Develop skills in bio fertilizer production and microbial identification.
4. Gain basic skills to analyze raw milk and determine the pasteurization efficacy.
5. Develop skills to perform efficiency tests of biofertilizers and biopesticides, microbial polysaccharide production.

Experiments:

1. Isolation of Air borne Pathogens
2. Study of Growth Curve and Generation time of Bacteria/ Yeast using turbidometry.
3. Water analysis – MPN and BOD.
4. Immobilization of whole yeast cells/ enzyme by Alginate beads.
5. Production of wine
6. Production of Biogas – In vitro & Compost Making.
7. Biofertilizer production/Spirulina production - field visit. (Report should be included in the record)
8. Isolation and identification of starter organisms from Idli batter/ curd
9. Grading of raw milk (Dye reduction test).
10. Determination of efficiency of Pasteurization by quantitative phosphatase test.
11. Preparation and Efficiency testing of Biofertilizer/ Biopesticide. (Demo)
12. Production of microbial Polysaccharide. (Demo)

Text Books

1. Aneja K R, Laboratory Manual of Microbiology and Biotechnology, MEDTECH, 2014.ISBN-13 : 978-9381714553
2. Vijaya Ramesh, (2007), Food Microbiology, MJP Publishers, Chennai, ISBN-13 : 978-8180940194

Reference Books

1. Raghuramulu, N., Madhavan Nair, K., and Kalyanasundaram, S. Ed., (1983), A Manual of Laboratory Techniques, National Institute of Nutrition, ICMR, Hyderabad.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PS O1	PS O2	PS O3
CLO1	3	2	3	2	2	2	3	3	3
CLO2	3	2	3	2	2	2	3	3	3
CLO3	3	2	3	2	2	2	3	3	3
CLO4	3	2	3	1	2	2	3	3	3
CLO5	3	2	3	1	2	2	3	3	3
TOTAL	15	10	15	8	10	10	15	15	15
Average	3	2	3	16	2	2	3	3	3

Course Code	Course Title	L	T	P	C
231AECCVED	Value Education	2	0	0	2

Course Objectives

CO 1: Provide insights into the central dogma of molecular biology and explain the mechanism of DNA replication.
CO 2:Elaborate the mechanism of transcription and reverse transcription.
CO 3:Highlight the characteristics of genetic code and describe the process of protein synthesis.
CO 4:Introduce the concept of regulation of gene expression in prokaryotes
CO 5:Familiarize the different types of mutations and explain the mechanism of DNA repair.

Course Content:

UNIT I:
Central Dogma of molecular Biology, DNA as the unit of inheritance. Experimental evidence by Griffith's transforming principle, Avery, McLeod and McCarthy's experiment, and Hershey and Chase Experiment. Replication in prokaryotes: Modes of replication, Meselson and Stahl's experimental proof for semiconservative replication. Mechanism of Replication – Initiation, events at Ori C, Elongation – replication fork, semi discontinuous replication, Okazaki fragments, and termination. Bidirectional replication, Inhibitors of replication. Models of replication-theta, rolling circle and D loop model.

UNIT II:
Transcription - Mechanism of transcription: DNA dependent RNA polymerase(s), recognition, binding and initiation sites, TATA/ Pribnow box, elongation and termination. Post-transcriptional modifications; inhibitors of transcription. RNA splicing and processing of mRNA, tRNA and rRNA. Reverse transcription.

UNIT III:
Genetic Code and its characteristics, Wobble hypothesis. Translation: Adaptor role of tRNA, Activation of amino acids, Initiation, elongation and termination of protein synthesis, post-translational modifications and inhibitors of protein synthesis

UNIT IV:
Regulation of gene expression in Prokaryotes – Principles of gene regulation, negative and positive regulation, concept of operons, regulatory proteins, activators, receptors, regulation of lac operon and trp operon.

UNIT V:
Mutation: Types-Nutritional, Lethal, Conditional mutants. Missense mutation and other point mutations. Spontaneous mutations; chemical and radiation – induced mutations. DNA repair: Direct repair, Photo reactivation, Excision repair, Mismatch repair, Recombination repair and SOS repair.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Illustrate the Central Dogma of molecular biology, explain the multiplication of DNA in the cell and describe the types and modes of replication.	PO1
CO2	Elaborate the mechanism of transcribing DNA into RNA, discuss the formation of different types of RNA.	PO1,PO2
CO3	Decipher the genetic code and summarize the process of translation.	PO4,PO6
CO4	Comprehend the principles of gene expression and explain the concept of operon in prokaryotes.	PO4,PO5, PO6
CO5	Distinguish the types of mutations and explain the various mechanisms of DNA repair.	PO3,PO8

Text Books (Latest Editions)	
1	Veer Bala Rastogi, 2008, Fundamentals of Molecular Biology, 1st edition, Anebooks India.
2	David Friefelder,1987, Molecular Biology, 2nd edition, Narosa Publishing House.
3	Dr.P.S.Verma and Dr.V.K.Agarwal,2013,Cellbiology, Genetics, Molecular Biology, Evolution and Ecology,1stedition,S.Chand&CompanyPvt.Ltd.
References Books	
1	Karp,G.,2010,Cell and Molecular Biology: Concepts and Experiments, 6thedition, John Wiley & Sons.Inc.
2	DeRobertis,E.D.P. and DeRobertis,E.M.F.,2010,Cell and Molecular Biology, 8thedition, Lippincott Williams and Wilkins, Philadelphia.
3	James.D.Watson,2013, Molecular Biology of the Gene7thedition, Benjamin Cummings.
Web Resources	
1	www.mednotes.net/notes/biology
2.	https://www.onlinebiologynotes.com/repair-mechanism-of mutation/
3	https://teachmephysiology.com/biochemistry/protein-synthesis/dna-translation/

Mapping with Programme Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3			3
CO 2	3						3			3
CO 3	3						3			3
CO 4	3	2					3			3
CO 5	3	2					3	1		3

3 – Strong, 2 – Medium, 1 - Low

Course Code	Course Title	L	T	P	C
23117AEC61	BIOENTREPRENEURSHIP	5	0	0	4

Course objectives

1. Students will be able to identify the challenges of being a Bioentrepreneur
2. Will understand the Business proposal for starting a company
3. Will learn about Vermicomposting and Sericulture
4. Will aspire to set up Mushroom Cultivation
5. Will learn the technique of Single cell protein Cultivation

Unit I **15 Hours**

Basics of Bio entrepreneurship -Biotechnology in a Global scale; types of Bio-industries – Biopharma, Bioagri and Bioservice innovations – Successful Entrepreneur – Creativity, Leadership, Managerial skills, Team building, Decision making; Public and private funding agencies (MSME, DBT, BIRAC, Startup & Make in India)

Unit II **15 Hours**

Business plan preparation; business feasibility analysis by SWOT, business plan proposal for virtual startup company; statutory and legal requirements for starting a company/venture; basics in accounting practices. Market Conditions, Identifying the need of the customers.

Unit III **15 Hours**

Vermicomposting–Earthworms-Ecologicaltypes-Vermiculture-Compostpit-Vermibed-a pplications. Sericulture-Mulberrycultivation-SilkwormRearing-Economicsofsilkworm Production-Chawki Rearing-Sericulture in India.

Unit IV **15 Hours**

Phases of Mushroom Cultivation; Selection of an acceptable ushroom species/strains, Management of mushroom development, Mushroom harvesting; Mushroom diseases, Medicinal and Nutritional properties of mushroom. Aquaponics- Systems-Fish and Vegetables-Nutrients and Biofilters-Advantages and Disadvantages.

UnitV1 **5 Hours**

Single Cell Protein Production: Source: Algae, Bacteria, Yeast – Cultivation of Single Cell protein: SPIRULINA Cultivation – Production site, Microorganism, Experimental design; harvesting and Drying.

Text Books

1. Shimasaki, C. D. (2014). Biotechnology entrepreneurship: Starting, managing, and leading biotech companies. Amsterdam: Elsevier. Academic Press is an imprint of Elsevier.
2. Onetti, A., & Zucchella, A. (n.d.). Business modeling for life science and biotech

companies: Creating value and competitive advantage with the milestone bridge. Routledge.
3. The Earthworm book,Ismail,S.A.,other India Press,Goa
4. An Introduction to sericulture by G.Ganga,J.Sulochana Chetty.
5. Silk: Processing, Properties and Applications Book by K. Murugesh Babu

Reference Books

1. Adams, D. J., & Sparrow, J. C. Enterprise for life scientists: Developing innovation and entrepreneurship in the biosciences. Bloxham: Scion.
2. Jordan, J. F. (2014). Innovation, Commercialization, and Start-Ups in Life Sciences. London: CRC Press.
3. Desai, V.The Dynamics of Entrepreneurial Development and Management. New Delhi: Himalaya Pub. House.
4. The Essential Guide to Cultivating Mushrooms: Simple and Advanced Techniques for Growing Shiitake, Oyster, Lion's Mane, and Maitake Mushrooms at Home by Stephen Rusell
5. Neutraceutical spirulina: Commercial cultivation using rural technology in india by Pushpa Srivastava

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	2	3	2	2	3	3	3
CLO2	3	2	2	3	2	2	3	3	3
CLO3	3	2	2	2	2	3	3	3	3
CLO4	3	2	2	2	2	3	3	3	3
CLO5	3	2	2	2	2	3	3	3	3
TOTAL	15	13	10	14	10	13	15	15	15
Average	3	2.6	2	2.8	2	2.6	3	3	3

Course Code	Course Title	L	T	P	C
23117AEC62	PHARMACEUTICAL BIOTECHNOLOGY	5	0	0	4

Course Objective

1. Students will understand the series of processes involved in drug development, patenting and drug approval.
2. Will learn about Biopharmaceuticals
3. Will understand about management of drugs
4. Will be familiar with Pharmaceutical sectors

Unit I

Objectives of Pharmaceutical Biotechnology - Generic and Biogeneric drugs. Stages in the drug development process -Drug discovery - Drug designing - Drug production - Preclinical trials - Clinical trials - Pharmacokinetics and Pharmacodynamics - Patenting & Drug Approval - Drug Marketing - Post clinical trials.

Unit II

Production of recombinant proteins - Development of Nucleic acid based therapies - Biopharmaceutical considerations - Pharmaceutical regulations - Formulation of Biotechnology products - Drug delivery - Pharmacognosy

Unit III

Human Insulin (Humulin), Growth hormones (Humatrope) - Blood coagulating factor (factor VIII - Kogenate) - Erythropoietin - (Epogen) Granulocyte colony stimulating factors (Neulasta) - Interferons (Avonex) - Antimicrobial peptides (β - defensin 2) - Vaccines (Pentavac), Biologics (Humira - Adalimumab), - Cancer based biologics (rituximab).

Unit IV

Drug toxicity analysis - Common side effects of drugs and managements - Drugs of abuse - Life changing complications - Prevention and management

Unit V

National and International Drug approval agencies - Top National and International pharmaceutical industries - Scope and career opportunities in pharmaceutical sectors

Text Books

1. Chandrakant Kokate and Pramod H.J 1st Edition (2011), Text Book of Pharmaceutical Biotechnology, Elsevier
2. Crommelin, Dean J. A., Sindelar, Robert, Meobohm, Bernd (Eds.) (2019), Pharmaceutical Biotechnology: Fundementals and Applications, Springer.
3. Ashish Dixit, Pawan Tiwari and Vivekanand Kishan Chatap (2015), Textbook of

Pharmaceutical Biotechnology, Studium Press (India) Pvt. Ltd.John F. Corpenter, Mark C. Manning (2012). Rational Design of stable formulation Theory and Practice, (1st edition), US: Springer Science, ISBN: 9781461351313.

Reference Books

1. Gary Walsh (2003), Biopharmaceuticals ; biochemistry and Biotechnology, John Wiley & Sons Ltd.
2. Oliver Kayser and Heribert Warzecha (2012), Pharmaceutical Biotechnology: Drug Discovery and Clinical Applications, Wiley - Blackwell.
3. Simon Wills, 2nd Edition (2005), Drugs of abuse, Pharmaceutical Press
4. Hiten J. Gutka, Harry Yang, Shefali Kakar (2018). Biosimilars: Regulatory, Clinical, and Biopharmaceutical Development, (1st ed), USA: Springer, ISBN: 978-3-319-99679-0.
5. Yui-Wing F. L. and Stuart S. (2019). Pharmacogenomics: Challenges and Opportunities in Therapeutic Implementation, (2nd Ed), TX, USA: Academic Press, ISBN: 9780128126264.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	3	3	3	3	3	3
CLO2	3	3	3	3	3	3	3	3	3
CLO3	3	3	3	3	3	3	3	3	3
CLO4	3	3	3	3	3	3	3	3	3
CLO5	3	3	3	3	3	3	3	3	3
TOTAL	15	15	15	15	15	15	15	15	15
Average	3	3	3	3	3	3	3	3	3

Course Code	Course Title	L	T	P	C
23117DSE63A	MARINE BIOTECHNOLOGY	5	0	0	3

Course Objective

1. Students will gain knowledge about Marin ecosystem and Resources. Will learn about bioactive compounds from Marine sources
2. Will learn about medicinal seaweeds
3. Will know about culture of seaweeds and Aquaculture Will know about Marine biotech products

Unit I

Marine Ecosystems & Its functioning, Ocean currents, Physical & chemical properties of seawater, Ecological divisions of the Sea- Euphotic-Mesopelagic- Bathopelagic- Benthos- Intertidal, Estuarine- Salt Marsh- Mangrove- Coral Reef.

Unit II

Marine microbial habitats- Screening for Secondary metabolites from marine microbes (Bacteria, Fungi, Actinomycetes and marine microalgae). Biofouling, Biofilm, Antifouling, Anticorrosion. Probiotic bacteria and their importance in aquaculture.

Unit III

Definitions- Medicinal compounds from flora (Seaweeds, Seagrass and Mangrove) and fauna (Sponges, Sea anemone and Corals)- marine toxins- antiviral and antimicrobial agents.

Unit IV

Culture aspect-Seaweed (Kappaphycus alvarezii), Fish chromosome manipulation in aquaculture- Hybridization- Gynogenesis- Androgenesis- Polyploidy, Artificial Insemination, Eyestalk ablation- Trangenesis and Cryopreservation.

Unit V

Agar- Agarose - Alginate- Carrageenan- Chitin- Chitosan- Heparin.

Text Books

1. Italy, E (Eds). 1998, New Developments in Marine Biotechnology, Plenum Pub. Corp.
2. Milton Fingerman and Rachakonda Nagabhushanam, 1996, Molecular Genetics of Marine Organisms, Science Pub Inc.
3. Y. Le Gal and H.O.Halvorson 1998, New Developments in Marine Biotechnology. Springer.
4. David H. Attaway, 2001. Marine Biotechnology, Volume 1, Pharmaceutical and Bioactive Natural Products.
5. Rita R. Colwell 1984. Biotechnology in the Marine Sciences (Advances in Marine Science & Biotechnology) Wiley Interscience

Reference Books

1. Scheupr, P.J. (Ed.), 1984. Chemistry of Marine Natural Products, ,Chemical and Biological Perspectives. Vol. I III, Academic Press, New York
2. Marine Biology- Lalli C.M. and T.R. Parsons., 1997. Biological Oceanography
   - An Introduction, Elsevier, 314 pp
3. Marine Pollution- Clark, R. B. 2001. Marine pollution, Fifth edition. Oxford University press, New York Inc., 231pp
4. Gloria Sanchez, Elizabeth Hernandez,(2019), Environmental Biotechnology and cleaner Bioprocess, (1st edition), CRC Press, ISBN 9780367455552
5. Kirchman, D.L.Gasol, J.M. (2018), Microbial ecology of the oceans, (3rdedition), Wiley –Blackwell.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	3	3	1	2	3	3	3	3
CLO2	3	3	3	1	2	3	3	3	3
CLO3	3	3	2	1	2	3	3	3	3
CLO4	3	3	2	1	2	3	3	3	3
CLO5	3	3	3	1	2	3	3	3	3
TOTAL	15	15	13	5	10	15	15	15	15
Average	3	3	2,6	1	2	3	3	3	3

Course Code	Course Title	L	T	P	C
23117DSE63B	FOOD TECHNOLOGY	5	0	0	3

Course Objective

1. Students will be able to understand the basic concepts of the food industry Will learn about classification of food
2. Will learn about fruits, vegetables and horticulture Will learn about Non vegetarian food
3. Will learn about food adulteration and biosensors to detect them

Unit I 15 Hours

Biotechnology relating to the food industry – Role of bioprocess engineering in biotechnology industry- Regulatory and social aspects of biotechnology in foods- Application of biotechnology in waste treatment of food industries. Historical evolution of food processing technology

Unit II 15 Hours

Cereals and Millets. Wheat- composition, types (hard, soft/ strong, weak). Malting, gelatinization of starch, types of browning- Maillard & caramelization. Rice- and composition, parboiling of rice- advantages and disadvantages.Structure and composition of pulses, toxic constituents in pulses, processing of pulses soaking, germination, decortications, cooking and fermentation. Fats and Oils. Refining of oils, types- steam refining, alkali refining, bleaching, steam deodorization, hydrogenation. Rancidity –Types- hydrolytic and oxidative rancidity and its prevention.

Unit III 15 Hours

Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fibre. Post-harvest changes in fruits and vegetables – Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes, pathological changes during the storage of fruits and vegetables

Unit IV 15 Hours

Concept of red meat and white meat, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat. Aquaculture, composition of fish, characteristics of fresh fish, spoilage of fish - microbiological, physiological and biochemical. Composition and nutritive value of egg, characteristics of fresh egg, deterioration of egg quality, difference between broiler and layers. Milk and Milk Products. Chemical composition of milk, its constituents, processing of milk, pasteurization, homogenization. An overview of types of market milk and milk products.

Unit V 15 Hours

Types of food adulterants – test to detect adulterants in foods – metal contaminants - contaminants of processed foods- Food products as analytical samples, general aspects of biosensors- biosensors for food contaminant analysis, commercially available biosensors for food analysis. Food additivies, FSSAI regulations, Methods of fortifying and enriching foods.

Text Books

1. Bawa. A.S, O.P Chauhan et al. Food Science. New India Publishing agency, 2013.
2. B. Srilakshmi, Food science, New Age Publishers,2002
3. Joshi, V.K. and Singh, R.S., A. (2013), Food Biotechnology- Principles and practices, I.K.International Publishing House Pvt. Ltd., New Delhi,.
4. RavishankarRai, V,(2015), Advances in Food Biotechnology, (First edition), John Wiley & Sons, Inc, ISBN 9781118864555.
5. Perry Johnson-Green.(2018), Introduction to Food Biotechnology, Special Indian Edition, CRC Press, ISBN 9781315275703.

Reference Books

1. Roday,S. Food Science, Oxford publication, 2011.
2. Meyer, Food Chemistry, New Age,2004 5. De Sukumar., Outlines of Dairy Technology, Oxford University Press, 2007
3. Foster, G.N., (2020), Food Biotechnology, (First edition), CBS Publishers & Distributors Pvt Ltd, ISBN 9789389396348.
4. Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath, Robert E. Levin(2005), Food Biotechnology, (2nd edition), CRC Press,ISBN 9780824753290.
5. Roday,S. Food Science, Oxford publication, 2011.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CLO1	3	2	1	1	2	2	3	3	3
CLO2	3	2	1	1	2	2	3	3	3
CLO3	3	2	1	1	2	2	3	3	3
CLO4	3	2	1	1	2	2	3	3	3
CLO5	3	2	1	1	2	2	3	3	3
TOTAL	15	10	5	5	10	10	15	15	15
Average	3	2	1	1	2	2	3	3	3

PONNAIYAH RAMAJAYAM INSTITUTE OF
SCIENCE & TECHNOLOGY (PRIST)
Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

SCHOOL ARTS AND SCIENCE

DEPARTMENT OF BIOTECHNOLOGY

M.Sc. BIOTECHNOLOGY CURRICULUM

REGULATION-2023

M.Sc., Graduate Attributes

- Research, inquiry and analytical thinking abilities.
- Capability and motivation for intellectual development.
- Ethical, social and professional understanding.
- Communication in intra and inter disciplinary
- Teamwork, collaborative and management skills in scientific research
- Information literacy in respective discipline

M.Sc., Program Educational Objectives-PEO

- PEO-1 To gain and apply knowledge of Biotechnology concepts to solve the problems.
- PEO-2 To identify, analyse and understand the problems related to biotechnology.
- PEO-3 Ability to design and develop solution to biotechnology.
- PEO-4 Ability to design, perform experiments, analyse, and interpret data for investigating complex problems.
- PEO-5 To decide and apply appropriate tools and techniques in biotechnologicals manipulations

M.Sc., Program Outcome-PO

- **PO1: Problem Solving Skill** - Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.
- **PO2: Decision Making Skill** - Foster analytical and critical thinking abilities for data based decision-making.
- **PO3: Ethical Value** - Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.
- **PO4: Communication Skill** - Ability to develop communication, managerial and interpersonal skills.
- **PO5: Individual and Team Leadership Skill** - Capability to lead themselves and the team to achieve organizational goals.
- **PO6: Employability Skill** - Inculcate contemporary business practices to enhance employability skills in the competitive environment.
- **PO7: Entrepreneurial Skill** - Equip with skills and competencies to become an entrepreneur

M. Sc Programme Specific Outcomes (Pos and PSos):

Programme Outcomes (Pos)	**PO1: Problem Solving Skill** Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context. **PO2: Decision Making Skill** Foster analytical and critical thinking abilities for data-based decision-making. **PO3: Ethical Value** Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities. **PO4: Communication Skill** Ability to develop communication, managerial and interpersonal skills. **PO5: Individual and Team Leadership Skill** Capability to lead themselves and the team to achieve organizational goals. **PO6: Employability Skill** Inculcate contemporary business practices to enhance employability skills in the competitive environment. **PO7: Entrepreneurial Skill** Equip with skills and competencies to become an entrepreneur. **PO8: Contribution to Society** Succeed in career endeavors and contribute significantly to society. **PO 9 Multicultural competence** Possess knowledge of the values and beliefs of multiple cultures and a global perspective. **PO 10: Moral and ethical awareness/reasoning** Ability to embrace moral/ethical values in conducting one's life.
Programme Specific Outcomes (PSOs)	**PSO1 – Placement** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions. **PSO 2 - Entrepreneur** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations. **PSO3 – Research and Development** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development. **PSO4 – Contribution to Business World** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO 5 – Contribution to the Society** To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

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M. Sc - BIOTECHNOLOGY - SYLLABUS – REGULATION 2023

EMPLOYABLITY
SKILL DEVELOPMENT
ENTREPRENEURSHIP
SKILL DEVELOPMENT/EMPLOYABILITY
EMPLOYABILITY / SKILL DEVELOPMENT/ENTREPRENEURSHIP

COURSE STRUCTURE

Course Code	Course Title	L	T	P	C
	SEMESTER I				
23217AEC11	Biochemistry	5	1	0	4
23217AEC12	Molecular Genetics	5	1	0	4
23217AEC13	Molecular Cell Biology	5	1	0	4
23217SEC14L	Molecular Genetics Cell Biology Lab	0	0	4	4
23217DSC15_	Discipline specific elective courses-I	5	1	0	3
23217RMC16	Research methodology	2	-	-	2
	Total	**22**	**4**	**4**	**21**
	SEMESTER II				
23217AEC21	Microbiology	4	1	0	4
23217AEC22	Plant and Animal Biotechnology	4	1	0	4
23217AEC23	Genetic Engineering	4	1	0	4
23217SEC24L	Plant and Animal Biotechnology Lab	0	0	4	4
23217DSC25_	Discipline specific elective courses -II	4	1	0	3

23217SEC26	Environmental Biotechnology	4	0	0	3
23217BRC27	Participation in bounded Research	2	0	0	2
23217SEC28	Internship	-	-	-	2
	Total	**22**	**4**	**4**	**26**

	SEMESTER III				
23217AEC31	Bioinformatics and Biostatistics	5	1	0	4
23217AEC32	Immunology	4	1	0	4
23217AEC33	Bioprocess Technology	4	1	0	4
2317SEC34L	Immunology and Bioprocess Technology Lab	0	0	4	4
23217DSC35_	Discipline specific elective courses -III	4	1	0	3
23217SEC36	Molecular basis of Disease	4	1	0	3
23217SEC37	Internship in Industries to Biotechnology	-	-	-	2
	Total	**21**	**5**	**4**	**24**
	SEMESTER IV				
23217AEC41	Proteomics	4	1	0	4
23217AEC42	Genomics	4	1	0	4
23217PRW43	Project and viva	0	0	10	4
23217DSC44_	Discipline specific elective courses -IV	4	1	0	3
23217DSC45_	Discipline specific elective courses -V	4	1	0	3
23215SEC46	Industrial Visit	-	-	-	2
	Total	**16**	**4**	**10**	**20**
	Total Credits for the Programme				**91**

Discipline specific Electives

Semester	Discipline specific Elective courses -I
I	a) 23217DSC15A - Bioinstrumentation b) 23217DSC15B - Enzymology
II	**Discipline specific Elective courses -II**
	a) 23217DSC25A- Regulatory affairs and Industrial standards b) 23217DSC25B - Human physiology
III	**Discipline specific Elective courses -III**
	a) 23217DSC35A-Nanobiotechnology b) 23217DSC35B- Molecular developmental biology
IV	**Discipline specific Elective courses -IV**
	a) 23217DSC44A- Stem cell Biology b) 23217DSC44B-Bioethics,human rights and social issues
IV	**Discipline specific Elective courses – V**
	a) 23217DSC45A – Industrial Biotechnology b) 23217DSC45B - Pharmaceutical Biotechnology

Credit Distribution

Semester	AEC	SEC	DSC	OEC	RSB Courses	Others	Total
I	12	4	3	-	2	-	21
II	12	9	3	-	2	-	26
III	12	9	3	-	-	-	24
IV	8	5	3	-	4	-	20
TOTAL	**44**	**27**	**12**	**-**	**08**	**-**	**91**

HOD **DEAN**

SEMESTER I

Course Code	Course Title	L	T	P	C
23217AEC31	BIOCHEMISTRY	5	1	0	4

AIM:

This paper provides the knowledge about different types of microorganisms and their identification techniques in modern biology and there by the usefulness of the techniques in research and commercial purposes.

LEARNING OBJECTIVES:

The paper imparts a thorough knowledge on the basics of all the Biochemical concepts, Metabolic reactions and its regulation. The student will get to understand the core concepts of metabolism and physiological processes of the body in both healthy and disease state.

OUTCOMES:

Course outcomes:

At the end of the Course, the Student will be able to:

- **CO-1** To understand the basics of pH and related principles and carbohydrate metabolism
- **CO-2** To provide basic knowledge about lipid metabolism and related significance
- **CO-3** To enlighten the students on Bio-energetics and Biological oxidation pathways
- **CO-4** To update the knowledge on Amino acids and Protein
- **CO-5** To assess and appraise the role of Nucleic acids

Unit I

pH, pK . acid, base .Buffers- Henderson- Haselbach equation, biological buffer system – Phosphate buffer system, protein buffer system, bicarbonate buffer system, amino acid buffer system and Hb buffer system. Water, Carbohydrates: Nomenclature, classification, structure,chemical and physical properties of carbohydrates. Metabolisms: glycogenesis, glycogenolysis, gluconeogenesis, pentose phosphate pathway

Unit II

Lipids: Nomenclature, classification, structure, chemical and physical properties of fatty acids. Metabolisms: biosynthesis of fatty acids, triglycerols, phospholipids, glycol lipids. Cholesterol biosynthesis, bile acids and salt formation. Eicosanoids, sphingolipids and steroid hormones.

Unit III

Bioenergetics – Concept of energy, Principle of thermodynamics, Relationship between standard free energy and Equilibrium constant, ATP ads universal unit of free energy in Biological systems. Biological oxidation: Electron transport chain, oxidative phosphorylation, glycolysis, citric acid cycle, cori.s cycle, glyoxalate pathway. Oxidation of fatty acids- mitochondrial and peroxisomal ß-oxidation, alpha and beta oxidation, oxidation of unsaturated and odd chain fatty acids, ketone bodies. Photosynthesis, urea cycle, hormonal regulation of fatty acids and carbohydrates metabolisms, Mineral metabolism

Unit IV

Amino acids and Protein: Nomenclature, Classification, structure, chemical and physical properties of amino acids and proteins. Metabolisms: Biosynthesis of amino acids. Degradation of proteins, nitrogen metabolisms and carbon skeleton of amino acids. Over all in born error metabolisms

Unit V

Nucleic acids: Nomenclature, Classification, structure, chemical and physical properties of purine and pyrimidines. In de novo and salvage synthesis of purines, pyrimidine bases, nucleosides and nucleotides. Catabolisms of purines and pyrimidines bases. Synthetic analogues of nitrogenous bases

Reference books:

- Philip Kuchel, Simon Easterbrook-Smith, Vanessa Gysbers, Jacqui M. Matthews, 2011. Schaum.s Outline of Biochemistry, Third Edition (Schaum.s Outline Series), McGraw Hill.
- Sathyanarayana.U and U.Chakrapani., 2011. Biochemistry. Books and Allied private limited, Kolkata.
- Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, 2010. Biochemistry, Seventh Edition, W. H. Freeman.
- Albert Lehninger, David L. NelsonVoet Donald, Judith G.Voet and Charlotte W.Pratt., 2008. Principles of Biochemistry. John Wiley and sons, Inc., New Jersey.
- Michael M. Cox, 2008. Lehninger Principles of Biochemistry, Fifth Edition, W. H. Freeman
- Food Microbiology – W.C. Frazier and D.C. Westhoff, Tata Mcgra Hill Publication • Microbial Biotechnology – Alexander N. Glazer, Hiroshni-Kaido, W.H. Freemanand Co. 1995.
- Chemical Microbiology – Antony H. Rose, Butterworths, 3rd Edition, PlenumPress, 1976. publishers.

Useful web sites:

. mcdb-webarchive.mcdb.ucsb.edu/.../biochemistry/.../website-tourf.htm .

www.biochemweb.org/

. http://golgi.harvard.edu/biopages.html

webarchive.mcdb.ucsb.edu/sears/biochemistry/info/website-

Course Code	Course Title	L	T	P	C
23217AEC12	**Molecular genetics**	5	1	0	4

Learning outcome:

The paper imparts a thorough knowledge on the basics of all the Genetics concepts, molecules and its regulation. The student will get to understand the core concepts of molecules and genetics.

Course outcomes:

At the end of the Course, the Student will be able to:

CO-1 To acquire good knowledge about the molecular mechanisms of gene expression and understand the theories behind the organization and functions of genetic material in the living world.

CO-2 Identify and distinguish genetic regulatory mechanisms at different levels and explain the processes behind mutations and other genetic changes and study various chromosomal abnormalities.

CO-3 Make the students understand different range of DNA damage and range of their tools for their detection an.

CO-4 Learn the concepts of the transposons and their applications.

CO-5 Detects the Allele frequencies and genotype frequencies in populations and describe the concepts behind the theory of evolution

Unit I

Gene as the unit of mutation and recombination. Identification of DNA as the geneticmaterial. Mutations: Molecular nature, mutagenesis by nitrous acid, hydroxylamine,alkylating agents, intercalators and UV, origin of spontaneous mutations and control,parasexual process in bacteria, transformation, transduction and conjugal gene transferthe phenomena, mechanisms and applications. Fine structure genetic analysis withexamples.

Unit II

Recombinations – Control, models and mechanisms. Gene as the unit of expression. Gene – cistron relationship in prokaryotes and eukaryotes. Colincarity of gene and polypeptide. Elucidation of the genetic code. Wobble base pairing. Suppression of nonsense, missense and frame shift mutations. Regulation of gene expression in prokaryotes and eukaryotes. The operon concept – positive and negative control, attention control. Control sequences, promoter, operator, terminator and attenuator, DNA methylation and epigenic regulation.

Unit III

DNA damage and repair DNA damage by UV, alkylating agents, cross linkers. Mechanisms of repair – photoactivation, excision repair, recombinational repair. The SOS and adoptive responses and their regulation, heat shock response.

Unit IV

Extrachromosomal heredity, Biology of plasmids – discovery, types and structure of RTF, col factors and Ti. Replication and portioning. Incompatibility and copy numbercontrol. Natural and artificial plasmid transfer and their applications. Transposablegenetic elements: discovery, early experiments of McClintock in maize. Insertion sequences in prokaryotes. Omplex transposons – Tn 10, Tn 5, Tn 9 and Tn 3 as examples. Mechanisms control, consequences and applications of transposition by simple and complex elements. Retro elements.

Unit V

Genetics of Eukaryotes: Gene linkage and chromosome mappling, crossing over, three point cross, tetrad analysis. Complementation. Organization of chromosomes, specialized chromosomes. Chromosome abnormalities, quantitative inheritance, population genetics. Developmental genetics using Drosophilla as model system. Somatic cell genetics.

Reference Books:

• Microbial Genetics – S.R. Maloy, J.E. Cronan and D. Friefelde 1994. Jones andBarlett Publishers.
• Molecular Genetics of Bacteria – J.W. Dale 1994 John Willey and Sons. •
Concepts of Genetics – W.S. Klug and M.R. Cumm Prentice Hall, 1997. •
Introduction of Genetic Analysis of Griffths – Freeeman Co., 1996.
• Advanced Molecular Biology of the Gene – Watson J.D. Hopkins NH, Roberts,J.W.Steitz. J.A.

Course Code	Course Title	L	T	P	C
23217AEC13	MOLECULAR CELL BIOLOGY	5	1	0	4

Learning Outcome:

The paper imparts a thorough knowledge on the basics of all the Cell biology concepts, molecules and its regulation. The student will get to understand the core concepts of molecules and cell biology.

Course outcomes:

CO-1 To understanding of the molecular machinery of living cells and the principles that govern the structures of macromolecules and their participation in molecular recognition.

CO-2 Identify the structures and purposes of basic components in prokaryotic and eukaryotic cells and their molecular mechanism

CO-3- Demonstrate knowledge and understanding of the principles and basic mechanisms of nuclear envelope and its functions.

CO-4 Understand the metabolic pathways and the process of transmission of extracellular signals

CO-5 Demonstrate the operation of various microscopes and microtomy in the laboratory

Unit I

Introduction to cell Biology- Basic properties of cells-Cellular dimension-Size of cells and their composition-Cell origin and Evolution (Endosymbiotic theory)–Microscopy- Light Microscopy, Electron Microscopy, Application of Electron Microscopy in cell biology, Phase Contrast Microscopy, Fluorescence Microscopy, Flow Cytometry and FRET .Organelles of the eukaryotic cell and its functions; Biomembranes - structural organization, transport across membrane (Passive, Active and Bulk transport); Cell-Cell adhesion- Cell junctions (Tight junctions, gap junctions, desmosomes, adherens); Extra cellular matrix (ECM)- components and role of ECM in growth.

Unit II

Carbohydrate – types, structure and functions of carbohydrates, biosynthesis, lipid biosynthesis, C2, C3, C4 cycles. Biosynthesis of fatty acids and triacyl glycerol.Secondary metabolites – occurrence, classification and functions of phenolics, terpenes, flavonoids, alkaloids, saponins, glycosides. Applications of secondary metabolites in food, dairy, agricultural, cosmetics and pharmaceutical Industries. peroxisome - protein glycosylation – mechanism and regulation of

vesicular transport – golgi and post-golgi sorting and processing – receptor mediated endocytosis; Synthesis of membrane lipids.

Unit III

Nucleus: Nuclear envelope – Nuclear pore complexes-nuclear matrix – organization of chromatin – supercoiling, linking number, twist - nucleosome and high order of folding and organization of chromosome(Solenoid and Zigzag model)-Global structure of chromosome – (Lamp brush and polytene chromosomes).

Unit IV

Molecular basis of eukaryotic cell cycle, Regulation and cell cycle check points; Programmed cell death (Apoptosis); Cell-Cell signaling-signaling molecules, types of signaling, signal transduction pathways (GPCR-cAMP, IP3 , RTK, MAP Kinase, JAK-STAT, Wnt Pathway).

Unit V

Cancer Biology: Multistage cancer development Mitogens, carcinogens, oncogenes and proto oncogenes, tumor suppressor genes-Rb, p 53, Apoptosis and significance of apoptosis

References

- Karp, G., 2009, Cell and Molecular Biology, Sixth edition, John Wiley & Sons, New York. · David E.Sadva., 2009. Cell biology organelles structure and function, CBS publishers and distributors, New Delhi.
- Prakash S. Lohar , 2009. Cell and Molecular Biology.
- Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, 2007.,Molecular Biology of the Cell, Fifth edition. Garland Science.
- Lodish,H., Berk, A., Zipursky, S.L., Matsudaira, P., Kaiser, A., Krieger, Scott and Darnell, J. 2007. Molecular Cell Biology. Media Connected, sixth edition. W.H.Freeman and Company · Geoffrey.M.Cooper, Robert.E.Hausman.2007.The Cell-A Molecular Approach, Fourth edition. Sinauer Associates.
- Luiz Carlos Uchoa, Janqueira, Jose, Carneiro. 2005. Basic HistologyText and Atlas. McGraw Hill Professional.
- Paul A, 2001, Text Book Of Cell And Molecular Biology 2edition Niyogi Books • · T.Fleming. 2002. Cell interactions: A practical approach Second edition.
- Alberts B, Molecular Cell Biology. 8. Casimeris et al., Lewin's cells. Jones and Bartlett. · Plopper, Principles of cell Biology. Jones and Bartlett.
- Gartner, Cell Biology and Histology. LWW.
- Pollard et al., Cell Biology. Sounders.
- Copper, The Cell a Molecular approach. Sinauer

Course Code	Course Title	L	T	P	C
23217SEC14L	MOLECULAR GENETICS CELL BIOLOGY LAB	0	0	4	4

Learning Outcome:

The practical will establish basic study skills on the subject and will improve the student's ability to calculate and improve their practical skill and knowledge.

Course outcomes:

On successful completion of the course the students will be able to

CO 1 (K2) Illustrate basic biochemistry procedures
CO 2 (K3) study the methods of estimation of biomolecules
CO 3 (K4) isolate & Analyze DNA, RNA & protein
CO 4 (K5) critically analyze the isolated biomolecules
CO 5 (K5) evaluate the quality and purity of DNA, RNA & Protein

1. Culture media preparation liquid and solid media.
2. Selective differential media
3. Methods of sterilization and testing of sterility
4. Enumeration of bacteria, fungi and actinomycetes from soil
5. Pure culture techniques – Pour, spread and looping methods
6. Maintenance and preservation of cultures
7. Staining of Bacteria – gram, spore and AFB, Fungal wet mount – LPB
8. Motility test – hanging drop and soft agar inoculation
9. Water quality test – MPN
10. Effect of different parameters on bacterial growth kinetics (Substrate, pH, Temperature)
11. Single colony – isolation and checking for genetic markers, measurements of growth rate one step growth curve using T7 phage.

12. Induced mutagenesis and isolation of antibiotic resistant and auxotrophic mutants enrichment methods for auxotrophic and antibiotic resistant mutants.
13. Genetic mapping by p1 transduction, genetic mapping of conjugation and transformation.
14. Transposan mutagenesis of chromosomal DNA, Transposan mutangenesis of plasmid DNA.
15. Experiments with gene fusion.

Book references:

- Sadasivam, S. and Manickam A. Biochemical Methods, 2nd Edition, New age
- International Private Ltd. Publishers.
- Laboratory Techniques in Biochemistry and Molecular Biology.
- A short Course in Bacterial Genetics – J.H. Miller 1992, Cold Spring Harbour • Laboratory.
- Methods for Genetics and Molecular Bacteriology – RGF Murray, W.A. Wood
- N.B. Krig 1994 American Society for Microbiology.

Course Code	Course Title	L	T	P	C
23217DSC15A	**DISCIPLINE SPECIFIC ELECTIVE I BIOINSTRUMENTATION**	5	1	0	3

Learning Outcome:

The paper imparts a thorough knowledge on the basics of all the instrumentation concepts, in biology. The student will get to understand the core concepts of biological instruments and their principles.

Course outcomes:

At the end of the Course, the Student will be able to:

CO-1 Introduction and various types of Microscopic techniques
CO-2 Impart understanding on centrifugation instruments and techniques
CO-3- Separation of Biomolecules
CO-4 Analytical methods on Spectroscopic Analysis
CO-5 Understand the application and Detection on Bioinstrumentation

Unit I

Microscopic Techniques: Principles and Applications: Compound, Light, Stereo, Phase Contrast, Fluorescent Microscopy, Scanning and Transmission Electron Microscopy, Scanning Electron Microscopy, Atomic Force Microscopy, Confocal Microscopy, FRET and Flow Cytometry.

Unit II

Centrifugation: pH meter, Principle and Applications of various types of centrifugation, Sedimentation Coefficient, Svedberg unit, RCF, Density Gradient Centrifugation. Chromatography Techniques: Principle and Application of Paper Chromatography, TLC, Gel Filtration Chromatography, Ion Exchange Chromatography, Affinity Chromatography, GC & HPLC.

Unit III

Electrophoretic Techniques: Principle and Application of Agarose Gel Electrophoresis, 2D-gel Electrophoresis, PAGE- NATIVE & SDS PAGE, Iso-electric Focusing, High resolution Electrophoresis, Immuno Electrophoresis (Immunofixation EP,), ELISA, RIA, Southern, Northern and Western Blotting. Electro blotting, PCR and RT-PCR, Microarray (DNA, Proteins)

Unit IV

Spectroscopic Techniques: Theory and Application of UV and Visible Spectroscopy, Fluorescence Spectroscopy, Mass Spectroscopy, IR Spectroscopy NMR, ESR, Atomic Absorption Spectroscopy, X- ray Spectroscopy, Laser Spectroscopy and Raman Spectroscopy

Unit V

Radio-isotopic Techniques: Introduction to Radioisotopes, Uses and their Biological Applications, Radioactive Decay – Types and Measurement , Principles and Applications of GM Counter, Solid and Liquid Scintillation Counter, Autoradiography, RIA, Radiation Dosimetry, Health effects of Radiations.

Reference books

- ·M.H. Fulekar and Bhawana Pandey Bioinstrumentation, Wiley
- Keith Wilson, John Walker, 2010. Principles and Techniques of Biochemistry and Molecular Biology (7th Edition), Cambridge University Press •
- David L. Nelson, Michael M. Cox. Menninger (2008). Principles of Biochemistry, Fifth edition W. H. Freeman, New York. •
- Experiments in Biochemistry: A Hands-On Approach by Shawn O. Farrell, Ryan T. Ranallo, Paperback: 324 pages, Publisher: Brooks Cole. 20 •
- Metzler D.E. 2001, the chemical reactions of living cells –Academic Press. 2nd edition. • Stryer L,1999, Biochemistry-W.H. Freeman & Company, New York. 1. • 4th edition • L.Veerakumari (2006) Bioinstrumentation MJP Publisher Kindle edition • Jefrey. M., Backer el al., 1996. Biotechnology- A Laboratory Course. Academic Press, New York.
- Holcapek, M., Byrdwell, Wm. C. 2017. Handbook of Advanced Chromatography /Mass • Spectrometry Techniques, Elsevier

Course Code	Course Title	L	T	P	C
23217DSC15B	ENZYMOLOGY	5	1	0	3

Learning Outcome:

The subject imparts knowledge on the fundamentals of enzyme structure and its kinetics. The student will be provided with a basic knowledge and understanding about the functions of enzyme as well as the industrial application of enzymes.

Course outcomes:

CO-1 Explain the basics of enzyme nomenclature and properties
CO-2 Classify and Cognize the native and immobilized enzyme
CO-3 Examine the equations of steady state kinetics
CO-4 Assess extraction and downstream processing of enzymes
CO-5 Compile the uses of enzymes and design enzymes for Industrial and Clinical application

Unit 1:

Introduction to enzymes, Classification, nomenclature and general properties like effects of pH, substrate and temperature on enzyme catalysed reactions. Extraction Isolation and purification of enzymes by precipitation, centrifugation, chromatography and electrophoresis and liquid-liquid extraction methods

Unit 2:

Kinetics of catalysed reaction : Single substrate reactions, bisubstrate reactions, concept of Michaelis - Menten, Briggs Haldane relationship, Determination and significance of kinetic constants, Limitations of Michaelis-Menten Kinetics, line weaver burk plot, Hanes wolf equation, Eadie hoofstee equation ,Inhibition of enzyme activity

UNIT 3 :

Enzyme catalysis: enzyme specificity and the concept of active site, determination of active site. Stereospecificity of enzymes. Mechanism of catalysis: Proximity and orientation effects, general acid-base catalysis, concerted acid - base catalysis, nucleophilic and electrophilic attacks, catalysis by distortion, metal ion catalysis

UNIT 4:

Theories on mechanism of catalysis.-Mechanism of enzymes action: mechanism of action of lysozyme, chymotrypsin, carboxypeptidase and DNA polymerase. Multienzymes system, Mechanism of action and regulation of pyruvate dehydrogenase and fatty acid synthetase complex

UNIT 5 :

Coenzyme action. Enzyme regulation: General mechanisms of enzyme regulation, Allosteric enzymes, sigmoidal kinetics and their physiological significance, Symmetric and sequential modes for action of allosteric enzymes. Reversible and irreversible covalent modification of enzymes, Immobilized enzymes and their industrial applications.Clinical and industrial applications of enzymes, Enzyme Engineering.

Reference Books

- Nicholas C.Price and Lewis Stevens., 2010. Fundamentals of Enzymology. Oxford University Press, New Delhi
- Lehninger, Nelson and Cox, 2005, Principles of Biochemistry - 4th edition, WH Freeman and Company, New York, USA
- Principles of Biochemistry with human focus - Garrett and Grisham, 2002, Harcourt College Publishers, Orlando, Florida, USA.
- Geoffrey L, Zubay, Biochemistry -, 1998, 4th edition. 23
- Donald Voet, Judith Voet and Pratt, 1995, Fundamentals of Biochemistry, 2nd edition. • Harper.s Biochemistry - Murray et al, 2000, 25th edition, Appleton and Lange Publishers. • Enzymes – Trevor Palmer 2002.

Useful Websites

- www.lsbu.ac.uk/biology/enztech/
- www. lsbu.ac.uk/biology/enzyme/
- http://www.aetlted.com/tech/applications.html

SEMESTER - II

Course Code	Course Title	L	T	P	C
23217AEC21	MICROBIOLOGY	4	1	0	4

Learning Outcome:

To provide a comprehensive knowledge on taxonomy and microbial diversity, growth, their harmful effects and beneficial role of microorganisms in agriculture and environment

Course outcomes:

CO-1 To understand the major discoveries of microbiology and describe microbial diversity, Microbial growth and metabolism.
CO-2 To provide basic knowledge about microbial culture, identification of microbes, principle and working of microscopes and sterilization techniques
CO-3 To enlighten the students on host microbe interaction and Epidemiology of microbial disease
CO-4 To update the knowledge on epidemic and pandemic diseases.
CO-5 To assess and appraise the role of novel microbes in environment and integrate them in specific innovative approaches.

UNIT-1

History and microbial taxonomy: Major discoveries related to the field of microbiology: Antony Von Leeuwenhoek, Louis Pasteur, Robert Koch and Edward Jenner. Microbial taxonomy: Bacteria, viruses, fungi, algae and protozoa, Microbial diversity: Biovars, Serovars and Prions, Microbial growth and metabolism: Microbial growth: Growth curve, factors affecting growth, Microbial metabolism- Methanogenesis, acetogenesis and auxotrophs.

UNIT-II

Microbial culture, identification, and control: Nutritional requirements for growth - Growth media and types, Pure culture techniques: Serial dilution and plating methods, Staining methods - Principles and types of staining (simple and differential), Identification of bacteria – Biochemical – IMViC, 16s rRNA sequencing. Microscopy: principles and applications of Bright field, florescent and Scanning electron microscopes, Microbial growth control: Physical Methods – Heat, Filtration, Low Temperatures, High Pressure, Desiccation, Osmotic Pressure, Radiation; Chemical Methods

UNIT-III

Host microbe interaction and Epidemiology: Human microbiome; Skin, Gastrointestinal tract, Oral cavity, Lung. Symbiotic relationship of microbes: Symbiosis, Mutualism, Parasitism, Commensalism and endophyte. Epidemiology of microbes: causes, types and transmission of epidemic, endemic and pandemic diseases

UNIT-IV

Microbial Diseases: Microbial diseases - General characteristics, pathogenesis, laboratory diagnosis and control measures of Pandemic and Epidemic diseases: Tuberculosis, Leprosy, Cholera, Typhoid, COVID-19, Yellow Fever, Flu, AIDS, Ebola, Zika Virus, Small Pox, Dengue, Chickungunya, Malaria, filariasis, Candidiasis, superficial mycosisg.

UNIT-V

Agricultural and Environmental Microbiology: Biological nitrogen fixation, free living, symbiotic nitrogen fixation, mechanism of Nitrogen, Biofertilizers- types and applications; Rhizosphere effect. Biogeochemical cycles-Carbon, Nitrogen, Sulphur and Phosphorous; Methanogenic bacteria Extremphiles- Thermophiles Acidophiles, Halophiles and alkalophiles; Biotechnological application of extremophiles

References

- Joanne Willey, Linda Sherwood, Christopher J. Woolverton, (2017). Prescott's
- Microbiology, (10th edition), McGraw-Hill Education, ISBN: 978-1259281594.
- Maheshwari D K, Dubey R C 2013. A Textbook of Microbiology.4th Edn S Chand Publishing India. · Ananthanarayan and Paniker's (2017) Textbook of Microbiology, (10th edition), The Orient Blackswan, ISBN: 978-9386235251.
- Benson HJ. (1999). Microbiological Applications: A Laboratory manual in General Microbiology, 7th Edition, McGraw Hill. 5
- Managing epidemics- Key facts about major deadly diseases, World Health Organization (WHO) 2018. 9. O'Flaherty, Vincent & Collins, Gavin & Mahony, Thérèse. (2010). Environmental Microbiology, Second Edition. 10.1002/9780470495117.ch11.

Web Sources

- https://www.who.int/emergencies/diseases/managing-epidemics-interactive.pdf ISBN 978-92-4-156553-0. https://doi.org/10.3389/fmicb.2020.631736
- https://www.agrimoon.com/wp-content/uploads/AGRICULTURAL-Microbiology.pdf.

Course Code	Course Title	L	T	P	C
23217AEC22	PLANT AND ANIMAL BIOTECHNOLOGY	4	1	0	4

Learning Outcome:

The paper imparts a thorough knowledge on the basics of all the biotechnological application on plant and animals. The student will get to understand the core concepts of biotechnology.

Course outcomes:

CO-1 To impart theoretical knowledge on various techniques of plant biotechnology like tissue culture, plant genetic transformation and their application in industries.
CO-2 Importance of secondary metabolites and production in plants.
CO-3 To develop concepts, principles and processes in animal biotechnology.
CO-4 Concept and different types in Animal Cell Culture and animal cell lines.
CO-5 Use of molecular biology techniques genetically engineer the animals to improve sustainability, productivity and suitability for pharmaceutical and industrial applications.

UNIT-I

Introduction of plant tissue culture, composition of media, Micropropagation, organogenesis, somatic embryogenesis, haploid and triploid production, protoplast isolation and fusion, hybrid and cybrid, synthetic seed production. Secondary metabolites in plants - Phytochemicals Glycosides and Flavonoids; Anthocyanins and Coumarins - Lignans, Terpenes, Volatile oils and Saponins; Carotenoids and Alkaloids: biogenesis, therapeutic applications

UNIT-II

Plant Transformation Direct transformation by electroporation and particle gun bombardment. Agrobacterium, Ti plasmid vector. Theory and techniques for the development of new genetic traits, conferring resistance to biotic and abiotic. Plant engineering towards the development of enriched food products, plant growth regulators; Molecular Marker aided breeding: RFLP maps, Linkage analysis, RAPD markers, STS Mirco satellite, SCAR, SSCP, QTL, Map based cloning and Molecular marker assisted selection

UNIT-III

Animal health disease diagnosis, hybridoma technique, monoclonal antibodies, application of

probes for disease diagnosis of existing and emerging animal diseases. Prophylaxis - Vaccines, Oral vaccines DNA Vaccines in animal disease. Cell culture: primary and established culture; organ culture; tissue culture

UNIT-IV

Disaggregation of tissue and primary culture; cell separation, Slide and coverslip cultures, flask culture, test tube culture techniques, cell synchronization, cryo preservation. Scaling up of animal cell culture, cell line and cloning micromanipulation and cloning, somatic cell cloning. Karyotyping; measuring parameters for growth, measurement of cell death, apoptosis and its determination, cytotoxicity assays

UNIT-V

Nuclear magnetic resonance methods of monitoring cell metabolism culturing animal cells in fluidised bed reactors. Application of animal cell culture for in vitro testing of drugs, in production of human and animal viral vaccines and pharmaceutical proteins. Culture Scale up and mass production of biologically important compounds. Harvesting of products, purification and assays. Transgenic animals: Production and application; transgenic animals in livestock improvement, transgenic animals as model for human diseases; Stem Cells- Properties, Types, Therapy, Prospects and Ethics in stem cell research.

Reference Books

- J.D.Watson, Gillman, J.Witknowski and M.Zoller, 2006. Recombinant DNA. 3rd ed. • W.H.Freeman. 26 K. Dass. 2005, Text book of Biotechnology, Second Edition, Wiley Dreamtech, India (P) Ltd.
- H.Kreuzer & A.Massey. 2001. Recombinant DNA and Biotechnology: A guide for teachers Second Edition. ASM press, Washington.
- M.Sudhir. 2000. Applied Biotechnology & Plant Genetics. Dominant publishers & Distributors.
- Genetic Engineering of Animals by (Ed) A.Puhler, VCH Publishers, Weinheim, FRG, 1993.
- Animal Cell culture Practical approach. Ed. John R.W.Masters, Oxford.2004. • Concepts in Biotechnology D. Balasubramaniam, Bryce, Dharmalingam, Green, Jayaraman Univ. Press, 1996.

Course Code	Course Title	L	T	P	C
23217AEC23	GENETIC ENGINEERING	4	1	0	4

Learning Outcome:

The paper imparts a thorough knowledge on the basics of all the biotechnological application on plant and animals. The student will get to understand the core concepts of biotechnology.

Course outcomes:

CO-1 Understanding the basic steps of gene cloning and the role of enzymes and vectors responsible for gene manipulation, transformation and genetic engineering.
CO-2 Getting detailed knowledge of gene transfer methods and identifying suitable hosts for cloning.
CO-3 Acquiring theoretical knowledge in the techniques, tools, and application and safety measures of genetic engineering.
CO-4 Describes the genome mapping and sequencing and methods for gene therapy.
CO-5 Elucidate different techniques involved in genetic engineering

Unit I

Gene cloning. Genetic engineering tools. Nucleic acid manipulating enzymes. Promoters, Selectable markers and reporters used in rDNA technology. Restriction digestion, Ligation, Transformation, Selection of Recombinants. Construction of gene libraries

Unit II

E.Coli vectors - pBR322 and its derivatives; Cloning vectors for gram negative bacteria - ColE1, p15A, R1, IncPa, pSC101; Lambda bacteriophage vectors, filamentous phages, Cosmids, Phasmids, Phagemids. Cloning in gram-positive bacteria (*Bacillus subtilis*)

Unit III

Cloning in yeast *Saccharomyces cerevisae*. Life cycle and types of vectors; Eukaryotic vectors. SV40 (molecular genetics and expression); Specialized cloning vector for cDNA; Synthesis of specific RNA in vitro; Vectors for cloning promoters and terminators; vectors with adjustable copy number

Unit IV

Nucleic acid hybridization techniques; Molecular probes (Types of probes and its construction); probe labeling. Nick translation, End labeling and Random primer labeling. Polymerase chain reaction and its variants; DNA fingerprinting; DNA sequencing first generation sequencing methods (Maxam and Gilbert sequencing, Sangers Dideoxy sequencing, Pyrosequencing, PCR based sequencing and hybridization sequencing).Second generation sequencing methods

Unit V

Site directed mutagenesis; DNA microarray; chromosome walking and jumping.Molecular techniques in prenatal diagnosis gene therapy, Transgenic animals (knockout mice) and plants (Flavr savr tomato), Pharmaceutical products (Vaccine, Humulin, etc), Crop improvement. Pesticide resistance, herbicide resistance, transgenic animals and GM foods; Modern Concepts in Genetic Analysis.

Reference Books:

- T.A. Brown, 2010. Gene cloning and DNA analysis: An introduction, 6th edition, Wiley Blackwell.
- Sandy B.Primrose and Richard Twyman, 2006. Principles of Gene Manipulation and genomics, 7th edition, Wiley-Blackwell.
- Lewin, 2009. Genes X, 10th edition, Jones & Barlett Publishers
- Raymond Rodriguez and David T.Denhart 2003.Vectors, A survey of molecular cloning vectors and their uses
- Errst-L. Winnacker 1987.From genes to clones. Introduction to Gene Technology, • Ed. David V. Geoddel 2002.Gene Expression technologies. Methods in enzymology (Vol.185)
- William Wu, Michael J.Welsh, Peter B.Kaufrmar, Helen H.Zhang 2001. Methods in • Gene Biotechnology

Course Code	Course Title	L	T	P	C
23217SEC24L	PLANT AND ANIMAL BIOTECHNOLOGY LAB	0	0	4	4

Learning Outcome:

The practical will establish a basic study skill on the subject and will improve the student's ability to have a hands on experience on the above core subjects.

Course outcomes:

CO-1 To know about the media preparation and sterilization techniques
CO-2 To understand the callus formation
CO-3 (K4) Examine Plant and Animal cells and their functions
CO-4 (K5) Assess extracted DNA, RNA and protein for rDNA technology

CO-5 (K6) to study cloning tools

Experiments

Demonstration

16srRNA sequencing

Plant and Animal Biotechnology - Practical: 15 Hours

1. Plant tissue culture media preparation
2. Plant tissue culture sterilization techniques.
3. Generation of Callus from leaf
4. Generation of Callus from root
5. Generation of Callus from bud
6. Generation of Callus from shoot apex

7. Maintenance of callus culture.
8. Cell suspension culture
9. Anther culture
10. Pollen culture
11. Embryo culture.
12. Isolation of plant protoplast
13. Culture of plant protoplast.
14. Protoplast viability test.
15. Localization of nucleus using nuclear stain.
16. Agrobacterium culture maintenance and isolation of plasmid DNA.
17. Mass culture of Chlorella /Spirulina
18. Introduction to Animal Cell culture: Procedure for handling cells and medium. 19. Cleaning and sterilization of glassware and plastic tissue culture flasks 20. Preparation of tissue culture media
19. Preparation of sera for animal cell culture
20. Preparation of single cell suspension from chicken liver (Primary cell culture). 23. Trypsinization of established cell culture.
21. Cell counting and viability - staining of cells (a) Vital Staining (Trypan blue, Erythrosin (b) Giemsa staining.
22. MTT Assay

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Course Code	Course Title	L	T	P	C
23217DSC25A	REGULATORY AFFAIRS AND INDUSTRIAL STANDARDS	4	1	0	3

Learning Outcome:

The subject imparts knowledge on the fundamentals of regulatory requirement in industries. The student will be provided with a basic knowledge and understanding about the regulatory affairs based on biotechnological industry requirements.

Course outcomes:

CO-1 Elucidate the basic requirements of establish laboratory for testing samples as per the regulatory body's requirements

CO-2 Describe the Scientific, technical knowledge about various food preservation techniques

CO-3 Describe the basic concepts of packing of food materials, various parameters observed during packaging

CO-4 Describe the testing of food materials and identifying of microbial food contaminant

CO-5 Explain the basic of food safety management system, good manufacturing practice and good hygienic practices

UNIT-I

Planning, Organisation and setting of Food testing laboratory and laboratory safety

Understand the requirements for setting up a laboratory for the legal defensibility of analytical data. The ideal structure design, environment, layout for microbiological testing and Air handling etc., Introduction about accreditation, Different accreditation bodies (NABL, APLAC, ILAC), Requirements for ISO/IEC 17025:2017, documentation, pre-requisites for accreditation,

management requirements, technical requirements, measurement of traceability, Laboratory safety: Personnel and laboratory hygiene, emergency planning, general hazards in a food laboratory, safety equipment, storage of chemicals, acids, flammables etc, handling and biological spills and waste disposal

UNIT-II

Principles of Food Preservation technology

Heat: Principles of Heat transfer, Blanching, Pasteurization, Heat sterilization, thermal extrusion, cooking. Water Removal: Forms of Water in Foods, Sorption of water in foods, Water activity, drying and evaporation technology. Temperature reduction: Chilling, Freezing, Radiation: Ionizing Radiation, Microwave, Use of chemicals: Class-I & Class-II preservatives, smoke other chemical additives, New non-thermal methods: High hydrostatic pressure, modified atmosphere, high intensity pulsed electric fields, intense pulsed light, oscillating magnetic fields, hurdle technology, ultrasonic and ohmic heating etc.

UNIT-III

Principles of Food Packaging technology

Effect of environment on food stability: light, oxygen, water, temperature, sensitivity to mechanical damage and attack by biological agents, Different packaging materials used for food packaging and their properties including barrier properties, strength properties, optical properties: Glass, metals, paper, plastics .Biodegradable and edible films and coatings aseptic packaging and combinations, Selection of packaging material and design for various food commodities including fresh produce (Fruits and vegetables), milk and milk products (dairy), cereal, pulses, oil, meat, fish, poultry, water and processed foods, Evaluation of quality and safety of packaging materials- different testing procedures, Function of packaging: Protective packaging and active packaging smart and intelligent packaging, Newer packaging technologies CAP/MAP packaging aseptic processing and packaging, irradiated packaging, retort pouch and microwaveable packaging.

UNIT-IV

Food Microbiology and testing

Introduction of Food microbiology: Classification and nomenclature of microorganisms. Morphology and structure of microorganisms in foods (yeast and Molds, Bacterial cells viruses), Important genera of mold, yeast, bacteria (Gram positive and Gram negative, facultative aerobic and anaerobic, endospore forming bacteria and non-sporulating bacteria), Bacterial groups (lactic acid, acetic acid, butyric acid etc.,), thermophilic, proteolytic, saccharomyticetc, coliforms, faecal coliforms, enteric pathogens and emerging microbes, Sources of microorganisms in food chain (raw materials, water, air, equipment etc) and microbiological quality of foods, Microbial

growth characteristics: Reproduction and growth (fission, generation time optimum growth, growth curve etc). Microbial growth in foods: intrinsic (pH, Moisture content, oxidation-reduction potential, nutrient content, antimicrobial constituents and extrinsic parameters (temperature of storage, relative humidity of environment, presence and concentration of gases in the environment, Thermal destruction of microorganisms: Thermal death time, D Value, Z Value, F-Value, thermal death time curve, 12 D Concept, Microbial food spoilage and food borne diseases, food pathogens, bacillus cereus and other bacillus species, campylobacter, clostridium species, Enterobacteriaceae, E. coli, listeria monocytogens, salmonella, shigella, staphylococcus aureus, vibrio species, yersinia enterocolitica, fungi, virus etc., Methods for the Microbiological examination of foods: Sampling activity and sampling plan, pure culture isolation: streaking, serial dilution and plating, cultivation, maintenance and preservation/stocking of pure culture, Observation of Indicator organisms: Direct examination, enumeration methods, plate count, MPN, biochemical test, Rapid methods detection of specific organisms.

UNIT-V

HACCP and Food safety management systems:

ISO 22000: Importance of implementing a HACCP system and how it can be applied to various products. Prerequisite programs, HACCP principles, some limitation of HACCP food safety objective (FSO). Food safety audits: Management review, audit certification and importance. Good manufacturing practices (GMP), Good hygienic practices (GHP), Food safety plan, food safety management risk analysis. Traceability food products recall and sanitation.

REFERENCE:

- ISO 9001, Quality management systems – Requirements
- ISO 17034 General requirements for the competence of reference material producers
- ISO/IEC 17043 Conformity assessment – General requirements for proficiency testing.
- Food safety standards authority regulation 2011.

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Course Code	Course Title	L	T	P	C
23217SEC26	ENVIRONMENTAL BIOTECHNOLOGY	3	0	0	2

Learning Outcome:

The subject imparts knowledge on the fundamentals of ecology and pollution. The student will be provided with a basic knowledge and understanding about the functions of ecosystem and reduction of pollution by biotechnological tools.

Course outcomes:

On successful completion of the course the students will be able to

CO-1 Explain various waste management methods
CO-2 Classify potential methods of biodegrading organic pollutants.
CO-3 Examine the techniques involved in remediation of polluted environments
CO-4 Assess types of pollution & its control
CO-5 Compile biotechnological approaches to degrade xenobiotic compounds

Unit I –Research

Selection of problem-stages in the execution of research: choosing a topic to publication preparation of manuscript-report writing- format of journals – proof reading – sources of information: Journals, reviews, books, monographs, etc, Bibilograpy. Journal ; standard of research journals – Impact factor.

Unit II: Statistical method

Measures of dispersion: Universe and population – delimiting population – sampling method – random sampling, stratified random sampling – types of variables: qualitative and quantitative variables – continuous and discontinuous variables – scaling method S- mean – standard deviation – standard error – coefficient of variation.

Unit III

Coparision of means, chisquard test, student test (ANOVA ‘’portioning of variation). F test – model sums on one way ANOVA with interpretation of data – introduction to MANIVA – Statistical and their use – significance test and fixing levels of significance – use of statistical

software like COSTAT and STATISTICA. Breif introduction to pie and histograms. Use of LCD.

UNIT IV:

Chromatography – priniciple, operative technique and applications of paper, TLC, adsorption chromatography, GLC and HPLC. Ion-Exchange, molecular sieve, Electrophoretic techniques – principle and technique of gel, SDS, high voltage and discontinuous electrophoresis, Isoelectric focusing, plused field gel electrophoresis and capillary electrophoresis. Spectrometry – Centrifugation techniques.

UNIT V:

X-Rays – X-Ray diffraction, crystals and detectors, quantitative analysis and applications. Radio chemical methods – Basic concepts, counting methods and applications. Autoradiography, detection and measurement of radioactivity, applications of radioisotopes in biology.

References:-

- An introduction to practical biochemistry by David T. Plummer.
- Laboratory Manual in Biochemistry by Pattabiraman and Acharya
- Practical Biochemistry by J. Jayaraman.
- Analytical Biochemistry, D. J. Homie and Hazel Peck, Longman group, 3rd edition, 1998.
- Physical Biochemistry – Application of Biochemistry and Molecular Biology, David Friefelder, W.H Freeman and Co, 2nd Edition 1999.
- Experimental Biochemistry, Robert Switzer and Liamgarrity, W.H. Freeman and Co, 3rd 1999.
- Davis, G.B and C.A Parker, 1997. Writing the doctoral dissertation, Barrons Education series, 2nd edition, Pp 160, ISBN: 081208005
- Duneary, P. 2003. Authoring a Ph. D thesis: how to plan, draft, write and finish a doctoral dissertation. Plagrave Macmillan, Pp256. ISBN 1403905843

THIRD SEMESTER

Course Code	Course Title	L	T	P	C
23217AEC31	BIOINFORMATICS AND BIOSTATISTICS	5	1	0	4

Learning Outcome:

The paper imparts a thorough knowledge of the basics of bioinformatics tools and all the statistical concepts, in biology. The student will get to understand the core concepts of computation principles for the data analysis and In-Silico biological research.

Course outcomes:

CO-1 To get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis.
CO-2 Describe the history, scope and importance of Bioinformatics and role of internet in Bioinformatics.
CO-3 Explain about the methods to characterize and manage the different types of Biological data.
CO-4 To update the knowledge on Tests of significance for large and small samples.
CO-5 To assess and appraise the role of novel microbes in environment and integrate them in specific innovative approaches.

Unit I

Database concepts, Introduction to internet and its application, Introduction to bioinformatics, Protein and nucleotide databases, Information retrieval from biological databases, Sequence alignment and database searching-similarity searches using BLAST and FASTA. Artificial Intelligence: Introduction to biological neural network, motivation for artificial neural network (ANN), Big data analysis - DNA/RNA/protein sequence or structure data, gene expression data, protein-protein interaction (PPI) data, pathway data and gene ontology (GO) data

Unit II

Sequence alignment basics, match, mismatch, similarity, scoring an alignment, gap penalty, protein vs DNA alignments, Dot-matrix alignment, pairwise alignment. Global and local alignment algorithms,multiple sequence alignment-progressive alignment and Iterative alignment algorithms, consensus sequence, patterns and profiles, Database searching: Pairwise alignment

based rigorous algorithm (Smith and Waterman) and Heuristic algorithms (FASTA and Blast). Multiple sequence alignment based database searching. PSI- Blast, PAM and Blosum matrices

Unit III

Bioinformatics for genome sequencing, EST Clustering and analyses, Finding genes in prokaryotic and eukaryotic genomes, Regulatory sequence analysis, Bioinformatics for Genome maps and markers, Bioinformatics for understanding Genome variation, Protein structure-X-ray crystallography, The protein databank and the PDBSum-SCOP, CATH, DALI and HSSP ;Visualization of molecular structures-RasMol and Pymol; Protein secondary structure prediction, Fold Recognition; Transmembrane topology prediction

Unit IV

Correlation and regression – correlation table – coefficient of correlation – Z transformation – regression – relation between regression and correlation. Probability – Markov chains applications – Probability distributions – Binomial (Gaussian distribution) and negative binomial, compound and multinomial distributions – Poisson distribution

Unit V

Normal distribution – graphic representation.– frequency curve and its characteristics –measures of central value, dispersion, coefficient of variation and methods of computation – Basis of Statistical Inference – Sampling Distribution – Standard error – Testing of hypothesis – Null Hypothesis –Type I and Type II errors

Reference Books:

- DassanayakeS.Ranil, Y.I.N. Silva Gunawardene, 2011. Genomic and Proteomic Techniques, Narosa Publishing House Pvt. Ltd, New Delhi.
- Thiagarajan B, Rajalakshmi.P.A., 2009. Computational Biology, MJP publishers, Chennai. • BosuOrpita, SimminderKaurThukral, 2007. Bioinformatics Databases, Tools and Algorithms, Oxford University press, New Delhi.
- Rastogi.S.C, Mendiratta.N, Rastogi.P, 2004. Bioinformatics methods and applications, Prentice Hall of India private limited, New Delhi.
- Lohar s. Prakash, 2009. Bioinformatics, MJP Publishers, Chennai.
- Stephen misener and Stephen A. Krawetz., 2000. Bioinformatics methods and protocols, Humana press Inc, New Jersey.
- Veer bala Rastogi. 2011. Fundamentals of Biostatistics. Ane books Pvt Ltd, Chennai. • Rosner,B (2005), "Fundamentals of Biostatistics", Duxbury Press.
- Warren,J; Gregory,E; Grant,R (2004), "Statistical Methods in Bioinformatics",1st edition, Springer
- Durbin.R, S.Eddy, A.Krogh and G.Mitchison, 1998. Biological sequence analysis, Cambridge university press, Cambridge.

Course Code	Course Title	L	T	P	C
23217AEC32	IMMUNOLOGY	4	1	0	4

Learning Outcome:

The paper imparts a thorough knowledge on the basics of immunology. The student will get to understand the core concepts of immune systems and their non-specific and specific mechanisms, vaccine, etc.

Course outcomes:

At the end of the course the students will be able to

CO-1 Illustrate various mechanisms that regulate immune responses and maintain tolerance

CO-2 Describe key events and cellular players in antigen presentation, and how the nature of the antigen will shape resulting effector responses

CO-3 Learn the concepts of cellular and molecular processes that represent the human immune system.

CO-4 Elucidate the role of immunological regulation and tolerance at a cellular and molecular level

CO-5 Compile concepts on immunological principles and diagnosis

Unit I

History and overview of the immune system. Types of immunity - innate, acquired, passive and active, self vs non-self-discrimination. Physiology of immune response: HI and CMI specificity and memory. Cells and organs of the immune system .Lymphoid tissue, origin and development. Hematopoiesis and differentiation of lymphocytes

Unit II

Lymphocyte-sub-populations of mouse and man. APC cells, lymphokines, Phagocytic cells, macrophage, dendritic cells, K and NK Cells. Nature and biology of antigens, epitopes, haptens, adjuvents. Immunoglobulins- structure, distribution and function. Immunoglobulin super family Isotypic,Allotypic and Idiotypic variants, generation of antibody diversity

Unit III

Monoclonal antibody production and its applications. Types of vaccine and vaccination schedule. Role of MHC antigens in immune responses, Structure and function of class I and class II MHC

molecules. MHC antigens in transplantation and HLA tissue typing. Transplantation immunology- immunological basis of graft rejection, cinical transplantation and Immunosuppressive therapy. Tumour Immunology - Tumour antigen, Immune response to tumours

Unit IV

Effector mechanisms in immunity - macrophage activation, cell mediated cytotoxicity, cytotoxicity assay. Hypersensitivity reactions and types. The complement system, mode of activation, classical and alternate pathway, biological functions of C proteins

Unit IV

Immunotechniques- Principle and Applications: Immuno diffusion,Immuno fluorescence, Insitu localization technique - FISH and GISH. RIA and ELISA, FACS, Western blot, ELISPOT assay. Agglutination tests. VDRL test.Purification ofantibodies, Quantitation of immunoglobulin by RID, EID and nephelometry, CMI techniques and Immunotherapy.

Reference Books:

- Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt,2011. • Roitt.s Essential Immunology, 12 edition, Wiley-Blackwell. USA.
- Kannan. I., 2010. Immunology. MJP Publishers, Chennai.
- Abbas, A.K., A.H.L. Lichtman and S.Pillai, 2010. Cellular and MolecularImmunology. 6th Edition. Saunders Elsevier Publications, Philadelphia.
- SeemiGarhat Bashir, 2009. Text Book of Immunology, PHI LearningPvt. Ltd. New Delhi.
- Thomas J. Kindt, Barbara A. Osborne and Richard A. Goldsby, 2006.Kuby Immunology, 6th edition, W. H. Freeman & Company.
- Nandini Shetty, 1996, Immunology: introductory textbook - I. NewAge International, New Delhi.

Course Code	Course Title	L	T	P	C
23217AEC33	BIOPROCESS TECHNOLOGY	4	1	0	4

Learning Outcome:

The paper imparts a thorough knowledge on the basics of bioprocess and industrial fermentation. The student will get to understand the core concepts of fermentation and its commercial application.

Course outcomes:

The student will learn about the:

CO-1 (K2) Outline the basis of Bioprocess Engineering
CO-2 (K3) Relate reactors in fermentation
CO-3 (K4) Differentiate fermentation processes
CO-4 (K5) Assess Scale up and Scale down
CO-5 (K6) Compile the output of fermentation processes

Unit I

Introduction to fermentation. General requirements of fermentation. Microbial growth kinetics of batch and continuous culture. Solid substrate, slurry fermentation and its application. Microbial cell culture. Immobilization of cells and enzymes. Food Safety: Introduction to food safety aspects and food related hazards – HACCP and ISO.

Unit II

Types of bioreactors: Submerged reactors, surface reactors, mechanically agitated reactors, non mechanically agitated reactors. Design of fermenters, body construction. Production of citric acid, penicillin and insulin. Isolation and improvement of Industrially important Micro organisms, Media for Industrial fermentation and Sterilization.

Unit III

Introduction to bioproducts and bioseparation. Primary recovery process: Cell disruption methods. Cell lysis and Flocculation: Osmotic and mechanical methods of lysis. Flocculation by electrolysis; polymorphic flocculation. Precipitation methods. Filtration: Principles,

Conventional, Crossflow filtration. Sedimentation: Principles, Sedimentation coefficients. Extraction Principles, Liquid liquid extraction, aqueous two phase extraction, supercritical fluid extraction.

Unit IV

Down Stream Processing: Chromatography Techniques, Membrane separation, ultrafiltration. Drying .Principles and operation of vacuum dryer, shelf dryer, rotary dryer, freezer and spray dryer. Crystallization and Whole broth processing.

Unit V

Aerobic and anaerobic fermentation processes and their application in the field of biotechnology industry. Production of commercially important primary and secondary metabolites, Effluent Treatment and Fermentation Economics.

Reference Books:

- Min-tzeLiong, 2011. Bioprocess Sciences and Technology. NovaScience Pub Inc.
- Michael L.Shuler, FikretKargi. 2003. Bioprocess Engineering. PHIpublishers.
- P.A.Belter, E.L.Cursler, and W.S.Hu. 1988.Bioseparation: Downstream processing for Biotechnology. John Wiley and sons.
- R.G. Harrison, P.Todd, SR.Rudge and D.P. Petrides. 2003.Bioseparation science and engineering. Oxford Press.

Course Code	Course Title	L	T	P	C
2317SEC34L	IMMUNOLOGY AND BIOPROCESS TECHNOLOGY	0	0	4	4

Learning Outcome:
The practical will establish a basic study skill on the subject and will improve the student's ability to calculate and improve their practical skill and knowledge.

Course outcomes:

- CO-1 (K2) to learn the Bioinformatics tools for sequence retrieval and alignment
- CO-2 (K3) to apply the learned tools for various applications
- CO-3 (K4) to isolate, identify & enumerate immune cells
- CO-4 (K5) to learn the technique of immunodiagnostics
- CO-5 (K6) to study upstream & downstream techniques

Unit I: Immunology Practical

1. Identification of various immune cells from human peripheral blood.
2. Lymphocyte separation and identification
3. Determination of lymphocyte viability by trypan blue method
4. WBC counting
5. Preparation of serum and plasma
6. Electrophoretic profile of human serum in native PAGE
7. Preparation of cellular antigen – human RBC
8. Preparation of antigen-adjuvent mixture for production of polyclonal antibody
9. Isolation of IgG molecule from serum
10. Immunodiagnostics: CRP
11. Immunodiagnostics: ASO
12. Immunodiagnostics: Widal
13. Immunodiagnostics: RA
14. Immunodiagnostics: Blood grouping and typing
15. Immunodiagnostics: hCG
16. ELISA
17. Radial Immunodiffusion
18. Ouchterlony Immunodiffusion
19. Immunoelectrophoresis
20. Rocket electrophoresis
21. Counter current immunoelectrophoresis.
22. Bioassays for cytokines
23. Radioimmunoassays (Demonstration)

Unit II: Bioprocess Technology - Practical

1. Parts and design of fermenter
2. Solid state fermentation
3. Submerged fermentation
4. Foaming and antifoaming agents
5. Media preparation and sterilization
6. Isolation of industrially important microorganisms for microbial processes.
7. Conservation of Bacteria by Lyophilization.
8. Production and estimation of protease
9. Production and estimation of amylase.
10. Production of wine using grapes
11. Production of penicillin
12. Determination of penicillin activity
13. Citric acid production
14. Use of alginate for cell immobilization.
15. Media standardization (C:N ratio) for maximum biomass production of an industrially important microorganism.
16. Cell disruption (Sonication)
17. Aqueous Two Phase Extraction of enzymes

Course Code	Course Title	L	T	P	C
23217DSC35A	NANOBIOTECHNOLOGY	4	1	0	3

Learning Outcome:

The subject imparts knowledge on the fundamentals of nanoparticles. The student will be provided with a basic knowledge and understanding about the role of nanoparticles in biotechnology.

Course outcomes:

CO-1 Understand the bases for Introduction to Nanotechnology
CO-2 To impart understanding on Nanoparticle based Drug Delivery. CO-3
Fabrication of nanomaterials for bone tissue grafting
CO-4 Methods of Nanofabrication
CO-5 Understand the application of Nanotechnology

Unit I

Introduction to Nanotechnology- Scientific revolution, Feynman's vision, Classification of nanobiomaterials -Types of nanomaterials – nanoparticles, nanotubes, nanowires, Nanofibers, Size deoendent variation in the properties of Nanomaterials, Nature's Nanophenomena.

Unit II

Preparation of Nanomaterials, Top down and bottom up approaches, Biosynthesis, Nanobiomaterials- Polymer, Ceramic, Metal based Nanobiomaterials, Carbon based Nanomaterials, DNA based Nanostructures, Protein based Nanostructures, Quantum dots, Magnetic Nanoparticles, Nanofibres, Hydrogels, Films and Scaffolds.

Unit III

Application of Nanomaterials in Bone substitutes and Dentistry, Food and Cosmetic applications, Bio-sensors and Lab-on-a-chip, Bio-devices and implantable devices, Bioremediation, Nanomaterials for anti-microbial coating – medical implants and paints, Application of Nanotechnology in textile industry.

Unit IV

Nanomaterials for diagnosis and therapy, Implications of drug delivery, Nano-carriers for application in medicine, polymeric nanoparticles as drug carriers, Drug release mechanism, Targeted Drug Delivery using nanocarriers, Nanoparticle technologies for cancer therapy and diagnosis, Point of Care and Personalized medicine, Magnetic nanoparticles for imaging and Hyperthermia.

Unit V

Nanotoxicology, Portals of Entry of the nanoparticles into the Human Body, Bio-toxicity of Nanoparticles, Nanoparticles in Mammalian systems and Health threats, Biological response and cellular interaction of implant materials and scaffolds, Risk assessment and Safety Regulation of nanoparticles.

Reference Books:

- Nanotechnology, S.Shanmugam, Mjp publication. 2011.
- Advanced nanomaterials, kurt E. geckeler, Hiroyuki Nishide , Wiley VHC.2010.
- Nanotechnology and tissue engineering. T.Laurencin, Lakshmi S. Nair, CRC press. 2012.
- Handbook of carbon nanomaterials. Francis D souza, Karl M. Kadish. • World scientific publishing co. pte. ltd. 2011.
- Oded Shoseyov (Editor), Ilan Levy, 2010. NanoBioTechnology: BioInspired Devices and Materials of the Future, Humana Press.
- Chad A. Mirkin and Christof M. Niemeyer, 2007. Nanobiotechnology II: More Concepts and Applications, Wiley-VCH.
- Challa S.S.R.Kumar (Ed). 2006. Biologicals and pharmaceutical nanomaterials, Wiley VCH Verlag Gmbh & Co, KgaA.
- K.K.K.Jain 2006. Nanobiotechnology in Molecualr Diagnostics: Current Techniques and Applications Horizon Bioscience
- Niemeyer, C.M., Mirkin, C.A. (Eds). 2004. Nanobiotechnology Concepts, Applications and Perspectives, Wiley-VCH, Weinheim.
- Andrze w. Miziolek, Shashi P.Karna, J malthew Mauro and Richard A.Vaia. 2005 Defense Applications of Nanomaterials :
- Springer Handbook of Nanotechnology- Ed. by B. Bhushan, Springer-Verlag (2004).
- The Chemistry of Nanomaterials: Synthesis, Properties and Applications, C.N.R. Rao, A. Muller, A. K. Cheetham (Eds), Wiley-VCH Verlag (2004)
- Nanomaterials for medical diagnosis and therapy, Challa Kumar, Wiley-VCH, 2007.
- Nanotechnology for cancer therapy, Mansoor M. Amiji, CRC Press, 2007. • K.K.Jain, Nano Biotechnology, Horizions Biosciences, 2006
- Nanomaterials: An introduction to synthesis, properties and application, Dieter Vollath, Wiley VCH, 2008
- Cato T. Laurencin and Lakshmi S. Nair, Nanotechnology and Tissue Engineering The • Scaffold, CRC Press taylor& Francis Group.
- Introduction to Nanoscience and Nanotechnology, Gabor .L et al, Fundamentals of Nanotechnology, Hornyak, G. Louis, Tibbals, H. F., Dutta, Joydeep, CRC Press, 2009.
- Assessing Nanoparticle Risks to Human Health, Gurumurthy Ramachandran, Elesvier, 2011.
- Nanotechnology: Environmental Health and safety, Risks, Regulation and Management, Matthew Hull and Diana Bowman, Elsevier, 2010.
- Nanotechnology: Health and Environmental Risks, Jo Anne Shatkin, CRC Press, 2013

Useful Websites: http://www.zyvex.com/nano www.fda.gov/nanotechnology/ www.nature.com/nnano/

Course Code	Course Title	L	T	P	C
23217SEC36	MOLECULAR BASIS OF DISEASE	4	1	0	3

Learning Outcome:

The course aims to integrate molecular aspects of chronic human disease into the context of histopathology and macroscopic specimens for each above disease topics outlined in the timetable and in Moodle. Furthermore, course aims mesh well with other disciplines including Anatomy, Biochemistry, Molecular Biology, Immunology, Microbiology, Pharmacology and Physiology.

Course outcomes:

CO-1 Account for the basic terms, principles and mechanisms within general pathology
CO-2 Explain about molecular and cellular pathophysiological mechanisms for common disorders
CO-3 To know about molecular basis of human diseases
CO-4 To identify the molecular basis of ischaemic diseases
CO-5 Give an account of the molecular connections in organ system-related diseases

Unit I

Intro to Infectious Disease Diseases - Clinical Epidemiology - Pathology of Human Disease, genes, cell cycles, and chromosomes, Human disease pedigree and hemophilia

Unit II

Molecular basis of infectious diseases a Tuberculosis, Amoebiasis, Malaria. Genetic Neuropathies - Parkinson's Disease - Mitochondrial Disorders - lysosomal disorders, storage disorders

Unit III

Signaling pathways and their disruption in cellular adaptation mechanisms including hypertrophy, hyperplasia, atrophy and metaplasia, leading to manifestation of signs and symptoms in diseases such as cardiac failure, obesity, diabetes, cancer, etc

Unit IV

Molecular basis of ischaemic diseases a Myocardial ischaemia and infarction including new diagnostic parameters, Cerebral ischaemia and infarction , ischaemic limb disorders , renal failure a acute and chronic, ischaemic placental disorder and foetal mal developments , obesity , Rheumatoid Arthritis.

Unit V

Molecular basis of metabolic diseases. Organ Transplantation - Heart Failure

Reference Books:

- Principles of Gene Manipulation ,Sandy B. Primrose, Richard Twyman, Bob Old,Wiley, 08- Feb-2002
- From Genes to Genomes: Concepts and Applications of DNA Technology. Jeremy W Dale and Malcom von Schantz Copyright 2002 John Wiley & Sons, Ltd.
- Synthetic Biology: Tools and Applications. Edited by Huimin Zhao.Academic Press. Amsterdam (The Netherlands) and Boston (Massachusetts): Elsevier. ISBN: 978-0-12-394430-6. 2013.

URL

- Metabolic and Molecular Bases of Inherited Disease (MMBID) – 8th Edition – http://ommbid.mhmedical.com, on Pitt campus or through Pulse Secure VPN ● Online Mendelian Inheritance in Man, OMIM: https://www.omim.org/ ● Genetics Home Reference: https://ghr.nlm.nih.gov/
- Gene Reviews: https://www.ncbi.nlm.nih.gov/books/NBK1116/
- Molecular Biology of the Cell (Alberts) 4th edition available from NCBI Bookshelf, https://www.ncbi.nlm.nih.gov/books/NBK21054/

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SEMESTER IV

Course Code	Course Title	L	T	P	C
23217AEC41	PROTEOMICS	4	1	0	4

AIM:

To understand the proteins enclosed by the genes with respect to structure, function, protein – protein interactions, techniques for separation and analysis, database and applications.

COURSE OUTCOME:

- Gain knowledge on phylogenetic profiles
- Describe the features of Yeast two-hybrid system.

UNIT I INTRODUCTION: Proteomics introduction – Protein sequencing – Protein Digestion Techniques – Mass Spectrometers for Protein and Peptide Analysis – Protein Identification by Peptide Mass Fingerprinting – Software Tools for Peptide Mass Fingerprinting: Finding the Matches – Peptide Sequence Analysis and Protein Identification with Tandem Mass Spectrometry

UNIT II PROTEOME DATABASES: Proteome databases – Comparative proteomics methods – 2D gel databases – Protein interaction data bases – Metabolic pathway databases – resources for interaction prediction – network and pathway visualization tools – Protein network analysis

UNIT III PROTEOMICS TOOLS: 2D gel electrophoresis and Mass spectra – Protein identification from 2D gel, mass spectra and sequence data – Protein property prediction – bulk, active sites, modification sites, interactive sites, location, localization, stability, shape, domains properties, secondary and tertiary structures – Protein identification programs – Muscot – Peptldent – Protein prospector – GFS

UNIT IV FUNCTIONAL PROTEOMICS: Functional proteomics – protein phenotypes – Protein Protein Interaction Mapping: Experimental – Yeast two-hybrid system – phage display – protein fragment complementation assays – Computational approach

UNIT V APPLICATION OF PROTEOMICS: Applications of Proteomics – Protein Expression Profiling – Identifying Protein – Protein Interactions and Protein Complexes – Mapping Protein Modifications – Protein Arrays and Protein Chips – Application of proteomics to medicine, toxicology and pharmaceuticals

REFERENCES

- Baxevanis D and Ouellette BFF, Bioinformatics: A practical guide to the analysis of genes and proteins (3rd Edn.), John Wiley & Sons, Inc. 2005.
- . Baxevanis D and Ouellette BFF, Bioinformatics: A practical guide to the analysis of genes and proteins (2nd Edn.), John Wiley & Sons, Inc. 2002.
- Brown TA, Genomes (2nd Edn.), BIOS Scientific Publishers, Oxford, UK, 2002.
- Sensen CW, Essentials of Genomics and Bioinformatics, Wiley–VCH. 2002.
- Sensen CW, Hand book of Genome Research, Wiley–VCH Verlag GmBh & Co.

Course Code	Course Title	L	T	P	C
23217AEC42	GENOMICS	4	1	0	4

AIM:

To study prokaryotic and eukaryotic genomes, general methods of genome sequencing techniques, genome analysis and annotations, genome mapping techniques and applications of genomics.

OUTCOME:

- Acquire the aspects of Gene Contig and Shotgun method.
- Know the features of the Genome Mapping databases.

UNIT -I INTRODUCTION: Genome structure and anatomy of prokaryotic and eukaryotic genome – Nuclear genomes – Organelle genomes – Repetitive DNA sequence – Transposable elements– Pseudo genes – Genome databases – organisms-specific databases.

UNIT -II GENOME SEQUENCING DNA: sequencing techniques: Maxam Gilbert method – Sanger‟s method – Pyrosequencing – Whole genome sequencing – Gene Contig and Shotgun method – Human genome project.

UNIT -III GENOME ANALYSIS AND ANNOTATION: Searching and locating Genes – Programs and databases – Determining function of genes – Gene Prediction – Methods of gene prediction – Softwares and tools.

UNIT -IV GENOME MAPPING: Mapping databases – Types of mapping – Genetic mapping: DNA markers – RFLP, SSLP, RH maps, SNP – Linkage analysis – Physical mapping: Restriction mapping – FISH – STS mapping

UNIT -V APPLICATIONS OF GENOMICS DNA: microarray and its applications – Medical applications: Development of Antibiotics – Vaccines – Drug discovery – Human genetics diseases: Identification – Gene Diagnosis and Gene therapy– Genomics in Plant Biology.

REFERENCES:

- Brown T.A., Genomes 3 (3rd Edn.), Garland Science Publishing, New York, 2007. ● Brown T.A., Gene Cloning and DNA Analysis – An Introduction (6th Edn.), A John Wiley & Sons, Ltd., Publications, UK, 2010.
- Jeremy W. Dale and Malcolm von Schantz, From Genes to Genomes – Concepts and Applications of DNA Technology, John Wiley & Sons, Ltd., Publications, UK, 2002. ● Richard J. Reece, Analysis of Genes and Genomes, John Wiley & Sons, Ltd., Publications, UK, 2004.

DISSERTATION

Course Code	Course Title	L	T	P	C
23217PRW43	**PROJECT VIVA**	0	0	10	4

Learning Outcome:

The paper imparts a thorough knowledge on the basics of academic research. The student will get to understand the core concepts of pursuing research.

Course Code	Course Title	L	T	P	C
23217DSC44_A	**DISCIPLINE SPECIFIC ELECTIVE COURSE-IV STEM CELL BIOLOGY**	4	1	0	3

Learning Outcome:

The subject imparts knowledge on the fundamentals of stem cells. The student will be provided with a basic knowledge and understanding about the application of stem cell biology.

Course Outcomes:

At the end of the Course, the Student will be able to:

CO1 To understand the major discoveries of stem cell biology
CO2 To provide basic knowledge about stem cell niche and functions
CO3 To enlighten the students on Stem cell isolation and culture techniques
CO4 To update the knowledge on Stem cell cycle
CO5 To assess and appraise Applications of Embryonic stem cells.

Unit- I

Stem cells - Definition, Characterization, Pluripotency, Self-renewal and differentiation. Types of stem cells- Embryonic stem cells, Adult stem cells and mesenchymal stem Cells, Adipose stem cells

Unit-II

Stem cell niche, Niche specification - Drosophila germ line stem cells. Receptors, genes and markers of stem cells

Unit-III

Stem cell isolation and culture techniques. Characterization of stem cells

Unit-IV

Stem cell cycle. Chromatin modification and transcriptional regulation, chromatin modifying factors, Chromosomal inactivation. JAK -STAT pathway, Ras\Raf pathway, PI3K cell signaling,

p53 check points, Role of LIF pathway in cell cycle control

Unit-V

Applications of Embryonic stem cells, Bone marrow stem cells, Adipose derived stem cells and Hematopoietic stem cells. Ethics in human stem cell research

Reference Books:

- Stem Cell Biology, Daniel Marshak, Richard L. Gardener and David Gottlieb, Cold Spring Harbour Laboratory Press
- Stem cell biology and gene therapy, Booth C., Cell Biology International, Academic Press
- Stem Cell and Gene-Based Therapy: Frontiers in Regenerative Medicine, Alexander Battler, Jonathan Leo, Springer, STEM CELL TECHNOLOGY Syllabus - Semester First References:
- Stem Cell Biology and Gene Therapy. Quesenberry PJ, Stein GS, eds. (£65.00.) Wiley, 1998.
- Progress in gene therapy, Volume 2,Pioneering stem cell/gene therapy trials, Roger Bertolotti, Keiya Ozawa and H. Kirk Hammond, VSP international science publishers ● Stem Cells Handbook: Stewart Sell, Humana Press; Totowa NJ, USA; Oct. 2003,
- Human Embryonic Stem Cells: The Practical Handbook by Stephen Sullivan and Chad A Cowan

Course Code	Course Title	L	T	P	C
23217DSC45A	DISCIPLINE SPECIFIC ELECTIVE COURSE-V BIOETHICS, BIOSAFETY, CLINICAL TRIALS, IPR & ENTREPRENEURSHIP	4	1	0	3

Learning Outcome:

This course provides the guidelines and regulations governing research; evaluate ethical conduct and social responsibilities; to adhere to safe working practices; to appreciate the need for protection of human subjects; to recognize the potential harms in research and show sensitivity to cultural and ethical issues; to create a general awareness about IPR.

Course outcomes:

CO-1	Understand the basics of biosafety and bioethics and its impact on biological sciences and the importance of human life.
CO-2	Apply the knowledge to recognize the importance of biosafety guidelines and good clinical practices.
CO-3	Acquire adequate knowledge in the use of genetically modified organisms and its effect on human health.
CO-4	Evaluate the benefits of GM technology and importance of IPR
CO-5	Analyse the importance of protection of new knowledge and innovations and its role in business and entrepreneurship

Unit I

Introduction to Bioethics Need for bioethics in social and cultural issues. Bioethics & GMO's Issues and concerns pertaining to Genetically modified foods & food crops, Organisms and their possible health implications and mixing up with the gene-pool. Bioethics in Medicine Protocols of ethical concerns related to prenatal diagnosis, gene therapy, Organ transplantation, Xenotransplantation, Containment facilities for genetic engineering experiments, regulations on field experiments and release of GMO`s labeling of GM foods.

Unit II

Clinical trials –Regulations. Bioethics & Cloning Permissions and Procedures in Animal Cloning, Human cloning, Risks and hopes. Bioethics in Research Stem cell research, Human Genome Project, Use of animals in research, human volunteers for Clinical research, Studies on Ethnic races. Ethics in patient care, Informed consent.

Unit III

Biosafety – Biological risk assessment. Biological agents and Hazard groups. Criteria in biological risk assessment. Guidelines for categorization of genetically modified plants for field test. Regulation, national and international guidelines of Biosafety, rDNA guidelines, Regulatory requirements for drugs and Biologics GLP. Biosafety levels. Safety equipments and Biological Safety cabinets.

Unit IV

IPR: Introduction to Intellectual Property rights, Patenting – Factors for patentability – Novelty, Non-obviousness, Marketability. Procedures for registration of Patents. Copyright works, ownership, transfer and duration of Copyright. Renewal and Termination of Copyright. Industrial Designs - Need for Protection of Industrial Designs. Procedure for obtaining Design Protection. Infringement, Right of Goodwill, Passing Off. Trademarks - Introduction to Trademarks. Need for Protection of Trademarks. Classification of Trademarks. Indian Trademarks Law. Procedural Requirements of Protection of Trademarks

Unit V

Geographical Indications - Indication of Source and Geographical Indication. Procedure for Registration, Duration of Protection and Renewal. Infringement, Penalties and Remedies. Layout- Designs of Integrated Circuits: Conditions and Procedure for Registration. Duration and Effect of Registration Protection of Plant variety and Plant breeders' rights in India. Protection of traditional knowledge, Bioprospecting and biopiracy. India's new IP Policy (2016), Govt of India's steps to promote IPR. Career opportunities in IP. Entrepreneurship: Definition and importance, Characteristics and functions of an entrepreneur.

Reference Books:

- "Bioethics & Biosafety" by Sateesh MK, IK International publications, 2008.
- USPTO Web Patent Databases at: www.uspto.gov/patft
- Government of India's Patents Website: patinfo.nic.in
- Intellectual property India: www.ipindia.nic.in
- "Indian Patent Law : Legal and Business Implications" by Ajit Parulekar, Sarita D'Souza Macmillan India publication, 2006
- "Agriculture and Intellectual Property Rights", edited by: Santaniello,V., Evenson, R.E., Zilberman, D. and Carlson, G.A. University Press publication, 2003
- Research papers and Reports provided from time to time
- Ganguli P, (2001), Intellectual Property Rights, Tata Mcgraw Hill.
- Ramesh Chandra, (2004), Issues Of Intellectual Property Rights, Isha Books.
- Erbisch F.h., Maredia K.M, (2000), Intellectual Property Rights In Agricultural Biotechnology, Universities Press.
- Shiv Sahai Singh, (2004), Law Of Intellectual Property Rights, Deep & Deep Publications (p) Ltd.

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SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

B.C.A COMPUTER APPLICATION CURRICULUM

FULL TIME

[Regulation 2023]

[Candidates admitted from the academic year 2023-2024 onwards]

THE REGULATIONS ON LEARNING OUTCOMES BASED CURRICULUM

FRAME WORK FOR UNDERGRADUATE EDUCATION

BCA (Bachelor of Computer Application)

1. Preamble

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Learning Outcomes-based Curriculum Framework (LOCF) which makes it student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. LOCF also aims at ensuring uniform education standard and content delivery across the state which will help the students to ensure similar quality of education irrespective of the institute and location.

Computer Application is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer Application is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Application can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer Application also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain. Computer Application has a wide range of specialties.

These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges. Computer Application is practiced by mathematicians, scientists and engineers. Mathematics, the origins of Computer Science, provides reason and logic. Science provides the methodology for learning and refinement. Engineering provides the techniques for building hardware and software.

Programme Outcome, Programme Specific Outcome and Course Outcome

Computer Application is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. The key core areas of study in Mathematics include Algebra, Analysis (Real & Complex), Differential Equations, Geometry, and Mechanics.

The Students completing this programme will be able to present Software application clearly and precisely, make abstract ideas precise by formulating them in the Computer languages. Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in software industry, banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST) LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME	
Programme:	**B.C.A.,**
Programme Code:	**23UGCOAGE**
Duration:	**3 years [UG].**
Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyze and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extrapolate from what one has learned and applies their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesizing and articulating; Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment

	or investigation **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team **PO8: Scientific reasoning**: Ability to analyze interprets and draws conclusions from quantitative/qualitative data; and critically evaluates ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demon starting the ability to identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.

	PO 15: Lifelong learning: Ability to acquire knowledge and skills, including learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/re-skilling.
Programme Specific Outcomes:	PSO1:Think in a critical and logical based manner PSO2:Familiarizethestudents with suitable software tools of computer science and industrial applications to handle issues and solve problems in Mathematics or statistics and real time application related sciences. PSO3: Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand. PSO4: Understand, formulate, develop programming model with logical approaches to an Address issues arising in social science, business and other contexts. PSO5: Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of Computer science and industrial statistics. PO6:Providestudents/learners sufficient knowledge and skills enabling them to undertake further studies in Computer Science or Applications or Information Technology and its allied a reason multiple disciplines linked with Computer Science. PO7: Equip with Computer science technical ability, problem solving Skills creative talent and power of communication necessary for various forms of Employment. PO8: Develop a range of generic skills helpful in employment, internships& societal activities. PO9: Get adequate exposure to global and local concerns that provides platform for further exploration into multi-dimensional aspects of computing sciences.

Programme Educational Objectives-PEO

- **PEO1**-To gain and apply knowledge of Programming concept to solve the problems.
- **PEO2**-Problem Analysis.
- **PEO3**-Design/Development of Solutions.
- **PEO4**-Conduct investigations of complex problems
- **PEO5**-Modern tool usage.
- **PEO6**-Applying to society

PO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
PO1	✓					
PO2		✓				
PO3			✓			
PO4				✓		
PO5					✓	
PO6						✓

Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Mathematics based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting an Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest - Artificial Intelligence.

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome/ Benefits
I	**Foundation Course** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning Literature and analyzing the world through the literary lens Gives rise to a new Perspective.	➢ Instill confidence among students ➢ Create interest for the subject
I,II,III,IV	**Skill Enhancement papers** (Discipline centric /Generic/Entrepreneurial)	➢ Industry ready graduates ➢ Skilled human resource ➢ Students are equipped with essential skills to Make them employable
		➢ Training on language and communication skills enable the students gain Knowledge and Exposure in the competitive world.
		➢ Discipline centric skill will improve the Technical knowhow of solving real life Problems.
III,IV,V& VI	Elective papers	➢ Strengthening the domain knowledge ➢ Introducing the stake holders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter-disciplinary nature ➢ Emerging topics in higher education/industry/ communication network/health sector etc. are introduced with hands-on-training.

IV	Elective Papers	➢ Exposure to industry molds students into solution providers ➢ Generates Industry ready graduates ➢ Employment opportunities enhanced
V	Elective papers	➢ Self-learning is enhanced ➢ Application of the concept to real situation is conceived resulting Intangible outcome
VI	Elective papers	➢ Enriches the study beyond the course. ➢ Developing a research framework and presenting their independent and Intellectual ideas effectively.
Extra Credits: **For Advanced Learners/Honors degree**		**1.** To cater to the need s of peer learners/research aspirants
Skills acquired from the Courses	Knowledge, Problem Solving, Analytical Ability ,Professional Competency, Professional Communication and Transferrable Skill	

1.1.3	color
EMPLOYABILITY	
SKILL DEVELOPMENT	
ENTREPRENEURSHIP	
EMPLOYABILITY,/ENTREPRENEURSHIP,/SKILL DEVELOPMENT	
EMPLOYABILITY,/SKILL DEVELOPMENT	
EMPLOYABILITY,/ENTREPRENEURSHIP	

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SCHOOL OF ARTS AND SCIENCE
DEPARTMENT OF COMPUTER SCIENCE
BCA (BACHLOR OF COMPUTER APPLICATION)
REGULATION 2023 – 2024
COURSE STRUCTURE -SEMESTER-I

Course Code	Course Title - BCA	L	T	P	C
THEORY					
23110AEC11/ 23111AEC11/ 23132AEC11/ 23135AEC11	Tamil – I/Advanced English-I/Hindi-I/ French - I	3	1	0	3
23111AEC12	English-I	3	1	0	3
23122AEC13	Python Programming	4	1	0	3
23122GEC14	Numerical Methods	3	1	0	3
23122GEC15	Statistics	3	1	0	3
PRACTICAL					
23122SEC16L	Python Programming Lab	0	0	3	3
SKILL ENHANCEMENT COURSE					
23122SEC17	Fundamentals of Information Technology	2	0	0	2
23122SEC18	Foundation Course	2	0	0	2
ABILITY ENHANCEMENT COMPULSORY COURSE(AECC1)					
231AECCINC	Indian Constitution	2	0	0	2
AUDIT COURSE					
231LSCUV	Universal Human Values	-	-	-	1
	Total	**22**	**5**	**3**	**25**

SEMESTER – II

Course Code	Course Title - BCA	L	T	P	C
THEORY					
23110AEC21/ 23111AEC21/ 23132AEC21/ 23135AEC21	Tamil – II/Advanced English-II/Hindi-II/ French - II	3	1	0	3
23111AEC22	English-II	3	1	0	3
23122AEC23	Object oriented programming concepts using C++	4	1	0	3
23122GEC24	Operations Research	4	1	0	3
23122GEC25	Discrete Mathematics	2	1	0	3
PRACTICAL					
23122SEC26L	C++ Programming Lab	0	0	3	3
SKILL ENHANCEMENT COURSE					
23122SEC27	Quantitative Aptitude	2	0	0	2
23122SEC28	Advanced Excel	2	0	0	2
ABILITY ENHANCEMENT COMPULSORY COURSE(AECC1)					
231AECCCMS	Communication Skills	2	0	0	2
AUDIT COURSE					
231SSCBE	Basic Behavioral Etiquette	-	-	-	1
	Total	**22**	**5**	**3**	**25**

SEMESTER – III

Course Code	Course Title - BCA	L	T	P	C
THEORY					
23110AEC31/ 23111AEC31/ 23132AEC31/ 23135AEC31	Tamil – III/Advanced English-III/Hindi-III/ French – III	3	1	0	3
23111AEC32	English-III	3	1	0	3
23122AEC33	Data Structure & Algorithm	5	1	0	4
23122DSC34_	Discipline Specific Elective-I	5	1	0	3
PRACTICAL					
23122SEC35L	Data Structure & Algorithm Lab using C++	0	0	3	3
SKILL ENHANCEMENT COURSE					
23122SEC36	Introduction to HTML	3	0	0	2
23122SEC37	Financial Accounting I	2	0	0	2
ABILITY ENHANCEMENT COMPULSORY COURSE(AECC1)					
23122RMC38	Research Methodology	2	0	0	2
AUDIT COURSE					
231ACLSOAN	Office Automation	-	-	-	1
	Total	**23**	**4**	**3**	**23**

SEMESTER – IV

Course Code	Course Title - BCA	L	T	P	C
THEORY					
23110AEC41/ 23111AEC41/ 23132AEC41/ 23135AEC41	Tami – IV/Advanced English-IV/Hindi-IV/ French – IV	3	0	0	3
23111AEC42	English-IV	3	0	0	3
23122AEC43	Programming in Java	5	1	0	3
23122DSC44_	Discipline Specific Elective-II	5	1	0	3
PRACTICAL					
23122SEC45L	Programming in Java Lab	0	0	3	3
SKILL ENHANCEMENT COURSE					
23122SEC46	Enterprise Resource Planning	3	0	0	2
23122SEC47	Multimedia Systems	2	0	0	2
ABILITY ENHANCEMENT COMPULSORY COURSE(AECC1)					
23122BRC48	Participation in Bounded Research	2	0	0	2
231AECCEVS	Environmental Studies	2	-	-	2
AUDIT COURSE					
231LCSCLS	Leadership and Management Skills	-	-	-	1
	Total	**25**	**2**	**3**	**24**

SEMESTER – V

Course Code	Course Title - BCA	L	T	P	C
THEORY					
23122AEC51	Operating System	5	1	0	4
23122AEC52	ASP.NET Programming	5	1	0	3
23122AEC53	Information Security	5	0	0	4
23122DSC54_	Discipline Specific Elective-III	4	0	0	4
23122DSC55_	Discipline Specific Elective-IV	4	0	0	4
PRACTICAL					
23122SEC56L	ASP.NET Programming Lab	0	0	3	3
23122SEC57	Internship / Industrial Training				2
AUDIT COURSE					
231ACLSPSL	Professional Skills	-	-	-	1
231AECCVED	Value Education	2	-	-	2
	Total	**25**	**2**	**3**	**27**

SEMESTER – VI

Course Code	Course Title - BCA	L	T	P	C
THEORY					
23122AEC61	Computer Network	5	1	0	4
23122AEC62	Data Analytics using R Programming	5	0	0	4
23122DSC63_	Discipline Specific Elective-V	5	0	0	3
PRACTICAL					
23122SEC64L	Data analytics using R Lab	0	0	3	3
23122PRW65	Project	8	0	0	4
23122SEC66	Professional Competency Skill General awareness for competitive examination	2	0	0	2
23122EXACT	Extension Activity	-	-	-	1
AUDIT COURSE					
231ACSIKWS	Indian Knowledge System	-	-	-	2
	Total	25	2	3	23
Total Credits-Programme					**140**
Total Credits-Audit Courses					**07**
Total Credits					**147**

Discipline Specific Electives

Semester	Discipline Specific Elective Courses-I
III	a)23122DSC34A-Grid Computing b)23122DSC34B- Big Data Analytics c)23122DSC34C-Natural Language Processing
	Discipline Specific Elective Courses-II
IV	a) 23122DSC44A-Image Processing b) 23122DSC44B- Analytics for Service Industry c)23122DSC44C-Computational Intelligence
V	**Discipline Specific Elective Courses-III**
	a) 23122DSC54A-Database Management System b)23122DSC54B- Agile Project Management c)23122DSC54C- Cloud Computing
	Discipline Specific Elective Courses-IV
	a)23122DSC55A-Disaster Management b)23122DSC55B- Artificial Neural Network c)23122DSC55C- Mobile Adhoc Network
	Discipline Specific Elective Courses-V
VI	a)23122DSC63A-Human Computer Interaction b)23122DSC63B- Data Science c)23122DSC63C- IOT and its Applications

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Credit Distribution for UG Programme

Consolidated Semester wise Credit distribution

SEM	AEC	SEC	GEC	DSC	AECC	Research	others	Total
I	9	7	6	-	2	-	1	25
II	9	7	6	-	2	-	1	25
III	10	7	-	3	-	2	1	23
IV	9	7	-	3	2	2	1	24
V	11	5	-	8	-	-	3	27
VI	8	5	-	3	-	4	3	23
Total	**56**	**38**	**12**	**17**	**6**	**8**	**10**	**147**

AUDIT COURSE CREDIT DISTRUBUTION

Sem	Audit
I	1
II	1
III	1
IV	1
V	1
VI	2
Total	7

HOD **DEAN**

Eligibility for admission

To be eligible to enroll in for the BCA Computer Application degree courses you need to clear the following eligibility criteria.

- Students need to have graduated their 12th standard in the science stream with physics, chemistry and mathematics (PCM),
- Students who have science with physics, chemistry and biology (PCB).

இக்கால இலக்கியம்

23110AEC11

முதல் பருவம்

பாட நோக்கங்கள்

1. இக்காலதமிழ்இலக்கியவகைகளின்மாதிரிகளைகற்பித்தல்.
2. தமிழின்இனிமையைஉணரச்செய்தல்
3. தமிழின்ஈடுபாட்டையும்சுவைக்கும்திறனையும்ஏற்படுத்துதல்.
4. கவிதை எழுதும் திறனை உருவாக்குதல்
5. **படைப்பாளர்களாக உருவாக்கும் திறனை** ஏற்படுத்துதல்.

பயன்கள்

- மொழி ஆளுமைத்திறன் பெறுதல்.
- சமூக சிந்தனையை வளர்த்துக் கொள்ளுதல்.
- **படைப்பாளர்களாக உருவாகும் திறனைப் பெறுதல்**.
- இலக்கியங்களின் அறிவை மேம்படுத்துதல்.
- கவிதைஎழுதும் முறையை புரிந்துக்கொள்ளுதல்

அலகு -1 மரபுக்கவிதை

1. பாரதியார்--விடுதலை, வந்தே மாதரம் ,காற்று

2.பாரதிதாசன் - அழகின்சிரிப்பு , தமிழனுக்கு வீழ்ச்சி இல்லை

3.கவிமணிதேசியவிநாயகம்பிள்ளை—தொழிலாளியின் முறையீடு

4.நாமக்கல்கவிஞர்—தருணம் இதுவே ,

5.கண்ணதாசன்-- அனுபவம்

அலகு -2புதுக்கவிதைகள்

1.அப்துல்ரகுமான் -வெற்றி

2.அறிவுமதி-நட்புக்காலம்

3.வைரமுத்து- ருசி, சிற்பி- ஓடுஓடுசங்கிலி

4.மு.மேத்தா- வெளிச்சம் வெளியே இல்லை

அலகு -3நாட்டுப்புறவியல்

1.பழமொழிகள்

2. விடுகதைகள்

3. தொழில்பாடல்

அலகு- 4 சிறுகதை

1. தடயம்- மா. ஜெயபிரகாசம்

2. எதார்த்தம் - சு. தமிழ்ச்செல்வி

3.நீதி-- பூமணி

அலகு- 5இலக்கியவரலாறு

1. கவிதை
2. சிறுகதை
3. நாட்டுப்புறவியல்

பொதுக்கட்டுரை –மனிதநேயம், வாழ்வியல்அறங்கள்

மனப்பாடப்பகுதி : பாரதியார் கவிதை- வேண்டும்,பாரதிதாசன் கவிதை-செந்தாமரை

பார்வை நூல்கள் :

1. பாரதியார் கவிதைகள் - மணிவாசகர் பதிப்பகம் சென்னை

2.**பாரதிதாசன்கவிதைகள் - பாரிநிலையம், சென்னை**

3. தமிழ் இலக்கிய வரலாறு - முவரதராஜன் சாகித்திய அகாதெமி,சென்னை.

4. நாட்டுப்புறவியல் - முனைவர். ஆறு. ராமநாதன் ,மணிவாசகர்பதிப்பகம், சென்னை.

5.**தமிழ்சிறுகதையும்தோற்றம்வளர்ச்சி – தமிழ் புத்தக நிலையம், சென்னை.**

இணையதளம் -www.tamilvu.org

www.noolulagam.com

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

Course Code	Course Title	L	T	P	C
23111AEC11	Advanced English-I	4	0	0	2

Objective:

To enhance vocabulary
To understand the impact of the speeches of famous people

Outcome:

Development of vocabulary

UNIT–I:

The Origin of Language - Development of Gesture, Animals and Human Language, Language and Disadvantage

UNIT–II:

Vowels, Diphthongs and Consonants Language Varieties: Dialects, Idiolect,

UNIT–III:

Linguistic Form Morphology, Grammar, Syntax, Semantics, Pragmatics

UNIT–IV:

Branches of Linguistics- Structural Linguistics, Sociolinguistics, Psycholinguistics, Neu linguistics, Applied Linguistics

UNIT–V:

Stylistics and Discourse Analysis: Relationship between Language and Literature, Style and Function, Discourse, Narrative Discourse and Dramatic Discourse

Course Code	Course Title	L	T	P	C
23111AEC12	English-I GENERAL ENGLISH	3	1	0	3

Course Objectives

CO1: To enable learners to acquire the linguistic competence necessarily required in various life situations.

CO2: To help them understand the written text and able to use skimming, scanning skills

CO3: To assist them in creative thinking abilities

CO4: To enable them become better readers and writers

CO5: To assist those in developing correct reading habits, silently, extensively and intensively

Course Content:

UNIT I:

Poetry

1.1 A Patch of Land –Subramania Bharati
1.3 A Nation's Strength – Ralph Waldo Emerson
1.4 Love Cycle - Chinua Achebe

UNIT II:

Prose

2.1 JRD - Harish Bhat

2.2 Us and Them - David Sedaris from Dress Your Family in Corduroy and Denim

UNIT III:

Short Stories

3.1 The Faltering Pendulum- Bhabani Bhattacharya

3.2 How I Taught my Grandmother to Read- Sudha Murthy

3.3 The Gold Frame- R.K. Laxman

UNIT IV:

Language Competency

4.1 Vocabulary: Synonyms, Antonyms, Word Formation

4.2 Appropriate use of Articles and Parts of Speech

4.3 Error correction

UNIT V:

English for Workplace

1.1 Self - introduction, Greetings
1.2 Introducing others
1.3 Listening for General and Specific Information
1.4 Listening to and Giving Instructions / Directions

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Develop and integrate the use of the four language skills i.e. Reading, Listening, Speaking and Writing	PO1
CO2	Understand the total content and underlying meaning in the context.	PO1, PO2
CO3	Form the habit of reading for pleasure and for information	PO4,PO6
CO4	Comprehend material other than the prescribed text	PO4, PO5, PO6
CO5	Develop the linguistic competence that enables them, in the future, to present the culture and civilization of their nation.	PO3, PO8

Text books (Latest Editions)	
1.	Steel Hawk and other stories by Bhattacharya, Bhabani, New Delhi: Sahitya Akademi, 1967
2.	How I taught my Grandmother to Read and other Stories, Murthy, Sudha,Penguin Books, India, 2004

Reference Books **(Latest Editions, and the style given must be strictly adhered to)**	
1.	English in use - A textbook for College Students (English ,Paper back, - T.Vijay Kumar, K DurgaBhavani, YL Srinivas
2.	Practical English Usage - 4th Edition By Michael Swan
3.	**The Art of Civilized Conversation: A Guide to Expressing Yourself with Style and Grace -Margaret Shepherd,Penny Carter, (Illustrator), Sharon Hogan, 2005.**

Web Resources

1.	A patch of land by Subramania Bharati translated by Usha Rajagoplan : https://books.google.co.in/books?id=iSHvOmXuvLMC&printsec=frontcover&dq=subramania+bharati+poems&hl=en&newbks=1&newbks_redir=0&source=gb_mobile_search&sa=X&redir_esc=y#v=onepage&q=subramania%20bharati%20poems&f=false
2.	The Sparrow by Paul Laurence Dunbar https://poets.org/poem/sparrow-0
3.	A Nation's Strength by Emerson https://poets.org/poem/nations-strength
4.	Love cycle by Chinua Achebe : https://www.best-poems.net/chinua-achebe/love-cycle.html
5.	JRD by Harish Bhat https://www.tata.com/newsroom/heritage/coffee-tea-jrd-tata-stories
.	Us and Them by David Sedaris From Dress Your Family in Corduroy and Denim https://legacy.npr.org/programs/morning/features/2004/jun/sedaris/usandthem.html
7.	Uncle Podger Hangs a Picture: http://rosyhunt.blogspot.com/2013/01/uncle-podger-hangs-picture.html
8.	The Gold Frame: https://fybaenglish.blogspot.com/2018/12/the-gold-frame-r-k-laxman.html

Mapping with Programme Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

Mapping with Programme Specific Outcomes:

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

FIRST YEAR

SEMESTER-I

Subject Code	Subject Name	Category	L	T	P	C		Marks		
								CIA	External	Total
23122AEC13	PYTHON PROGRAMMING	Core	4	1	0	3		25	75	100

Learning Objectives		
LO1	To make students understand the concepts of Python programming.	
LO2	To apply the OOPs concept in PYTHON programming.	
LO3	To impart knowledge on demand and supply concepts	
LO4	To make the students learn best practices in PYTHON programming	
LO5	To know the costs and profit maximization	
UNIT	**Contents**	**No. of Hours**
I	**Basics of Python Programming:** History of Python-Features of Python-Literal-Constants-Variables - Identifiers–Keywords-Built-in Data Types-Output Statements –Input Statements-Comments – Indentation-Operators-Expressions-Type conversions. **Python Arrays:** Defining and Processing Arrays–Array methods.	**15**
II	**Control Statements:** Selection/Conditional Branching statements: if, if-else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops .**Jump Statements: b**reak, continue and pass statements**.**	**15**
III	Functions: Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement. Function Arguments: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments-Recursion. Python Strings: String operations- Immutable Strings - Built-in String Methods and Functions - String Comparison. **Modules**: import statement- The Python module – dir() function – Modules and Namespace–Defining our own modules.	**15**

IV	Lists: Creating a list-Access values in List-Updating values in Lists-Nested lists-Basic list operations-List Methods. Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple–Nested tuples Difference between lists and tuples .Dictionaries: Creating, Accessing, Updating and Deleting Elements in a Dictionary–Dictionary Functions and Methods-Difference between Lists and Dictionaries.	**15**
V	**Python File Handling:** Types of files in Python -Opening and Closing files-Reading and Writing files: write() and write lines()methods-append()method–read() and readlines() methods–with keyword–Splitting words –File methods- File Positions- Renaming and deleting files.	**15**
	TOTALHOURS	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Learn the basics of python, Do simple programs on python, Learn how to use an array.	PO1,PO2,PO3,PO4,PO5, PO6
CO2	Develop program using selection statement, Work with Looping and jump statements, Do programs on Loops and jump statements.	PO1,PO2,PO3,PO4,PO5, PO6
CO3	Concept of function, function arguments, Implementing the concept strings in various application, Significance of Modules, Work with functions, Strings and modules.	PO1,PO2,PO3,PO4,PO5, PO6
CO4	Work with List, tuples and dictionary; Write program using list, Tuples and dictionary.	PO1,PO2,PO3,PO4,PO5, PO6
CO5	Usage of File handlings in python, Concept of reading and writing files, Do programs using files.	PO1,PO2,PO3, PO4,PO5,PO6

Text books

1	Reema Thareja, ―Python Programming using problem solving approach‖, First Edition, 2017, Oxford University Press.
2	Dr.R.NageswaraRao,―Core Python Programming‖,First Edition, 2017, Dreamtech Publishers.

Reference Books

1.	Vamsi Kurama,―Python Programming:A Modern Approach‖,Pearson Education.
2.	Mar klutz, Learning Python‖,Orielly.
3.	Adam Stewarts, ―Python Programming ‖, Online.
4.	Fabio Nelli,―Python Data Analytics‖, A Press.

5.	Kenneth A. Lambert,—Fundamentals of Python–First Programs ǁ,CENGAGE Publication.
Web Resources	
1.	https://www.programiz.com/python-programming
2.	https://www.guru99.com/python-tutorials.html
3.	https://www.w3schools.com/python/python_intro.asp
4.	https://www.geeksforgeeks.org/python-programming-language/
5.	https://en.wikipedia.org/wiki/Python_(programming_language)

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**2**	**2**	**3**	**2**	**3**
CO3	**3**	**2**	**2**	**3**	**2**	**2**
CO4	**3**	**2**	**2**	**3**	**2**	**3**
CO5	**3**	**2**	**2**	**3**	**3**	**3**
Weightage of course contributed to each PSO	15	10	10	15	13	14

S-Strong-3 M-Medium-2L-Low-1

ALLIED MATHEMATICS
PAPER-1 NUMERICAL METHODS

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
23122GEC14	Allied	3	1	0	3			25	75	100

Learning Objectives	
LO1	To introduce the various topics in Numerical methods.
LO2	To make understand the fundamentals of algebraic equations.
LO3	To apply interpolation and approximation on examples.
LO4	To solve problems using numerical differentiation and integration.
LO5	To solve linear systems, numerical solution of ordinary differential equations

UNIT	DETAILS
I	**FUNDAMENTALS OF ALGEBRAIC EQUATION**: Solution of algebraic and transcendental Equations-Bisection method – Fixed point iteration method – Newton Raphson method –linear system of equations – Gauss elimination method – Gauss Jordan method.
II	**ITERATIVE, INTERPOLATION AND APPROXIMATION:** Iterative methods - Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by Power method and Jacobi's method for symmetric matrices. Interpolation with unequal intervals – Lagrange's interpolation – Newton's divided difference interpolation
III	**INTERPOLATION WITH EQUAL INTERVAL:** Difference operators and relations. - Interpolation with equal intervals – Newton's forward and backward difference formulae.
IV	**NUMERICAL DIFFERENTIATION AND INTEGRATION:** Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule
V	**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS:** Single step methods – Taylor's series method – Euler's method – Modified Euler's method – Runge Kutta method for solving(first, second , Third and 4th) order equations – Multi step methods

Course Outcomes

CO1	Know how to solve various problems on numerical methods	PO1
CO2	Use approximation to solve problems	PO1,PO2
CO3	Differentiation and integration concept are applied	PO4,PO6
CO4	Apply , direct methods for solving linear systems	PO4,PO5, PO6

CO5	Numerical solution of ordinary differential equations	PO3,PO8

Text Books (Latest Editions)	
1	Charles Dierbach, "Introduction to Computer Science using Python - A computational Problem solving Focus", Wiley India Edition, 2015.
2	Wesley J. Chun, "Core Python Applications Programming", 3rd Edition , Pearson Education, 2016
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	Mark Lutz, "Learning Python Powerful Object Oriented Programming", O'reilly Media 2018, 5th Edition.
2	Timothy A. Budd, "Exploring Python", Tata MCGraw Hill Education Private Limited 2011, 1 st Edition.
Web Resources	
	https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	2	3	3	3	2	1	3
CO2	2	1	3	1	3	3	3	2	1	2
CO3	3	2	3	1	3	3	3	2	1	3
CO4	1	2	3	2	3	3	3	2	1	1
CO5	3	1	2	3	3	3	3	2	1	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

ALLIED MATHEMATICS
PAPER-2 STATISTICS

Subject Code	Category	L	T	P	C	Credits	Inst. Hours	Marks		
								CIA	External	Total
23122GEC15	Allied	3	1	0	3			25	75	100

Learning Objectives	
LO1	Distinguish among different scales of measurement and their implications for solving problems
LO2	Create tables and graphs to format, organize, and interpret data; summarize and present data
LO3	Calculate and analyze numerical descriptive measures for a given data set
LO4	Apply concepts of sample space and probability to solving problems
LO5	Calculate measures of central tendency and variation; use statistical software to analyze

UNIT	DETAILS
I	**Data:** quantitative and qualitative, attributes, variables, Scales of measurement: nominal, ordinal, interval and ratio, Measures of Central Value: Meaning, Need for measuring central value. Characteristics of an ideal measure of central value. Types of averages - mean, median, mode, harmonic mean and geometric mean. Merits, Limitations and Suitability of averages.
II	**Correlation Analysis:** Meaning and significance. Correlation and Causation, Types of correlation, Methods of studying simple correlation - Scatter diagram, Karl Pearson's coefficient of correlation, Spearman's Rank correlation coefficient.
III	**Regression Analysis:** Meaning and significance, Regression vs. Correlation, Simple Regression model: Linear Regression, Conditions for simple linear regression
IV	**Time Series :**Analysis of Time Series, Methods of measuring trend and seasonal variations
V	**Index Numbers:** Consumers price index and cost of living indices

Course Outcomes		
CO1	The learners will apprehend the basics of data science and data analysis like Averages and forecasting techniques.	PO1
CO2	The learners will comprehend the basics of data science and data analysis like Averages and forecasting techniques.	PO1,PO2
CO3	The learners will understand use of Time series and Index numbers in management decisions.	PO4,PO6
CO4	The learners will be able to understand the business implications and probabilities of every decision being made.	PO4,PO5, PO6
CO5	Gain entrance into careers as well as in graduate or professional school.	PO3,PO8

Text Books (Latest Editions)	
1	P A Navanitham (2006): Business Mathematics and Statistics

2	Gupta S.P. (2017) : Statistical Methods, Sultan Chand & Sons, 45h Revised Edition
	Levin, R. and Rubin, D. (2017). Statistics for Management. 8thed. New Delhi: Pearson
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	HaraldCramér ***Mathematical Methods of Statistics,*** Princeton Mathematical Series, vol. 9. Princeton University Press, Princeton, N. J., 1946. xvi+575 pp
2	S.C.Gupta, Business Statistics
Web Resources	
	https://www.ascdegreecollege.ac.in/wp-content/uploads/2020/12/Business-Statistics-by-Gupta.pdf

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	2	3	3	3	2	1	3
CO2	2	1	3	1	3	3	3	2	1	2
CO3	3	2	3	1	3	3	3	2	1	3
CO4	1	2	3	2	3	3	3	2	1	1
CO5	3	1	2	3	3	3	3	2	1	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Marks		
								CIA	External	Total
23122SEC16L	PYTHON LAB	Core	0	0	3	3		25	75	100

Learning Objectives	
LO1	Be able to design and program Python applications.
LO2	Be able to create loops and decision statements in Python.
LO3	Be able to work with functions and pass arguments in Python.
LO4	Be able to build and package Python modules for reusability.
LO5	Be able to read and write files in Python.

LAB EXERCISES	Required Hours
1. Program using variables, constants, I/O statements in Python. 2. Program using Operators in Python. 3. Program using Conditional Statements. 4. Program using Loops. 5. Program using Jump Statements. 6. Program using Functions. 7. Program using Recursion. 8. Program using Arrays. 9. Program using Strings. 10. Program using Modules. 11. Program using Lists. 12. Program using Tuples. 13. Program using Dictionaries. 14. Program for File Handling.	**60**

Course Outcomes	
On completion of this course, students will	
CO1	Demonstrate the understanding of syntax and semantics of PYTHON language
CO2	Identify the problem and solve using PYTHON programming techniques.
CO3	Identify suitable programming constructs for problem solving.
CO4	Analyze various concepts of PYTHON language to solve the problem in an efficient way.
CO5	Develop a PYTHON program for a given problem and test for its correctness.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	1	3	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	15	15	13	15	13	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	C	Marks		
							CIA	External	Total
23122SEC17	FUNDAMENTALS OF INFORMATION TECHNOLOGY	Skill enhancement course	2	2	0	2	25	75	100

Learning Objectives	
LO1	Understand basic concepts and terminology of information technology.
LO2	Have a basic understanding of personal computers and their operation
LO3	Be able to identify data storage and its usage
LO4	Get great knowledge of software and its functionalities
LO5	Understand about operating system and their uses

UNIT	Contents	No. of. Hours
I	**Introduction to Computers**-Generations of Computer–Data and Information – Components of Computer – Software – Hardware – Input Devices-Output Devices—Types of Operating System.	**6**
II	**MSWord**: Introduction–Elements of Window–Files, Folders and Directories – Text Manipulating: Cut, Copy, Paste, Drag and Drop – Text Formatting: Font – Style, Size, Face and Colors (Both foreground and background)–Alignment-Bullets and Numbering- Header and footer-Watermark– inserting objects (images, other application document)–Table creation – Mail merge.	**6**
III	**MsExcel**: Introduction–Inserting rows and columns–Sizing rows and columns–Implementing formulas–Generating series-Functions in excel–Creation of Chart–Inserting objects–Filter–Sorting–Inserting worksheet.	**6**
IV	**MS Power Point**: Introduction–Slides Manipulation (Inserting new, Copy, paste, delete and duplicate slides) –Slide show– Types of Views – Types of Animations–Inserting Objects–Implementing Multimedia (Video and Audio)–Templates (Built-in and User-Defined).	**6**
V	**Internet**: Introduction to Internet and Intranet–Services of Internet-Domain Name – URL – Browser – Types of Browsers – Search Engine -E-Mail – Basic Components of E-Mail –.How to send group mail **E-Commerce**: Digital Signature– Digital Currency–Online shopping and Transaction.	**6**
TOTAL HOURS		**30**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Learn the basics of computer, Construct the structure of the required things in computer, learn how to use it.	PO1, PO2, PO3,PO4,PO5 ,PO6
CO2	Develop organizational structure using for the devices present currently under input or output unit.	PO1, PO2, PO3,PO4,PO5 ,PO6
CO3	Concept of storing data in computer using two headers namely RAM and ROM with different types of ROM with advancement in storage basis.	PO1, PO2, PO3,PO4,PO5 ,PO6
CO4	Work with different software, Write program in the software and Applications of software.	PO1, PO2, PO3,PO4,PO5 ,PO6
CO5	Usage of Operating system in information technology which really acts as an interpreter between software and hardware.	PO1,PO2,PO3, PO4,PO5,PO6
Text books		
1	Anoop Mathew, S.Kavitha Murugeshan(2009),—Fundamental of Information Technology‖, Majestic Books.	
2	Alexis Leon, Mathews Leon, ‖Fundamental of Information Technology‖, 2ndEdition.	
3	S.KBansal, —Fundamental of Information Technology ‖.	
Reference Books		
1.	Bhardwaj Sushil Puneet Kumar,—Fundamental of Information Technology‖	
2.	GGWILKINSON,—FundamentalsofInformationTechnology‖,Wiley-Blackwell	
3.	ARavichandran,—FundamentalsofInformationTechnology‖,KhannaBookPublishing	
Web Resources		
1.	https://testbook.com/learn/computer-fundamentals	
2.	https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html	
3.	https://www.javatpoint.com/computer-fundamentals-tutorial	
4.	https://www.tutorialspoint.com/computer_fundamentals/index.htm	
5.	https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	2	1	1
CO2	3	2	3	2	3	3
CO3	3	2	2	2	2	3
CO4	2	3	3	3	3	1
CO5	3	3	3	3	3	2
Weightage of course Contributed to each PSO	13	13	13	12	12	10

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst.	Marks		
									CIA	External	Total
23122SEC18	**Structured Programming Language in C**	FC	2	-	-	-		2	25	75	100

Course Objective	
LO1	To familiarize the students with the Programming basics and the fundamentals of C, Data types in C, Mathematical and logical operations.
LO2	To understand the concept using if statements and loops
LO3	This unit covers the concept of Arrays
LO4	This unit covers the concept of Functions
LO5	To understand the concept of implementing pointers.

UNIT	**Details**	**No. of Hours**	**Course Objectives**
I	**Overview of C**: Importance of C, sample C program, C program structure, executing C program. Constants, Variables, and Data Types: Character set, C tokens, keywords and identifiers, constants, variables, data types, declaration of variables, Assigning values to variables---Assignment statement, declaring a variable as constant, as Volatile. Operators and Expression.	6	CO1
II	**Decision Making and Branching**: Decision making with If, simple IF, IF ELSE, nested IF ELSE, ELSE IF ladder, switch, GOTO statement. **Decision Making and Looping**: While, Do-While, For, Jumps in loops.	6	CO2
III	**Arrays**: Declaration and accessing of one & two-dimensional arrays, initializing two-dimensional arrays, Multi-dimensional arrays.	6	CO3
IV	**Functions**: The form of C functions, Return values and types, calling a function, categories of functions, Nested functions, Recursion, functions with arrays, call by value, call by reference, storage classes-character arrays and string functions	6	CO4
V	**Pointers:** definition, declaring and initializing pointers, accessing a variable through address and through pointer, pointer expressions, pointer increments and scale factor, pointers and arrays, pointers and functions, pointers and	6	CO5

	Structures.		
	Total	**30**	

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Remember the program structure of C with its syntax and semantics	PO1,PO3,PO5
2	Understand the programming principles in C(data types, operators, branching and looping, arrays, functions, structures, pointers and files)	PO2,PO3,PO6,PO7
3	Apply the programming principles learnt in real-time problems	PO3,PO4,PO7
4	Analyze the various methods of solving a problem and choose the best method	PO4,PO5,PO6
5	Code, debug and test the programs with appropriate Test cases	PO7,PO8

Text Book	
1	E.Balagurusamy, Programming in ANSI Fifth Edition, Tata McGraw-Hill, 2010.

Reference Books	
1.	Byron Gottfried, Schaum‘s Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018.
2.	Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998
3.	Yashavant Kanetkar, Let Us C, Eighteenth Edition, BPB Publications,2021

Web Resources	
1.	https://codeforwin.org/
2.	https://www.geeksforgeeks.org/c-programming-language/
3.	http://en.cppreference.com/w/c
4.	http://learn-c.org/
5.	https://www.cprogramming.com/

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**1**	**2**	**2**	**2**	**2**	**-**
CO2	**2**	**2**	**2**	**2**	**-**	**2**
CO3	**3**	**2**	**2**	**1**	**1**	**-**
CO4	**3**	**2**	**2**	**1**	**-**	**1**
CO5	**1**	**2**	**2**	**2**	**2**	**3**
Weightage of course contributed to each PSO	7	10	10	18	15	6

S-Strong-3 M-Medium-2L-Low-1

INDIAN CONSTITUTION

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
231AECCINC	AECC	2	-	-	2		2	25	75	100

Learning Objectives	
LO1	To make the students understand about the democratic rule and parliamentarian administration
LO2	To appreciate the salient features of the Indian constitution
LO3	To know the fundamental rights and constitutional remedies
LO4	To make familiar with powers and positions of the union executive, union parliament and the Supreme Court
LO5	To exercise the adult franchise of voting and appreciate the electoral system of Indian democracy

UNIT	DETAILS
I	**The making of Indian constitution:** The constitution assembly organization - character - work salient features of the constitution- written and detailed constitution - socialism -secularism-democracy and republic.
II	**Fundamental rights and fundamental duties of the citizens:** Right of equality - right of freedom- right against exploitation -right to freedom of religion- cultural and educational rights -right to constitutional remedies -fundamental duties.
III	**Directive principles of state policy:** Socialistic principles - Gandhi an principles-liberal and general principles -differences between fundamental rights and directive principles
IV	**The union executive, union parliament and Supreme Court :** Powers and positions of the president - qualification – method of election of president and vice president -prime minister - Rajya Sabah - Lok Sabah .the supreme court - High court -functions and position of supreme court and high court
V	**State council -election system and parliamentary democracy in India:** State council of ministers -chief minister -election system in India-main features election commission-features of Indian democracy.

Course Outcomes		
CO1	Students can know about constitution our fundamental rights and duties	PO1
CO2	Students can get knowledge of the Indian administrative systems.	PO1,PO2
CO3	Students will be able to understand the Nature of Indian Politics	PO4,PO6
CO4	Students will be able to understand the Indian constitution and Fundamental rights and Duties.	PO4,PO5, PO6
CO5	Integrate knowledge of the diversity of cultures and peoples.	PO3,PO8

Text Books (Latest Editions)	
1	India's Constitution by M.V.Pylee., 16th edt.,S.Chand& Company Ltd, Ram Nagar, New Delhi-110055.
2	Introduction to the Constitution of India by Durga Das Basu · 2015,.LexisNexis publication,SBN:9789351434467, 935143446X.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	Palekar.s.a. Indian constitution government and politics, ABD publications, India
2	Aiyer, alladikrishnaswami, Constitution and fundamental rights 1955.
3	Markandan. K.c.directive Principles in the Indian constitution 1966.
Web Resources	
	https://www.google.co.in/books/edition/India_s_Constitution_16th_Edition/yjJlDwAAQBAJ?hl=en&gbpv=1&dq=indian+constitution+pdf&printsec=frontcover

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

UNIVERSAL HUMAN VALUES

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
231LSCUV	AC	-	-	-	1		-	25	75	100

Learning Objectives	
LO1	The present course deals with meaning, purpose, and relevance of universal human values and how to inculcate and practice them consciously to be a good human being and realize one's potentials

UNIT	DETAILS
I	Introduction: What is love? Forms of love for self, parents, family, friend, spouse, community, nation, humanity and other beings, both for living and non-living Love and compassion and inter-relatedness Love, compassion, empathy, sympathy and non-violence Individuals who are remembered in history for practicing compassion and love. Narratives and anecdotes from history, literature including local folklore Practicing love and compassion: What will learners learn gain if they practice love and compassion? What will learners lose if they don't practice love and compassion? Sharing learner's individual and/or group experience(s) Simulated Situations Case studies
II	Introduction: What is truth? Universal truth, truth as value, truth as fact(veracity, Sincerity, honesty among others) Individuals who are remembered in history for practicing this value Narratives and anecdotes from history, literature including local folklore Practicing Truth: What will learners learn/gain if they practice truth? What will learners lose if they don't practice it? Learners' individual and/or group experience(s) Simulated situations Case studies
III	Introduction: What is nonviolence? Its need. Love, compassion, empathy sympathy for others as pre-requisites for non-violence Ahimsa as non-violence and non-killing Individuals and organizations that are known for their commitment to non-violence Narrativesandanecdotesaboutnon-violencefromhistory,andliteratureincluding

	local folklore Practicing on-violence: What will learners learn/gain if they practice non- violence? What will learners lose if they don't practice it? Sharing learner's individual and/or group experience(s) about non-violence Simulated situations Case studies
IV	Introduction: What is righteousness? Righteousness and *dharma*, Righteousness and Propriety Individuals who are remembered in history for practicing righteousness Narratives and anecdotes from history, literature including local folklore Practicing righteousness: What will earners learn/gain if they practice righteousness? What will learners lose if they don't practice it? Sharing learners' individual and/or group experience(s) Simulated situations Case studies
V	Introduction: What is peace? Its need, relation with harmony and balance Individuals and organizations that are known for their commitment to peace Narratives and Anecdotes about peace from history, and literature including local folklore Practicing peace: What will learners learn/gain if they practice peace? What will learners lose if they don't practice it? Sharing learner's individual and/or group experience(s) about peace Simulated situations Case studies
VI	Introduction: What is service? Forms of service, for self, parents, family, friend, spouse, community, nation, humanity and other beings—living and non-living, persons in distress or disaster. Individuals who are remembered in history for practicing this value. Narratives and anecdotes dealing with instances of service from history, literature including local folklore Practicing service: What will earners learn/gain gain if they practice service? What will

	Learners lose if they don't practice it? Sharing learners' individual and/or group experience(s) regarding service Simulated situations Case studies
VII	Introduction: What is renunciation? Renunciation and sacrifice. Self-restrain and Ways of overcoming greed. Renunciation with action as true renunciation Individuals who are remembered in history for practicing this value. Narratives and anecdotes from history and literature, including local folklore about individuals who are remembered for their sacrifice and renunciation. Practicing renunciation and sacrifice: What will learners learn/gain if they practice Renunciation and sacrifice? What will learners lose if they don't practice it? Sharing learners' individual and/or group experience(s) Simulated situations Case studies.

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	2	2
CO2	3	3	3	2	3	3	3	2	3	2
CO3	2	3	3	3	2	3	3	2	2	2
CO4	3	3	3	3	3	3	3	2	3	2
CO5	3	2	3	3	3	3	3	2	2	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Course Code	Course Title	L	T	P	C
23110AEC21	Tamil-II	3	1	0	3

பக்தி இலக்கியம் - 23110AEC21

இரண்டாம்பருவம்

பாட நோக்கங்கள்

- காலந்தோறும் பக்தி இலக்கியம் வளர்ந்துள்ள தன்மையைக் கற்பித்தல்.
- நாயன்மார்கள், ஆழ்வார்களின் பக்திச்சிறப்பைஅறியசெய்தல்.
- ஆழ்வார்களின் பக்தி உணர்வை ஊட்டுதல்
- பாடல்களில் இசை இன்பம், ஓசை நயம் ஆகியவற்றை உணரச்செய்தல்
- குழந்தைப் பருலத்தின் தன்மையை உணர்த்துதல்

பயன்கள்

- **நாயன்மார்கள் பக்திச்சிறப்பை அறிதல்**.
- ஆழ்வார்களின் பக்திநெறியை உணர்தல்.
- பக்தி இலக்கியம்காலம் தோறும் வளர்ந்ததை அறிதல்.
- பாடல்களில் இசை இன்பம், ஓசை நயம் அறிதல்.
- குழந்தைப் பருலத்தின் தன்மையை உணர்தல்.

அலகு- 1 பன்னிருதிருமுறைகள்

1. திருஞானசம்பந்தர்– திருத்தில்லைப்பதிகம்
2. திருநாவுக்கரசர் - திருநீற்றுப்பதிகம்
3. சுந்தரர் - திருவெண்ணைநல்லூர்
4. திருமூலர்- திருமந்திரம்(இளமைநிலையாமை)

அலகு- 2 பன்னிருஆழ்வார்கள்

1. ஆண்டாள் - திருப்பாவை
2. பெரியாழ்வார்- மூன்றாம்திருமுறை(பத்துபாடல்கள்)
3. மதுரகவியாழ்வார் - கண்ணின்நுண்சிறுதாம்பு

அலகு- 3சிற்றிலக்கியங்கள்

1. மீனாட்சியம்மைப்பிள்ளைத்தமிழ்– செங்கீரைபருவம், அம்புலிபருவம்
2. நந்திக்கலம்பகம்
3. குற்றாலகுறவஞ்சி- குறத்திநகர்வளம்கூறுதல்
4. காளமேகப் புலவர் பாடல்கள்

அலகு- 4 புதினம

1. நா .பார்த்தசாரதியின்- குறிஞ்சிமலர்

அலகு-5 தமிழ் இலக்கிய வரலாறு

1. பக்திஇலக்கியங்கள்

2. சைவமும்தமிழும்
3. வைணவசமயம்போற்றிவளர்த்ததமிழ்
4. சிற்றிலக்கியங்கள்
5. நாவல்இலக்கியம்

பார்வைநூல்கள் :

1. தேவாரம் - மணிவாசகர்பதிப்பகம்சென்னை
2. நாலாயிரதிவ்ய பிரபந்தம் - வர்த்தமான பதிப்பகம் சென்னை.
3. தமிழ்இலக்கியவரலாறு - முனைவர்சசுபாஷ்சந்திரபோஸ், இயல்வெளியீடு ,தஞ்சாவூர
4. தமிழ் நாவல் இலக்கியம் -காகைலாசபதி- தமிழ் புத்தக,நிலையம், சென்னை

இணையதளம் -www.tamilvu.org , www.noolulagam.com

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

FIRST YEAR - SEMESTER II

PAPER II –GENERAL ENGLISH

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
23111AEC22	Language	3	1	-	3		6	25	75	100

Learning Objectives	
LO1	To introduce learners to the essential skills of communication in English
LO2	To enable them use these skills effectively in academic and non-academic contexts
LO3	To help them identify and eliminate common mistakes in writing and speaking
LO4	To enable them use various business communication strategies and to use advanced vocabulary
LO5	To familiarize them in writing descriptive essays and respond to arguments orally and in writing

Unit No.	Unit Title & Text	No. of Periods for the Unit
I	**Poetry** 1.1 Very Indian Poem in Indian English - Nissim Ezekiel 1.2 Still I Rise - Maya Angelou 1.3 On Killing a Tree -Gieve Patel	20
II	**Prose** 2.1 If You Are Wrong Admit it- Dale Carnegie 2.2 Kindly Adjust Please –ShashiTharoor 2.3 The Spoon-fed Age- W.R.Inge	20
III	**Fiction** Alchemist - Paulo Coelho	20
IV	**Language Competency** 4.1 Homonyms, Homophones, Homographs Portmanteau words 4.2 Subject Verb Agreement	15
V	**English in the Workplace** 5.1 Reading for General and Specific information [charts, tables, schedules, graphs etc] 5.2 Reading news and weather reports 5.3 Writing paragraphs 5.4 Taking and making notes	15

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Learn to introduce themselves and talk about everyday activities confidently	PO1
CO2	Be able to write short paragraphs on people, places and events	PO1, PO2
CO3	Identify the purpose of using various tenses and effectively employ them in speaking and writing	PO4, PO6
CO4	Gain knowledge to write subjective and objective descriptions	PO4, PO5,PO6
CO5	Identify and use their skills effectively in formal contexts.	PO3,PO8

Text Books(Latest Editions)	
1	The Alchemist - Paulo Coelho Harper – 2005
Reference Books **(Latest editions, and the style as given below must be strictly adhered to)**	
1	Advanced English Grammar. Martin Hewings. Cambridge University Press, 2000
2	Descriptive English. SP Bakshi, Richa Sharma · 2019, Arihant Publications (India) Ltd.
3	The Reading Book: A Complete Guide to Teaching Reading. Sheena Cameron, Louise Dempsey, S & L. Publishing, 2019.
4	Skimming and Scanning Techniques, Barbara Sherman, Liberty University Press, 2014
5	Brilliant Speed Reading: Whatever you need to read, however ...Phil Chambers, Pearson, 2013.
6	The Archer, Paulo Coelho. Penguin Viking, 2020.
Web Resources	
1	Very Indian poem by Nissim Ezekiel http://econtent.in/pacc.in/admin/contents/40_%20_2020103001102714.pdf
2	Still I Rise by Maya Angelou https://www.poetryfoundation.org/poems/46446/still-i-rise
3	The Flower by Tennyson: https://www.poemhunter.com/poem/the-flower-2/
4	On Killing a tree by Gieve Patel: https://www.poemhunter.com/poem/on-killing-a-tree/
5	If you are wrong, admit it: https://www.tbr.fun/if-youre-wrong-admit-it/

6	Kindly Adjust please –ShashiTharoor https://www.theweek.in/columns/shashi-tharoor/2018/05/25/kindly-adjust-to-our-english.html?fbclid=IwAR3IhtdXqvuV4ySECn9S7SA6HmCEYISyd1QHd3BlwKgiNKKwdkeSg3qWp-U/
7	The Spoon Fed Age: https://www.nrkacademy.com/2016/04/spoon-feeding-by-wringe.html
8	The Alchemist: https://www.youtube.com/watch?v=lxBYpmxjeDU

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes:

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

SEMESTER II

Title of the Course/Paper	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23122AEC23	OBJECT ORIENTED PROGRAMMING CONCEPTS USING C++	Core	4	1	0	3		5	25	75	100

Course Objective	
LO1	Describe the procedural and object oriented paradigm with concepts of streams, class, functions, data and objects
LO2	Understand dynamic memory management techniques using pointers, constructors, destructors, etc
LO3	Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
LO4	Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
LO5	Demonstrate the use of various OOPs concepts with the help of programs

UNIT	Details	No.of Hours
I	Introduction to C++ - key concepts of Object-Oriented Programming – Advantages–Object Oriented Languages–I/O in C++ - C++ Declarations. Control Structures:- Decision Making and Statements: If. else, jump, go to, break, continue, Switch case statements - Loops in C++ :for, while, do - functions in C++ - in line functions – Function Overloading.	15
II	Classes and Objects: Declaring Objects – Defining Member Functions –Static Member variables and functions–array of objects– friend functions – Overloading member functions – Bit fields and classes – Constructor and destructor with static members.	15
III	Operator Overloading: Overloading unary, binary operators– Overloading Friend functions –type conversion – Inheritance: Types of Inheritance – Single, Multilevel, Multiple, Hierarchal, Hybrid, Multi path inheritance–Virtual base Classes–Abstract Classes.	15
IV	Pointers–Declaration–Pointer to Class, Object–this pointer–Pointers	15

	to derived classes and Base classes – Arrays – Characteristics – array of classes – Memory models – new and delete operators – dynamic object –Binding, Polymorphism and Virtual Functions.	
V	Files –File stream classes –file modes–Sequential Read /Write operations– Binary and ASCII Files–Random Access Operation– Templates –Exception Handling- String –Declaring and Initializing string objects–String Attributes–Miscellaneous functions.	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	Up on completion of the course the students would be Able to:	
1	Remember the program structure of C with its syntax and semantics	PO1,PO6
2	Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)	PO2
3	Apply the programming principles learnt in real-Time problems	PO4,PO7
4	Analyze the various methods of solving a problem And choose the best method	PO6
5	Code, debug and test the programs with appropriate test cases	PO7,PO8

Text Book

1	E.Balagurusamy,―Object-Oriented Programming with C++‖, TMH2013, 7thEdition.

Reference Books

1.	Ashok N Kamthane,―Object-Oriented Programming with ANSI and Turbo C++ ‖, Pearson Education 2003.
2.	Maria Litvin& Gray Litvin, ―C++ for you ‖,Vikas publication 2002.

Web Resources

1.	https://alison.com/course/introduction-to-c-plus-plus-programming

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**1**	**-**	**-**	**1**
CO2	**2**	**2**	**2**	**1**	**-**	**-**
CO3	**3**	**1**	**1**	**-**	**1**	**-**
CO4	**1**	**2**	**1**	**2**	**2**	**1**
CO5	**3**	**2**	**1**	**2**	**3**	**2**
Weightage of course contributed to each PSO	12	9	6	5	6	4

S-Strong-3 M-Medium-2L-Low

SEMESTER II
ALLIED MATHEMATICS
PAPER-III OPERATIONS RESEARCH

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
23122GEC24	Allied	4	1	0	3			25	75	100

Learning Objectives	
LO1	To understand the methodology of OR problem solving and formulate linear Programming problem.
LO2	To develop formulation skills in transportation models and finding solutions
LO3	To understand the basics in the field of game theory and assignment problems
LO4	To know how project management techniques help in planning and scheduling a project
LO5	To know the basics of dynamic programming and simulation

UNIT	DETAILS
I	Definition of operations research, models of operations research, scientific methodology of operations research, scope of operations research, importance of operations research in decision making, role of operations management, limitations of OR
II	Linear Programming: Introduction – Mathematical formulation of a problem – Graphical solutions, standard forms the simplex method for maximization and minimization problems. Method application to management decisions.
III	Transportation problem – Introduction – Initial basic feasible solution - NWC method – Least cost method – Vogel's method – MODI – moving towards optimality – solution procedure without degeneracy
IV	Assignment problem – Algorithm – Hungarian method – simple problems.
V	Network models and simulation. Network models for project analysis CPM; Network construction and time analysis; cost time trade off, PERT – problems

Course Outcomes		
CO1	To recognize the importance and value of Operations Research and linear programming in solving practical problems in industry	PO1
CO2	Interpret the transportation models' solutions and infer solutions to the real-world problems.	PO1,PO2
CO3	To know, how to transport a thing in minimum cost.	PO4,PO6
CO4	Gain knowledge about the assigning process	PO4,PO5, PO6

CO5	Gain knowledge of drawing project networks for quantitative analysis of projects	PO3,PO8

Text Books (Latest Editions)	
1	Kalavathy, Operations Research
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	KantiSwarup, Gupta.P.K. & Man Mohan, operations Research, S.Chand& Sons
2	Taha.H.A, operation Research: An Introduction, McMilan publishing Co., 1982. 7 th ed.
Web Resources	
	https://rccmindore.com/wp-content/uploads/2015/06/Operations-Research.pdf

Mapping with Programme Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	1	3	2	3	3	3	2	1	3
CO2	2	1	3	1	3	3	3	2	1	2
CO3	3	2	3	1	3	3	3	2	1	3
CO4	1	2	3	2	3	3	3	2	1	1
CO5	3	1	2	3	3	3	3	2	1	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

ALLIED MATHEMATICS
PAPRER-IV DISCRETE MATHEMATICS

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
23122GEC25	Allied	2	1	0	3			25	75	100

Learning Objectives	
LO1	Use mathematically correct terminology and notation.
LO2	Apply logical reasoning to solve a variety of problems.
LO3	Construct correct direct and indirect proofs
LO4	Use division into cases in a proof.
LO5	Use counterexamples.

UNIT	DETAILS
I	**SET THEORY:** Introduction- set and Its Element – Set Description (Roster, Set Builder and cardinal number method) Types of Sets- Set Operations and Laws of set Theory. Partition of sets. Countable and uncountable set. Algebra of sets and Duality
II	**MATHEMATICAL LOGIC:** Basic Logic and Proof, logical operations – Logic Propositional equivalence, Predicates and Quantities, Tautology-Contradiction-Methods of proofs (Direct and Indirect) - Function- Definition-Notation- Types of Function- Composition of Functions
III	**NUMBER THEORY:** The Integers and Division, Integers and Algorithms, (Multiplication, Addition and Division -Sequences and Summations, Recursive algorithms, Program correctness
IV	**RELATIONS:** Relations – Relations and their properties, Representing Relations, Closures of relations, Equivalence relations, Partial orderings-Recurrence Relations Binary Relations
V	**MATRIX, DETERMINANT OF MATRIX AND ITS APPLICATION:** Introduction, definitions, Types of Matrix, Properties of matrix, operations on matrix, Inverse of matrix, Cayley Hamilton of matrix-applications

Course Outcomes		
CO1	To gain knowledge on set theory	PO1
CO2	Able to understand different mathematical logics and functions	PO1,PO2
CO3	To get an idea on Permutations and Combinations	PO4,PO6

CO4	Understanding the different form of number theory	PO4,PO5, PO6
CO5	Able to understand Relations and its applications	PO3,PO8

Text Books (Latest Editions)	
1	Rosen K.H. Discrete Mathematics and its Applications, 5th edition, Tata McGraw – Hills,2003
2	J.K Sharma "DISCRETE MATHEMATICS" 3 rd Edition Macmillan Reprint2011
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	Johnson Baugh R, and Carman R, Discrete mathematics, 5th edition, Person Education, 2003.
2	Kolman B, Busoy R.C, and Ross S.C, Discrete Mathematical Structures, 5th edition, Pretitice – Hall, 2004.
Web Resources	
	Web resources from NDL Library, E-content from open-source libraries

Mapping with Programme Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	1	3	2	3	3	3	2	1	3
CO2	2	1	3	1	3	3	3	2	1	2
CO3	3	2	3	1	3	3	3	2	1	3
CO4	1	2	3	2	3	3	3	2	1	1
CO5	3	1	2	3	3	3	3	2	1	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Title of the Course/Paper	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23122SEC26L	C++ PROGRAMMING LAB	Core	0	0	3	3		4	25	75	100

Course Objective	
LO1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
LO2	Understand dynamic memory management techniques using pointers, constructors, destructors ,etc
LO3	Describe the concept to function overloading, operator overloading, virtual functions and polymorphism
LO4	Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
LO5	Demonstrate the use of various OOPs concepts with the help of programs

S. No	Details	No. of Hours
1	Write a C++ program to demonstrate function overloading, Default Arguments and Inline function.	
2	Write a C++ program to demonstrate Class and Objects	
3	Write a C++ program to demonstrate the concept of Passing Objects to Functions	
4	Write a C++ program to demonstrate the Friend Functions.	
5	Write a C++ program to demonstrate the concept of Passing Objects to Functions	
6	Write a C++ program to demonstrate Constructor and Destructor	
7	Write a C++ program to demonstrate Unary Operator Overloading	
8	Write a C++ program to demonstrate Binary Operator Overloading	

9	Write a C++ program to demonstrate • Single Inheritance • Multilevel Inheritance • Multiple Inheritance • Hierarchical Inheritance • Hybrid Inheritance	
10	Write a C++ program to demonstrate Virtual Functions.	
11	Write a C++ program to manipulate a Text File.	
12	Write a C++program to perform Sequential I/O Operations on a file.	
13	Write a C++ program to find the Biggest Number using Command Line Arguments	
14	Write a C++ program to demonstrate Class Template	
15	Write a C++ program to demonstrate Function Template.	
16	Write a C++ program to demonstrate Exception Handling.	

Course Outcomes		**Programme Outcomes**
CO	Up on completion of the course the students would be able to:	
1	Remember the program structure of C with its syntax and semantics	PO1,PO6
2	Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)	PO2
3	Apply the programming principles learnt in real-time problems	PO4,PO7
4	Analyze the various methods of solving a problem and choose the best method	PO6
5	Code, debug and test the programs with appropriate test cases	PO7,PO8

Text Book

1	E.Balagurusamy,—Object-Oriented Programming with C++‖, TMH2013, 7th Edition.

Reference Books

1.	Ashok N Kamthane,―Object-Oriented Programming with ANSI and Turbo C++‖, PearsonEducation2003.
2.	Maria Litvin & Gray Litvin, ―C++ for you‖,Vikas publication 2002.
Web Resources	
1.	https://alison.com/course/introduction-to-c-plus-plus-programming

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**3**	**3**	**3**	**1**	**2**
CO2	**2**	**3**	**3**	**3**	**1**	**2**
CO3	**2**	**3**	**3**	**3**	**1**	**2**
CO4	**2**	**3**	**3**	**3**	**1**	**2**
CO5	**2**	**3**	**3**	**3**	**1**	**2**
Weightage of course contributed to each PSO	11	15	15	15	5	10

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23122SEC27	QUANTITATIVE APTITUDE	Skill Enhancement. Course	2	0	0	2		2	25	75	100

Course Objective	
LO1	To understand the basic concepts of numbers
LO2	Understand and apply the concept of percentage, profit & loss
LO3	To study the basic concepts of time and work, interests
LO4	To learn the concepts of permutation, probability, discounts
LO5	To study about the concepts of data representation, graphs

UNIT	Details	No. of Hours
I	Numbers-HCF and LCM of numbers-Decimal fractions-Simplification-Square root and cube roots-Average-problems on Numbers.	6
II	Problems on Ages-Surds and Indices- percentage -profits and loss - ratio and proportion-partnership-Chain-rule.	6
III	Time and work-pipes and cisterns-Time and Distance -problems on trains-Boats and streams-simple interest -compound interest-Logarithms-Area-Volume and surface area-races and Games of skill.	6
IV	Permutation and combination-probability-True Discount-Bankers Discount– Height and Distances-Odd man out & Series.	6
V	Calendar-Clocks-stocks and shares- Data representation-Tabulation – Bar Graphs-Pie charts-Line graphs.	6
	Total	**30**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
1	Understand the concepts, application and the problems of numbers	PO1
2	To have basic knowledge and understanding about percentage, profit & loss related processing's	PO2,PO3
3	To understand the concepts of time and work	PO4,PO6
4	Speaks about the concepts of probability, discount	PO4,PO5,PO 6
5	Understanding the concept of problem solving involved in stocks & shares, graphs	PO3,PO8

Text Book	
1	—Quantitative Aptitude‖ ,R.S.AGARWAL., S.Chand & Company Ltd.,
Reference Books	
1.	
Web Resources	
1.	https://www.javatpoint.com/aptitude/quantitative
2.	https://www.toppr.com/guides/quantitative-aptitude/

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**3**	**1**	**2**	**-**	**2**
CO2	**2**	**2**	**2**	**3**	**3**	**1**
CO3	**3**	**2**	**2**	**2**	**3**	**3**
CO4	**3**	**2**	**3**	**2**	**3**	**3**
CO5	**2**	**3**	**1**	**2**	**3**	3
Weightage of course Contributed to each PSO	12	12	9	11	12	12

S-Strong-3 M-Medium-2L-Low-1

Subject Code	SUBJECT NAME	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23122SEC28	ADVANCED EXCEL	Skill Enhancement Course	2	0	0	2		2	25	75	100

Course Objective	
LO1	Handle large amounts of data
LO2	Aggregate numeric data and summarize in to categories and sub-categories
LO3	Filtering, sorting, and grouping data or subsets of data
LO4	Create pivot tables to consolidate data from multiple files
LO5	Presenting data in the form of charts and graphs

UNIT	Details	No. of Hours
I	Basics of Excel-Customizing common options-Absolute and relative cells-Protecting and un- protecting worksheets and cells-Working with Functions-Writing conditional expressions- logical functions-lookup and reference functions-VlookUP with Exact Match, Approximate Match-Nested VlookUP with Exact Match-VlookUP with Tables, Dynamic Ranges-Nested VlookUP with Exact Match- Using VLookUP to consolidate Data from Multiple Sheets	6
II	Data Validations-Specifying a valid range of values-Specifying a list of valid values-Specifying custom validations based on formula-Working with Templates Designing the structure of a template-templates for standardization of worksheets - Sorting and Filtering Data –Sorting tables –multiple –level sorting-custom sorting-Filtering data for selected view -advanced filter options-Working with Reports Creating sub totals-Multiple-level sub-total.	6
III	Creating Pivot tables Formatting and customizing Pivot tables-advanced options of Pivot tables-Pivot charts-	6

	Consolidating data from multiple sheets and files using Pivot tables- external data sources-data consolidation feature to consolidate data-Show Value As % of Row,% of Column, Running Total, Compare with Specific Field-Viewing Sub-total under Pivot-Creating Slicers.	
IV	More Functions Date and time functions-Text functions-Database functions-Power Functions – Formatting Using auto formatting option for worksheets-Using conditional formatting option for rows, columns and cells-What If Analysis- Goal Seek-Data Tables-Scenario Manager.	6
V	Charts -Formatting Charts-3D Graphs-Bar and Line Chart together-Secondary Axis in Graphs-Sharing Charts with PowerPoint/ MS Word, Dynamically- New Features Of Excel Spark lines ,Inline Charts, data Charts-Overview of all the new features.	6
	Total	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, student swill	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1,PO2
3	Learn and apply different mining algorithm and recommendation systems for large volumes of data.	PO4,PO6
4	Perform analytics on data streams.	PO4,PO5,PO6
5	Learn No –SQL databases and management.	PO3,PO8

Text Book	
1	**Excel2019All**
2	**MicrosoftExcel2019PivotTable Data Crunching**
Reference Books	
Web Resources	

1.	https://www.simplilearn.com
2	https://www.javatpoint.com
3	https://www.w3schools.com

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**2**	**2**	**1**	**3**	**-**
CO2	**3**	**2**	**2**	**1**	**1**	**3**
CO3	**3**	**2**	**1**	**2**	**1**	**3**
CO4	**3**	**3**	**2**	**2**	**2**	**1**
CO5	**3**	**2**	**1**	**3**	**1**	**3**
Weightage of course Contributed to each PSO	14	11	8	9	8	10

S-Strong-3 M-Medium-2L-Low-1

SOFT SKILL -2-COMMUNICATION SKILL

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
231AECCCMS	AECC	2	0	0	2		2	25	75	100

Learning Objectives	
LO1	Identify common communication problems that may be holding learners back
LO2	Identify what their non-verbal messages are communicating to others
LO3	Understand role of communication in teaching-learning process
LO4	Learning to communicate through the digital media
LO5	Understand the importance of empathetic listening
LO6	Explore communication beyond language.

UNIT	DETAILS
I	**Listening** • Techniques of effective listening • Listening and comprehension • Probing questions • Barriers to listening
II	**Speaking** • Pronunciation • Enunciation • Vocabulary • Fluency • Common Errors
III	**Reading** • Techniques of effective reading • Gathering ideas and information from a given text i. Identify the main claim of the text ii. Identify the purpose of the text iii. Identify the context of the text iv. Identify the concepts mentioned • Evaluating these ideas and information i. Identify the arguments employed in the text ii. Identify the theories employed or assumed in the

	text • Interpret the text i. To understand what a text says ii. To understand what a text does iii. To understand what a text means
IV	**Writing and different modes of writing** • Clearly state the claims • Avoid ambiguity, vagueness, unwanted generalizations and oversimplification of issues • Provide background information • Effectively argue the claim • Provide evidence for the claims • Use examples to explain concepts • Follow convention • Be properly sequenced • Use proper signposting techniques • Be well structured i. Well-knit logical sequence ii. Narrative sequence iii. Category groupings • Different modes of Writing - i. E-mails ii. Proposal writing for Higher Studies iii. Recording the proceedings of meetings iv. Any other mode of writing relevant for learners
V	**Digital Literacy** • Role of Digital literacy in professional life • Trends and opportunities in using digital technology in workplace • Internet Basics • Introduction to MS Office tools i. Paint ii. Office iii. Excel iv. PowerPoint
VI	**Effective use of Social Media** • Introduction to social media websites • Advantages of social media • Ethics and etiquettes of social media • How to use Google search better

	• Effective ways of using Social Media • Introduction to Digital Marketing
VII	**Non-verbal communication** • Meaning of non-verbal communication • Introduction to modes of non-verbal communication • Breaking the misbelieves • Open and Closed Body language • Eye Contact and Facial Expression • Hand Gestures • Do's and Don'ts • Learning from experts • Activities-Based Learning

Course Outcomes		
CO1	By the end of this program participants should have a clear understanding of what good communication skills are and what they can do to improve their abilities.	PO1

References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	S. Madhu c chanda (2010), *An Introduction to Critical Thinking*, Pearson, Delhi
2	Silvia P. J. (2007), *How to Read a Lot*, American Psychological Association, Washington DC

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	3	3	3	3	3	3	3	2	2	2
CO3	2	3	3	3	2	3	3	2	2	2
CO4	3	3	3	2	3	3	3	2	3	2
CO5	3	2	3	3	3	3	3	2	2	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Course Code	Course Title - BCA	L	T	P	C
THEORY					
23110AEC31/	Tamil – III	3	1	0	3

காப்பிய இலக்கியம் - 23110AEC31
மூனை்றாம் பருவம்

**பாடந
ாக்கங்கள்**

- தமிழ்க்காப்பியங்ககள அறிமுகப்படுத்Fதல்.
- காப்பியங்கள் கூறும் வாழ்வியல் அறங்ககள உணர்த்Fதல்.
- காப்பிய இலக்கியங்களில் இலக்கியச் சுகவகய பயிற்றுவித்தல்.
- நாடக இலக்கியத்தின் தனித்Fவத்கதக்கற்பித்தல்.
- புராணச் சசய்திகள மமம்படுத்திக்சகாள்ளச்சசய்தல்.

பயைகள்

- இலக்கியங்களின் சிறப்புகள அறிவர்.
- காப்பியக்ககதகள்வழிஅறச்சிந்தகனசபறுவர்
- பல்மவறு காப்பியவடிவங்கள பற்றிய அறிவுசபறுவர்.
- நாடக பகடப்பாக்கத்திற்கான தூண்டுதகலப் சபறுவர்
- புராணச் சசய்திகள் வழி தமிழ்கலாச்சாரத்கத அறிவர்.

அலகு-1 காப்பியங்கள்

1.சிலப்பதிகாரம் - மFகரகாண்டம் (வழக்குகரகாகத)]

2.மணிமமகல - விழாவகறகாகத

3.சீவகசிந்தாமணி - குணமாகலயார்இலம்பகம்

அலகு-2 காவியங்கள்

1. கம்பராமாயணம்- மந்தகரசூழ்ச்சிபடலம்
2. மகாபாரதம் - ஆரண்யபருவம்

அலகு-3புராணங்கள்

1. சபரியபுராணம்- இகளயான்குடிமாறநாயனார்புராணம்.
2. சீறாப்புராணம் – ஈத்தங்குகழவரவகழத்தப்படலம்.
3. மதம்பாவணி- பிரிந்தமககனகாண்படலம்.

அலகு-4 ாடகம் - சாபம்? விமமாசனம்

அலகு-5 இலக்கியவரலாறு

1. காப்பியங்கள்
2. இரட்கடக்காப்பியங்கள்

3. நாடகஇலக்கியம்

பார்டவ நூல்கள் :

1. காப்பியத்திறன்- மணிவாசகர்நூலகம், சிதம்பரம்.

2. தமிழ்காப்பியங்கள் - கி. வா .செகன்செகநாதன் , அமுதநிகலயம், சசன்கன.

3 .நவீனநாடகஉருவாக்கம் - மகாபழனி , தமிழ்பல்ககலக்கழகம், தஞ்சாவூர்.

4.இகணயதளம் -www.tamilvu.org, www.noolulagam.com

5. சாபம்? விமமாசனம்

மு.இராமசுவாமி,

சசண்பகம்இராமசுவாமி,

பாகவபதிப்பகம்,ெ◌ானிெ◌ான்சாகல,சசன்கன – 14

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

SECOND YEAR - SEMESTER III

Part-II

Language

ENGLISH - III

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
23111AEC32	LANGUAGE	3	1	0	3		4	25	75	100

Learning Objectives	
LO1	To enhance the level of literary and aesthetic experience of students and to help them respond creatively.
LO2	To sensitize them to the major issues in the society and the world.
LO3	To provide them with an ability to build and enrich their communication skills
LO4	To equip them to utilize the digital knowledge resources effectively for their chosen fields of study
LO5	To help them think and write imaginatively and critically.
UNIT	**DETAILS**
I	**Poetry:** 1.1 The Voice of the Mountains -Mamang Dai 1.2 A Song of Hope –Oodgeroo Noonuccal 1.3 In an Artist's Studio - Christina Rossetti
II	**Scenes From Shakespeare:** 2.1 Romeo & Juliet -The Balcony Scene 2.2 Macbeth-Banquet Scene 2.3 Julius Caesar - Murder Scene
III	**Speeches of Famous personalities** 3.1 Yes, We Can-Barack Obama 3.2 You've Got to Find What You Love-Steve Jobs
IV	**Language Competency** 4.1 Writing letters and emails. 4.2 Writing and messaging in social media platforms. [blogs, twitter, instagram, face book]. 4.3 Learning netiquette, email etiquette.
V	**English for Workplace** 5.1 Data Interpretation and Reporting 5.2 Data Presentation and analysis 5.3 Meeting Etiquettes - language, dress code, voice modulation. Online Meetings - Terms and expressions used 5.4 Conducting and participating in a meeting

Course Outcomes		
CO1	Broaden their outlook and sensibility and be acquainted with cultural diversity and divergence in perspectives.	PO1
CO2	Be updated with basic informatics skills and attitudes relevant to the emerging knowledge society	PO1,PO2
CO3	Produce grammatically and idiomatically correct language.	PO4,PO6
CO4	Gain knowledge in writing techniques to meet academic and professional needs.	PO4,PO5, PO6
CO5	Be equipped with sufficient practice in Vocabulary, Grammar, Comprehension and Remedial English from the perspective of career oriented tests.	PO3,PO 8

Text Books (Latest Editions)	
1	**Arden Shakespeare Complete works by Shakespeare (Author), William (Author), Bloomsbury, 2011)**
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	The Shakespeare Book: Big Ideas Simply Explained, Stanley Wells et al. DK Publishing, 2015
2	Famous Speeches by Mahatma Gandhi, Create space Independent Publishing Platform, 2016
3	How to Build a Professional Digital Profile Kindle Edition by Jeanne Kelly Bernish,Bernish Communications Associates, LLC; 1st edition (May 29, 2012)
4	Keys to Teaching Grammar to English Language Learners, Second Ed.: A Practical Handbook by Keith S Folse, Michigan Teacher Training, 2016.
5	Role Play-Theory and Practice.Krysia M Yardley-Matwiejczuk, SAGE publications ltd, 1997
Web Resources	
1	The Voice of the Mountains by Mamang Dai: https://www.scribd.com/document/558838656/The-Voice-of-the-Mountain-By-Mamang-Dai-Adivasi-Resurgence
2	A song of Hope by Kath Walker: http://www.wordslikethis.com.au/a-song-of-hope/
3	In an artist's studio by Christina Rossetti: https://www.poetryfoundation.org/poems/146804/in-an-artist39s-studio
4	Sita by Toru Dutt: https://www.poetrynook.com/poem/s%E2%94%9C%C2%ABta
5	Tryst with Destiny: https://www.cam.ac.uk/files/a-tryst-with-destiny/index.html#:~:text=Jawaharlal%20Nehru%2C%20delivering%20his%20Tryst%20with%20Destiny%20speech.&text=%22Long%20years%20ago%20we%20made,awake%20to%20life%20and%20freedom.

6	Yes, We Can: https://www.englishspeecheschannel.com/english-speeches/barack-obama-speech/
7	You've got to find what you love: https://www.businessbusinessbusiness.com.au/steve-jobs-youve-got-to-find-what-you-love/#:~:text=Steve%20Jobs%2C%20in%20his%20commencement,emphasizes%20on%20believing%20in%20oneself.

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Semester III

Title of the Course /Paper	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23122AEC33	DATA STRUCTURES AND ALGORITHMS	Core	5	1	0	4		5	25	75	100

Course Objective	
LO1	To understand the concepts of ADTs
LO2	To learn linear data structures-lists, stacks, queues
LO3	To learn Tree structures and application of trees
LO4	To learn graph structures and application of graphs
LO5	To understand various sorting and searching

UNIT	Details	No. of Hours
I	Abstract Data Types (ADTs)- List ADT-array-based implementation-linked list implementation singly linked lists-circular linked lists-doubly-linked lists-applications of lists-Polynomial Manipulation-All operations-Insertion-Deletion-Merge-Traversal	15
II	Stack ADT-Operations-Applications-Evaluating arithmetic expressions – Conversion of infix to postfix expression-Queue ADT-Operations-Circular Queue-Priority Queue-deQueue applications of queues.	15
III	Tree ADT-tree traversals-Binary Tree ADT-expression trees-applications of trees-binary search tree ADT- Threaded Binary Trees-AVL Trees-B-Tree- B+ Tree –Heap-Applications of heap.	15
IV	Definition-Representation of Graph-Types of graph-Breadth first traversal – Depth first traversal-Topological sort- Bi-connectivity – Cut vertex-Euler circuits- Applications of graphs.	15
V	Searching- Linear search-Binary search-Sorting-Bubble sort-Selection sort-Insertion sort-Shell sort-Radix sort- Hashing-Hash functions- Separate chaining-Open Addressing-Rehashing Extendible Hashing	15
	Total	**75**

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation	PO1,PO6
2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO2
3	Describe the hash function and concepts of collision and It's are solution methods	PO2,PO4
4	Solve problem involving graphs, trees and heaps	PO6,PO8
5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO7
Text Book		
1	1.MarkAllenWeiss,—DataStructuresandAlgorithmAnalysisinC++‖,Pearson Education2014, 4thEdition.	
2	Reema Thareja,—Data Structures Using C‖, Oxford Universities Press2014,2nd Edition	
Reference Books		
1.	Thomas H.Cormen, Chales E.Leiserson, Ronald L.Rivest, Clifford Stein,— Introduction to Algorithms ‖, McGraw Hill 2009, 3rd Edition.	
2.	Aho,HopcroftandUllman,—Data Structures and Algorithms ‖,Pearson Education 2003	
Web Resources		
1.	NPTEL & MOOC course titled Data Structures	
2.	https://nptel.ac.in/courses/106106127/	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**3**	**3**	**-**	**1**	**-**
CO2	**1**	**2**	**1**	**-**	**-**	**-**
CO3	**3**	**1**	**2**	**1**	**-**	**-**
CO4	**2**	**2**	**1**	**-**	**-**	**1**
CO5	**3**	**1**	**1**	**-**	**-**	**-**
Weightage of course Contributed to each PSO	12	9	8	1	1	1

S-Strong-3 M-Medium-2L-Low-1

Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23122DSC34A	Grid Computing	Elective	5	1	-	3		4	25	75	100

Course Objective	
LO1	To learn the basic construction and application of Grid computing.
LO2	To learn grid computing organization and their Role.
LO3	To learn Grid Computing Anotomy.
LO4	To learn Grid Computing road map.
LO5	To learn various type of Grid Architecture.

UNIT	Details	No.of Hours
I	Introduction: Early Grid Activity, Current Grid Activity, Overview of Grid Business areas, Grid Applications, Grid Infrastructures.	12
II	Grid Computing organization and their Roles: Organizations Developing Grid Standards, and Best Practice Guidelines, Global Grid Forum (GCF), #Organization Developing Grid Computing Toolkits and Framework#, Organization and building and using grid based solutions to solve computing, commercial organization building and Grid Based Solutions.	12
III	Grid Computing Anatomy: The Grid Problem, The conceptual of virtual organizations, # Grid Architecture # and relationship to other distributed technology.	12
IV	The Grid Computing Road Map: Autonomic computing, Business on demand and infrastructure virtualization, Service-Oriented Architecture and Grid, #Semantic Grids#.	12
V	Merging the Grid services Architecture with the Web Services Architecture: Service-Oriented Architecture, Web Service Architecture, #XML messages and Enveloping #, Service message d encryption Mechanisms, Relationship between Web Services and Grid Services, Web services Interoperability and the role of the WS-I organization.	12
	Total	**60**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
1	To understand the basic elements and concepts of Grid computing.	PO1
2	To understand the Grid computing toolkit sand Framework.	PO1,PO2
3	To understand the concepts of Anatomy of Grid Computing.	PO4,PO6
4	To understand the concept of service oriented Architecture.	PO4,PO5,PO6
5	To Gain knowledge on grid and web service Architecture.	PO3,PO8
Text Book		
1	Joshy Joseph and Craig Fellenstein, Grid computing, Pearson/IBMPress, PTR, 2004.	
Reference Books		
1.	1 .Ahmer Abbas and Graig computing, A Practical Guide to technology and applications, Charles River Media, 2003.	
Web Resources		
1.	https://en.wikipedia.org/wiki/Grid_computing	
2.	https://link.springer.com/chapter/10.1007/978-1-84882-409-6_4	
3.	https://www.redb ooks.ibm.com/redbooks/pdfs/sg246778.pdf	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**3**	**1**	**2**	**1**	**2**
CO2	**2**	**1**	**2**	**1**	**3**	**1**
CO3	**3**	**2**	**1**	**1**	**-**	**1**
CO4	**3**	**-**	**3**	**2**	**1**	**3**
CO5	**2**	**3**	**1**	**2**	**3**	2
Weightage of course Contributed to each PSO	12	9	8	8	8	9

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23122DSC34B	Big Data Analytics	EC	4	-	-	-	3	4	25	75	100

Course Objective	
LO1	Understand the Big Data Platform and its Use cases, Map Reduce Jobs
LO2	To identify and understand the basics of cluster and decision tree
LO3	To study about the Association Rules, Recommendation System
LO4	To learn about the concept of stream
LO5	Understand the concepts of No SQL Databases

UNIT	Details	No. of Hours
I	Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value – Understanding Big Data Storage —A General Overview of High-Performance Architecture— HDFS—Map Reduce And YARN—Map Reduce Programming Model	12
II	Advanced Analytical Theory and Methods: Overview of Clustering — K-means — Use Cases — Overview of the Method—Determining the Number of Clusters—Diagnostics — Reasons to Choose and Cautions .- Classification: Decision Trees—Overview of a Decision Tree — The General Algorithm — Decision Tree Algorithms—Evaluating a Decision Tree—Decision Trees in R — Naïve Bayes — Bayes Theorem—Naïve Bayes Classifier.	12
III	Advanced Analytical Theory and Methods: Association	12

	Rules—Overview—Apriori Algorithm—Evaluation of Candidate Rules—Applications of Association Rules—Finding Association & finding similarity — Recommendation System: Collaborative Recommendation- Content Based Recommendation — Knowledge Based Recommendation- Hybrid Recommendation Approaches.	
IV	Introduction to Streams Concepts—Stream Data Model and Architecture—Stream Computing, Sampling Data in a Stream — Filtering Streams — Counting Distinct Elements in a Stream — Estimating moments—Counting on enessina Window—Decaying Window—Real-time Analytics Platform (RTAP) applications — Case Studies — Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics	12
V	No SQL Databases : Schema-less Models: Increasing Flexibility for Data Manipulation-Key Value Stores-Document Stores — Tabular Stores — Object Data Stores—Graph Databases Hive—Shading—H base — Analyzing big data with twitter — Big data for E-Commerce Big data for blogs — Review of Basic Data Analytic Methods using R.	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1,PO2

3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4,PO6
4	Perform analytics on data streams.	PO4,PO5,PO6
5	Learn No SQL databases and management.	PO3,PO8
Text Book		
1	Anand Rajaraman and Jeffrey David Ullman, ―Mining of Massive Datasets‖, CambridgeUniversityPress, 2012.	
Reference Books		
1.	David Loshin,―Big Data Analytics: From Strategic Planning to Enterprise IntegrationwithTools,Techniques,NoSQL,andGraph‖,MorganKaufmann/ElsevierPublishers,2013	
2.	EMC Education Services,―Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data‖, Wiley publishers, 2015.	
Web Resources		
1.	https://www.simplilearn.com	
2.	https://www.sas.com/en_us/insights/analytics/big-data-analytics.html	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	3	2	2	3	1
CO2	3	2	3	2	3	3
CO3	1	3	2	2	2	1
CO4	3	3	3	1	3	3
CO5	3	2	3	3	3	3
Weightage of course contributed to each PSO	11	13	13	10	14	11

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
23122DSC34C	NATURAL LANGUAGE PROCESSING	Elect	4	-	-	-	3	25	75	100

Learning Objectives	
LO1	To understand approaches to syntax and semantics in NLP.
LO2	To learn natural language processing and to learn how to apply basic algorithms in This field.
LO3	To understand approaches to discourse, generation, dialogue and summarization with n NLP.
LO4	To get acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, pragmatics etc.
LO5	To understand current methods for statistical approaches to machine translation.

UNIT	Contents	No.of. Hours
I	**Introduction :** Natural Language Processing tasks in syntax, semantics, and pragmatics – Issue- Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.	**12**
II	**Word level and Syntactic Analysis:** Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction- Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency-Parsing-Probabilistic Parsing.	**12**
III	**Semantic analysis and Discourse Processing:** Semantic Analysis: Meaning Representation-Lexical Semantics-Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution-Discourse Coherence and Structure.	**12**
IV	**Natural Language Generation: Architecture** of NLGS systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation. Characteristics of Indian Languages-Machine Translation Approaches-Translation involving Indian Languages.	**12**
V	**Information retrieval and lexical resources:** Information Retrieval:	

	Design features of Information Retrieval Systems-Classical, Non-classical, and Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net Stemmers- POS Tagger-Research Corpora SSAS.	**12**
TOTAL		**60**
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Describe the fundamental concepts and techniques of natural language processing.	PO1, PO2,PO3, PO4,PO5, PO6
CO2	Use NLP technologies to explore and gain abroad understanding of text data.	PO1, PO2,PO3, PO4,PO5, PO6
CO3	Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions.	PO1, PO2,PO3, PO4,PO5, PO6
CO4	Analyze large volume text data generated from a range of real-world applications.	PO1, PO2,PO3, PO4,PO5, PO6
CO5	Determine the framework in which artificial intelligence and the Internet of things may function, including interactions with people, enterprise functions, and environments.	PO1, PO2,PO3, PO4,PO5, PO6
Text books		
1	DanielJurafsky, JamesH.Martin, ―Speech & language processing ‖, Pearson publications.	
2	Allen, James. Natural language understanding. Pearson, 1995.	
Reference Books		
1.	PierreM.Nugues,―An Introduction to Language Processing with Perland Prolog‖,Springer	
Web Resources		
1.	https://en.wikipedia.org/wiki/Natural_language_processing	
2.	https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	1
CO2	2	3	3	3	2	3
CO3	1	3	3	3	1	3
CO4	3	2	1	3	2	3
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	12	14	13	15	11	13

S-Strong-3 M-Medium-2L-Low-1

Title of the Course/ Paper	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23122SEC35L	**DATA STRUCTURES AND ALGORITHMS LAB using C++**	Core	0	0	3	3	4	4	25	75	100

Course Objective	
LO1	To understand the concepts of ADTs
LO2	To learn linear data structures- lists, stacks, queues
LO3	To learn Tree structures and application of trees
LO4	To learn graph structures and application of graphs
LO5	To understand various sorting and searching

S .No	Details	No .of Hours
1.	Write a program to implement the List ADT using arrays and Linked lists.	
2.	Write a programs to implement the following using a singly linked list. • Stack ADT • Queue ADT	
3.	Write a program that reads an infix expression, converts the expression to postfix form and then evaluates the postfix expression (use stack ADT).	
4.	Write a program to implement priority queue ADT.	
5.	Write a program to perform the following operations: • Insert an element in to a binary search tree. • Delete an element from a binary search tree. • Search for a key element in a binary search tree.	
6.	Write a program to perform the following operations • Insertion in to an AVL-tree • Deletion from an AVL-tree	

7.	Write a programs for the implementation of BFS and DFS for a given graph.	
8	Write a programs for implementing the following searching methods: • Linear search • Binary search.	
9.	Write a programs for implementing the following sorting methods: • Bubble sort • Selection sort • Insertion sort • Radix sort.	
	Total	

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation	PO1,PO4,PO5
2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO1,PO4,PO8
3	Describe the hash function and concepts of collision and Its resolution methods	PO1,PO3,PO6
4	Solve problem involving graphs ,trees and heaps	PO3,PO4
5	Apply Algorithm for solving problems like sorting, searching, insertion an deletion of data	PO1,PO5,PO6
Text Book		
1	Mark Allen Weiss, Data Structures and Algorithm Analysis in C++‖, Pearson Education 2014, 4th Edition.	
2	ReemaThareja,—DataStructuresUsingC‖,OxfordUniversitiesPress2014,2nd Edition	
Reference Books		
1	ThomasH.Cormen,ChalesE.Leiserson,RonaldL.Rivest,CliffordStein,—Introduction to Algorithms‖,McGrawHill2009,3rdEdition	
2.	Aho, Hop croft and Ullman,—Data Structures and Algorithms‖, Pearson Education2003	
Web Resources		
1.	NPTEL & MOOC courses titled Data Structures	
2.	https://nptel.ac.in/courses/106106127/	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**3**	**3**	**2**	**1**	**-**
CO2	**1**	**2**	**1**	**-**	**-**	**2**
CO3	**3**	**1**	**2**	**1**	**-**	**-**
CO4	**2**	**2**	**1**	**2**	**3**	**1**
CO5	**3**	**2**	**1**	**-**	**-**	**-**
Weightage of course contributed to each PSO	12	10	8	5	4	4

S-Strong-3 M-Medium-2L-Low-1

Subject-Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CI	Ex	Tot
23122SEC36	**INTRODUCTION TO HTML**	Specific Elective	3	0	0	2	2	25	75	100

Learning Objectives	
LO1	Insert a graphic with in a web page.
LO2	Create a link with in a web page.
LO3	Create a table with in a web page.
LO4	Insert heading levels within a web page.
LO5	Insert ordered and unordered lists with in a webpage. Create a webpage.

UNIT	Contents	No. Of. Hours
I	Introduction: Web Basics: What are Internet– Web browsers–What is Webpage–HTML Basics: Understanding tags?	**6**
II	Tags for Document structure(HTML, Head ,Body Tag).Block level text elements: Headings paragraph(<p>tag)–Font style elements:(bold, italic, font, small, strong, strike, big tags)	**6**
III	Lists: Types of lists: Ordered, Unordered– Nesting Lists –Other tags: Marquee, HR, BR-Using Images–Creating Hyperlinks.	**6**
IV	Tables: Creating basic Table, Table elements, Caption–Table and cell alignment–Rowspan, Colspan –Cell padding.	**6**
V	Frames: Frameset– Targeted Links– No frame–Forms: Input, Text area, Select, Option.	**6**
	TOTALHOURS	**30**

Course Outcomes		**ProgrammeOutcomes**
CO	On completion of this course, students will	
CO1	Knows the basic concept in HTML Concept of resources in HTML	PO1, PO2, PO3,PO4,PO5, PO6
CO2	Knows Design concept .Concept of Meta Data Understand the concept of save the files.	PO1, PO2, PO3,PO4,PO5, PO6
CO3	Understand the page formatting. Concept to flist.	PO1, PO2, PO3,PO4,PO5, PO6
CO4	Creating Links. Know the concept of creating link to email address	PO1, PO2,PO3, PO4,PO5,PO6
CO5	Concept of adding images Understand the table creation.	PO1, PO2,PO3, PO4,PO5,PO6

Text books

1. —Mastering HTML5 and CSS3 Made Easy‖,Teach U CompInc., 2014.
2. **Thomas Michaud, "Foundations of Web Design: Introduction to HTML & CSS"**

Web Resources

1. https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf
2. https://www.w3schools.com/html/default.asp

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	3
CO2	3	3	2	3	3	3
CO3	2	3	3	3	3	3
CO4	3	3	3	3	3	3
CO5	3	3	3	2	3	3
Weightage of course Contributed to each PSO	14	15	14	14	15	15

S-Strong-3 M-Medium-2 L-Low-1

COURSECODE	COURSE TITLE	L	T	P	C
23122SEC37	FINANCIAL ACCOUNTING I	2	0	0	2

OBJECTIVES

- To understand the basic accounting concepts and standards.
- To know the basis for calculating business profits.
- To familiarize with the accounting treatment of depreciation.
- To learn the methods of calculating profit for single entry system.
- To gain knowledge on the accounting treatment of insurance claims.

UNIT–I

Fundamentals of Financial Accounting

Financial Accounting – Meaning, Definition, Objectives, Basic Accounting Concepts and Conventions -Journal, Ledger Accounts– Subsidiary Books — Trial Balance - Classification of Errors – Rectification of Errors– Preparation of Suspense Account– Need and Preparation-Bank Reconciliation Statement

UNIT–II

Final Accounts

Final Accounts of Sole Trading Concern- Capital and Revenue Expenditure and Receipts–Preparation of Trading, Profit and Loss Account and Balance Sheet with Adjustments.

UNIT– III

Depreciation and Bills of Exchange

Depreciation-Meaning–Objectives–Accounting Treatments-Types-Straight Line Method Diminishing Balance method–Conversion method. Annuity Method–Depreciation Fund Method–Insurance Policy Method–Revaluation Method–Depletion Method – Sum of Digits Method – Machine Hour Rate Method .**Bills of Exchange** – Definition – Specimens – Discounting of Bills – Endorsement of Bill – Collection –Noting– Renewal–Retirement of Bill under rebate–Insolvency of Acceptor–Accommodation.

UNIT–IV

Accounting from Incomplete Records

Incomplete Records -Meaning and Features -Limitations -Difference between Incomplete Records and Double Entry System - Methods of Calculation of Profit - Statement of Affairs Method – Preparation of final statements by Conversion method. Average Due Date and Account Current

UNIT–V

Royalty and Insurance of Claims

Meaning–Minimum Rent–Short Working–Recoupment of Short Working–Lessor and Lessee–Sub lease-Accounting Treatment.

Course Outcomes

- CO1 Remember the concept of rectification of errors and Bank reconciliation statements
- CO2 Apply the knowledge in preparing detailed accounts of sole trading concerns
- CO3 Analyze the various methods of providing depreciation
- CO4 Evaluate the methods of calculation of profit
- CO5 Determine the royalty accounting treatment and claims from insurance companies in case of loss of stock.

Text books	
1.	S.P. JainandK. L. Narang Financial Accounting- I, Kalyani Publishers, New Delhi.
2.	S.N.Maheshwari, Financial Accounting,Vikas Publications,Noida.
3.	ShuklaGrewalandGupta,"AdvancedAccounts",volume1, S.Chandand Sons,NewDelhi.
4.	Radhaswamy and R.L.Gupta: Advanced Accounting, Sultan Chand, NewDelhi.
5.	R.L.Guptaand V.K. Gupta, "Financial Accounting", Sultan Chand, New Delhi.
Reference Books	
1.	Dr.Arulanandanand Raman:AdvancedAccountancy,Himalaya Publications, Mumbai.
2.	Tulsian, Advanced Accounting, Tata McGraw-Hill's, Noida.
3.	Charumathiand Vinayagam, Financial Accounting, S.Chandand Sons, New Delhi.
4.	Goyaland Tiwari, Financial Accounting,Taxmann Publications, New Delhi.
5.	Robert NAnthony,DavidHawkins,KennethA.Merchant,Accounting: Text and Cases.McGraw-HillEducation, Noida.
NOTE: Latest Edition of Textbooks May be Used.	
Web Resources	
1.	https://www.slideshare.net/mcsharma1/accounting-for-depreciation-1
2.	https://www.slideshare.net/ramusakha/basics-of-financial-accounting
3.	https://www.accountingtools.com/articles/what-is-a-single-entry-system.html

MAPPINGWITHPROGRAMMEOUTCOMESA NDPROGRAMMESPECIFICOUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	3	2	3	2	2	3	2	2
CO2	3	2	3	3	3	2	2	2	3	2	2
CO3	3	2	3	3	3	2	2	2	3	2	2
CO4	3	2	3	3	2	2	2	2	3	2	2
CO5	3	2	3	3	3	2	2	2	3	2	2
TOTAL	15	10	15	15	13	11	10	10	15	10	10
AVERAGE	3	2	3	3	2.6	2.2	2	2	3	2	2

3– Strong,2-Medium,1-Low

COURSECODE	COURSETITLE	L	T	P	C
23122RMC38	Research Methodology	2	0	0	2

AIM:

To create a basic appreciation towards research process and awareness of various research publication.

OBJECTIVES:

- To understand the steps in research process and the suitable methods.
- To identify various research communications and their salient features
- To carry out basic literature survey using the common data-based
- To give exposure to MATLAB platform for effective computational and graphic works required for quality research

PREREQUISITIES:

Basic computer skill for working in window environment & conceptual knowledge on basic matrices.

UNIT-I Introduction to Research Methodology

Meaning of research – Objectives of research – Type of research – Significance of research – Research approaches.

UNIT-II Research Methods

Research methods versus Methodology – Research and scientific method – criteria of good research – Problems encountered by researchers in India.

UNIT-III Literature Survey

Articles – Thesis – Journals – Patents – Primary sources of journals and patents – Secondary sources – Listing of titles – Abstracts – Review – General treatises – Monographs.

UNIT-IV Database Survey

Database search – NIST –MSDS –PubMed – Scopus – Science citation index – Information about a specific search.

UNIT-V Introduction to MATLAB:

What is MATLAB? Matrix and its application in different areas: MATLAB approach to environmental modeling; Arithmetic Matrix – Operators; Arithmetic Array – Operators and its applications in MATLAB; Expressions, Opening M-Files; Structure of MATLAB Programming; Programming; Concatenation of strings; Vectorization ; Basic Graphics.

OUTCOME:

Ability to carry out independent literature survey corresponding to the specific publication type and assess basic computation frame works used in mathematical researches.

REFERENCES BOOK:

1. C.R. Kothari, Research Methodology, New Age International publishers. New Delhi, 2004.

2. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.

3. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2005.

4. A Guide to MATLAB: For Beginners and experienced Users by Brian R. Hunt (Editor), Ronald L. Lipsman, J. Rosenberg.

5. Introduction to MATLAB for Engineers by William J. Palm III.

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
231ACLSOAN	**OFFICE AUTOMATION**	AC	-	-	-	1		2	25	75	100

Learning Objectives	
LO1	Understand the basics of computer systems and its components.
LO2	Understand and apply the basic concepts of a word processing package.
LO3	Understand and apply the basic concepts of electronic spreadsheet software.
LO4	Understand and apply the basic concepts of database management system.
LO5	Understand and create a presentation using PowerPoint tool.

UNIT	Contents	No. of Hours
I	Introductory concepts: Memory unit– CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems & its features: DOS–UNIX–Windows. Introduction to Programming Languages.	6
II	**Word Processing:** Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing– Preview, options , merge.	6
III	**Spreadsheets :**Excel–opening ,entering text and data, formatting, navigating; Formulas– entering, handling and copying; Charts–creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics.	6
IV	**Database Concepts:** The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of data files; Understanding Programming environment in DBMS; Developing menu drive applications in query language(MS–Access).	6
V	**Power point:** Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition–Animation effects, audio inclusion, timers.	6

	Total	30

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Possess the knowledge on the basics of computers and its components	PO1,PO2,PO3,PO6,PO8
CO2	Gain knowledge on Creating Documents, spreadsheet and presentation.	PO1,PO2,PO3,PO6
CO3	Learn the concepts of Database and implement the Query in Database.	PO3,PO5,PO7
CO4	Demonstrate the understanding of different automation tools.	PO3,PO4,PO5,PO7
CO5	Utilize the automation tools for documentation, calculation and presentation purpose.	PO4,PO6,PO7,PO8

Text Book	
1	PeterNorton, "Introduction to Computers"–Tata McGraw-Hill.

Reference Books	
1.	Jennifer Ackerman Kettle, Guy Hat-Davis, Curt Simmons, "Microsoft 2003", Tata McGraw Hill.

Web Resources	
1.	https://www.udemy.com/course/office-automation-certificate-course/
2.	https://www.javatpoint.com/automation-tools

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**14**	**14**	**15**	**15**	**15**

S-Strong-3 M-Medium-2 L-Low-1

சங்க இலக்கியம் - 23110AEC41

நான்காம் பருவம்

பாடநோக்கங்கள்

- இலக்கியங்கள் வாயிலரக சமுதாயக்கருத்தக்களை
- பழந்தமிழ்இலக்கியவளத்தைஉணர்த்துதல்.
- சங்கஅக. புறபாடல்மரபுகளைப்பயிற்றுவித்தல்
- வாழ்வியல்அறங்கள்மற்றும்வரலாற்றுச்செய்திகளை .பயிற்றுவித்தல்
- புறஇலக்கியங்கள்காட்டும்வாழ்வியல்அறங்களைளடுத்துக்கூறுதல்

பயன்கள்

- பழந்தமிழ்இலக்கியமரபைஅறிவர்.
- சங்கஇலக்கியங்களில்உள்ளஅழகியல்கூறுகளைஉணர்வர்.
- வாழ்வியல்அறங்கள்மற்றும்வரலாற்றுச்செய்திகளைஅறிவர்.
- சங்கஅக, புறபாடல்மரபுகளைபுரிந்துக்கொள்வர்.
- புறஇலக்கியங்கள்காட்டும்வாழ்வியல்அறங்களைஉணர்வர்.

அலகு-1

1. குறுந்தொகை– பாடல்எண்: 28,38
2. நற்றிணை– பாடல்எண்: 1,27,28,167,168
3. ஐங்குறுநூறு– பாடல்எண்: இளவேனில்பத்து

அலகு-2

1. கலித்தொகை– பாடல்எண்: 3,7
2. அகநானூறு– பாடல்எண்:5,42,100
3. புறநானூறு– பாடல்எண்: 182,204,41,121

அலகு-3

1 சிறுபாணாற்றுப்படைமுழுவதும்

அலகு-4

1. திருக்குறள்– செய்நன்றிஅறிதல், கூடாநட்பு ,நலம்புனைந்துரைத்தல்.
2. நாலடியார் – பாடல்எண்: 1,172,215,253

அலகு-5

இலக்கியவரலாறு

1. சங்கஇலக்கியம்
2. எட்டுத்தொகை, பத்துப்பாட்டு
3. பதினெண்கீழ்க்கணக்குநூல்கள்

பார்வைநூல்கள்

1. குறுந்தொகை - கழகவெளியீடு,சென்னை.
2. நற்றிணை - கழகவெளியீடு,சென்னை.
3. ஐங்குறுநூறு - கழகவெளியீடு,சென்னை.
4. கலித்தொகை - கழகவெளியீடு,சென்னை.
5. அகநானூறு - கழகவெளியீடு,சென்னை.
6. புறநானூறு - கழகவெளியீடு,சென்னை.
7. திருக்குறள் -பரிமேலழகர்உரை ,கழகவெளியீடு,சென்னை

8.இணையதளம் -www.tamilvu.org , www.noolulagam.com

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

SECOND YEAR - SEMESTER IV

PAPER II –GENERAL ENGLISH [23111AEC42]

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
23111AEC42	Language	3	0	0	3		6	25	75	100

Learning Objectives	
LO1	To help learners imbibe the rules of language unconsciously and tune to deduce language structure and usage.
LO2	To enable them use receptive skills through reading and listening to acquire good exposure to language and literature.
LO3	To help them develop style in speech and writing and manipulate the tools of language for effective communication.
LO4	To provide exposure to plays, autobiographies and expose them to value based ideas.
LO5	To enhance their language skills especially in the areas of grammar and pronunciation.

Unit No.	Unit Title & Text	No. of Periods for the Unit
I	**Life Writing** 1.1 I am Malala-MalalaYousafzai - Chapter 1 1.2 My Inventions - Nikola Tesla - Chapter 2	20
II	**One Act Plays** 2.1The Zoo Story- Edward Albee 2.2 The Proposal- Anton Chekhov	20
III	**Interviews** 3.1 Nelson Mandela's Interview with Larry King. 3.2 Rakesh Sharma's Interview with Indira Gandhi from Space 3.3 Lionel Messi with Sid Lowe (Print)	20
IV	**Language Competency** 4.1 Refuting, Arguing & Debating 4.2 Making Suggestions & Responding to Suggestions, Asking for and Giving Advice or Help4.3 Interviews (face to face, telephone and video conferencing)	15

V	**English for Workplace** 5.1 Job Applications: Covering letters, CV and Resume 5.2 Creating a digital profile - LinkedIn 5.3 Filling Forms (Online & Manual): creation of account, railway reservation, ATM,Credit/debit card 5.4 Body Language -Practical Skills for Interviews	15

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Learn to communicate effectively and appropriately in real life situation.	PO1
CO2	Use English effectively for study purpose across the curriculum	PO1,PO2
CO3	Develop interest in and appreciation of Literature	PO4,PO6
CO4	Develop and integrate the use of the four language skills	PO4,PO5,PO 6
CO5	Enhance their language skills especially in the areas of grammar and pronunciation.	PO3,PO8

Text Books (Latest Editions)	
1	I Am Malala The Girl Who Stood Up for Education and Was Shot by the Taliban by MalalaYousafzai, Christina Lamb , Little Brown, 2013.
2	My Inventions by Nikola Tesla Ingram Short title, 2011 Edition
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	**Autobiographies, Mary**, Taylor & Francis, 2021

2	One-act Plays for Acting Students: An Anthology of Short Norman A. Bert · 1987 ·
3	The One-Act Play Companion: A Guide to plays, playwrights ... Colin Dolley, Rex Walford · 2015
4	How to Build a Professional Digital Profile Kindle Edition by Jeanne Kelly Bernish, Bernish Communications Associates, LLC; 1st edition (May 29, 2012)
5	Role Play-Theory and Practice.Krysia M Yardley-Matwiejczuk, SAGE publications ltd, 1997

Web Resources	
1	For Readers' Theatre: https://www.youtube.com/watch?v=JaLQJt8orSw&t=469s(the link to the performance; refer scripts by Aaron Sheperd)
2	http://BBC learn English.com
3	http://onestopenglish.com
4	http://hearn-english-today.com
5	http://talkenglish.com
6	TheZooStory: http://www.lem.seed.pr.gov.br/arquivos/File/livrosliteraturaingles/zoostory.pdf
7	The Proposal: https://www.one-act-plays.com/comedies/proposal.html
8	Nelson Mandela with Larry King Interviews: http://edition.cnn.com/TRANSCRIPTS/0005/16/lkl.00.html
9	Rakesh Sharma with Indira Gandhi Interview : https://www.ndtv.com/offbeat/what-first-indian-astronaut-rakesh-sharma-told-indira-gandhi-about-india-from-space-2204839
10	Lionel Messi with Sid Lowe Interview:https://www.worldsoccer.com/world-soccer-latest/lionel-messi-interview-part-one-338553

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	2
CO2	3	3	2	3	3	2
CO3	3	3	3	3	3	2
CO4	3	3	2	3	3	2
CO5	3	3	2	3	3	2
Weightage of course contributed to each PSO	15	14	11	15	15	10

S-Strong-3 M-Medium-2 L-Low-1

SEMESTER IV

Subject Code	Subject Name	Category	L	T	P	C		Inst.	Marks		
									CIA	Ext	Total
23122AEC43	**PROGRAMMING IN JAVA**	Core	5	1	0	3		5	25	75	100

Learning Objectives	
LO1	To provide fundamental knowledge of object-oriented programming
LO2	To equip the student with programming knowledge in Core Java from the basics up.
LO3	To enable the students to use AWT controls, Event Handling and Swing for GUI.
LO4	To provide fundamental knowledge of object-oriented programming.
LO5	To equip the student with programming knowledge in Core Java from the basics up.

UNIT	**Contents**	**No. of Hours**
I	**Introduction:** Review of Object Oriented concepts – History of Java – Java buzz words – JVM architecture – Data types - Variables - Scope and life time of variables - arrays - operators – control statements - type conversion and casting - simple java program - constructors - methods - Static block - Static Data – Static Method String and String Buffer Classes.	15
II	**Inheritance**: Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword. **Packages**: Definition- Access Protection –Importing Packages. **Interfaces**: Definition–Implementation–Extending Interfaces. **Exception Handling**: try – catch- throw - throws – finally – Built-in exceptions - Creating own Exception classes.	15

III	**Multithreaded Programming**: Thread Class - Runnable interface –Synchronization–Using synchronized methods– Using synchronized statement- Inter thread Communication –Deadlock. **I/O Streams:** Concepts of streams - Stream classes- Byte and Character stream - Reading console Input and Writing Console output - File Handling.	15
IV	**AWT Controls:** The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Colour - Fonts and layout managers. **Event Handling:** Events - Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes	15
V	**Swing:** Introduction to Swing - Hierarchy of swing components. Containers - Top level containers – JFrame – JWindow – JDialog – JPanel – JButton – JToggleButton – JCheckBox – JRadioButton – JLabel,JTextField – JtextArea – JList – JComboBox – JScrollPane.	15
	Total	**75**

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic Object-oriented concepts. Implement the basic constructs of Core Java.	PO1, PO2, PO6
CO2	Implement inheritance, packages, interfaces and exception handling of Core Java.	PO2, PO3, PO8
CO3	Implement multi-threading and I/O Streams of Core Java	PO1, PO3, PO5
CO4	Implement AWT and Event handling.	PO2, PO6
CO5	Use Swing to create GUI.	PO1, PO3, PO6

Text Books:	
1.	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010
2.	Gary Cornell, *Core Java 2 Volume I – Fundamentals*, Addison Wesley, 1999
References :	
1.	Head First Java, O'Rielly Publications,
2.	Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010
Web Resources	
1.	https://javabeginnerstutorial.com/core-java-tutorial
2.	http://docs.oracle.com/javase/tutorial/
3.	https://www.coursera.org/

Mapping with Programme Outcomes:

S-Strong-3 M-Medium-2 L-Low-1

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**2**	**2**	**3**
CO3	**2**	**2**	**1**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**1**
Weightage of course contributed to each PSO	**14**	**14**	**13**	**14**	**14**	**11**

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23122DSC44A	Image Processing	Elective	5	1	0	3	3	4	25	75	100

Course Objective	
LO1	To learn fundamentals of digital image processing.
LO2	To learn about various2D Image transformations
LO3	To learn about various image enhancement processing methods and filters
LO4	To learn about various classification of Image segmentation techniques
LO5	To learn about various image compression techniques

UNIT	Details	No. of Hours
I	**Digital Image Fundamentals:** Image representation - Basic relationship between pixels, Elements of DIP system -Applications of Digital Image Processing - 2D Systems - Classification of 2D Systems – Mathematical Morphology- Structuring Elements- Morphological Image Processing- 2D Convolution-2D Convolution Through Graphical Method-2D Convolution Through Matrix Analysis	12
II	2D Image transforms: Properties of 2D-DFT-Walsh transform-Hadamard transform-Haar transform-Discrete Cosine Transform-Karhunen -Loeve Transform- Singular Value Decomposition	12
III	Image Enhancement: Spatial domain methods-Point processing-Intensity transformations-Histogram processing-Spatial m filtering-smoothing filter- Sharpening filters - Frequency domain methods: low pass filtering, high pass Filtering-Homomorphic filter.	12
IV	Image segmentation: Classification of Image segmentation techniques –Region approach–Clustering techniques-Segmentation based on thresholding-Edge based segmentation-Classification of edges-Edge Detection- Hough transform-Active contour.	12
V	Image Compression: Need for compression-Redundancy-Classification Of image-Compression schemes-Huffman coding-Arithmetic coding- Dictionary based compression-Transform based compression,	12
	Total	**60**

Course Outcomes	Programme Outcome

CO	On completion of this course, students will	
1	Understand the fundamental concepts of digital image processing.	PO1
2	Understandvarious2DImagetransformations	PO1,PO2
3	Understand image enhancement processing Techniques and filters	PO4,PO6
4	Understand the classification of Image segmentation techniques	PO4,PO5,PO6
5	Understand various image compression techniques	PO3,PO8
Text Book		
1	SJayaraman,SEsakkirajan,TVeerakumar,Digitalimageprocessing,TataMcGrawHill,2015	
2	GonzalezRafelC,DigitalImageProcessing,PearsonEducation,2009	
Reference Books		
1.	1.JainAnilK,Fundamentalsofdigitalimageprocessing:,PHI,1988	
2.	KennethRCastleman,Digitalimageprocessing:,PearsonEducation,2/e,2003	
3.	PrattWilliamK,DigitalImageProcessing:,JohnWiley,4/e,2007	
Web Resources		
1.	https://kanchiuniv.ac.in/coursematerials/Digital%20image%20processing%20-Vijaya%20Raghavan.pdf	
2.	http://sdeuoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20-%20R.%20Gonzalez%2C%20R.%20Woods-ilovepdf-compressed.pdf	
3.	https://dl.acm.org/doi/10.5555/559707	
4.	https://www.ijert.org/image-processing-using-web-2-0-2	

Mapping with Programme Outcomes:

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	1	3	2	2	3	1
CO2	3	2	3	2	3	3
CO3	3	3	2	2	2	1
CO4	3	3	3	1	3	3
CO5	3	2	3	3	3	3
Weightage of course contributed to each PSO	13	13	13	10	14	11

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Marks		
								CIA	External	Total
23122DSC44B	ANALYTICS FOR SERVICE INDUSTRY	Elective	5	1	0	3		25	75	100

Learning Objectives

LO1	Recognize challenges in dealing with data sets in service industry.
LO2	Identify and apply appropriate algorithms for analyzing the healthcare, Human Resource, hospitality and tourism data.
LO3	Make choices for a model for new machine learning tasks.
LO4	To identify employees with high at triton risk.
LO5	To Prioritizing various talent management initiatives for your organization.

UNIT	Contents	No. Of. Hours
I	**Healthcare Analytics:** Introduction to Healthcare Data Analytics- Electronic Health Records– Components of EHR- Coding Systems- Benefits of EHR- Barrier to Adopting HER Challenges- Phenotyping Algorithms. Biomedical Image Analysis and Signal Analysis- Genomic Data Analysis for Personalized Medicine. Review of Clinical Prediction Models.	**12**
II	**Healthcare Analytics Applications:** Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health- Fraud Detection in Healthcare –Data Analytics for Pharmaceutical Discoveries-Clinical Decision Support Systems- Computer-Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data.	**12**
III	**HR Analytics:** Evolution of HR Analytics, HR information systems anddata sources, HR Metric and HR Analytics, Evolution of HR Analytics; HR Metrics and HR Analytics; Intuition versus analytical thinking; HRMS/HRIS and data sources; Analytics frameworks like LAMP, HCM: 21(r) Model.	**12**
IV	**Performance Analysis:** Predicting employee performance, Training requirements, evaluating training and development, Optimizing selection And promotion decisions.	**12**
V	**Tourism and Hospitality Analytics:** Guest Analytics – Loyalty Analytics–Customer Satisfaction–Dynamic Pricing–optimized Disruption management–Fraud detection in payments.	**12**
	TOTAL HOURS	**60**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Understand and critically apply the concepts and methods of business analytics	PO1, PO2,PO3, PO4,PO5, PO6
CO2	Identify, model and solve decision problems in different settings.	PO1,PO2, PO3,PO4,PO5, PO6
CO3	Interpret results/solutions and identify appropriate courses of action for a given managerial situation whether a problem or an opportunity.	PO1,PO2,PO3, PO4, PO5,PO6
CO4	Create solutions to decision making problems.	PO1,PO2, PO3,PO4,PO5, PO6
CO5	Instill a sense of ethical decision-making and a commitment to the long-run welfare of both organizations and the communities they serve.	PO1, PO2,PO3, PO4,PO5, PO6
Text books		
1	Chandan K. Reddy and Charu C Aggarwal, ―Health care data analytics ‖, Taylor & Francis, 2015.	
2	EdwardsMartinR,EdwardsKirsten(2016),―PredictiveHRAnalytics:Masteringthe HRMetric‖, Kogan Page Publishers, ISBN-0749473924	
3	Fitz-enzJac(2010),―The new HR analytics :predicting the economic value of your company'shumancapitalinvestments‖,AMACOM,ISBN-13:978-0-8144-1643-3	
4	RajendraSahu, ManojDashandAnilKumar.ApplyingPredictiveAnalyticsWithintheServiceSector.	
Reference Books		
1.	HuiYangandEvaK.Lee,―Healthcare Analytics: From Datato Knowledge to HealthcareImprovement,Wiley,2016	
2.	Fitz-enzJac,MattoxIIJohn(2014),―PredictiveAnalyticsforHumanResources‖, Wiley,ISBN-1118940709.	
Web Resources		
1.	https://www.ukessays.com/essays/marketing/contemporary-issues-in-marketing-marketing-essay php	
2.	https://yourbusiness.azcentral.com/examples-contemporary-issues-marketing-field-26524.html	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	3
CO2	2	3	3	3	3	3
CO3	3	3	2	3	3	2
CO4	3	3	3	3	3	3
CO5	3	3	3	3	3	3
Weightage of course Contributed to each PSO	14	15	14	15	15	14

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23122DSC44C	**Computational Intelligence**	Elective	5	1	0	3		4	25	75	100

Course Objective	
LO1	To identify and understand the basics of AI and its search.
LO2	To study about the Fuzzy logic systems.
LO3	Understand and apply the concepts of Neural Network and its functions.
LO4	Understand the concepts of Artificial Neural Network
LO5	To study about the Genetic Algorithm.

UNIT	Details	No. of Hours
I	**Introduction to AI**: Problem formulation – AI Applications – Problems – State Space and Search – Production Systems–Breadth First and Depth First– Travelling Salesman Problem – Heuristic search techniques: Generate and Test – Types of Hill Climbing.	12
II	**Fuzzy Logic Systems:** Notion of fuzziness – Operations on fuzzy sets – T-norms and other aggregation operators – Basics of Approximate Reasoning – Compositional Rule of Inference – Fuzzy Rule Based Systems – Schemes of Fuzzification – Inference – De fuzzification – Fuzzy Clustering–fuzzy rule-based classifier.	12
III	**Neural Networks** What is Neural Network, Learning rules and various activation functions, Single layer Perceptions, Back Propagation networks, Architecture of Back propagation (BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications	12

IV	**Artificial Neural Networks:** Fundamental Concepts – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs–McCulloch-Pitts Neuron–Linear Separability– Hebb Network.	12
V	**Genetic Algorithm:** Introduction–Biological Background – Genetic Algorithm Vs Traditional Algorithm–Basic Terminologies in Genetic Algorithm–Simple GA–General Genetic Algorithm–Operators in Genetic Algorithm	12
	Total	**60**

2.	ChinTengLin,C.S.GeorgeLee,‖Neuro-FuzzySystems‖,PHI.
Web Resources	
1.	https://www.javatpoint.com/artificial-intelligence-tutorial
2.	https://www.w3schools.com/ai/

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23122SEC45L	**JAVA PROGRAMMING LAB**	Core	0	0	3	3	4	4	25	75	100

Learning Objectives	
LO1	To provide fundamental knowledge of object-oriented programming.
LO2	To equip the student with programming knowledge in Core Java from the basics up.
LO3	To enable the students to know about Event Handling.
LO4	To enable the students to use String Concepts.
LO5	To equip the student with programming knowledge in to create GUI using AWT controls.

EXERCISE	**Details**
1	Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer
2	Write a Java program to multiply two given matrices.
3	Write a Java program that displays the number of characters, lines and words in a text
4	Generate random numbers between two given limits using Random class and print messages according to the range of the value generated.
5	Write a program to do String Manipulation using CharacterArray and perform the following string operations: a. String length b. Finding a character at a particular position c. Concatenating two strings
6	Write a program to perform the following string operations using String class:

	a. String Concatenation b. Search a substring c. To extract substring from given string	
7	Write a program to perform string operations using String Buffer class: a. Length of a string b. Reverse a string c. Delete a substring from the given string	
8	Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.	
9	Write a threading program which uses the same method asynchronously to print the numbers 1to10 using Thread1 and to print 90 to100 using Thread2.	60
10	Write a program to demonstrate the use of following exceptions. a. Arithmetic Exception b. Number Format Exception c. ArrayIndexOutofBoundException d. NegativeArraySizeException	
11	Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes	
12	Write a program to accept a text and change its size and font. Include bold italic options. Use frames and controls.	
13	Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired.	

	(Use adapter classes).	
14	Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.	
15	Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "stop" or "ready" or "go" should appear above the buttons in a selected color. Initially there is no message shown.	
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the basic Object-oriented concepts. Implement the basic constructs of Core Java.	PO1
2	Implement inheritance, packages, interfaces and exception handling of Core Java.	PO1, PO2
3	Implement multi-threading and I/O Streams of Core Java	PO4, PO6
4	Implement AWT and Event handling.	PO4, PO5, PO6
5	Use Swing to create GUI.	PO3, PO6

Text Book

1	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010.
2.	Gary Cornell, *Core Java 2 Volume I – Fundamentals*, Addison Wesley, 1999.

Reference Books

1.	Head First Java, O'Rielly Publications,
2.	Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010.

Web Resources

1.	https://www.w3schools.com/java/
2.	http://java.sun.com
3.	http://www.afu.com/javafaq.html

Mapping with Programme Outcomes:
S-Strong M-Medium L-Low

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	2
CO2	3	3	3	2	2	3
CO3	2	2	1	3	3	3
CO4	3	3	3	3	3	2
CO5	3	3	3	3	3	2
Weightage of course contributed to each PSO	14	14	13	14	14	12

Subject Code	Subject Name	Category	L	T	P	C		Hours	Marks		
									CIA	External	Total
23122SEC46	**Enterprise Resource Planning**	Skill Enhancement Course	3	-	-	2		2	25	75	100

Course Objectives

LO1	To understand the basic concepts, Evolution and Benefits of ERP.
LO2	To know the need and Role of ERP in logical and Physical Integration.
LO3	Identify the important business functions provided by typical business software such A sender price are source planning and customer relationship management
LO4	To train the students to develop the basic understanding of how ERP enriches the Business organizations in achieving a multidimensional growth
LO5	To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills

UNIT	Details	No. of Hours
I	ERP Introduction, Benefits, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP, Components and needs of ERP,ERP Vendors; Benefits & Limitations of ERP Packages.	6
II	Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System Integration, Benefits & limitations of System Integration, ERP's Role in Logical and Physical Integration. Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Management (PLM),LAP, Supply chain Management.	6
III	ERP Market place and Market place Dynamics: Market Overview, Market place Dynamics, and the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications. Cloud and Open Source, Quality Management, Material Management, Financial Module, CRM and Case Study.	6

IV	ERP Implementation Basics, ERP implementation Strategy, ERP Implementation Life Cycle, Pre-Implementation task, Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.	6
V	ERP & E-Commerce, Future Directives-in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP In to organizational culture. Using ERP tool: either SAP or ORACLE format to case study.	6
	Total	**30**
Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic concepts of ERP.	PO1,PO2,PO6
CO2	Identify different technologies used in ERP	PO2,PO3,PO8
CO3	Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules	PO1,PO3,PO7
CO4	Discuss the benefits of ERP	PO2,PO6
CO5	Apply different tools used in ERP	PO1,PO3,PO8
Reference Text:		
1.	Enterprise Resource Planning–Alexis Leon, Tata McGraw Hill.	
References:		
1.	Enterprise Resource Planning–Diversified by Alexis Leon, TMH.	
2.	Enterprise Resource Planning–Ravi Shankar & S. Jaiswal, Galgotia	
Web Resources		
1.	1.https://www.tutorialspoint.com/management_concepts/enterprise_resource_planning.htm	
2.	1.https://www.saponlinetutorials.com/what-is-erp-systems-enterprise-resource-planning/	
3.	1.https://www.guru99.com/erp-full-form.html	
4.	2.https://www.oracle.com/in/erp/what-is-erp/	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**1**	**3**	**2**	**1**	**3**	**2**
CO2	**3**	**2**	**-**	**1**	**2**	**-**
CO3	**2**	**3**	**2**	**2**	**3**	**2**
CO4	**1**	**-**	**2**	**1**	**-**	**2**
CO5	**3**	**3**	**-**	**1**	**3**	**-**
Weightage of course contributed to each PSO	10	11	6	7	11	6

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		V. Hours	Marks		
									CIA	External	Total
23122SEC47	**Multimedia Systems**	Skill Enhancement Course	2	-	-	2		2	25	75	100

Course Objective	
LO1	Understand the definition of Multimedia
LO2	To study about the Image File Formats, Sounds Audio File Formats
LO3	Understand the concepts of Animation and Digital Video Containers
LO4	To study about the Stage of Multimedia Project
LO5	Understand the concept of Ownership of Content Created for Project Acquiring Talent

UNIT	**Details**	**No.of Hours**
I	Multimedia Definition-Use Of Multimedia-Delivering Multimedia- Text: About Fonts and Faces-Using Text in Multimedia-Computers and Text Font Editing and Design Tools-Hypermedia and Hypertext.	6
II	Images: Plan Approach-Organize Tools-Configure Computer Workspace-Making Still Images-Color – Image File Formats. Sound: The Power of Sound-Digital Audio-Midi Audio- Midi vs. Digital Audio-Multimedia System Sounds Audio File Formats-Vaughan's Law of Multimedia Minimums-Adding Sound to Multimedia Project	6
III	Animation: The Power of Motion-Principles of Animation- Animation by Computer-Making Animations that Work. Video: Using Video – Working with Video and Displays-Digital Video Containers- Obtaining Video Clips-Shooting and Editing Video	6
IV	Making Multimedia: The Stage of Multimedia Project-The Intangible Needs -The Hardware Needs - The Software Needs-An Authoring System's Needs-Multimedia Production Team.	6
V	Planning and Costing: The Process of Making Multimedia-Scheduling-Estimating-RFPs and Bid Proposals. Designing and Producing-Content and Talent: Acquiring Content-Ownership of Content Created for Project-Acquiring Talent	6
	Total	**30**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
1	understand the concepts, importance, application and the process of developing multimedia	PO1
2	To have basic knowledge and understanding about image related processing	PO1,PO2
3	To understand the framework of frames and bit images to animations	PO4,PO6
4	Speaks about the multimedia projects and stages of requirement in phases of project.	PO4,PO5,PO6
5	Understanding the concept of cost involved in multimedia planning designing, and producing	PO3,PO8
Text Book		
1	TayVaughan,"Multimedia:MakingItWork",8thEdition,Osborne/McGraw-Hill, 2001.	
Reference Books		
1.	Ralf Steinmetz & KlaraNahrstedt"Multimedia Computing, Communication&Applications",PearsonEducation,2012.	
Web Resources		
1.	https://www.geeksforgeeks.org/multimedia-systems-with-features-or-characteristics/	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**3**	**3**	**2**	**1**
CO2	**3**	**2**	**3**	**3**	**2**	**1**
CO3	**3**	**2**	**3**	**3**	**2**	**1**
CO4	**3**	**2**	**3**	**3**	**1**	**1**
CO5	**3**	**3**	**3**	**3**	**1**	**1**
Weightage of course contributed to each PSO	15	11	15	15	8	5

S-Strong-3 M-Medium-2 L-Low-1

ABILITY ENHANCEMENT COMPULSORY COURSE(AECC1)					
23122BRC48	Participation in Bounded Research	2	0	0	2

Course Code	Course Title	L	T	P	C
231AECCEVS	Environmental Studies	2	0	0	2

AIM:

To create the awareness about environmental problems among the students.

OBJECTIVE:

- It deals with the study of flow of energy and materials in the environment
- It deals with the study of natural and its function

UNIT–I

The Multidisciplinary Nature of Environmental Studies – Definition, Scope and Importance - Need for public awareness - **Natural Resources: Renewable and Non-Renewable Resources** - Forest resources - Water resources - Mineral resources - Food resources - Energy resources - Land resources.

UNIT-II

Ecosystems - Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids - Types of ecosystem - Forest ecosystem - Grassland ecosystem - Desert ecosystem - Aquatic ecosystems.

UNIT-III

Biodiversity and its Conservation – Definition - Genetic, species and ecosystem diversity - Bio geographical classification of India - Values of biodiversity - Biodiversity at global, National and local levels - India as a mega - diversity nation - Hot-spots of biodiversity - Threats to biodiversity - Endangered and endemic species of India - Conversation of biodiversity.

UNIT-IV

Environmental Pollution – Definition - Air pollution - Water pollution - Soil pollution - Marine pollution - Noise pollution - Thermal pollution - Nuclear hazards - Solid waste Management - Role of an individual in prevention of pollution - Disaster management.

UNIT-V

Social Issues and the Environment - From Unsustainable to Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, watershed management - Environmental ethics - Climate change greenhouse effect and global warming - Ozone depletion - Waste land reclamation - Consumerism and waste products - Environmental Legislation - Issues involved in enforcement of environmental legislation - Public awareness - **Human Population and the Environment**.

REFERENCE BOOK:

1. “ENVIRONMENTAL STUDIES”, K.Kumarasamy, A.Alagappa Moses, M.Vasanthy.

SEMESTER IV

Course Code	Course Title	L	T	P	C
231LCSCLS	Leadership and Management Skills	-	-	-	1

Aim:

The aim of the course cultivating and nurturing the innate leadership skills of the youth so that they may transform these challenges into opportunities and become torch bearers of the future by developing creative solutions.

Course Objective:

The Module is designed to**:**

- Help students to develop essential skills to influence and motivate others
- Inculcate emotional and social intelligence and integrative thinking for effective leadership
- Create and maintain an effective and motivated team to work for the society
- Nurture a creative and entrepreneurial mindset
- Make students understand the personal values and apply ethical principles in professional and social contexts.

Course Outcomes:

Upon completion of the course students will be able to:

1. Examine various leadership models and understand/assess their skills, strengths and abilities that affect their own leadership style and can create their leadership vision
2. Learn and demonstrate a set of practical skills such as time management, self-management, handling conflicts, team leadership, etc.
3. Understand the basics of entrepreneurship and develop business plans
4. Apply the design thinking approach for leadership
5. Appreciate the importance of ethics and moral values for making of a balanced personality.

UNIT I- Leadership Skills

a. **Understanding Leadership and its Importance**
   - What is leadership?
   - Why Leadership required?
   - Whom do you consider as an ideal leader?

Traits and Models of Leadership
   - Are leaders born or made?
   - Key characteristics of an effective leader
   - Leadership styles
   - Perspectives of different leaders

Basic Leadership Skills
   - Motivation
   - Team work
   - Negotiation
   - Networking

UNIT II - Managerial Skills

a. Basic Managerial Skills
   - Planning for effective management
   - How to organize teams?
   - Recruiting and retaining talent
   - Delegation of tasks
   - Learn to coordinate
   - Conflict management

Self-Management Skills
   - Understanding self-concept
   - Developing self-awareness
   - Self-examination
   - Self-regulation

UNIT III - Entrepreneurial Skills

a. Basics of Entrepreneurship
   - Meaning of entrepreneurship
   - Classification and types of entrepreneurship
   - Traits and competencies of entrepreneur

Creating Business Plan
   - Problem identification and idea generation
   - Idea validation
   - Pitch making

UNIT IV - Innovative Leadership and Design Thinking

a. Innovative Leadership

- Concept of emotional and social intelligence
- Synthesis of human and artificial intelligence
- Why does culture matter for today's global leaders

Design Thinking

- What is design thinking?
- Key elements of design thinking:
  - Discovery
  - Interpretation
  - Ideation
  - Experimentation
  - Evolution.

- How to transform challenges into opportunities?
- How to develop human-centric solutions for creating social good?

UNIT V- Ethics and Integrity

a. Learning through Biographies

- What makes an individual great?
- Understanding the persona of a leader for deriving holistic inspiration
- Drawing insights for leadership
- How leaders sail through difficult situations?

Ethics and Conduct

- Importance of ethics
- Ethical decision making
- Personal and professional moral codes of conduct
- Creating a harmonious life

Bibliography and Suggested Readings:

Books

- Ashokan, M. S. (2215). *Karmayogi: A Bibliography of E. Sreedharan*. Penguin, UK.
- Brown, T. (2212). *Change by Design.* Harper Business
- Elkington, J., & Hartigan, P. (2208). *The Power of Unreasonable People: How Social Entrepreneurs Create Markets that Change the World*. Harvard Business Press.
- Goleman D. (1995). *Emotional Intelligence*. Bloomsbury Publishing India Private Limited.
- Kalam A. A. (2203). *Ignited Minds: Unleashing the Power within India*. Penguin Books India
- Kelly T., Kelly D. (2214). *Creative Confidence: Unleashing the Creative Potential Within Us All.* William Collins
- Kurien V., & Salve G. (2212). *I Too Had a Dream*. Roli Books Private Limited
- Livermore D. A. (2210). *Leading with cultural intelligence: The New Secret to Success*. New

York: American Management Association

- McCormack M. H. (1986). *What They Don't Teach You at Harvard Business School: Notes From A Street-Smart Executive*. RHUS
- O'Toole J. (2219) *The Enlightened Capitalists: Cautionary Tales of Business Pioneers Who Tried to Do Well by Doing Good.* HarperCollins
- Sinek S. (2209). *Start with Why: How Great Leaders Inspire Everyone to Take Action*. Penguin
- Sternberg R. J., Sternberg R. J., & Baltes P. B. (Eds.). (2204). *International Handbook of Intelligence*. Cambridge University Press.

E-Resources

- Fries, K. (2219). 8 Essential Qualities That Define Great Leadership. *Forbes*. Retrieved 2219- 02-15 from https://www.forbes.com/sites/kimberlyfries/2218/02/08/8-essential- qualities-that-define-great-leadership/#452ecc963b63.
- How to Build Your Creative Confidence, Ted Talk by David Kelly - https://www.ted. com/talks/david_kelley_how_to_build_your_creative_confidence.
- India's Hidden Hot Beds of Invention Ted Talk by Anil Gupta - https://www.ted.com/ talks/anil_gupta_india_s_hidden_hotbeds_of_invention.
- Knowledge@Wharton Interviews Former Indian President APJ Abdul Kalam - . "A Leader Should Know How to Manage Failure" https://www.youtube.com/ watch?=laGZaS4sdeU
- Martin, R. (2207). How Successful Leaders Think. *Harvard Business Review, 85*(6): 60.
- NPTEL Course on Leadership - https://nptel.ac.in/courses/122105021/9.

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Subject Code	Subject Name	Category	L	T	P	C		V. Hours	Marks		
									CIA	External	Total
23122AEC51	**Operating Systems**	Core	5	1	-	4		5	25	75	100
Course Objective											
LO1	Understanding the design of the Operating System										
LO2	Imparting knowledge on CPU scheduling, Process and Memory Management.										
LO3	To code specialized programs form an aging over all resources and operations of the computer.										
LO4	To study about the concept of Job and processor scheduling										
LO5	To learn about the concept to memory organization and multiprogramming										
UNIT	**Details**							**No. of Hours**			
	Introduction: operating system, history (1990sto2000 and beyond), distributed computing, parallel computation. **Process concepts:** definition of process, process states-Lifecycle of a process, process management-process state transitions, process control block(PCB), process operations , suspend and resume, context switching, Interrupts-Interrupt processing, interrupt classes, Inter process communication-signals, message passing.							15			
II	**Asynchronous concurrent processes:** mutual exclusion- critical section, mutual exclusion primitives, implementing mutual exclusion primitives, Petersons algorithm, software solutions to the mutual Exclusion Problem-,n-thread mutual exclusion-Lamports Bakery. Algorithm. Semaphores–Mutual exclusion with Semaphores, thread synchronization with semaphores,							15			

	Counting semaphores, implementing semaphores. **Concurrent programming:** monitors, message passing	
III	**Dead lock and in definite postponement:** Resource concepts, four necessary conditions for deadlock, deadlock prevention, deadlock avoidance and Dijkstra's Banker's algorithm, deadlock detection, deadlock recovery.	15
IV	**Job and processor scheduling:** scheduling levels, scheduling objectives, scheduling criteria, Preemptive non-preemptive scheduling, interval time orient interrupting clock, priorities, scheduling algorithms-FIFO scheduling, RR scheduling, quantum size, SJF scheduling, SRT scheduling, HRN scheduling, multilevel feedback queues, Fair share scheduling.	15
V	**Real Memory organization and Management**: Memory organization, Memory management, Memory hierarchy, Memory management strategies, contiguous vs non- contiguous memory allocation, single user contiguous memory allocation, fixed partition multiprogramming, variable partition multiprogramming, Memory swapping **Virtual Memory organization:** virtual memory basic concepts, multilevel storage organization, Block mapping, paging basic concepts, segmentation, paging/segmentation systems. **Virtual Memory Management:** Demand Paging, Page replacement strategies	15
	Total	**75**

Course outcomes		Programme Outcomes
CO	On completion of this course, students will	
1	Define the fundamentals of OS and identify the concepts relevant to process, process life cycle, Scheduling Algorithms, Deadlock and Memory management	PO1
2	Know the critical analysis of process involving various algorithms, an exposure to threads and semaphores	PO1,PO2
3	Have a complete study about Deadlock and its impact over OS. Knowledge of handling Deadlock with respective algorithms and measures to retrieve from deadlock.	PO4,PO6
4	Have complete knowledge of Scheduling Algorithms and its types.	PO4,PO5,PO6
5	Understand memory organization and management	PO3,PO8
Text Book		
1	H.M.Deitel,OperatingSystems,ThirdEdition,PearsonEducationAsia,2011	
Reference Books		
1.	William Stallings, Operating System: Internals and Design Principles, Seventh Edition, Prentice-Hall of India, 2012.	
2.	A.Silberschatz, and P.B. Galvin., Operating Systems Concepts, Nineth Edition, JohnWiley&Sons(ASIA)PteLtd.,2012	
Web Resources		
1.		
2.		

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**-**	**1**	**2**	**-**	**1**
CO2	**2**	**3**	**1**	**2**	**-**	**1**
CO3	**3**	**2**	**-**	**3**	**-**	**1**
CO4	**1**	**3**	**1**	**1**	**3**	**2**
CO5	**3**	**-**	**1**	**3**	**2**	**1**
Weightage of course contributed to each PSO	12	8	4	11	5	6

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Hours	Marks		
									CIA	External	Total
23122AEC52	ASP.Net Programming	Core	5	1	-	3		5	25	75	100
Course Objective											
LO1	To identify and understand the goals and objectives of the .NET framework and ASP.NET with C# language.										
LO2	To develop ASP.NET Web application using standard controls.										
LO3	To implement file handling operations.										
LO4	TohandlesSQLServerDatabaseusingADO.NET.										
LO5	Understand the Grid view control and XML classes.										
UNIT	**Details**							**No. of Hours**			
I	Overview of .NET framework: Common Language Runtime (CLR), Framework Class Library-C# Fundamentals: Primitive types and Variables – Operators –Conditional statements-Looping statements –Creating and Using Objects–Arrays–String operations.							15			
II	Introduction to ASP.NET-IDE-Language supported Components-Working with Web Forms– Web form standard controls: Properties and its events–HTML Controls-List Controls: Properties and its events.							15			
III	Rich Controls: Properties and its events–validation controls: Properties and its events– File Stream classes - File Modes – File Share – Reading and Writing to files – Creating, Moving, Copying and Deleting files –File uploading.							15			
IV	ADONET Overview–Database Connections–Commands –Data Reader- Data Adapter- Data Sets- Data Controls and							15			

	Its Properties–Data Binding	
V	Grid View control: Deleting, editing, Sorting and Paging.XML classes–Web form to manipulate XML files-Website Security-Authentication-Authorization– Creating a Web application.	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Develop working knowledge of C# programming constructs and the .NET Framework	PO1,PO2,PO6
2	To develop a software to solve real-worldproblemsusingASP.NET	PO2,PO3,PO8
3	To Work On Various Controls Files	PO1,PO3,PO7
4	To create a web application using Microsoft ADO.NET.	PO2,PO6
5	To develop web applications using XML	PO1,PO3,PO8

Text Book

1	Svetlin Nakov, VeselinKolev &Co, Fundamentals of Computer Programming with C#, Faber publication, 2019.
2	Mathew, MacDonald, The completeReferenceASP.NET, TataMcGraw-Hill,2015.

Reference Books

1.	Herbert Schildt, The Complete Reference C#. NET, Tata McGraw-Hill, 2017.
2.	Kogent Learning Solutions, C# 2012 Programming Covers .NET4.5BlackBook, Dream tech press, 2013.
3.	Anne Boehm, Joe lMurach, Murach‘sC#2015, Mike Murach & AssociatesInc.2016.
4.	Denielle Otey, MichaelOtey, ADO.NET: The Complete reference, McGraw Hill, 2008.
5.	Matthew Mac Donald, Beginning ASP.NET 4 in C# 2010, A PRESS, 2010.

Web Resources

1.	https://www.geeksforgeeks.org/introduction-to-net-framework/
2.	https://www.javatpoint.com/net-framework

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**1**	**2**	**2**	**1**	3
CO2	**3**	**2**	**2**	**2**	**2**	3
CO3	**3**	**3**	**2**	**2**	**3**	3
CO4	**3**	**1**	**2**	**2**	**1**	3
CO5	**3**	**1**	**2**	**2**	**1**	2
Weightage of course contributed to each PSO	15	8	10	10	8	14

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23122AEC53	**Information Security**	**Elective**	5	-	-	4		4	25	75	100

Course Objectives	
LO1	To know the objectives of information security
LO2	Understand the importance andapplicationofeachofconfidentiality,integrity,authenticationand availability
LO3	Understand various cryptographic algorithms
LO4	Understand the basic categories of threats to computers and networks
LO5	To study about the concepts of security in networks, web security

UNIT	**Details**	**No. of Hours**
I	Introduction to Information Security: Security mindset, Computer Security Concepts(CIA), Attacks, Vulnerabilities and protections, Security Goals, Security Services, Threats, Attacks, Assets, malware, program analysis and mechanisms	12
II	The Security Problem in Computing: The meaning of computer Security, Computer Criminals, Methods of Defense. Cryptography: Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption	12
III	Symmetric and Asymmetric Cryptographic Techniques: DES, AES, RSA algorithms .Authentication and Digital Signatures: Use of Cryptography for authentication, Secure Hash function, Key management–Kerberos	12

IV	Program Security : Non-malicious Program errors –Buffer overflow, Incomplete mediation, Time-of-check to Time-of- use Errors, Viruses, Trapdoors, Salami attack, Man-in-the- middle attacks, Covert channels. File protection Mechanisms, User Authentication Designing Trusted O.S: Security polices, models of security, trusted O.S design, Assurance in trusted O.S. Implementation examples	12
V	Security in Networks: Threats in networks, Network Security Controls–Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honey pots, Traffic flow security. Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction	12
	Total	**60**

Course Outcomes

Course Outcomes	On completion of this course, students will;	**Programme Outcomes**
CO1	Understand network security threats, security services, and counter measures	PO1
CO2	Understand vulnerability analysis of network security	PO1,PO2
CO3	Acquire background on hash functions; authentication; firewalls; intrusion detection techniques	PO4,PO6
CO4	Gain hands-on experience with programming and simulation techniques for security protocols.	PO4,PO5,PO6
CO5	Apply methods for authentication, access control, Intrusion detection and prevention	PO3,PO8

Text Books

(Latest Editions)

1.	Security in Computing, Fourth Edition, by Charles. Pfleeger, Pearson Education
2.	Cryptography And Network Security Principles And Practice, Fourth or Fifth Edition, William Stallings, Pearson
References Books **(Latest editions, and the style as given below must be strictly adhered to)**	
1.	Cryptography and Network Security: CKShyamala, NHarini, Dr TR Padmanabhan,WileyIndia,lst Edition
2.	Cryptography and Network Security: Forouzan Mukho padhyay, McGraw Hill,2"dEdition
3.	Information Security, Principles and Practice: Mark Stamp, Wiley India
4.	Principles of Computer Security: WM.Arthur Conklin, Greg White, TMH
Web Resources	
1.	https://www.geeksforgeeks.org/what-is-information-security/
2.	https://www.tutorialspoint.com/what-is-information-security#:~:text=Information%20security%20is%20designed%20and,destruction%2C%20alteration%2C%20and%20disruption.

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**3**	**1**	**2**	**3**	**2**
CO2	**2**	**-**	**1**	**-**	**3**	**2**
CO3	**-**	**3**	**1**	**3**	**-**	**-**
CO4	**2**	**3**	**1**	**3**	**3**	**-**
CO5	**2**	**3**	**1**	**3**	**3**	**2**
Weightage of course contributed to each PSO	8	12	5	11	12	6

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23122DSC54A	**Database Management System**	Core	4	-	-	4		4	25	75	100

Course Objective	
LO1	To enable the students to learn the designing of database systems, foundation on the Relational model of data and normal forms.
LO2	To understood the concepts of database management system, designs implement Database Models
LO3	To learn and understand to write queries using SQL, PL/SQL.
LO4	To enable the students to learn the designing of database systems, foundation on the Relational model of data and normal forms.
LO5	To understood the concepts of database management system, design simple Database Models

UNIT	**Details**	**No. of Hours**
	Database Concepts: Database Systems-Data vs Information - Introducing the database -File system - Problems with file system – Database systems. Data models-Importance-Basic Building Blocks-Business rules - Evolution of Data models - Degrees of Data Abstraction	12
II	**Design Concepts:** Relational database model – logical view of data-keys-Integrity rules-relational set operators – data dictionary and the system catalog-relationships-data redundancy revisited- indexes-codd's rules. Entity relationship model-ER diagram	12
III	**Normalization of Database Tables**: Database tables	12

	and Normalization – The Need for Normalization – The Normalization Process–Higher level Normal Form. **Introduction to SQL**: Data Definition Commands– Data Manipulation Commands– SELECT Queries–Additional Data Definition Commands– Additional SELECT Query Keywords–Joining Database Tables.	
IV	**Advanced SQL**: Relational SET Operators: UNION –UNIONALL–INTERSECT-MINUS. SQL Join Operators: Cross Join – Natural Join – Join USING Clause – JOIN ON Clause – Outer Join. **Sub Queries and Correlated Queries**: WHERE – IN – HAVING – ANY and ALL – FROM. SQL Functions: Date and Time Function–Numeric Function–String Function–Conversion Function	12
V	**PL/SQL:** A Programming Language: History– Fundamentals – Block Structure – Comments – Data Types – Other Data Types – Variable Declaration – Assignment operation –Arithmetic operators. **Control Structures and Embedded SQL**: Control Structures –Nested Blocks–SQL in PL/SQL–Data Manipulation – Transaction Control statements.**PL/SQL Cursors and Exceptions**: Cursors – Implicit Cursors, Explicit Cursors and Attributes–Cursor FOR loops– SELECT…FOR UPDATE – WHERE CURRENT OF clause – Cursor with Parameters – Cursor Variables –Exceptions–Types of Exceptions.	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	

1	Understand the various basic concepts of Data Base System. Difference between file system and DBMS And compare various data models.	PO1
2	Define the integrity constraints. Understand the Basic concepts of Relational Data Model, Entity-Relationship Model.	PO1,PO2
3	Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML)	PO4,PO6
4	Classify the different functions and various join Operations and enhance the knowledge of handling Multiple tables.	PO4,PO5,PO6
5	Learn to design Database operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop program using Cursors, Exceptions	PO3,PO8
Text Book		
1	Coronel, Morris,Rob,"Database Systems, Design, Implementation and Management", Ninth Edition	
2	NileshShah,"DatabaseSystemsUsingOracle",2nd edition,PearsonEducationIndia,2016	
Reference Books		
1.	Abraham Silberschatz, Henry F.Korth and S.Sudarshan,―Database System Concepts‖, McGraw Hill International Publication, VI Edition	
2.	Shio Kumar Singh,―Database Systems―,Pearson publications, I Edition	
Web Resources		
1.	Web resources from NDL Library, E-content from open-source libraries	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	3
CO2	3	3	3	3	2	3
CO3	3	3	3	3	3	3
CO4	3	3	2	3	3	3
CO5	3	3	3	3	3	2
Weightage of course contributed to each PSO	15	15	14	15	14	14

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23122DSC54B	**Agile Project Management**	Elective	4	-	-	-	3	4	25	75	100
Course Objective											
LO1	Learning of software design, software technologies and APIs.										
LO2	Detailed demonstration about Agile development and testing techniques.										
LO3	Learning about Agile Planning and Execution.										
LO4	Learning of Agile Management Design and Quality Check.										
LO5	Detailed examination of Agile development and testing techniques.										
UNIT	**Details**										**No.of Hours**
I	**Introduction: Modernizing Project Management: Project** Management Needed a Makeover–Introducing Agile Project Management. **Applying the Agile Manifesto and Principles:** Understanding the Agile manifesto – Outlining the four values of the Agile manifesto – Defining the 15 Agile Principles – Adding the Platinum Principles – Changes as a result of Agile Values–The Agile must test. **Why Being Agile Works Better:** Evaluating Agile benefits – How Agile approaches beat historical approaches – Why people like being Agile.										12
II	**Being Agile** **Agile Approaches:** Diving under the umbrella of Agile approaches – Reviewing the Big Three: Lean, Scrum, Extreme Programming- Summary										12

	Agile Environments in Action: Creating the physical environment– Low –tech communicating–High-tech communicating–Choosing tools. **Agile Behaviours in Action:** Establishing Agile roles–Establishing new values–Changing team philosophy.	
III	**Agile Planning and Execution** **Defining the Product Vision and Roadmap:** Agile planning–Defining the product vision – Creating a product roadmap – Completing the product backlog. **Planning Releases and Sprints:** Refining requirements and estimates – Release planning–Sprint planning. **Working Throughout the Day:** Planning your day–Tracking progress – Agile roles in the sprint – Creating shippable functionality – The end of the day. **Showcasing Work, Inspecting and Adapting:** The sprint review – The sprint retrospective. **Preparing for Release:** Preparing the product for deployment (the release sprint) – Preparing the operational support–Preparing the organization for product deployment - Preparing the market place for product deployment	12
IV	**Agile Management** **Managing Scope and Procurement:** What‘s different about Agile scope management–Managing Agile scope–What‘s different about Agile procurement–Managing Agile procurement. **Managing Time and Cost:** What‘s different about Agile time management– Managing Agile schedules–What‘s different about Agile cost management–Managing Agile budgets. **Managing Team Dynamics and Communication:** What‘s different about Agile team dynamics– Managing Agile team dynamics–What‘s	12

	Different about Agile communication–Managing Agile communication. **Managing Quality and Risk:** What's different about Agile quality–Managing Agile quality–What's different about Agile risk management –Managing Agile risk.	
V	**Implementing Agile** **Building a Foundation:** Organizational and individual commitment – Choosing the right pilot team members– Creating an environment that enables Agility–Support Agility initially and overtime. **Being a Change Agent:** Becoming Agile requires change–why change doesn't happen on its own – Platinum Edge's Change Roadmap – Avoiding pitfalls– Signs your changes are slipping. **Benefits, Factors for Success and Metrics:** Ten key benefits of Agile project management – Ten key factors for project success – Ten metrics for Agile Organizations.	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understanding of software design, software technologies and APIs using Agile Management.	PO1
2	Understanding of Agile development and testing techniques.	PO1,PO2
3	Understanding about Agile Planning and Execution using Sprint.	PO4,PO6
4	Understanding of Agile Management Design, scope, Procurement, managing Time and Cost and Quality Check.	PO4,PO5,PO6

5	Analyzing of Agile development and testing techniques.	PO3,PO8
Text Book		
1	MarkC.Layton, Steven J. Ostermiller, Agile Project Management for Dummies, 2nd Edition, Wiley India Pvt. Ltd., 2018.	
	Jeff Sutherland, Scrum – The Art of Doing Twice the Work in Half the Time, Penguin, 2014.	
Reference Books		
1.	Mark C. Layton, David Morrow, *Scrum for Dummies*, 2nd Edition, Wiley India Pvt. Ltd., 2018.	
2.	Mike Cohn, Succeeding with Agile–Software Development using Scrum, Addison-Wesley Signature Series, 2010.	
3.	Alex Moore, Agile Project Management, 2020.	
4.	Alex Moore, *Scrum*, 2020.	
5.	Andrew Stellman and Jennifer Greene, *Learning Agile: Understanding Scrum, XP, Lean, and Kanban*, Shroff/O'Reilly, First Edition, 2014.	
Web Resources		
1.	www.agilealliance.org/resources	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**3**	**1**	**2**	**1**	**2**
CO2	**3**	**1**	**2**	**1**	**3**	**1**
CO3	**3**	**2**	**1**	**1**	**3**	**1**
CO4	**3**	**2**	**3**	**2**	**1**	**3**
CO5	**2**	**3**	**1**	**2**	**3**	2
Weightage of course Contributed to each PSO	13	11	8	8	11	9

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.Hours	Marks		
									CIA	External	Total
23122DSC54C	Cloud Computing	Elective	4	-	-	-	3	4	25	75	100

Course Objective	
LO1	Learning fundamental concepts and Technologies of Cloud Computing.
LO2	Learning various cloud service types and their uses and pitfalls.
LO3	To learn about Cloud Architecture and Application design.
LO4	To know the various aspects of application design, benchmarking and security on the Cloud.
LO5	To learn the various Case Studies in Cloud Computing.

UNIT	Details	No. of Hours
I	Introduction to Cloud Computing: Definition of Cloud Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples–Cloud-based Services and Applications. Cloud Concepts and Technologies: Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Software Defined Networking–Network Function Virtualization– Map Reduce – Identity and Access Management–Service Level Agreements–Billing.	12
II	Cloud Services Compute Services: Amazon Elastic Computer Cloud - Google Compute Engine-Windows Azure Virtual Machines Storage Services: Amazon Simple Storage Service –Google Cloud Storage-Windows Azure storage Database Services: Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure SQL Database- Windows Azure Table Service Application Services: Application Runtimes and Frameworks – Queuing Services-Email Services-Notification Services-Media Services Content Delivery Services: Amazon Cloud Front- Windows Azure Content Delivery Network Analytics Services: Amazon Elastic Map Reduce - Google Map Reduce Service-Google Big Query-Windows Azure HD Insight	12

	Deployment and Management Services: Amazon Elastic Bean stack- Amazon Cloud Formation Identity and Access Management Services: Amazon Identity and Access Management-Windows Azure Active Directory Open Source Private Cloud Software: Cloud Stack– Eucalyptus - Open Stack	
III	**Cloud Application Design:** Introduction – Design Consideration forCloudApplications–Scalability–ReliabilityandAvailability–Security – Maintenance and Up gradation – Performance – Reference Architectures for Cloud Applications–Cloud Application Design Methodologies: Service Oriented Architecture(SOA),Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), Restful Web Services –Data Storage Approaches: Relational Approach (SQL), Non-Relational Approach(No SQL).	12
IV	**Cloud Application Benchmarking and Tuning:** Introduction to Benchmarking – Steps in Benchmarking – Workload Characteristics – Application Performance Metrics–Design Consideration for Benchmarking Methodology–Benchmarking Tools and Types of Tests –Deployment Prototyping. **Cloud Security:** Introduction – CSA Cloud Security Architecture – Authentication (SSO)–Authorization–Identity and Access Management – Data Security: Securing data at rest, securing data in motion –Key Management–Auditing.	12
V	**Case Studies:** Cloud Computing for Healthcare – Cloud Computing for Energy Systems - Cloud Computing for Transportation Systems – Cloud Computing for Manufacturing Industry-Cloud Computing for Education.	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the fundamental concepts and Technologies in Cloud Computing.	PO1
2	Able to understand various cloud service types and their uses and pitfalls.	PO1,PO2
3	Able to understand Cloud Architecture and	PO4,PO6

	Application design.	
4	Understand the various aspects of application design, benchmarking and security in the Cloud.	PO4,PO5,PO6
5	Understand various Case Studies in Cloud Computing.	PO3,PO8
Text Book		
1	Arshdeep Bahga, Vijay Madisetti, *Cloud Computing–A Hands On Approach*, Universities Press(India) Pvt.Ltd.,2018	
Reference Books		
1.	AnthonyT Velte,TobyJVelte, Robert Elsenpeter, *Cloud Computing: A Practical Approach*, Tata McGraw-Hill, 2013.	
2.	Barrie Sosinsky, *Cloud Computing Bible*, Wiley India Pvt. Ltd., 2013.	
3.	David Crookes, *Cloud Computing in Easy Steps*, Tata McGraw Hill, 2015.	
4.	Dr.Kumar Saurabh, *Cloud Computing*, Wiley India, Second Edition 2012.	
Web Resources		
1.	https://en.wikipedia.org/wiki/Cloud_computing	
2.	https://link.springer.com/chapter/10.1007/978-3-030-34957-8_7	
3.	https://webobjects.cdw.com/webobjects/media/pdf/solutions/cloud-computing/121838-CDW-Cloud-Computing-Reference-Guide.pdf	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**2**	**2**	**3**	**3**	**1**
CO2	**3**	**1**	**2**	**3**	**3**	**-**
CO3	**3**	**2**	**1**	**2**	**1**	**3**
CO4	**3**	**3**	**2**	**3**	**2**	**-**
CO5	**2**	**2**	**1**	**3**	**3**	**3**
Weightage of course contributed to each PSO	13	10	8	14	12	7

S-Strong-3 M-Medium-2L-Low-1

Course Code	Course Title	L	T	P	C
23122DSC55A	Disaster Management	4	0	0	4

AIM: Disaster management aims to reduce, or avoid the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery.

Course Objectives:

1. To provide students an understanding the need for studying the disaster management
2. Develop an understanding about the various types of disasters.
3. To expose students to the risk and vulnerability analysis
4. To create awareness about disaster prevention and risk reduction
5. To establish relationship between disasters and developments.
6. To understand Rehabilitation, Reconstruction and Recovery in the event of Disaster
7. To gain knowledge on Climate Change Adaptation and IPCC Scenario and Scenarios in the context of India.

Course Outcomes:

CO1: Understand the need and significance of studying disaster management

CO2: Understand the different types of disasters and causes for disasters.

CO3: Gain knowledge on the impacts Disasters on environment and society

CO4: Study and assess vulnerability of a geographical area.

CO5: Students will be equipped with various methods of risk reduction measures and risk mitigation.

CO6: Understand the role of Information Technology in Disaster Management

CO7: Understand Geographical Information System applications in Disaster Management

Content of Course
Unit I: Introduction to Disasters
Chapter No.1 Disaster: Concept, Meaning, and Definition **Chapter No.2** History of Major Disaster Events in India **Chapter No.3** Types of Disasters– Natural Disasters: Famine, Drought, Flood, Cyclone, Tsunami, Earthquake
Unit II: Disaster Mitigation and Disaster Management
Chapter No. 4 Man-made Disasters: Riots, Blasts, Industrial, Militancy **Chapter No. 5** Profile, Forms and Reduction of Vulnerability **Chapter No. 6** Disaster Mitigation: Concept and Principles
Unit III: Impact of Disaster
Chapter No.7 Disaster Management: Concept and Principles **Chapter No.8** Pre-disaster- Prevention and Preparedness **Chapter No.9** Physical, Economic, Social, Psycho-socio Aspects, Environmental Impacts
Unit IV: Disaster Process and Intervention
Chapter No.10 During Disaster-Rescue and Relief **Chapter No.11** Post-disaster-Rehabilitation and Reconstruction **Chapter No.12** Victims of Disaster- Children, Elderly, and Women **Chapter No.13** Displacement-Causes , Effects and Impact
Unit V: Disaster Intervention
Chapter No.14 Major Issues and Dynamics in the Administration of Rescue,Relief, Reconstruction and Rehabilitation **Chapter No.15** Components of Rescue, Relief, Reconstruction; Rehabilitation **Chapter No.16** Disaster Policy in India; Disaster Management Authority-NDMA, SDMA, DDMA; Disaster Management Act, 2005

Key *Words:* Disaster, Disaster Mitigation, Disaster Management and Disaster Process

References:

Anil Sinha (2001), Disaster Management-Lessons Drawn and Strategies for Future. New Delhi, Jain Publications.

Backer, C.W. and Chapman.(ed.).(1969),Man and Society in Disasters, New Delhi,

Clarke, J.I., Peter Curson, et.al.(ed.)(1991),Population and Disaster,Oxford,Basil Blackwell Ltd.

Cuny, Frederick(1984), Disasters and Development,Oxford,Oxford University Press. Disaster Management Act 2005

Garb,S. and Eng.(1969),Disasters Hand Book, New York, Springer.

Gupta, M.C, L.C. Gupta, B. K. Tamini and Vinod K. Sharma (2000), Manual on Natural Disaster Management in India, New Delhi, National Institute of Disaster Management. Hoff, A. (1978),People in Crisis-Understanding and Helping, California,AddisonWesley.

Maskrey, Andrew (1989), Disaster Mitigation: A Community Based Approach, Oxford, Oxfarm.

Narayan, Sachindra (ed.) (2000), Anthropology of Disaster Management, New Delhi, Gyan Publishing House.

Nidhi G Dhawan (2014), Disaster Management and Preparedness, New Delhi, Jain Publications.

Parasuraman, S. and Unnikrishnan, P.V. (2000), India Disasters Report: Towards Policy Initiative, New Delhi, and Oxford University Press.

Satendra, K.J. Anandha Kumar and V.K.Naik (2013), India's Disaster Report, New Delhi, National Institute of Disaster Management.

Singh, R.B. (ed.) (2000), Disaster Management, New Delhi, Rawat Publications.

Sinha, P.C. (ed.) (1998), Encyclopedia of Disaster Management (Vol.1-10), New Delhi, Anmol Publications.

Tata Institute of Social Sciences (2002). Special Volume on Disaster Management, Indian Journal of Social Work, Vol.63, Issue 2, April.

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23122DSC55B	**Artificial Neural Networks**		4	-	-	-	3	4	25	75	100
Course Objective											
LO1	**Understand the basics of artificial neural networks, learning process, single layer And multi-layer perceptron networks.**										
LO2	Understand the Error Correction and various learning algorithms and tasks.										
LO3	Identify the various Single Layer Perception Learning Algorithm.										
LO4	Identify the various Multi-Layer Perception Network.										
LO5	Analyze the Deep Learning of various Neural network and its Applications.										
UNIT	**Details**										**No. of Hours**
I	Artificial Neural Model-Activation functions-Feed forward and Feedback, Convex Sets, Convex Hull and Linear Reparability, Non- Linear Separable Problem - Multilayer Networks. Learning Algorithms- Error correction-Gradient Descent Rules, Perception Learning Algorithm, Perception Convergence Theorem.										12
II	Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation.										12
III	Single layer Perception: Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, Learning in continuous perception. Limitation of Perception.										12
IV	Multi-Layer Perception Networks: Introduction, MLP with2hidden layers, Simple layer of a MLP, Delta learning rule of the output layer,										12
	Multi-layer feed forward neural network with continuous perceptions, Generalized dealt a learning rule, Back propagation algorithm										

V	Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neo cognition, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzmann Machines, Training of DNN And Applications	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Students will learn the basics of artificial neural networks with single layer and multi-layer Perception networks.	PO1
2	Learn about the Error Correction and various Learning algorithms and tasks.	PO1,PO2
3	Learn the various Perception Learning Algorithm.	PO4,PO6
4	Learn about the various Multi-Layer Perception Network.	PO4,PO5,PO6
5	Understand the Deep Learning of various Neural Network and its Applications.	PO3,PO8

Text Book	
1	Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill-Second Edition.
2.	―Neural Network- A Comprehensive Foundation‖-Simon Haykins, Pearson Prentice Hall, 2nd Edition,1999.
Reference Books	
1.	Artificial Neural Networks- B.Yegnanarayana, PHI, New Delhi1998.
Web Resources	
1.	https://www.w3schools.com/ai/ai_neural_networks.asp
2.	https://en.wikipedia.org/wiki/Artificial_neural_network
3.	https://link.springer.com/chapter/10.1007/978-3-642-21004-4_12

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23122DSC55C	Mobile Adhoc Network		4	-	-	-	3	4	25	75	100

UNIT-1

INTRODUCTION: Introduction to ad-hoc networks–definition, characteristics features, applications. Characteristics of wireless channel, ad-hoc mobility models: indoor and outdoor models.

UNIT-2

MEDIUM ACCESS PROTOCOLS:

MAC Protocols: Design issues, goals and classification. Contention based protocols–with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15.HIPERLAN.

UNIT-3

NETWORK PROTOCOLS:

Routing Protocols: Design issues, goals and classification. Proactive vs reactive routing, unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, energy aware routing algorithm, hierarchical routing, QoSaware routing.

UNIT-4

END–END DELIVERY AND SECURITY:

Transport Layer: Issues in designing – Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

UNIT–5

CROSS LAYER DESIGN:

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of adhoc with Mobile IP networks.

TEXT BOOKS:

1. C.SivaRamMurthy and B.S.Manoj, Adhoc Wireless Networks Architecture and Protocols, 2nd edition, Pearson Edition, 2007.
2. Charles Perkins, Adhoc Networking, Addison–Wesley, 2000.

REFERENCES:

1. Stefano Basagni, MarcoConti, Silvia Giordano and Ivanstojmenovic, Mobile ad-hoc networking, Wiley-IEEE press, 2004.
2. Mohammad Ilyas, The handbook of ad-hoc wireless networks, CRC press, 2002.
3. T.Camp,J.Boleng, and V.Davies"A Survey of Mobility Models for Ad-hoc Network"
4. Research, "Wireless Commun, and MobileComp.Special Issue on Mobile Ad-hoc Networking Research, Trends and Applications, Vol.2, no.5, 2002, pp.483–502.
5. A survey of integrating IP mobility protocols and Mobile Ad-hoc networks, Fekri M.bduljalil and Shrikant K.Bodhe, IEEE communication Survey and tutorials, no: 12007.

Subject Code	Subject Name	Category	L	T	P	C		Inst.	Marks		
									CIA	External	Total
23122AEC56L	**ASP.Net Programming LAB**	Core	-	-	3	3		5	25	75	100
Course Objective											
LO1	To develop ASP.NET Web application using standard controls.										
LO2	To create rich database applications using ADO .NET.										
LO3	To implement file handling operations.										
LO4	To implement XML classes.										
LO5	To utilize ASP.NET security features for authenticating the website										
Sl. No	**Programs**										
1.	Create an exposure of Web applications and tools										
2.	Implement the Html Controls										
3.	Implement the Server Controls										
4.	Web application using Web controls.										
5.	Web application using List controls.										
6.	Web Page design using Rich control. Validate user input using Validation controls. Working with File concepts.										
7.	Web application using Data Controls.										
8.	Data binding with Web controls										
9.	Data binding with Data Controls.										
10.	Database application to perform insert, update and delete operations.										
11.	Database application using Data Controls to Perform insert, delete, edit, paging and sorting operation.										

12.	Implement the Xml classes.	
13.	Implement Authentication–Authorization.	
14.	Ticket reservation using ASP.NET controls.	
15.	Online examination using ASP.NET controls	
	Total	
Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	To create web applications and implement various controls	PO1,PO2,PO6
2	Create a web pages in Rich control.	PO3,PO8
3	Develop knowledge about file handling operations	PO1,PO4,PO8
4	An ability to design XML classes	PO2,PO6,PO7
5	To develop a software to solve real-world problems using ASP.NET	PO1,PO3,PO5,PO8
Text book		
1	Svetlin Nakov, Veselin Kolev & Co, Fundamentals of Computer Programming with C#, Faber publication, 2019.	
2	Mathew, MacDonald, The Complete Reference ASP.NET, Tata McGraw-Hill, 2015.	
Reference Books		
1.	Herbert Schildt, The Complete Reference C#. NET, Tata McGraw-Hill, 2017.	
2.	Kogent Learning Solutions, C# 2012 Programming Covers .NET4.5 Black Book, Dream tech press, 2013.	
3.	Anne Boehm, Joel Murach , Murach‘s C# 2015, Mike Murach & Associates Inc.2016.	
4.	Denielle Otey, Michael Otey,ADO.NET: The Complete reference, McGraw Hill,2008.	
5.	Matthew MacDonald, Beginning ASP.NET4 in C# 2010, A PRESS, 2010.	
Web Resources		
1.	https://www.geeksforgeeks.org/introduction-to-net-framework/	
2.	https://www.javatpoint.com/net-framework	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**2**	**2**	**1**	1
CO2	**3**	**2**	**3**	**2**	**2**	2
CO3	**3**	**3**	**2**	**2**	**1**	1
CO4	**3**	**2**	**3**	**2**	**1**	1
CO5	**3**	**2**	**2**	**2**	**1**	2
Weightage of course contributed to each PSO	**15**	11	12	10	6	7

S-Strong-3 M-Medium-2L-Low-1

23122SEC57	Internship / Industrial Training				2

231ACLSPSL	Professional Skills	-	-	-	1

231AECCVED	Value Education	2	-	-	2

Course Objectives:

- To understand the meaning of values
- To interpret Indian culture in a scientific manner
- To assess the values of health, mind, aestheticism, spiritualism,
- To evaluate the impact of society
- To appraise moral values in the society

Unit: I	**Introduction to Value Education**

Value Education–Definition, Views on Education–Socrates ,Plato, Aristotle, Mahatma Gandhi, Swami Vivekananda, Sri Aurbindo, Rabindrath Tagore and Dr.R.Radhakrishnan– Concept of Human Values–Family Values–Aesthetic Values–Ethical Values–Spiritual Values

Unit: II	**Character Formation–Personal &Personality Development**

Self-Discipline–Self-Confidence–Self-Initiative–Self-awareness–Empathy–Compassion–Forgiveness–Honestyand Courage Leadership qualities–Personality Development

Unit: III	**Religious Values and Communal Harmony**

Introduction to Religious Vales– Karma Yoga in Hinduism–Love and Justice in Christianity–Brotherhood in Islam–Compassion in Buddhism–Ahimsa in Jainism Courage in Sikhism–Need for Religious Harmony

Unit :IV	**The Power of Mind–Therapeutic Measures**

Controlling Mind–Physical Exercise–Meditation–Mudras–Yoga–Asanas Concept of Mind in the Upanishads–Moralization of Desires–Neutralization of Anger–Five Ways to Check Worry Habit and Eradication–Benefits of Blessings The Power of Mind–the Power of Positive Thinking

Unit: V	Human Rights and Universal Values	

Concept of Human Rights–Classifications–Human Rights of Women and Children–Violation and Redressal–Safeguards Universal Values– Mutual respect for different cultures, people in India and across the globe

Books for Study:

1. Materials will be prepared by Dr.V.P.Rathiand Dr.R.Meenakshi Devi

Books for References:

1. Das,M.S.&Gupta,V.K.:*SocialValuesamongYoungadults:AchangingScenario*,M.D.Publications,NewDelhi,1995.
2. Jash,P. *Glimpses of Hindu Cults and Culture*, Sundeep Prakashan, Deli,1997.NCERT,Education in Values,NewDelhi,1992.
3. R. C. Pradhan, "Language and Mind in the Upanishads", *Language and Mind: The Classical Indian Perspective*, ed. K. S. Prasad, Hyderabad Studies in Philosophy no. 5, Decent Books, New Delhi,2008.
4. Vincent Peale, Norman. *Six Attitudes for Winners*, Jaico Publishing Hose, Mumbai,2009.
5. Vivekananda, Swami. "Personality Development", Advaita Ashrama, Kolkata,2008.

Web Resources:

https://www.hzu.edu.in/bed/Basics-in-Education%20(NCERT).pdfhttps://nptel.ac.in/content/storage2/courses/109101003/downloads/Lecture-notes/Lecture-6.pdf

https://nptel.ac.in/content/storage2/courses/109104115/PDF/lec38.pdf

Course Outcomes		K Level
CO1:	Understand the meaning of values and culture	K2
CO2:	Develop as socially responsible citizens	K3
CO3:	Create a communal harmonious society and practice unity in diversity	K6
CO4:	Identify the power oft thoughts and words	K3
CO5:	Correlate the relationship between values and human rights	K4

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23122AEC61	Computer Networks	CORE/ Elective	5	1	-	4		5	25	75	100

Course Objective	
LO1	To understand the concept of Data communication and Computer network
LO2	To get a knowledge on routing algorithms.
LO3	To impart knowledge about networking and inter-networking devices
LO4	To study about Network communication.
LO5	To learn the concept to Transport layer

UNIT	Details	No.of Hours
I	Introduction–Network Hardware–Software–Reference Models–OSI and TCP/IP Models – Example Networks: Internet, ATM, Ethernet and Wireless LANs-Physical Layer–Theoretical Basis for Data Communication-Guided Transmission Media	15
II	Wireless Transmission- Communication Satellites–Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues–Error Detection and Correction.	15
III	Elementary Data Link Protocols - Sliding Window Protocols – Data Link Layer in the Internet - Medium Access Layer – Channel Allocation Problem–Multiple Access Protocols–Bluetooth	15
IV	Network Layer-Design Issues-Routing Algorithms-Congestion Control Algorithms– IP Protocol–IP Addresses–Internet Control Protocols.	15
V	Transport Layer-Services-Connection Management-Addressing, Establishing and Releasing a Connection–Simple Transport Protocol–Internet Transport Protocols (ITP)-Network Security: Cryptography.	15
	Total	**75**

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
1	To Understand the basics of Computer Network architecture, OSI and TCP/IP reference model	PO1

2	To gain knowledge on Telephone systems using Wireless network	PO1,PO2
3	To understand the concept to fMAC	PO4,PO6
4	To analyze the characteristics of Routing and Congestion control algorithms	PO4,PO5,PO6
5	To understand network security an define various Protocols such as FTP, HTTP, Telnet, DNS	PO3,PO8
Text Book		
1	A.S. Tanenbaum,—Computer Networks‖, 4th Edition, Prentice-Hall of India, 2008.	
Reference Books		
1.	B.A.Forouzan,—DataCommunicationsandNetworking‖,TataMcGrawHill,4th Edition,2017	
2.	F. Halsall, —Data Communications, Computer Networks and Open Systems‖,PearsonEducation,2008	
3.	D.Bertsekasand R. Gallagher, —Data Networks‖, 2nd Edition, PHI, 2008.	
4.	Lamarca,—Communication Networks ‖,TataMcGraw-Hill,2002	
Web Resources		
1.	https://en.wikipedia.org/wiki/Computer_network	
2.	https://citationsy.com/styles/computer-networks	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**-**	**2**	**1**	**-**
CO2	**3**	**2**	**1**	**2**	**2**	**-**
CO3	**3**	**-**	**-**	**2**	**-**	**2**
CO4	**3**	**1**	**-**	**2**	**1**	**-**
CO5	**3**	**3**	**-**	**2**	**1**	**-**
Weightage of course Contributed to each PSO	15	8	1	10	5	2

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst.Hours	Marks		
									CIA	External	Total
23122AEC62	Data Analytics Using R Programming	Core	5	-	-	4		6	25	75	100

Course Objective	
LO1	To understand the problem solving approaches
LO2	To learn the basic programming constructs in R Programming
LO3	To learn the basic programming constructs in R Programming
LO4	To use R Programming data structures-lists, tuples, and dictionaries.
LO5	To do input/output with files in R Programming.

UNIT	Details	No.of Hours
I	Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value –Understanding Big Data Storage —A General Overview of High-Performance Architecture—HDFS— Map Reduce and YARN— Map Reduce Programming Model	18
II	CONTROL STRUCTURES AND VECTORS - Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical	18

	Operations, Vector Indexing, Common Vector Operations	
III	LISTS- Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations	18
IV	FACTORS AND TABLES-Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables, Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and maxima, Calculus, Functions for Statistical Distributions R PROGRAMMING.	18
V	OBJECT-ORIENTED PROGRAMMING S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an SClass, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation	18
	Total	**90**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data utilizing clustering and classification algorithms.	PO1,PO2

3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4,PO6
4	Perform analytics on data streams.	PO4,PO5,PO6
5	Learn No SQL databases and management.	PO3,PO8
Text Book		
1	RogerD.Peng,‖RProgrammingforDataScience—,2012	
2	Norman Mat off,‖ The Art of R Programming- A Tour of Statistical Software Design‖, 2011	
Reference Books		
1.	1.GarrettGrolemund, HadleyWickham,‖Hands-OnProgrammingwithR:WriteYourOwnFunctionsand Simulations‖, 1stEdition,2014	
2.	Venables, W.N.,and Ripley,‖ Sprogramming—,Springer,2000.	
Web Resources		
1.	https://www.simplilearn.com	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**-**	**3**	**1**	**-**
CO2	**3**	**3**	**2**	**2**	**-**	**2**
CO3	**1**	**2**	**3**	**1**	**2**	**1**
CO4	**2**	**2**	**1**	**-**	**2**	**1**
CO5	**2**	**2**	**2**	**1**	**3**	**1**
Weightage of course Contributed to ach PSO	11	11	8	7	8	5

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23122DSC63A	**Human Computer Interaction**	Elective	5	-	-	3		4	25	75	100
Course Objective											
LO1	To learn about the foundations of Human Computer Interaction.										
LO2	To learn the design and software process technologies.										
LO3	To learn HCI models and theories.										
LO4	To learn Mobile Ecosystem.										
LO5	To learn the various types of Web Interface Design.										
UNIT	**Details**										**No. of Hours**
I	**FOUNDATIONSOFHCI:** • The Human: I/O channels–Memory • Reasoning and problem solving; The Computer: Devices– Memory–processing and networks; • Interaction: Models– frameworks–Ergonomics–styles–elements–interactivity-Paradigms.-Case Studies										12
II	**DESIGN&SOFTWAREPROCESS:** • Interactive Design: • Basics– process–scenarios • Navigation: screen design Iteration and prototyping. • HCI in software process: • Software life cycle – usability engineering – Prototyping in practice–design rationale. Design rules: principles, standards, Guidelines, rules. Evaluation Techniques–Universal Design										12

III	**MODELSANDTHEORIES:** • HCI Models: Cognitive models:-Socio-Organizational issues and stakeholder requirements Communication and collaboration models-Hypertext, Multimedia and WWW.	12
IV	**Mobile HCI:** • Mobile Ecosystem: Platforms, Application frameworks • Types of Mobile Applications: Widgets, Applications, Games • MobileInformationArchitecture,Mobile2.0, • Mobile Design: Elements of Mobile Design, Tools.- Case Studies	12
V	**WEB INTERFACE DESIGN:** Designing Web Interfaces – Drag &Drop,DirectSelection,ContextualTools,Overlays,InlaysandVirtualPages ,ProcessFlow –Case Studies	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the fundamentals of HCI.	PO1
2	Understand the design and software process technologies.	PO1,PO2
3	Understand HCI models and theories.	PO4,PO6
4	Understand Mobile Ecosystem, types of Mobile Applications, mobile Architecture and design.	PO4,PO5,PO6
5	Understand the various types of Web Interface Design.	PO3,PO8

Text Book

1	AlanDix,JanetFinlay,GregoryAbowd,RussellBeale,Human-Computer Interaction,III Edition,PearsonEducation,2004(UNITI,II&III)
2	BrianFling,—‖Mobile Design and Development‖,IEdition,O_ReillyMediaInc.,2009(UNIT–IV)
3	BillScottandTheresaNeil,—DesigningWebInterfaces‖,FirstEdition,O_Reilly,

	2009.(UNIT-V)
Reference Books	
1.	Shneiderman,—DesigningtheUserInterface:StrategiesforEffectiveHuman-Computer Interaction, Edition, Pearson Education.
Web Resources	
1.	https://www.interaction-design.org/literature/topics/human-computer-interaction
2.	https://link.springer.com/10.1007/978-0-387-39940-9_192
3.	https://en.wikipedia.org/wiki/Human%E2%80%93computer_interaction

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**-**	**1**	**2**	**1**	**2**
CO2	**2**	**1**	**2**	**1**	**3**	**1**
CO3	**3**	**2**	**1**	**1**	**-**	**1**
CO4	**2**	**-**	**3**	**2**	**1**	**3**
CO5	**2**	**3**	**-**	**2**	**3**	2
Weightage of course contributed to each PSO	11	6	7	8	8	9

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.Hours	Marks		
									CIA	External	Total
23122DSC63B	Introduction to Data Science	Elective	5	-	-	-	4	5	25	75	100

Course Objective	
LO1	To learn about basics of Data Science and Big data.
LO2	To learn about overview and building process of Data Science.
LO3	To learn about various Algorithms in Data Science.
LO4	To learn about Hadoop Framework.
LO5	To learn about case study about Data Science.

UNIT	Details	No.of Hours
I	**Introduction:** Benefits and uses–Facts of data–Data science process–Big data ecosystem and data science	15
II	**The Data science process**: Overview–research goals-retrieving data-Transformation–Exploratory Data Analysis–Model building.	15
III	**Algorithms**: Machine learning algorithms–Modeling process–Types –Supervised– Unsupervised-Semi-supervised	15
IV	**Introduction to Hadoop**: Hadoop framework–Spark–replacing Map Reduce–No SQL–ACID–CAP–BASE–types	15
V	**Case Study**: Prediction of Disease-Setting research goals-Data retrieval–preparation-exploration-Disease profiling-presentation and automation	15
	Total	**75**

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
1	Understand the basics in Data Science and Big data.	PO1
2	Understand overview and building process in Data Science.	PO1,PO2
3	Understand various Algorithms in Data Science.	PO4,PO6
4	Understand Hadoop Framework in Data Science.	PO4,PO5,PO6

5	Case study in Data Science.	PO3,PO8
Text Book		
1	DavyCielen,ArnoD.B.Meysman,MohamedAli,—Introducing Data Science‖, manningpublications2016	
Reference Books		
1.	RogerPeng,—TheArtofDataScience‖,lulu.com2016.	
2.	MurtazaHaider,—GettingStartedwithDataScience–MakingSenseofDatawith Analytics, IBMpress,E-book.	
3.	DavyCielen, ArnoD.B.Meysman, MohamedAli,—Introducing DataScience:Big Data,MachineLearning,andMore,UsingPythonTools‖,DreamtechPress2016.	
4.	AnnalynNg, KennethSoo,—Numsense! Data Science for the Layman:NoMath Added‖,2017,1stEdition.	
5.	CathyO'Neil,RachelSchutt,—DoingDataScienceStraightTalkfromtheFrontline‖, O'ReillyMedia2013.	
6.	LillianPierson,—DataScienceforDummies‖,2017IIEdition	
Web Resources		
1.	https://www.w3schools.com/datascience/	
2.	https://en.wikipedia.org/wiki/Data_science	
3.	http://www.cmap.polytechnique.fr/~lepennec/en/post/references/refs/	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**`1**	**2**	**2**	**-**
CO2	**2**	**3**	**2**	**2**	**-**	**1**
CO3	**3**	**2**	**2**	**1**	**1**	**3**
CO4	**1**	**2**	**2**	**1**	**3**	**1**
CO5	**2**	**2**	**-**	**3**	**1**	**1**
Weightage of course Contributed to each PSO	11	11	7	9	7	6

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23122DSC63C	**Internet of Things and its applications**	Elective	4	-	-	-	3	4	25	75	100

Course Objective	
C1	Use of Devices, Gateways and Data Management in IoT.
C2	Design IoT applications in different domain and be able to analyze their performance
C3	Implement basic IoT applications on embedded platform
C4	To gain knowledge on Industry Internet of Things
C5	To Learn about the privacy and Security issues in IoT

UNIT	Details	No. of Hours
I	IoT& Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.	12
II	M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	12
III	IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-	12

	Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views	
IV	IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management	12
V	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO5

Text Book

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, 1st Edition.

Reference Books

1. Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and

	Smart Cities Are Changing the World", kindle version.
2.	Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications 2013, 1st Edition,.
3	WaltenegusDargie, ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice" 4..CunoPfister, "Getting Started with the Internet of Things", O"Reilly Media 2011
Web Resources	
1.	https://www.simplilearn.com
2.	https://www.javatpoint.com
3.	https://www.w3schools.com

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**2**	**2**	**3**	**3**	**3**
CO3	**3**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**12**	**11**	**15**	**15**	**14**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst.Hours	Marks		
									CIA	External	Total
23122AEC64L	R Programming-LAB	Core	-	-	3	3		5	25	75	100

Course Objective	
LO1	To understand the problem solving approaches
LO2	To learn the basic programming constructs in R Programming
LO3	To practice various computing strategies for R Programming- based solutions to real world problems
LO4	To use R Programming data structures-lists, tuples, and dictionaries.
LO5	To do input/output with files in R Programming.

Sl. No	Details	
1.	Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending Upon user‘ choice.	
2.	Program, to find the area of rectangle, square, circle and triangle by accepting suitable input Parameters from user.	
3.	Write a program to find list of even numbers from 1 to n using R-Loops.	
4.	Create a function to print squares of numbers in sequence.	
5.	Write a program to join columns and rows in a data frame using cbind() and rbind() in R.	
6.	Implement different String Manipulation functions in R.	
7.	Implement different data structures in R(Vectors, Lists, Data Frames)	

8	Write a program to read a cv file and analyze the data in the file in R.	
9	Create pie chart and bar chart using R.	
10	10.Create a data set and do statistical analysis on the data using R.	
11	Program to find factorial of the given number using recursive function	
12	**Write an R program to count the number of even and odd numbers from array of N numbers.**	
	Total	

Course Outcomes		**Programe Outcome**
CO	On completion of this course, students will	
1	Acquire programming skills in core R Programming	PO1,PO4,PO5
2	Acquire Object-oriented programming skills In RProgramming.	PO1,PO4,PO8
3	Develop the skill of designing graphical-user interfaces(GUI) in RProgramming	PO1,PO3,PO6
4	Acquire RProgramming skills to move into Specific branches	PO3,PO4
5		PO1,PO5,PO6

Text Book	
1	RogerD.Peng,‖RProgrammingforDataScience—,2012
2	NormanMatloff,‖The Art of R Programming-A To our of Statistical Software Design‖, 2011
Reference Books	
1	Garrettn Grolemund, Hadley Wickham,‖Hands –On Programming with R:Write Your Own Functions and Simulations‖,1stEdition,2014
2.	Venables,W.N.,andRipley,‖Sprogramming—,Springer,2000.
web Resources	
1.	https://www.simplilearn.com

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**3**	**3**	**3**	**1**	**2**
CO2	**2**	**3**	**3**	**3**	**1**	**2**
CO3	**2**	**3**	**3**	**3**	**1**	**2**
CO4	**2**	**3**	**3**	**3**	**1**	**2**
CO5	**2**	**3**	**3**	**3**	**1**	**2**
Weightage of course contributed to each PSO	11	15	15	15	5	10

S-Strong-3 M-Medium-2L-Low-1

Course Code	Course Title	L	T	P	C
23122PRW65	Project Work	8	0	0	4

231ACSIKWS	**INDIAN KNOWLEDGE SYSTEM**	**0**	**0**	**0**	**2**

Course Objectives:

The course design seeks to address the following issues:

• To introduce to the students the overall organization of IKS

• To develop an appreciation among the students the role and importance of Veda, Vedanta's, Upa Vedas and Purāṇas.

• To show case the multi-dimensional nature of IKS and their importance in the contemporary society.

• To motivate the students to take up a detailed study of some of these topics and explore their application potential

Course Outcomes:

CO1: Explain the historicity of Indian Knowledge System and the broad classification of Indian philosophical systems.

CO2: Explain the potential of Sanskrit in natural language processing.

CO3: Explain the features of Indian numeral system and its role in science & technology advancement.

CO4: Illustrate the basic elements of the Indian calendar and the components of Indian Panchanga.

CO5: Outline the science, engineering & technology heritage of ancient and medieval India.

Syllabus

Unit I: Introduction to Indian Knowledge System (IKS), Definition, Concept and Scope of IKS (4)

Definition, Concept and Scope of IKS

IKS based approaches on Knowledge Paradigms

IKS in ancient India and in modern India

Unit II: IKS and Indian Scholars, Indian Literature (8)

1. Philosophy and Literature(MaharishiVyas,Manu,Kanad,Pingala,Parasar,Banabhatta, Nagarjuna and Panini)
2. Mathematics and Astronomy(Aryabhatta,Mahaviracharya,Bodhayan,Bhashkaracharya, Varahamihira and Brahmgupta)
3. Medicine and Yoga(Charak,Susruta,MaharishiPatanjaliandDhanwantri)
4. Sahitya(Vedas,Upvedas,Upavedas(Ayurveda,Dhanurveda,Gandharvaveda)
5. PuranandUpnishad)andshaddarshan(Vedanta,Nyaya.Vaisheshik,Sankhya,Mimamsa, Yoga, Adhyatma and Meditation)

6. Shasta(Nyaya,vyakarana,Krishi,Shilp,Vastu,Natya and Sangeet)

Unit III: Indian Traditional/tribal/ethnic communities, their livelihood and local wisdom (6)

1. Geo physical aspects, Resources and Vulnerability
2. Resource availability ,utilization pattern and limitations
3. Socio-Cultural linkages with Traditional Knowledge System
4. Tangible and in tangible cultural heritage.

Unit IV: Unique Traditional Practices and Applied Traditional Knowledge (8)

1. Myths, Rituals, Spirituals, Taboosand Belief System, Folk Stories, Songs, Proverbs, Dance, Play, Acts and Traditional Narratives
2. Agriculture, animalusban dry, Forest,SarcedGroves,WaterMills,SacredWaterBodies,Land, water and Soil Conservation and management Practices

3. Indigenous Bio-resource Conservation, Utilization Practices and Food Preservation Methods, Handicrafts, Wood Processing and Carving, -Fiber Extraction and Costumes
4. Vaidya(traditional healthcare system),Tantra-Mantra, Amchi Medicine System
5. Knowledge of dyeing, chemistry of dyes, pigments and chemicals

Unit V: Protection, preservation, conservation and Management of Indian Knowledge System (4)

1. Documentation and Preservation of IKS
2. Approaches for conservation and Management of nature and bio-resources
3. Approaches and strategies to protection and conservation of IKS **Mapping with Programme Outcomes:**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	3
CO2	3	3	3	3	2	3
CO3	3	3	3	3	3	3
CO4	3	3	2	3	3	3
CO5	3	3	3	3	3	2
Weightage of course contributed to each PSO	15	15	14	15	14	14

S-Strong-3 M-Medium-2L-Low-1

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

M.C.A.,

SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

PG CURRICULUM

FULL TIME

[Regulation 2023]

[Candidates admitted from the academic year 2023-2024 onwards]

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST) REGULATIONS ON LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION	
Programme	**M.C.A.,**
Programme Code	**23PGCOAGE**
Duration	**PG - Two Years**
Programme Outcomes (Pos)	**PO1: Problem Solving Skill** Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context. **PO2: Decision Making Skill** Foster analytical and critical thinking abilities for data-based decision-making. **PO3: Ethical Value** Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities. **PO4: Communication Skill** Ability to develop communication, managerial and interpersonal skills. **PO5: Individual and Team Leadership Skill** Capability to lead themselves and the team to achieve organizational goals. **PO6: Employability Skill** Inculcate contemporary business practices to enhance employability skills in the competitive environment. **PO7: Entrepreneurial Skill** Equip with skills and competencies to become an entrepreneur. **PO8: Contribution to Society** Succeed in career endeavors and contribute significantly to society. **PO 9 Multicultural competence** Possess knowledge of the values and beliefs of multiple cultures and a global perspective. **PO 10: Moral and ethical awareness/reasoning** Ability to embrace moral/ethical values in conducting one's life.
Programme Specific Outcomes (PSOs)	**PSO1 – Placement** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, and beliefs and apply diverse frames of reference to decisions and actions. **PSO 2 - Entrepreneur** To create effective entrepreneurs by enhancing their critical thinking,

	problem solving, decision making and leadership skill that will facilitate startups and high potential organizations. **PSO3 – Research and Development** Design and implement HR systems and practices grounded in research that complies with employment laws, leading the organization towards growth and development. **PSO4 – Contribution to Business World** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO 5 – Contribution to the Society** To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

1.1.3	color
EMPLOYABILITY	
SKILL DEVELOPMENT	
ENTREPRENEURSHIP	
EMPLOYABILITY,/ENTREPRENEURSHIP,/SKILL DEVELOPMENT	
EMPLOYABILITY,/SKILL DEVELOPMENT	
EMPLOYABILITY,/ENTREPRENEURSHIP	

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)
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U/s 3 of UGC Act, 1956

SCHOOL OF ARTS AND SCIENCE
DEPARTMENT OF COMPUTER SCIENCE
MCA (MASTER OF COMPUTER APPLICATION)
REGULATION 2023 – 2024
COURSE STRUCTURE
SEMESTER-I

Course Code	Course Title – MCA	L	T	P	C
THEORY					
23222AEC11	Discrete Mathematics	5	1	0	4
23222AEC12	Linux and shell programming	4	1	0	3
23222AEC13	Python Programming	4	1	0	3
PRACTICAL					
23222SEC14L	Linux and shell programming Lab	0	0	3	3
23222SEC15L	Python Programming Lab	0	0	3	3
23222SEC16	Data Science	2	-	-	2
23222RMC17	Research Methodology	2	-	-	2
	Total	17	3	6	20

SEMESTER – II

Course Code	Course Title – MCA	L	T	P	C
THEORY					
23222AEC21	Data Structures and Algorithms	4	1	0	3
23222AEC22	Big Data Analytics	4	1	0	3
23222DSC23_	Internet of Things	5	0	0	4
23222DSC24_	Cyber Security	5	0	0	4
PRACTICAL					
23222SEC25L	Data Structures and Algorithms Lab	0	0	3	3
23222SEC26L	Big Data Analytics Lab	0	0	3	3
23222SEC27	NME Fundamentals of Human Rights	2	0	0	2
23222BRC28	Participation in Bounded Research	2	0	0	2
23222SEC29	Internship Industrial Activity			0	2
	Total	22	2	6	26

SEMESTER – III

Course Code	Course Title – MCA	L	T	P	C
	THEORY				
23222AEC31	Advanced Java Programming	5	2	0	6
23222AEC32	Web Technology	5	2	0	6
23222AEC33	Advanced Machine Learning (AML)	5	2	0	5
	PRACTICAL				
23222SEC34L	Advanced Java Programming lab	0	0	3	3
23222SEC35L	Web Technology Lab	0	0	3	3
23222SEC36	Industrial visit	0	0	0	2
	Total	15	6	9	25

SEMESTER – IV

Course Code	Course Title – MCA	L	T	P	C
	THEORY				
23222AEC41	Data Visualization Tools	5	1	0	4
23222AEC42	Mobile Computing	5	1	0	4
23222DSC43_	Social Networks	5	1	0	4
23222PRW44	Project with Viva voce	0	0	10	4
23222SEC45	Skill Enhancement Professional Competency Skill	2	0	0	2
23222SEC46	Internship Industrial Activity	-	-	-	2
	Total	17	3	10	20
	Total Credits for the Programme				91

Discipline Specific Electives

Semester	**Discipline Specific Elective Courses-I**
II	a) 23222DSC23A- Internet of Things b) 23222DSC23B- Internet of Things Lab c) 23222DSC23C- Computer Vision
	Discipline Specific Elective Courses-II
II	a) 23222DSC24A- Cyber Security b) 23222DSC24B- Cyber Security Lab c) 23222DSC24C- Block chain Technologies
	Discipline Specific Elective Courses-III
IV	a) 23222DSC43A- Social Networks b) 23222DSC43B- Social Networks Lab c) 23222DSC43C- High Performance Computing

Credit Distribution for PG Programme

MCA (MASTER OF COMPUTER APPLICATION)

SEM	**AEC**	**SEC**	**DSC**	**RSB Courses**	**others**	**Total**
I	10	8	-	2	-	20
II	6	10	8	2	-	26
III	17	8	-	-	-	25
IV	8	4	4	-	4	20
Total	**41**	**30**	**12**	**4**	**4**	**91**

Course Code	Course Title – MCA	L	T	P	C
23222AEC11	Discrete Mathematics	5	1	0	4

Course Objective

- To know the concepts of relations and functions
- To distinguish among different normal forms and quantifiers
- To solve recurrence relations and permutations & combinations

Unit-I

Relations- Binary relations-Operations on relations- properties of binary relations in a set – Equivalence relations— Representation of a relation by a matrix -Representation of a relation by a digraph – **Functions**-Definition and examples-Classification of functions-Composition of functions-Inverse function

Unit-II

Mathematical Logic-Logical connectives-Well-formed formulas – Truth table of well formed formula –Algebra of proposition –Quine's method- Normal forms of well formed formulas- Disjunctive normal form-Principal Disjunctive normal form-Conjunctive normal form-Principal conjunctive normal form-Rules of Inference for propositional calculus – Quantifiers- Universal Quantifiers-Existential Quantifiers

Unit-III

Recurrence Relations- Formulation -solving recurrence Relation by Iteration- solving Recurrence Relations- Solving Linear Homogeneous Recurrence Relations of Order Two- Solving Linear Non homogeneous Recurrence Relations. Permutations-Cyclic permutation- Permutations with repetitions-permutations of sets with indistinguishable objects- Combinations- Combinations with repetition

Unit-IV

Matrices- special types of matrices-Determinants-Inverse of a square matrix-Cramer's rule for solving linear equations-Elementary operations-Rank of a matrix-solving a system of linear equations-characteristic roots and characteristic vectors-Cayley-Hamilton Theorem-problems

Unit-V

Graphs -Connected Graphs -Euler Graphs- Euler line-Hamiltonian circuits and paths –planar graphs – Complete graph-Bipartite graph-Hyper cube graph-Matrix representation of graphs

Text book

1. N.Chandrasekaran and M.Umaparvathi, Discrete mathematics, PHI Learning Private Limited, New Delhi, 2010.

Reference Book

1. Kimmo Eriksson & Hillevi Gavel, Discrete Mathematics & Discrete

Models, Student literature AB, 2015.

Course Code	Course Title – MCA	L	T	P	C
23222AEC12	Linux and shell programming	4	1	0	3

Course Outcomes

On the successful completion of the course, students will be able

CO1:	To understand the concepts of relations and functions distinguish among normal forms	K2	IO
CO2:	To analyze and evaluate the recurrence relations	K4,K5	HO
CO3:	To distinguish among various normal forms and predicate calculus	K5	HO
CO4:	To solve and know various types of matrices	K1	LO
CO5:	To evaluate and solve various types of graphs	K5	HO

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Course Objective

- To teach principles of operating system including File handling utilities, Basic Linux commands, Scripts and filters.
- To familiarize fundamentals of shell (bash), shell programming, pipes, Control structures, arithmetic in shell interrupt processing, functions, debugging shell scripts.
- To impart fundamentals of file concepts kernel support for file, File structure related system calls (file API's).
- To facilitate students in understanding Inter process communication, semaphore and shared memory.
- To explore real-time problem solution skills in Shell programming.

Unit-I

Basic bash Shell Commands: Interacting with the shell-Traversing the file system-Listing files and directories-Managing files and directories-Viewing file contents. **Basic Script Building:** Using multiple commands-Creating a script file-Displaying messages-Using variables-Redirecting input and output-Pipes-Performing math-Exiting the script. **Using Structured Commands:** Working with the if-then statement-Nesting ifs-Understanding the test command-Testing compound conditions-Using double brackets and parentheses-Looking at case.

Unit-II

More Structured Commands: Looping with for statement-Iterating with the until statement-Using the while statement-Combining loops-Redirecting loop output. **Handling User Input:** Passing parameters-Tracking parameters-Being shifty-Working with options-Standardizing options-Getting user input. **Script Control:** Handling signals-Running scripts in the background-Forbidding hang-ups -Controlling a Job-Modifying script priority-Automating script execution.

Unit-III

Creating Functions: Basic script functions-Returning a value-Using variables in functions-Array and variable functions-Function recursion-Creating a library-Using functions on the command line. **Writing Scripts for Graphical Desktops:** Creating text menus-Building text window widgets-Adding X Window graphics. **Introducing sed and gawk:** Learning about the sed Editor-Getting introduced to the gawk Editor-Exploring sed Editor basics.

Unit-IV

Regular Expressions: Defining regular expressions-Looking at the basics-Extending our patterns-Creating expressions. **Advanced sed:** Using multiline commands-Understanding the hold space-Negating a command-Changing the flow-Replacing via a pattern-Using sed in scripts-Creating sed utilities. **Advanced gawk:** Reexamining gawk-Using variables in gawk-Using structured commands-Formatting the printing-Working with functions.

Unit-V

Working with Alternative Shells: Understanding the dash shell-Programming in the dash shell-Introducing the zsh shell-Writing scripts for zsh.**Writing Simple Script Utilities:** Automating backups-Managing user accounts-Watching disk space. **Producing Scripts for Database, Web, and E-Mail:** Writing database shell scripts-Using the Internet from your scripts-Emailing reports from scripts. **Using Python as a Bash Scripting Alternative:** Technical requirements-Python Language-Hello World the Python way-Pythonic arguments-Supplying arguments-Counting arguments-Significant whitespace-Reading user input-Using Python to write to files-String manipulation.

Text book:

1. Richard Blum, Christine Bresnahan, "Linux Command Line and Shell Scripting BIBLE", Wiley Publishing, 3rd Edition, 2015.**Chapters:** 3, 11 to 14, and 16 to 25.
2. Mokhtar Ebrahim, Andrew Mallett, "Mastering Linux Shell Scripting", Packt Publishing, 2nd Edition, 2018. **Chapter:** 14.

3. **Reference Books:**

    1. ClifFlynt,SarathLakshman,ShantanuTushar, "Linux Shell Scripting Cookbook ", Packt Publishing, 3rd Edition, 2017.
    2. Stephen G.Kochan, Patrick Wood, "Shell Programming in Unix, Linux, and OS X", Addison Wesley Professional, 4th Edition, 2016.
    3. Robert Love, "Linux System Programming", O'Reilly Media, Inc, 2013
    4. W.R. Stevens, "Advanced Programming in the UNIX environment", 2nd Edition, Pearson Education, 2013
    5. Graham Glass, King Ables, " UNIX for Programmers and Users", 3rd Edition, Pearson Education, 2003

Course Outcomes

On the successful completion of the course, students will be able

CO1:	To understand, apply and analyze the concepts and methodology of Linux shell programming	K1-K6
CO2:	To comprehend, impart and apply fundamentals of control structure and script controls	K1-K6
CO3:	To understand, analyses and evaluate the functions, graphical desktop interface and editors	K1-K6
CO4:	To collaborate, apply and review the concepts and methodology of regular expression and advanced gawk	K1-K6
CO5:	To comprehend, use and illustrate the advance concepts such as alternate shell script, data connectivity and bash scripting using python	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	S	S	S	-	S	L	-	M	M	M	M	S
CO2	S	S	M	-	S	L	-	M	M	M	M	S
CO3	S	S	M	-	S	L	-	M	M	S	S	S
CO4	S	S	M	-	S	L	-	M	M	M	M	S
CO5	S	S	M	-	S	L	-	M	M	M	M	S

S- Strong; M-Medium; L-Low

23222AEC13	**Python Programming**	4	1	0	3

Course Objectives:

- To acquire programming skills in core Python
- To learn Strings and function
- To develop object oriented skills in Python
- To comprehend various Python Packages
- To develop web applications using Django

Unit I

Introduction : Fundamental ideas of Computer Science - Strings, Assignment, and Comments - Numeric Data types and Character sets – Expressions – Loops and Selection Statements: Definite iteration: the for Loop - selection: if and if-else statements - Conditional iteration: the while Loop

Unit II

Strings and Text Files: Accessing Characters and substrings in strings - Data encryption-Strings and Number systems- String methods – Text - Lists and Dictionaries: Lists – Dictionaries – Design with Functions: A Quick review - Problem Solving with top-Down Design - Design with recursive Functions - Managing a Program's namespace - Higher-Order Functions

Unit III

Design with Classes: Getting inside Objects and Classes – Data-Modeling Examples – Building a New Data Structure – The Two – Dimensional Grid - Structuring Classes with Inheritance and Polymorphism Graphical User Interfaces -The Behavior of terminal-Based programs and GUI-Based programs - Coding Simple GUI-Based programs - Windows and Window Components - Command Buttons and responding to events

Unit IV

Working with Python Packages: NumPy Library-Ndarray – Basic Operations – Indexing, Slicing and Iteration – Array manipulation - Pandas –The Series – The Data Frame - The Index Objects – Data Visualization with Matplotlib – The Matplotlib Architecture – pyplot – The Plotting Window – Adding Elements to the Chart – Line Charts – Bar Charts – Pie charts

Unit V

Django: Installing Django – Building an Application – Project Creation – Designing the Data Schema - Creating an administration site for models - Working with QuerySets and Managers – Retrieving Objects – Building List and Detail Views

Text Book:

1. K.A. Lambert, " Fundamentals of Python: first programs", Second Edition, Cengage Learning, 2018 **(Unit - I, II and III)**
2. Fabio Nelli, "Python Data Analytics: With Pandas, NumPy, and Matplotlib", Second Edition, Kindle Edition, 2018 **(Unit - IV)**
3. Antonio Mele, "Django 3 By Example", Third Edition, 2020 **(Unit - V)**

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Comprehend the programming skills in python and develop applications using conditional branches and loop	**K1- K6**
CO2	Create python applications with strings and functions	
CO3	Understand and implement the Object Oriented Programming paradigm with the concept of objects and classes, Inheritance and polymorphism	
CO4	Evaluate the use of Python packages to perform numerical computations and data vizualization	
CO5	Design interactive web applications using Django	

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	S	S	M	S	M	S	S	S	S	M	S	S
CO2	S	S	S	M	S	S	S	S	S	S	M	S
CO3	S	M	S	S	M	S	M	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S	M	S
CO5	S	S	S	S	S	S	S	S	S	M	M	S

S- Strong; M-Medium; L-Low

23222SEC14L	**Linux and shell programming Lab**	0	0	3	3

Course Objectives

- To enable the students to study and understand the efficiency of Linux shell script.
- To demonstrate the File Backup process.
- To develop and implement the shell script for GUI processing.
- To develop and implement the shell script for IPC and Networking.
- To demonstrate Postgre SQL.

List of Programs

1. Write a Shell Script program to calculate the number of days between two dates.
2. Write a Shell Script program to check systems on local network using control structures with user input.
3. Write a Shell Script program to check systems on local network using control structures with file input.
4. Write a Shell Script program to demonstrate the script control commands.
5. Write a Shell Script program to demonstrate the Shell script function.
6. Write a Shell Script program to demonstrate the Regular Expressions.
7. Write a Shell Script program to demonstrate the sed and awk Commands.
8. Write a Shell Script program to demonstrate the File Backup process through creating a daily archive location.
9. Write a Shell Script program to create a following GUI tools.

    a) Creating text menus

    b) Building text window widgets

10. Write a Shell Script program to demonstrate to connect a Postgre SQL database and performing CRUD operations.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	To understand, apply and analyze the concepts and methodology of Linux shell programming	K1-K6
CO2:	To comprehend, impart and apply fundamentals of control structure and script controls	K1-K6
CO3:	To understand, analyses and evaluate the functions, graphical desktop interface and editors	K1-K6
CO4:	To collaborate, apply and review the concepts and methodology of regular expression and advanced gawk	K1-K6
CO5:	To comprehend, use and analyze the advance concepts such as alternate shell script, dy and bash scripting using PostgreSQL	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	S	S	S	-	S	-	-	-	M	-	-	-
CO2	S	S	S	-	S	-	-	-	M	-	-	-
CO3	S	S	S	-	S	-	-	-	M	S	S	S
CO4	S	S	S	-	S	-	-	-	M	-	-	-
CO5	S	S	S	-	S	-	-	-	M	S	S	S

S- Strong; M-Medium; L-Low

23222SEC15L	**Python Programming Lab**	0	0	3	3

Course Objectives:

This course enables the students:

- To master the fundamentals of writing python scripts
- To create program using elementary data items
- To implement Python programs with conditionals and loops
- To use functions for structuring Python programs
- To develop web programming with Django

Implement the following in Python:

1. Program using elementary data items, lists, dictionaries and tuples
2. Program using conditional branches, loops
3. Program using functions
4. Program using classes and objects
5. Program using inheritance
6. Program using polymorphism
7. Program using Numpy
8. Program using Pandas
9. Program using Matplotlib
10. Program for creating dynamic and interactive web pages using forms

Course Outcomes

On the successful completion of the course, students will be able to

CO1	Comprehend the programming skills in python and write scripts	**K1- K6**
CO2	Create python applications with elementary data items, lists, dictionaries and tuples	
CO3	Implement the Object Oriented Programming concepts such as objects and classes, Inheritance and polymorphism	
CO4	Assess the use of Python packages to perform numerical computations and perform data visualization	
CO5	Create interactive web applications using Django	

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12
CO1	S	S	M	S	S	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	S	S	S	M	S
CO3	S	S	S	S	S	S	M	S	S	M	L	S
CO4	S	S	S	S	S	S	S	M	S	S	S	S
CO5	S	S	S	S	L	S	M	S	S	M	M	S

S- Strong; M-Medium; L-Low

23222SEC16	Data Science	2	-	-	2

Unit – I:

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

Unit – II:

Data Collection and Data Pre-Processing Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

Unit – III:

Exploratory Data Analytics Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

Unit – IV:

Model Development Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

Unit – V:

Model Evaluation Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Over fitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

REFERENCES:

1. Jojo Moolayil, “Smarter Decisions: The Intersection of IoT and Data Science”, PACKT, 2216.

2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2215.

3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2213

4. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

23222RMC17	**RESEARCH METHODOLOGY**	2	-	-	2

OBJECTIVES:

- To understand the approaches towards and constraints in good research.
- To identify various statistical tools used in research methodology
- To appreciate and compose the manuscript for publication
- To train in MATLAB platform for basic computational programing and analysis.

OUTCOME:

Ability to develop research questions and the various research strategies and compile research results in terms of journal manual scripts.

UNIT-I Introduction to research methodology Objectives of research – type of research – Significance of research. Research methodology – Research and scientific method – Criteria of good research – Problems encountered by research in India.

UNIT-II Data base and Literature Survey Articles – Thesis – Journals – Patents – Primary sources of journals and patens – Secondary sources – Listing of titles – Abstracts –Chemical Abstract Service – Reviews – Monographs – Literature search.

UNIT-III Data Analysis: Precision and accuracy – Reliability – Determinate and random errors – Distribution of random errors –normal distribution curve – Statistical treatment of finite samples – T test and F test (ANOVA) co – Variance (ANCOVA) correlation and multiple regression.

UNIT-IV Thesis and paper writing: Conventions in writing – General format – Page and chapter format – Use of quotations and footnotes – Preparations of tables and figures – Reference and Appendices.

UNIT-V Application on MATLAB: Numerical Integration – Numerical integration, ordinary differential equations, partial differential equations, and boundary value problems - Fourier analysis – Fourier transforms, convolution.

References:

1. C.R. Kothari, Research Methodology, New Age International publishers. New Delhi, 2224.

2. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.

3. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2225.

4. A Guide to MATLAB: For Beginners and experienced Users by Brian R. Hunt (Editor), Ronald L. Lipsman, J. Rosenberg

5. Introduction to MATLAB for Engineers by William J. Palm III.

23222AEC21	**Data Structures and Algorithms**	4	1	0	3

Course Objectives:

- To get a clear understanding of various ADT structures.
- To understand how to implement different ADT structures with real-time scenarios.
- To analyze the various data structures with their different implementations.
- To get an idea of applying right models based on the problem domain.
- To realize, and understand how and where to implement modern data structures with Python language.

Unit-I

Abstract Data Types: Introduction-Date Abstract Data Type-Bags-Iterators. **Arrays**: Array Structure-Python List-Two Dimensional Arrays-Matrix Abstract Data Type. **Sets, Maps:** Sets-Maps-Multi-Dimensional Arrays.

Unit-II

Algorithm Analysis: Experimental Studies-Seven Functions-Asymptotic Analysis. **Recursion:** Illustrative Examples-Analyzing Recursive Algorithms-Linear Recursion- Binary Recursion-Multiple Recursion.

Unit-III

Stacks, Queues, and Deques: Stacks- Queues- Double-Ended Queues Linked. **Lists:** Singly Linked Lists-Circularly Linked Lists-Doubly Linked Lists. **Trees:** General Trees-Binary Trees-Implementing Trees-Tree Traversal Algorithms.

Unit-IV

Priority Queues: Priority Queue Abstract Data Type- Implementing a Priority Queue- Heaps-Sorting with a Priority Queue. **Maps, Hash Tables, and Skip Lists:** Maps and Dictionaries-Hash Tables-Sorted Maps-Skip Lists-Sets, Multisets, and Multimaps.

Unit-V

Search Trees: Binary Search Trees-Balanced Search Trees-AVL Trees-Splay Trees. **Sorting and Selection:** Merge sort-Quick sort-Sorting through an Algorithmic Lens- Comparing Sorting Algorithms-Selection. **Graph Algorithms:** Graphs-Data Structures for Graphs-Graph Traversals-Shortest Paths-Minimum Spanning Trees.

Text book:

1. Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011. (Unit – 1)**Chapters:** 1, 2, 3.
2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", John Wiley & Sons, 2013. (Unit – 2, 3, 4, and 5)**Chapters:** 3 to 12, and 14.

Reference books:

1. Dr. Basant Agarwal; Benjamin Baka, "Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7", Packt Publishing, 2018.
2. Magnus Lie Hetland, "Python Algorithms: Mastering Basic Algorithms in the Python Language", Apress, 2014.

Course Outcome:

On the successful completion of the course, students will be able to,

CO1	Understand various ADT concepts	K1-K6
CO2	Familiar with implementation of ADT models with Python language and understand how to develop ADT for the various real-time problems	
CO3	Apply with proper ADT models with problem understanding	
CO4	Apply and Analyze right models based on the problem domain	
CO5	Evaluate modern data structures with Python language	

K1- Remember, K2 - Understand, K3 - Apply , K4 - Analyze, K5 - Evaluate, K6 -Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	L	S	S	S	L	M	M
CO2	S	M	S	M	M	L	L	L	L	L	M	M
CO3	S	S	S	L	L	L	M	M	M	M	M	L
CO4	S	S	S	L	L	L	M	M	M	L	L	L
CO5	S	S	S	L	M	M	S	S	S	S	M	L

L - Low, M- Medium, S - Strong

23222AEC22	**Big Data Analytics**	4	1	0	3

Course Objectives

- To introduce big data tools & Information Standard formats.
- To understand the basic concepts of big data.
- To learn Hadoop, HDFS and Map Reduce concepts.
- To teach the importance of No SQL.
- To explore the big data tools such as Hive, H Base and Pig.

UNIT I

Big Data and Analytics: Classification of Digital Data: Structured Data- Semi Structured Data and Unstructured Data. Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Big Data - Traditional Business Intelligence versus Big Data - Data Warehouse and Hadoop. Environment Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments – Basically Available Soft State Eventual Consistency - Top Analytics Tools

UNIT II

Technology Landscape: No SQL, Comparison of SQL and No SQL, Hadoop -RDBMS Versus Hadoop - Distributed Computing Challenges – Hadoop Overview - Hadoop Distributed File System - Processing Data with Hadoop - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem

UNIT III

Mongodb and Mapreduce Programming: MongoDB: Mongo DB - Terms used in RDBMS and Mongo DB - Data Types - MongoDB Query Language.

MapReduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression

UNIT IV

Hive: Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions – Bucketing – Views - Sub- Query – Joins – Aggregations - Group by and Having – RCFile - Implementation - Hive User Defined Function - Serialization and Deserialization.

UNIT V

Pig: Introduction - Anatomy – Features – Philosophy - Use Case for Pig - Pig Latin Overview - Pig Primitive Data Types - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined Functions - Parameter Substitution – Diagnostic Operator - Word Count Example using Pig - Pig at Yahoo! - Pig Versus Hive

Text Book:

1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley Publications, First Edition,2015

Reference Book:

1. Judith Huruwitz, Alan Nugent, Fern Halper, Marcia Kaufman, “Big data for dummies”, John Wiley & Sons, Inc. (2013)
2. Tom White, “Hadoop The Definitive Guide”, O’Reilly Publications, Fourth Edition, 2015
3. Dirk Deroos, Paul C.Zikopoulos, Roman B.Melnky, Bruce Brown, Rafael Coss, “Hadoop For Dummies”, Wiley Publications, 2014

Course Outcomes On the successful completion of the course, students will be able to

CO1:	To understand, illustrate and evaluate the concepts and techniques of Data Science, Big Data Analytics and its tools	K1-K6
CO2:	To collaborate, apply and review the computing for big data in Hadoop, and NoSQL environment.	K1-K6
CO3:	To comprehend, implement and review the concepts of data science and big data analytics projects using MapReduce, and MongoDB	K1-K6
CO4:	To understand, use and analyze the concepts of big data analytics projects using HIVE database.	K1-K6
CO5:	To illustrate, develop and review the concepts of PIG database in Hadoop environment.	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5 Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO1 2
CO1	S	-	-	-	-	L	-	-	-	-	-	-
CO2	S	-	M	-	M	L	-	-	-	-	-	-
CO3	S	-	S	-	S	L	-	-	-	S	S	S
CO4	S	-	S	-	S	L	-	-	-	S	S	S
CO5	S	-	S	-	S	L	-	-	-	S	S	S

S- Strong; M-Medium; L-Low

23222SEC25L	**Data Structures and Algorithms Lab**	0	0	3	3

Course Objectives:

- To understand Stack, Queue and Doubly Linked ADT structures.
- To implement different ADT structures with real-time scenarios.
- To analyze the recursion concepts.
- To apply different sorting and tree techniques.
- To implement modern data structures with Python language.

Implement the following problems using Python 3.4 and above

1. Recursion concepts.
    i) Linear recursion
    ii) Binary recursion.

2. Stack ADT.
3. Queue ADT.
4. Doubly Linked List ADT.
5. Heaps using Priority Queues.
6. Merge sort.
7. Quick sort.
8. Binary Search Tree.
9. Minimum Spanning Tree.
10. Depth First Search Tree traversal.

Course Outcome:

On the successful completion of the course, students will be able to,

CO1	Strong understanding in various ADT concepts	K1-K6
CO2	To become a familiar with implementation of ADT models	
CO3	Apply sort and tree search algorithms	
CO4	Evaluate the different data structure models	
CO5	Learn how to develop ADT for the various real-time problems	

K1- Remember, K2 - Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 -Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	M	L	L	L	L	S	S	M	M	S	S
CO2	S	M	S	M	M	L	S	M	S	L	M	M
CO3	S	S	S	L	L	L	M	M	M	M	S	L
CO4	S	S	S	M	M	S	M	M	S	S	S	L
CO5	S	S	S	S	L	M	S	M	M	M	M	L

L - Low, M- Medium, S - Strong

23222SEC26L	**Big Data Analytics Lab**	0	0	3	3

Course Objectives

- To teach the fundamental techniques for handling the big data tools.
- To familiarize the tools required to manage big data.
- To analyze big data using Hadoop, Map Reduce, Hive, and Pig
- To teach the fundamental principles in achieving big data analytics with scalability and streaming capability
- To enable students to have skills that will help them to solve complex.

List of Programs

1. Implement File System Shell Commands for HDFS in Hadoop Environment
2. Write a Map reduce program using single reduce function for finding Maximum and Minimum Number
3. Write a Map reduce program using multiple reduce function for Word Count in an given Text document
4. Implement the following using Pig Latin Input and Output Operations Relational Operations
5. Implement the following using Pig Latin User Defined Functions Advanced Relational Operations
6. Write a Word Count program using Pig Latin Script
7. Write a program to find a maximum temperature using Pig Latin Script
8. Implement the following using Hive commands Handling the Database Creating and Manipulating table
9. Implement Simple Queries for database using Mongo
10. Implement Simple Queries for collections using Mongo

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand and develop conceptually how Big Data is stored and implement it using different tools	K1-K6
CO2:	Comprehend and implement programs for data storage in HDFS and table manipulation using Big Data tools in Hadoop environment	K1-K6
CO3:	Understand and Critically analyze existing Big Data datasets and implementations the solutions for it using Mongo DB	K1- K6
CO4:	Understand and examine existing Big Data datasets and implementations the solutions using HIVE database	K1- K6
CO5:	Comprehend and review existing datasets and implementations the solutions to handle it using PIG	K1- K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	S	S	M		M	S	-	-	-	-	-	-
CO2	S	M	S	S	S	M	-	-	-	-	-	-
CO3	S	S	S	S	S	S	-	-	-	-	-	-
CO4	S	M	S	S	S	M	-	-	-	-	-	-
CO5	S	S	S	S	S	S	-	-	-	-	-	-

23222DSC23A	**Internet of Things**	5	0	0	4

Course Objectives:

- To get familiar with the evolution of IOT with its design principles
- To outline the functionalities and protocols of internet communication
- To analyze the hardware and software components needed to construct IOT applications

UNIT I: FUNDAMENTALS OF IOT Evolution of Internet of Things – Enabling Technologies – IOT Architectures: oneM2M, IOT World Forum (IOTWF) and Alternative IOT models – Simplified IOT Architecture and Core IOT Functional Stack -– Fog, Edge and Cloud in IOT – Functional blocks of an IOT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II: IOT PROTOCOLS IOT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IOT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

UNIT – III: DESIGN AND DEVELOPMENT Prototyping Embedded Devices: Electronics - Embedded Computing Basics – Arduino - Raspberry Pi - Beagle Bone Black - Electric Imp. Prototyping the Physical Design: Non digital Methods - Laser Cutting - 3D printing - CNC Milling - Repurposing/Recycling.

UNIT – IV: Prototyping Online Components: Getting started with an API - Writing a New API - Real-Time Reactions - Other Protocols. Techniques for Writing Embedded Code: Memory Management - Performance and Battery Life – Libraries - Debugging.

UNIT – V: Business Models: History of Business Models – Model – Internet of Starting up – Lean Startups. Moving to Manufacture: Designing Kits - Designing Printed circuit boards – Certification – Costs - Scaling up Software. Ethics: Privacy – Control – Environment – Solutions.

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017 (UNIT I and II)
2. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014. (UNIT III, IV and V)

Reference Books:

1. Ovidiu Vermesan and Peter Friess, "Internet of Things – From Research and Innovation to Market Deployement", River Publishers, 2014.
2. Peter Waher, "Learning Internet of Things",Packt Publishing, 2015.
3. Donald Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBoneBlack", McGraw Hill, 2015.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Comprehend the IoT evolution with its architecture and sensors	K1- K6
CO2:	Understand the networking concepts for communication and underlying IoT protocols	
CO3:	Assess the embedded technologies and develop prototypes for the IoT products	
CO4:	Evaluate the use of Application Programming Interface and design an API for IoT in real-time	
CO5:	Recognize the ethics of business models and perform security analysis	

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	M	S	S	M	S
CO3	S	M	S	S	S	S	M	S	S	M	S	S
CO4	S	S	S	S	S	S	S	S	S	S	M	S

S- Strong; M-Medium; L-Low

23222DSC23B	Internet of Things Lab	0	0	3	3

Course Objectives:

- To create IoT program to turn ON/OFF LED
- To implement IoT program for object detection
- To develop IoT programs for agricultural purpose
- To create web server program for local hosting
- To design IoT application for health monitoring

1. To develop an IoT program to turn ON/OFF LED light (3.3V)
2. To develop an IoT program using IR sensor (Smart Garbage Monitoring, Detecting Parking Availability, etc.)
3. To develop an IoT program using Humidity and Temperature Monitoring (Forest fire Detection, Weather Monitoring)
4. To develop an IoT web server program for local hosting
5. To develop an IoT program using Soil Moisture Sensor
6. To develop an IoT program using Ultrasonic Sensor (Distance Measurement, etc.)
7. To develop an real-time IoT program using Relay Module (Smart Home Automation with 230V)
8. To develop an IoT program for Fire Detection (Home, Industry,etc.)
9. To develop an IoT program for Gas Leakage detection (Home, Industry, etc.)
10. To develop an IoMT program using Heartbeat Sensor

Course Outcomes

On the successful completion of the course, students will be able to,

CO1	Implement IoT programs to turn ON/OFF LED	K1 - K6
CO2	Develop IoT programs for object detection	
CO3	Create IoT programs for agricultural purpose	
CO4	Implement web server program for local hosting	
CO5	Design IoT application for health monitoring	

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	S	S	M	S	S	S	S	S
CO2	S	S	S	S	S	S	S	M	S	S	M	S
CO3	S	M	S	S	S	S	M	S	S	M	S	S
CO4	S	S	S	S	S	S	S	S	S	L	M	S
CO5	S	S	S	S	M	S	L	S	S	M	M	S

S- Strong; M-Medium; L-Low

23222DSC24A	**Cyber Security**	5	0	0	4

Course Objectives:

- To understand the basics of Cybercrime and Computer forensics with protecting mechanism
- To explore the working principles of WLAN, Email and Smartphone along with security mechanism and guidelines

Unit – I

Introduction to cybercrime: Classification of cybercrimes – reasons for commission of cybercrime – malware and its type – kinds of cybercrime – authentication – encryption – digital signatures – antivirus – firewall – steganography – computer forensics – why should we report cybercrime – introduction counter cyber security initiatives in India – generating secure password – using password manager-enabling two-step verification – security computer using free antivirus.

Unit – II

Tips for buying online: Clearing cache for browsers – wireless LAN-major issues with WLAN-safe browsing guidelines for social networking sites – email security tips – introduction-smartphone security guidelines – purses, wallets, smart phones – platforms, setup and installation-communicating securely with a smartphone.

Unit – III

Cyber investigation roles**:** Introduction – role as a cybercrime investigator – the role of law enforcement officers – the role of the prosecuting attorney – incident response: introduction-post mortem versus live forensics – computer analysis for the hacker defender program-network analysis – legal issues of intercepting Wi-Fi transmission – Wi-Fi technology – Wi-Fi RF-scanning RF – eavesdropping on Wi-Fi – fourth amendment expectation of privacy in WLAN

Unit – IV

Seizure of digital information: introduction – defining digital evidence – digital evidence seizure methodology – factors limiting the wholesale seizure of hardware – other options for seizing digital evidence – common threads within digital evidence seizure – determining the most appropriate seizure method– conducting cyber investigations–demystifying computer/cyber crime – IP addresses – the explosion of networking – interpersonal communication.

Unit – V

Digital forensics and analyzing data: introduction – the evolution of computer forensics–phases of digital forensics-collection – examination-analysis – reporting – Cyber crime prevention: Introduction – crime targeted at a government agency.

Text books:

1. Dr.JeetendraPande, **"**Introduction to Cyber Security" Published by Uttarakhand Open University, 2017.(Chapter: 1.2-6.4,9.3-12.2)
2. Anthony reyes, Kevin o'shea, Jim steele, Jon R. Hansen, Captain Benjamin R. Jean Thomas Ralph, "Cyber-crime investigations" - bridging the gaps between security professionals, law enforcement, and prosecutors, 2007.(Chapter: 4, 5, 6, 7, 8, 9,10)

Reference Books:

1. Sebastian Klipper, "Cyber Security" EinEinblickfurWirtschaftswissenschaftlerFachmedien Wiesbaden,2015
2. John G.Voller Black and Veatch, "Cyber Security" Published by John Wiley & Sons, Inc., Hoboken, New Jersey Published simultaneously in Canada ©2014.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand, describe, analyze and examine the basics of Cyber security concepts and its implementation in India	K1- K6
CO2:	Comprehend and demonstrate the security tips in browsers, WLAN, social networks, Email security and Smart phone. Apply the investigations in post mortem andForensics	K1- K6
CO3:	Understand, apply and evaluate the various investigation roles and Wi Fi protecting mechanisms.	K1- K6
CO4:	Understand, illustrate and evaluate the method of seize the digital information and evidences forensics data and evaluate the forensics reports	K1- K6
CO5:	Comprehend, apply and appraise the methods digital forensics with cybercrime prevention techniques	K1- K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L	-	L	M	L	M	M	-	M	-	-
CO2	M	S	-	L	M	L	M	M	-	M	-	-
CO3	M	S	L	L	M	L	M	M	-	M	M	L
CO4	S	M	L	S	M	L	S	M	-	M	-	-
CO5	M	S	M	L	S	L	M	S	-	S	-	-

S- Strong; M-Medium; L-Low

23222DSC24B	Cyber Security Lab	5	0	0	4

COURSE OBJECTIVES

- To learn and implement to Change the wireless device mode as monitor mode
- To develop in multiple vulnerabilities webserver
- To understand and implement the open ports in the network
- To acquire programming skills in Implement various wireless device modes
- To comprehend related to find the sub domains of webpage

Implement the following using any cyber security tools

1. Install virtual box (kali Linux)
2. Generate a secure password using keepass
3. Change the wireless device mode as monitor mode
4. Find the known and open vulnerabilities of system using metaspolit
5. Identify the multiple vulnerabilities webserver using nikto tool
6. Identify the open ports in the network using nmap tools
7. List all the network around us and display the information about the networks
8. Sniff and capture the packet sent over HTTP requests
9. Find the owners of internet resources using Whois Lookup tool
10. Find the subdomains of webpage using knock tool

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Comprehend the programming skills in Change the wireless device mode as monitor mode	K1-K6
CO2:	Understand and implement multiple vulnerabilities webserver	K1-K6
CO3:	Evaluate the use of different wireless device modes	K1-K6
CO4:	Design to Solve related to find the subdomains of webpage	K1-K6
CO5:	Create and applyopen ports in the network	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5-Evaluate, K6- Create

Mapping Course outcomes with Programme outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	-	-	-	-	L	-	-	-	-	-	-
CO2	S	-	M	-	M	L	-	-	-	-	-	-
CO3	S	-	S	-	S	L	-	-	-	S	S	S
CO4	S	-	S	-	S	L	-	-	-	S	S	S
CO5	S	-	S	-	S	L	-	-	-	S	S	S

S- Strong; M-Medium; L-Low

23222DSC24C	Block chain Technologies	5	0	0	4

COURSE OBJECTIVES

- To understand about Block chain is an emerging technology platform for developing decentralized applications and data storage.
- To comprehend fundamentals of Public Key Cryptography technology and Consensus Algorithms.

Unit I: Block chain, Decentralization

Block chain: The growth of block chain technology - Distributed systems - The history of block chain and Bit coin – Block chain - Consensus - CAP theorem and block chain. **Decentralization:** Decentralization using block chain - Methods of decentralization -Routes to decentralization – Block chain and full ecosystem decentralization - Pertinent terminology - Platforms for decentralization - Innovative trends.

Unit II: Public Key Cryptography, Consensus Algorithms and Smart Contracts

Public Key Cryptography: Asymmetric cryptography - Cryptographic constructs and block chain technology. **Consensus Algorithms:** Introducing the consensus problem -Analysis and design - Classification - Algorithms - Choosing an algorithm. **Smart Contracts:** History - Definition - Ricardian contracts - Smart contract templates – Oracles - Deploying smart contracts - DAO

Unit III: Bit coin

Bit coin: Bit coin—an overview - Cryptographic keys - Transactions – Block chain – Mining. **Bit coin Network and Payments:** The Bit coin network - Wallets – Bi tcoin payments -Innovation in Bit coin - Advanced protocols - Bitcoin investment and buying and selling Bitcoin. **Bit coin Clients and APIs:** Bitcoin client installation - Experimenting further with bit coin-cli – Bit coin programming.

Unit IV: Alternative Coins

Alternative Coins: Theoretical foundations - Difficulty adjustment and retargeting algorithms - Bitcoin limitations - Extended protocols on top of Bitcoin -Development of altcoins.**Ethereum: Ethereum –** an overview - Ethereum network - Components of the Ethereum ecosystem - EthereumVirtual Machine (EVM) - Smart contracts. - Blocks and block chain - Wallets and client - Nodes and miners - APIs, tools, and DApps - Supporting protocols - Programming languages.

Unit V: Development Tools and Frameworks, Use Cases & Security

Development Tools and Frameworks: Languages - Compilers - Tools and libraries - Frameworks - Contract development and deployment - Layout of a Solidity source code file - Solidity language. **Use Cases:** IoT – Government - Health -Finance – Media. **Scalability and Other Challenges:** Scalability - Privacy - Security - Other challenges.

TEXT BOOKS

Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder. Bitcoin and Cryptocurrency Technologies. Princeton University Press, 2016. ISBN 978-0691171692

REFERENCES

Andreas Antonopoulos. Mastering Bitcoin: Programming the open block chain. Oreilly Publishers, 2017. ISBN 978-9352135745

Course Outcomes On the successful completion of the course, students will be able t

CO1	Understand, apply and examine the characteristics of block chain, bit coin and consensus algorithm in centralized and decentralized methods.	K1-K6
CO2:	Comprehend and demonstrate the application of hashing and public key cryptography in protecting the block chain.	K1-K6
CO3:	Understand and analyses the elements of trust in a Block chain: validation, verification, and consensus.	K1-K6
CO4	Comprehend and evaluate the alternate coin, Ethereum and smart contract.	K1-K6
CO5	Grasp and apply the knowledge of Tools and languages for applications	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5-Evaluate, K6- Create

Mapping Course outcomes with Programme outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	-	-	-	-	L	-	-	-	-	-	-
CO2	S	-	M	-	M	L	-	-	-	-	-	-
CO3	S	-	S	-	S	L	-	-	-	S	S	S
CO4	S	-	S	-	S	L	-	-	-	S	S	S
CO5	S	-	S	-	S	L	-	-	-	S	S	S

23222SEC27	**NME Fundamentals of Human Rights**	2	0	0	2

Unit I: Introduction:

Meaning and Definitions of Human Rights – Characteristics and Importance of Human Rights – Evolution of Human Rights – Formation, Structure and Functions of the UNO - Universal Declaration of Human Rights – International Covenants – Violations of Human Rights in the Contemporary Era.

Unit II: Human Rights in India:

Development of Human Rights in India – Constituent Assembly and Indian Constitution – Fundamental Rights and its Classification – Directive Principles of State Policy – Fundamental Duties.

Unit III:

Rights of Marginalized and other Disadvantaged People: Rights of Women – Rights of Children – Rights of Differently Abled – Rights of Elderly - Rights of Scheduled Castes – Rights of Scheduled Tribes – Rights of Minorities – – Rights of Prisoners – Rights of Persons Living with HIVAIDS – Rights of LGBT.

Unit IV:

Human Rights Movements: Peasant Movements (Tebhaga and Telangana) – Scheduled Caste Movements (Mahar and Ad-Dharmi) – Scheduled Tribes Movements (Santhal and Munda) – Environmental Movements (Chipko and Narmada BachaoAndolan) – Social Reform Movements (Vaikom and Self Respect).

Unit V:

Redressal Mechanisms: Protection of Human Rights Act, 1993 (Amendment 2019) – Structure and Functions of National and State Human Rights Commissions – National Commission for SCs – National Commission for STs – National Commission for Women – National Commission for Minorities – Characteristics and Objectives of Human Rights Education.

References

1. Sudarshanam Gankidi, Human Rights in India: Prospective and Retrospective, Rawat Publications, Jaipur, 2019.
2. SatvinderJuss, Human Rights in India, Routledge, New Delhi, 2020.
3. Namita Gupta, Social Justice and Human Rights in India, Rawat Publications, Jaipur, 2021.
4. Mark Frezo, the Sociology of Human Rights, John Willy & Sons, U.K. 2014.

23222AEC31	**Advanced Java Programming**	4	1	-	4

Course Objectives

- To gain knowledge of Object Oriented Programming Concept in Java
- To understand usages of String functions in Java
- To familiarize with the applet and swing
- To grasp the concepts on Java Beans
- To comprehend the connection between Relational Database and Java.

Unit – I

An Overview of Java: Object Oriented Programming- Data Types, Variables, and Arrays: Primitive Types-Literals Variables - Type Conversion and Casting- Arrays-Operators: Control Statements-Classes and Methods – Inheritance- Exception Handling.

Unit – II

String Handling: The String Constructors - String Length - Special String Operations - Character Extraction - String Comparison - Searching Strings - Modifying a String - Input/Output: The I/O Classes and Interfaces – File - Byte Streams - Character Streams.

Unit – III

The Applet Class: Basic Architecture - Applet Skeleton - Display methods - Status Window – Passing Parameters. Introducing GUI Programming with Swing– Introducing Swing - Swing Is Built on the AWT- Two Key Swing Features - The MVC Connection - Components and Containers - The Swing Packages - A Simple Swing Application - Exploring Swing.

Unit- IV

Java Beans: Introduction - Advantages of Beans – Introspection - The JavaBeans API - A Bean Example. Servlets: Life Cycle Simple Servlet-Servlet API-Packages-Cookies session tracking.

Unit – V

Network Programming: Working with URLs- Working with Sockets - Remote Method Invocation. Introduction to Database Management Systems - Tables, Rows, and Columns - Introduction to the SQL SELECT Statement - Inserting Rows - Updating and Deleting Existing Rows - Creating and Deleting Tables - Creating a New Database with JDBC - Scrollable Result Sets.

Text Books:

1. Herbert Schildt, "Java the Complete Reference", 10th edition, McGraw Hill Publishing Company Ltd, New Delhi, 2017.
2. Tony Goddis, "Starting out with Java from Control Structures Through Objects" 6th Edition, Pearson Education Limited, 2016

Reference books:

1. Herbert Schildt, Dale Skrien, "Java Fundamentals – A Comprehensive Introduction", TMGH Publishing Company Ltd, New Delhi, 2013
2. John Dean, Raymond Dean, "Introduction to Programming with JAVA – A Problem Solving Approach", TMGH Publishing Company Ltd, New Delhi,2012.

Course Outcomes On the successful completion of the course, students will be able

CO1:	Understand the Object Oriented Program including classes and methods; inheritance and exception handling	K1-K6
CO2:	Complete comprehension of String functions and I/O Streams	K1-K6
CO3:	Creation of graphical representation using Applet	K1-K6
CO4:	Application of Servlets for designing Web based applications	K1- K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	-	M	S	-	-	-	S	M	-
CO2	S	S	S	-	M	S	-	-	-	L	M	-
CO3	S	S	M	-	L	S	-	-	-	M	M	-
CO4	M	S	M	-	S	S	-	-	-	M	S	-
CO5	S	M	M	-	M	L	-	-	-	M	M	-

S- Strong; M-Medium; L-Low

23222AEC32	**Web Technology**	5	2	0	6

COURSE OBJECTIVES:

- Understand the fundamentals of the web and thereby develop web applications using various development languages and tools.
- Enrich knowledge about XHTML control and Cascading Style Sheets.
- Provide in- depth knowledge about JavaScript.

UNIT –I

WEB FUNDAMENTALS AND HTML: A Brief Introduction to the Internet - The World Wide Web - Web Browsers - Web Servers -URLs, MIME, HTTP, Security- Introduction to HTML- Origins and Evolution of HTML and HTML - Basic Syntax - Standard HTML Document Structure - Basic Text Markup - Images- Hypertext Links - Lists, Tables, Forms, The Audio Element, The Video Element - Organization Elements, The Time Element

UNIT – II

INTRODUCTION TO XHTML AND CSS: Basic syntax, Standard structure, Basic text-markup, Images, Hypertext Links. Lists, Tables, Forms, Frames, syntactic differences between HTML and XHTML-Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and tags, Conflict resolution.

UNIT - III

THE BASICS OF JAVASCRIPT: Overview of JavaScript, Object orientation and JavaScript, general Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts. JAVASCRIPT AND XHTML DOCUMENTS: The JavaScript Execution Environment, The Document Object Model, Elements Access in Java Script, Events and Event Handling, Handling Events from Body Elements, Handling Events from Text Box and password Elements, The DOM2 Model

UNIT- IV

DYNAMIC DOCUMENTS WITH JAVASCRIPT AND XML: Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Color and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements. Introduction to XML, Syntax of XML, XML Document Structure, Document type definitions, Namespaces, XML schemas, displaying raw XML documents, Displaying XML documents with CSS, XSLT Style Sheets, Web services.

UNIT - V

PHP, ANGULAR JS AND JQUERY: Introduction to PHP: Overview of PHP -General Syntactic Characteristics - Primitives, Operations, and Expressions - Output - Control Statements - Arrays - Functions - Pattern Matching - Form Handling - Cookies - Session Tracking - Introduction to JQuery, Syntax, selectors, events, JQuery HTML, JQuery Effects, JQuery CSS. Introduction to Angular JS, Directives, Expressions, Controllers, Filters, Services, Events, Forms, Validations, Examples.

TEXT BOOKS:

1. Robert W. Sebesta: Programming the World Wide Web, Eighth Edition, Pearson education, 2015. **UNITS:** 1,2,3,4
2. Dayley Brad, Dayley Brendan ,"AngularJS, JavaScript, and jQuery All in One", Sams Teach Yourself 1st Edition, Kindle Edition, 2015.**UNIT**: 5

REFERENCE BOOKS:

1. M. Srinivasan: Web Programming Building Internet Applications, 3rdEdition, Wiley India, 2009.
2. Jeffrey C. Jackson: Web Technologies-A Computer Science Perspective, Pearson Education, 7thImpression,2012.
3. Chris Bates: Web Technology Theory and Practice, Pearson Education, 2012.
4. Raj Kamal: Internet and Web Technologies, McGraw Hill Education.

COURSE OUTCOMES:

On the successful completion of the course, students will be able

CO1	Design dynamic web pages using JavaScript, Jquery and Angular Java script	K1	LO
CO2	Develop Web pages using HTML, CSS and XML	K2	IO
CO3	Create web application using PHP and MySQL	K3, K4	HO
CO4	To design dynamic web pages using Angular JavaScript	K2,K3	HO
CO5	Develop interactive web pages using Jquery	K4,K5	HO

MAPPING WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	S	S	S	M	M	S	M	M	S	S
CO2	S	S	M	S	S	S	M	S	S	S	S	S
CO3	S	S	S	M	S	S	M	M	S	M	M	S
CO4	S	S	S	M	S	M	M	S	S	M	S	M
CO5	S	S	S	M	S	S	M	S	M	S	S	M

S- STRONG; M-MEDIUM; L-LOW

23222AEC33	**Advanced Machine Learning (AML)**	5	2	0	5

Course Objectives

- To understand the concepts of Machine Learning.
- To understand the theoretical and practical aspects of types of machine learning
- To teach and get familiarized with supervised learning and their applications.
- To teach and get familiarized with the concepts and algorithms of unsupervised learning.
- To appreciate the concepts and algorithms of deep learning.

Unit I:

Introducing Machine Learning: The Origins of Machine Learning, Uses and Abuses of Machine learning _ Basics of Machine Learning Algorithm Model Works - Steps to apply Machine Learning - Choosing a Machine Learning Algorithm - Using Machine Learning concepts. Managing and Understanding Data: Data Structures, Vectors and Factors: Lists, Data frames, Matrixes and arrays - Managing Data - Exploring and Understanding Data: Exploring the Structure of Data, Exploring Numeric variables - Exploring Categorical Variables- Exploring Relationships between Variables.

Unit II:

Lazy Learning – C**lassification Using Nearest Neighbors:** The kNN Algorithm- Diagnosing Breast Cancer with the kNN Algorithm- Probabilistic Learning – Classification Using Naive Bayes: Basic concepts of Bayesian Methods- The Naïve Bayes Algorithm- Example – filtering Mobile Phone Spam with the Naive Bayes Algorithm. Divide and Conquer – **Classification Using Decision Trees and Rules:** Understanding Decision Trees- Example – Identifying Risky Bank Loans using C5.0 Decision Trees- Understanding Classification Rules- Example – Identifying Poisonous Mushrooms with Rule Learners.

Unit III:

Forecasting Numeric Data – **Regression Methods:** Understanding Regression- Example – Predicting Medical Expenses using Linear Regression- Understanding Regression Trees and Model Trees- Example – Estimating the Quality of Wines with Regression Trees and Model Trees. Black Box Methods Neural Networks and Support Vector Machines: Understanding Neural Networks, from Biological to Artificial Neurons, Activation Functions, Network Topology, Training Neural Networks with Back propagation - Modeling the Strength of Concrete with ANNs- Understanding Support Vector Machines- Performing OCR with SVMs- Finding Patterns – Market Basket Analysis Using Association Rules: Understanding Association Rules- Example – Identifying Frequently Purchased Groceries with Association Rules.

Unit IV:

Finding Groups of Data – **Clustering with K-Means:** Understanding Clustering- The k-means Algorithm for clustering- Finding teen market segments using k-means Clustering- Evaluating Model Performance: Measuring Performance for Classification- beyond Accuracy – other Measures of Performance, Visualizing Performance Tradeoffs.

Improving Model Performance: Tuning Stock Models for Better Performance-Using Caret for Automated Parameter Tuning- Creating a simple Tuned Model- Customizing the Tuning Process-Improving Model Performance with meta-learning- Understanding Ensembles- Bagging- Boosting-Random forests.

Unit V:

Introduction to Deep Learning: Introduction to Deep Learning, Single Layer Perceptron Model (SLP), Multilayer Perceptron Model (MLP), Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs),Restricted Boltzmann Machines (RBMs).

Convolutional Neural Networks (CNNs): Structure and Properties of CNNs - Components of CNN Architectures- Convolutional Layer, Pooling Layer, Rectified Linear Units (ReLU) Layer, Fully Connected (FC) Layer, Loss Layer - Tuning Parameters ,Notable CNN Architectures, Regularization-Recurrent Neural Networks (RNNs): Fully Recurrent Networks, Training RNNs with Back-Propagation Through Time (BPPT)- Elman Neural Networks, Neural History Compressor, Long Short-Term Memory (LSTM), Traditional and Training LSTMs - Structural Damping Within RNNs, Tuning Parameter Update Algorithm.

Text Books:

1. Brett Lantz, “Machine Learning with R”, Addison-Wesley Packt Publishing, 2013.
2. TawehBeysolow, “Introduction to Deep Learning Using R: A Step-by-Step Guide to Learning and Implementing Deep Learning Models Using R”, San Francisco, California, USA, 2017.

Reference Books:

1. Daniel T. Larose, Chantal D. Larose, “Data mining and Predictive analytics”, Second Ed., Wiley Publication, 2015.
2. Bertt Lantz, “Machine Learning with R: Expert techniques for predictive modeling”, 3rd Edition, April 15,2019,
3. Jason Bell, “Machine Learning: Hands-On for Developers and Technical Professionals”, Wiley Publication,2015.

Course Outcomes

On the successful completion of the course, students will be able to

CO1	To understand, impart and analyze the concepts and of Machine Learning Techniques and types of data	**K1-K6**
CO2	To comprehend, apply and evaluate the classification techniques for real-world applications	**K1-K6**
CO3	To understand, use and perform evaluation of Regression methods	**K1-K6**
CO4	To recognize, implement and analyse the unsupervised techniques for real-world applications	**K1-K6**
CO5	To understand, identify, implement and review the deep learning techniques for real-time applications	**K1-K6**

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	S	S	-	-	S	L	-	S	-	-	-	-
CO2	S	S	M	-	S	L	-	S	-	-	-	-
CO3	S	S	S	-	S	L	-	S	-	S	S	S
CO4	S	S	M	-	S	L	-	S	-	-	-	-
CO5	S	S	S	-	S	L	-	S	-	S	S	S

S- Strong; M-Medium; L-Low

23222SEC34L	**Advanced Java Programming lab**	0	0	3	3

COURSE OBJECTIVES:

- To implement object oriented concepts in JAVA
- Develop the program using concepts Network programme
- Learn how to create a program in java beans.
- Learn how to connect relational database to Java
- Develop the program using concepts Applet

List of Experiments:

1. Implementation of and Exception handling concepts with different type of Exception.
2. Build a Swing application to implement metric conversion.
3. Use Grid Layout to design a calculator and simulate the functions of a simple calculator.
4. Create a Color palette with a matrix of buttons using Applet.
5. To invoke a servlet from HTML forms.
6. To invoke servlet from Applets.
7. To invoke servlet from JSP.
8. Implement message communication using Network Programming.
9. Write a program to connect databases using JDBC.
10. Implementation of Java Beans.

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Implement classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem	K1, K2	LO
CO2:	Apply Applets and Swing programs	K3	IO
CO3:	Develop Servlets and JSP for creating Web based applications using JDBC	K4, K5	HO

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	S	S	S	M	M	S	M	M	S	S
CO2	S	S	M	S	S	S	M	S	S	S	S	S
CO3	S	S	S	M	S	S	M	M	S	M	M	S

S- Strong; M-Medium; L-Low

23222SEC35L	Web Technology Lab	0	0	3	3

COURSE OBJECTIVES:

At the end of the course, the student should be able to do:

- Learn how to create web pages using HTML, CSS and Java script.
- Implement dynamic web pages using Java script, J query and Angular Java script
- To create web applications using PHP and MySQL
- Create web pages using XML and Cascading Style Sheets
- Create XML documents and Schemas.

PROGRAM LIST

1. Develop a web page to display your education details in a tabular format. 2. Develop a web page to display your CV on a web page.

3. Design a Homepage having three links: About Us, Our Services and

Contact Us. Create separate web pages for the three links.

4. Design a web page to demonstrate the usage of inline CSS, internal CSS

And external CSS.

5. Design an XML document and create a style sheet in CSS & display the

Document in the browser.

6. Develop a web page to Create image maps.

7. Design a web page to perform input validation using Angular Java script.

8. Develop a web page in PHP to fetch details from the database.

9. Design a web page to hide paragraph using J Query

10. Create a web page and add Java script to handle mouse events and form events

COURSE OUTCOMES:

On the successful completion of the course, students will be able

CO1	Design dynamic web pages using JavaScript, J query and Angular Java script	K1	LO
CO2	Develop Web pages using HTML, CSS and XML	K2	IO
CO3	Create web application using PHP and MySQL	K3, K4	HO
CO4	Develop interactive web pages using J query	K2,K3	HO
CO5	To design dynamic web pages using Angular java script	K4,K5	HO

MAPPING WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	S	S	S	M	M	S	M	M	S	M
CO2	S	S	M	S	S	S	M	S	S	S	M	S
CO3	S	S	S	M	M	S	M	M	S	M	M	S
CO4	S	M	S	M	S	M	M	S	S	M	S	M
CO5	M	M	S	M	S	S	M	S	M	M	S	M

S- STRONG; M-MEDIUM; L-LOW

23222AEC41	Data Visualization Tools	5	1	0	4

COURSE OBJECTIVES

Today's fast world requires the data to be presented in an abstract and appealing way to attract the audience. Most of the websites like social media, ecommerce use info graphics and dashboards to engages their visitors. The use of different data visualization techniques make all these requirements possible through this four weeks Data Visualization Course. This course predominantly uses Python libraries for creating charts, interactive figures and animations.

COURSE OUTCOMES:

- By the end of this course, the learners will be able to
- Use python libraries for data visualization
- Conduct exploratory data analysis using Python
- Interpret results of exploratory data analysis
- Paraphrase the results for documentation

COURSE CONTENTS:

Module 1

Basic Plotting Line plot - Bar plot - Pie Chart - Scatter Plot - Histogram - Stacked Bar Charts - Sub Plots - Matplotlib, Searborn, Plotly - Seaborn Styles

Module 2

Applied Visualizations Box plot - Density Plot - Area Chart - Heat map - Tree map - Graph Networks

Module 3

Interactive Visualizations and Animations Dynamic charts - Dynamic maps - Animation types - 2D, 3D, Motion Animation - Animation Principles - Altair Package - Statistical Visualizations

Module4

Principles of Information Visualization Visual Perception and Cognition - Gestalt's Principles - Tuft's Principles - Applications of Principles of Information Visualization - Dashboard Design

Reference Books:

1. "Information Dashboard Design" by Stephen Few

2. A Data Visualization Guide for Business Professionals" by Cole Nussbaum Knifelike

23222AEC42	Mobile Computing	5	1	0	4

Course Objective:

- To introduce the concepts of wireless devices with signal, Antenna, Radio Frequencies, Signal Propagation.
- To introduce wireless communication and networking principles, that support connectivity to cellular networks, Wireless LAN, GSM, and CDMA.

Unit-I

Introduction – Applications – History of wireless communication – A Simplified reference model - Wireless transmission – Frequencies for radio transmission – Regulations – Signals –Antennas - Signal propagation: Path loss of radio signals - Additional signal propagation effects - Multi-path propagation – Multiplexing –Modulation Chapters: 1, 2.1 to 2.6

Unit-II

Spread spectrum – Direct sequence spread spectrum – Frequency hopping spread spectrum – Cellular systems. Medium access control: Hidden and exposed terminals – Near and far terminals – SDMA, FDMA, TDMA, Fixed TDM, Classical Aloha, slotted Aloha, Carrier sense multiple access – Reservation TDMA – Multiple access with collision avoidance – Polling – CDMA – Spread Aloha multiple access. Chapters: 3.1 to 3.3, 3.4.1 to 3.4.4, 3.4.7 to 3.4.9, 3.5.1

Unit-III

GSM - Mobile services – System architecture – Radio interface – Protocols – Localization and calling – Handover – Security – New Data services. UMTS and IMT-2000 - Satellite Systems: Applications – Basics – Routing – Localization – Handover. Chapters: 3.6, 4.1.1 to 4.1.8, 4.4, and 5.2 to 5.6

Unit-IV

Wireless LAN: Infra red vs. radio transmission – Infrastructure and ad-hoc network – IEEE 802.11 – System architecture – Protocol architecture – Physics layer – Medium access control layer – MAC management – Blue tooth. Mobile network layer: Mobile IP: Goals, assumptions and requirements – entities and terminology – packet delivery – Agent discovery – Registration – Tunneling and encapsulation Recent technologies Chapters: 7.1 to 7.3.5, 7.5, 8.1.1 to 8.1.6

Unit-V

WAP: Architecture – wireless datagram Protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Mobile ad-hoc networks – MANET Characteristics – Classification of MANETs, Routing of MANETs, Proactive Routing Protocol - DSDV, Reactive Routing Protocols – DSR, AODV.Chapter10.3.1 to 10.3.6 (Text Book 2- 6.1, 6.2, 6.4, 6.5, 6.6)

Course Outcomes:

- On the successful completion of the course, students will be able to:
- Understanding the basic concepts of Wireless Communication
- Understanding the basic concepts of Spread Spectrum
- Analyzing the concepts of Medium Access Control
- Analyzing the concepts of Global System for Mobile Communication
- Understanding the basic concepts of Wireless LAN
- Understanding the basic concepts of Mobile Network Layer
- Understanding the basic concepts of Wireless Application Protocol
- Analyzing the concepts of Routing Protocols in MANET

Text Book:

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2013.
2. KumKumGarg, "Mobile Computing Theory and Practice", Pearson Education, 2014.

Reference Books:

1. Rifaat A. Dayen, "Mobile Data & Wireless LAN Technologies", Prentice Hall,1997.
2. Steve Mann and Scoot Schibli, "The Wireless Application Protocol", John Wiley & Inc., 2000.

Course Outcomes:

On the successful completion of the course, students will be able to

CO1	Understanding the basic concepts of Mobile and Wireless Communication	K1, K2	LO
CO2	Understanding the basic concepts of Spread Spectrum. Analyzing the concepts of Medium Access Control.	K3	IO
CO3	Analyzing the concepts of Global System for Mobile Communication and Satellite Communications. Understanding the basic concepts of Wireless LAN	K4	HO
CO4	Understanding the basic concepts of Wireless LAN. Evaluate the performance of Mobile Network Layer	K2, K5	HO
CO5	Understanding the basic concepts of Wireless Application Protocol and create a MoileApp with real time application. Analyzing the concepts of Routing Protocols in MANET	K2, K4, K6	HO

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping Course outcomes with Programme outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L	-	-	-	-	-	-	-	-	-	-	-
CO2	S	M	M	M	M	-	M	-	-	-	-	-
CO3	S	M	M	M	M	-	M	-	-	L	-	M
CO4	S	M	M	M	M	-	M	-	-	L	-	M
CO5	S	M	M	M	M	-	M	-	-	L	-	M

3. S- Strong; M-Medium; L-Low

23222DSC43A	Social Networks	5	1	0	4

Course Objectives

- To learn about Social media, Social networking and Webcasts
- To understanding and building a Word Press Powered Website
- To analysis the Social Networking & Micro-Blogging.
- To learn and analysis the Widgets & Badges.
- To explore the importance of Website optimization.

UNIT I: Introduction: Social Media Strategy-Important First Decisions -Websites, Blogs - RSS Feeds Mapping -Preparation - Multimedia Items Gathering Content for Blog Posts RSS Feeds & Blogs-RSS Feeds-The Feed Reader-The Feed-Options for Creating an RSS Feed-Planning Feed-Blogs-Options for Starting. Blog and RSS Feed-Feed or Blog Content-Search Engine Optimization (SEO)-Feed Burner-RSS Feed and Blog Directories-An Optimization Plan for Blog or RSS Feed

UNIT II: Building a Word Press Powered Website: Word Press as A CMS - Diversity of Word Press Sites-The Anatomy of a Word Press Site -a Brief Look at the Word Press Dashboard Planning - Site Themes Plug-ins setting up Sidebars Building Pages- Posting Blog Entries. Podcasting, Vidcasting, & Webcasting- Publishing Options for Podcast- Creating and Uploading Podcast Episodes-Publishing Podcast Optimizing Podcast- Webcasting

UNIT III: Social Networking & Micro-Blogging: Facebook-The Facebook Profile -Myspace LinkedIn-Twitter-Niche Social Networking Sites-Creating Own Social Network-Promoting Social Networking Presence- Social Bookmarking & Crowd-Sourcing - Social Bookmarking-A Social Bookmarking Strategy- Crowd-Sourced News Sites- Preparation And Tracking Progress Media Communities-Image Sharing Sites-Image Sharing Strategy-Video Sharing Sites-Video Sharing Strategy-Searching And Search Engine Placement-Connecting With Others.

UNIT IV: Widgets & Badges: Highlighting Social Web Presence-Sharing And Syndicating Content Making Site More Interactive-Promoting Products And Making Money-Using Widgets In Word Press-Widget Communities And Directories- Working Widgets Into Strategy Social Media Newsrooms-Building Social Media Newsroom - Populating The Newsroom-Social Media News Releases-Social Media Newsroom Examples. More Social Tools-Social Calendars-Social Pages Wikis-Social Search Portals-Virtual Worlds.

Unit V: Website optimization: A Website Optimization Plan-Streamlining Web Presence-An Integration Plan- Looking to the Future-Life streaming: The Future of Blogging-Distributed Social Networking-Social Ranking, Relevancy, and ―Defriending-Web 3.0 or The Semantic Web-Mobile Technology- Measuring Your Success-A Qualitative Framework-A Quantitative Framework-Tools to Help You Measure-Come To Your Own Conclusions

Text Book:

1. Deltina hay ―A Survival Guide To social Media and Web 2.0 Optimization‖, Dalton Publishing, 2009

Reference Books:

1. Miriam Salpeter ―Social networking for Career Success‖ Learning Express, 2011.
2. Miles, Peggy, ―Internet world guide to webcasting‖ Wiley, 2008
   Professionals", Wiley Publication, 2015.

Course Outcomes On the successful completion of the course, students will be able to

CO1:	To understand, impart and summarize the concepts of Social media, Social networking and Webcasts	K1-K6
CO2:	To comprehend, design and develop a Word Press Powered Website	K1-K6
CO3:	To understand, implement and perform evaluation of Social Networking and Micro-Blogging	K1-K6
CO4	To collaborate, implement and analyze the Widgets and Badges in social networking environment	K1-K6
CO5	To understand, illustrate and perform evaluation of web optimization for social networks	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	S	S	S	-	S	L	-	S	-	S	S	S
CO2	S	S	S	-	S	L	-	S	-	S	S	S
CO3	S	S	S	-	S	L	-	S	-	S	S	S
CO4	S	S	S	-	S	L	-	S	-	S	S	S
CO5	S	S	S	-	S	L	-	S	-	S	S	S

S- Strong; M-Medium; L-Low

23222DSC43B	Social Networks Lab	0	0	3	3

Course Objectives

- To familiarize the tools required to manage social network applications
- To analyze social networks like Facebook, LinkedIn, Google+, GitHub
- To teach the fundamental techniques and principles in achieving social networking environment.
- To enable students to have skills that will help them to solve real time applications.
- To get explore in the Github API.

List of Programs

1. Creating and Exploring Twitter's API
2. To analyzing and visualizing tweets and tweet entities with frequency analysis
3. Creating and Exploring Facebook's Social Graph API
4. To analyzing the Facebook's Social Graph connections
5. Creating and Exploring LinkedIn API
6. To downloading LinkedIn connections as a CSV file
7. Creating and Exploring Google+ API
8. To create and querying Human Language Data with TF-IDF
9. Creating and Exploring GitHub's API
10. To analyzing GitHub interest graph

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	To understand, implement and review the fundamental techniques and principles for social networks.	K1-K6
CO2:	To design and develop the programs using the tools required to develop and manage social network like Facebook, LinkedIn, Google+, GitHub	K1-K6
CO3:	To create and explore the functionality of social networking tools such as GitHub	K1-K6
CO4	To understand, implement and review the fundamental principles for social network graph.	K1-K6
CO5	To comprehend and critically analyze the existing API for social networks	K1-K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	S	S	M		M	S	-	-	-	S	-	-
CO2	S	M	S	S	S	M	-	-	-	S	-	-
CO3	S	S	S	S	S	S	-	-	-	S	S	S
CO4	S	M	S	S	S	M	-	-	-	S	-	-
CO5	S	S	S	S	S	S	-	-	-	S	S	S

S- Strong; M-Medium; L-Low

23222DSC43C	High Performance Computing	5	1	0	4

Course Objectives:

- To get a clear idea of High Performance Computing concept.
- To get brief knowledge about how to function the HPC systems.
- To get idea of what techniques used in HPC models.
- To understand a Parallel computing concepts.
- To get familiar with Open MP technology that is widely used in HPC technology.

Unit-I

Modern processors: Stored-program computer architecture-General purpose cache based microprocessor architecture-Memory hierarchies-Multicore processors-Multithreaded processors-Vector processors. **Basic optimization techniques for serial code:** Scalar profiling-Common sense optimizations-Simple measures, large impact-The role of compilers-C++ optimizations.

Unit-II

Data access optimization: Balance analysis and light speed estimates-Storage order-Algorithm classification and access optimizations-The Jacobi algorithm-Algorithm classification and access optimizations-Sparse matrix-vector multiply. **Parallel computers:** Taxonomy of parallel computing paradigms-Shared-memory computers-Distributed memory computers-Hierarchical systems-Networks.

Unit-III

Basics of parallelization: Introduction to Parallelism -Parallel scalability. **Shared memory parallel programming with Open MP:** Short introduction to Open MP-Open MP-parallel Jacobi algorithm.

Unit-IV

Efficient Open MP programming: Profiling Open MP programs-Performance pitfalls-Parallel sparse matrix-vector multiply. **Locality optimizations on ccNUMA architectures:** Locality of access on ccNUMA-ccNUMA optimization of sparse MVM-Placement pitfalls-ccNUMA issues with C++.

Unit-V

Distributed-memory parallel programming with MPI: Message passing-A short introduction to MPI-MPI parallelization of a Jacobi solver. **Efficient MPI programming:** MPI performance tools-Communication parameters-Synchronization, serialization, contention-Reducing communication overhead-Understanding internode point-to-point communication.

Text book:

1. Georg Hager, Gerhard Wellein "Introduction to High Performance Computing for Scientists and Engineers", CRC Press, 2011.**Chapters:** 1 to 10.

Reference books:

1. Michael W. Berry, Kyle A. Gallivan, EfstratiosGallopoulos, Ananth Grama, Bernard Philippe, Yousef Saad, Faisal Saied, "High-performance scientific computing: algorithms and applications", Springer, 2012.
2. Victor Eijkhout, "Introduction to High Performance Scientific Computing", MIT Press, 2011.

Course Outcome:

On the successful completion of the course, students will be able to,

CO1	Understand of the HPC and ccNUMA concepts	K1 - K6
CO2	Design and develop a parallel programming with modern C, C++ and new version of FORTRAN	
CO3	Apply with parallel computing	
CO4	Develop an efficient Open MP programming	
CO5	Evaluate an efficient MPI programming	

K1- Remember, K2 - Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 -Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	S	L	M	L	L	L	S	S	S	S	M	L
CO2	S	M	L	M	M	L	S	L	S	L	S	L
CO3	S	S	S	M	M	L	M	L	M	L	S	L
CO4	S	S	S	M	S	L	M	L	M	S	S	S
CO5	S	S	S	M	M	L	M	M	M	M	S	L

L - Low, M- Medium, S - Strong

23222PRW44	Project with Viva voce	0	0	10	4

Each student will develop and implement individually developed application software based on any of the latest technologies.

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

B.Sc., COMPUTER SCIENCE CURRICULUM

FULL TIME

[Regulation 2023]

[Candidates admitted from the academic year 2023-2024 onwards]

INDEX

REGULATIONS ON LEARNING OUTCOMES BASED CURRICULUM FRAME WORK FOR UNDERGRADUATE EDUCATION

1. Preamble

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Learning Outcomes-based Curriculum Framework (LO CF) which makes it student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. LOCF also aims at ensuring uniform education standard and content delivery across the state which will help the students to ensure similar quality of education irrespective of the institute and location.

Computer Science is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer science is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Science can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain. Computer science has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges. Computer Science is practiced by mathematicians, scientists and engineers. Mathematics, the origins of Computer Science, provides reason and logic. Science provides the methodology for learning and refinement. Engineering provides the techniques for building hardware and software.

Programme Outcome, Programme Specific Outcome and Course Outcome

Computer Science is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. The key core areas of study in Mathematics include Algebra, Analysis (Real & Complex), Differential Equations, Geometry, and Mechanics. The Students completing this programme will be able to present Software application clearly and precisely, make abstract ideas precise by formulating them in the Computer languages. Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in software industry, banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST) LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME	
Programme:	**B.Sc. Computer Science**
Programme Code:	**23UGCSCGE**
Duration:	**3 years [UG]**
Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3:Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyze and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extrapolate from what one has learned and applies their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesizing and articulating; Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation

PO7: Cooperation/Team work: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team**PO8: Scientific reasoning**: Ability to analyze interprets and draws conclusions from quantitative/qualitative data; and critically evaluates ideas, evidence and experiences from an open-minded and reasoned perspective.

PO9: Reflective thinking: Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.

PO10 Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO 11 Self-directed learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.

PO 12 Multicultural competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO 13: Moral and ethical awareness/reasoning: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demon starting the ability to identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.

PO 14: Leadership readiness/qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.

PO 15: Lifelong learning: Ability to acquire knowledge and skills, including „learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

Programme Specific Outcomes:	**PSO1**: To enable students to apply basic microeconomic, macroeconomic and monetary concepts and theories in real life and decision making. **PSO 2**: To sensitize students to various economic issues related to Development, Growth, International Economics, Sustainable Development and Environment. **PSO 3**: To familiarize students to the concepts and theories related to Finance, Investments and Modern Marketing. **PSO 4**: Evaluate various social and economic problems in the society and develop answer to the problems as global citizens. **PSO 5:** Enhance skills of analytical and critical thinking to analyze effectiveness of economic policies.

PROGRAM OUTCOMES

PO1	➢ Scientific aptitude will be developed in Students
PO2	➢ Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the Computer Science & humanities stream.
PO3	➢ Students will become employable; Students will be eligible for career opportunities in education field, Industry, or will be able to opt for entrepreneurship.
PO4	➢ Students will possess basic subject knowledge required for higher studies, professional and applied courses.
PO5	➢ Students will be aware of and able to develop solution oriented approach towards various Social and Environmental issues.
PO6	➢ Ability to acquire in-depth knowledge of several branches of Computer Science and aligned areas. This Programme helps learners in building a solid foundation for higher studies in Computer Science and applications.
PO7	➢ The skills and knowledge gained leads to proficiency in analytical reasoning, which can be utilized in modeling and solving real life problems.
PO8	➢ Utilize computer programming skills to solve theoretical and applied problems by critical understanding, analysis and synthesis.
PO9	➢ To recognize patterns and to identify essential and relevant aspects of problems.
PO10	➢ Ability to share ideas and insights while seeking and benefitting from knowledge and insight of others.
PO11	➢ The skills and knowledge gained leads to proficiency in analytical reasoning, which can be utilized in modeling and solving real life problems.

PROGRAM SPECIFIC OUTCOMES

PSO1	Think in a critical and logical based manner.
PSO2	Familiarize the students with suitable software tools of computer science and industrial applications to handle issues and solve problems in mathematics or Statistics and real-time application related sciences.
PSO3	Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.
PSO4	Understand, formulate, develop programming model with logical approaches to a Address issues arising in social science, business and other contexts.
PSO5	Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of Computer science and Industrial statistics.
PSO6	Provide students/learners sufficient knowledge and skills enabling them to undertake further studies in Computer Science or Applications or Information Technology and its allied areas on multiple disciplines linked with Computer Science.
PSO7	Equip with Computer science technical ability, problem solving skills, creative talent and power of communication necessary for various forms of employment.
PSO8	Get adequate exposure to global and local concerns that provides platform for further exploration into multi-dimensional aspects of Computing sciences.
PSO9	Get adequate exposure to global and local concerns that provides platform for further exploration into multi-dimensional aspects of Computing sciences.

PROGRAMME EDUCATIONAL OBJECTIVE (PEO)

PEO1	To study about I/O management, storage management.
PEO2	To know the methods of connecting them to the peripheral devices
PEO3	- To learn Software design and Implementation
PEO5	To learn the basic principles of database and database design
PEO6	To understand dynamic memory allocation, structure and pointers
PEO7	To understand computational development of graphics with mathematics
PEO8	Design and implement reliable and maintainable object-oriented applications of Moderate complexity composed of several classes

Eligibility for admission

To be eligible to enroll in for the B. Sc. in computer science degree courses you need to clear the following eligibility criteria.

- Students need to have graduated their 12th standard in the science stream with physics, chemistry and mathematics (PCM),
- Students who have science with physics, chemistry and biology (PCB).

Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final
- Semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Mathematics based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.

- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest - Artificial Intelligence.

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome/ Benefits
I	**Foundation Course** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning Literature and analyzing the world through the literary lens Give rise to a new perspective.	➢ Instill confidence among students ➢ Create interest for the subject
I,II,III,IV	**Skill Enhancement papers**(Discipline centric /Generic/Entrepreneurial)	➢ Industry ready graduates ➢ Skilled human resource ➢ Students are equipped with essential skills to Make them employable
		➢ Training on language and communication skills enable the students gain knowledge and Exposure in the competitive world.
		➢ Discipline centric skill will improve the Technical knowhow of solving real life Problems.
III,IV,V & VI	Elective papers	➢ Strengthening the domain knowledge ➢ Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter-disciplinary nature ➢ Emerging topics in higher education/industry/communicationnetwork/healthsectoretc.areintroducedwith hands-on-training.

IV	Elective Papers	➢ Exposure to industry moulds students in to solution providers ➢ Generates Industry ready graduates ➢ Employment opportunities enhanced
V Semester	Elective papers	➢ Self-learning is enhanced ➢ Application of the concept to real situation is conceived resulting intangible outcome
VI Semester	Elective papers	➢ Enriches the study beyond the course. ➢ Developing are search framework and presenting their independent and intellectual ideas effectively.
Extra Credits: **For Advanced Learners /Honors degree**		**1.** To cater other needs of peer learners/research aspirants
Skills acquired from the Courses		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

1.1.3	colour
EMPLOYABILITY	
SKILL DEVELOPMENT	
ENTREPRENEURSHIP	
EMPLOYABILITY,/ENTREPRENEURSHIP,/SKILL DEVELOPMENT	
EMPLOYABILITY,/SKILL DEVELOPMENT	
EMPLOYABILITY,/ENTREPRENEURSHIP	

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SCHOOL OF ARTS AND SCIENCE
DEPARTMENT OF COMPUTER SCIENCE
B.Sc. COMPUTER SCIENCE
REGULATION 2023 – 2024
COURSE STRUCTURE
SEMESTER-I

Course Code	Course Title - B.Sc.(cs)	L	T	P	C
THEORY					
23110AEC11/ 23111AEC11/ 23132AEC11/ 23135AEC11	Tamil – I/Advanced English-I/Hindi-I/ French – I	3	1	0	3
23111AEC12	English-I	3	1	0	3
23120AEC13	Python Programming	4	1	0	3
23120GEC14	Numerical Methods	3	1	0	3
23120GEC15	Statistics	3	1	0	3
PRACTICAL					
23120SEC16L	Python Programming Lab	0	0	3	3
SKILL ENHANCEMENT COURSE					
23120SEC17	Fundamentals of Information Technology	2	0	0	2
23120SEC18	Problem Solving Techniques	2	0	0	2
ABILITY ENHANCEMENT COMPULSORY COURSE(AECC1)					
231AECCINC	Indian Constitution	2	0	0	2
AUDIT COURSE					
231LSCUV	Universal Human Values	-	-	-	1
	Total	**22**	**5**	**3**	**25**

SEMESTER – II

Course Code	Course Title - B.Sc.(cs)	L	T	P	C
THEORY					
23110AEC21/ 23111AEC21/ 23132AEC21/ 23135AEC21	Tamil – II/Advanced English-II/Hindi-II/ French - II	3	1	0	3
23111AEC22	English-II	3	1	0	3
23120AEC23	Data Structure & Algorithms	4	1	0	3
23120GEC24	Operations Research	3	1	0	3
23120GEC25	Discrete Mathematics	3	1	0	3
PRACTICAL					
23120SEC26L	Data Structure and Algorithms lab	0	0	3	3
SKILL ENHANCEMENT COURSE					
23120SEC27	Quantitative Aptitude	2	0	0	2
23120SEC28	Advanced Excel	2	0	0	2
ABILITY ENHANCEMENT COMPULSORY COURSE(AECC1)					
231AECCCMS	Communication Skills	2	0	0	2
AUDIT COURSE					
231SSCBE	Basic Behavioural Etiquette	-	-	-	1
	Total	**22**	**5**	**3**	**25**

SEMESTER – III

Course Code	Course Title - B.Sc.(cs)	L	T	P	C
THEORY					
23110AEC31/ 23111AEC31/ 23132AEC31/ 23135AEC31	Tamil – III/Advanced English-III/Hindi-III/ French – III	3	1	0	3
23111AEC32	English-III	3	1	0	3
23120AEC33	Microprocessor and Microcontroller	5	1	0	4
23120DSC34_	Discipline Specific Elective-I	5	1	0	3
PRACTICAL					
23120SEC35L	Microprocessor and Microcontroller lab	0	0	3	3
SKILL ENHANCEMENT COURSE					
23120SEC36	Introduction to HTML	3	0	0	2
23120SEC37	Cloud Computing	2	0	0	2
ABILITY ENHANCEMENT COMPULSORY COURSE(AECC1)					
23120RMC38	Research Methodology	2	0	0	2
AUDIT COURSE					
231ACLSOAN	Office Automation	-	-	-	1
	Total	**23**	**4**	**3**	**23**

SEMESTER – IV

Course Code	Course Title - B.Sc.(cs)	L	T	P	C
THEORY					
23110AEC41/ 23111AEC41/ 23132AEC41/ 23135AEC41	Tamil – IV/Advanced English-IV/Hindi-IV/ French – IV	3	0	0	3
23111AEC42	English-IV	3	0	0	3
23120AEC43	Java Programming	5	1	0	3
23120DSC44_	Discipline Specific Elective-II	5	1	0	3
PRACTICAL					
23120SEC45L	Java Programming lab	0	0	3	3
SKILL ENHANCEMENT COURSE					
23120SEC46	PHP Programming	3	0	0	2
23120SEC47	Software Testing	2	0	0	2
ABILITY ENHANCEMENT COMPULSORY COURSE(AECC1)					
23120BRC48	Participation in Bounded Research	2	0	0	2
231AECCEVS	Environmental Studies	2	-	-	2
AUDIT COURSE					
231LCSCLS	Leadership and Management Skills	-	-	-	1
	Total	**25**	**2**	**3**	**24**

SEMESTER – V

Course Code	Course Title - B.Sc.(cs)	L	T	P	C
THEORY					
23120AEC51	Software Engineering	5	1	0	4
23120AEC52	Database Management System	5	1	0	3
23120AEC53	IOT and its Applications	5	0	0	4
23120DSC54_	Discipline Specific Elective-III	4	0	0	4
23120DSC55_	Discipline Specific Elective-IV	4	0	0	4
PRACTICAL					
23120SEC56L	Database Management System lab	0	0	3	3
23120SEC58	Internship / Industrial Training				2
AUDIT COURSE					
231ACLSPSL	Professional Skills	-	-	-	1
231AECCVED	Value Education	2	-	-	2
	Total	**25**	**2**	**3**	**27**

SEMESTER – VI

Course Code	Course Title - B.Sc.(cs)	L	T	P	C
THEORY					
23120AEC61	Computer Networks	5	1	0	4
23120AEC62	Data Analytics Using R	5	1	0	4
23120DSC63_	Discipline Specific Elective-V	5	0	0	3
PRACTICAL					
23120SEC64L	Data Analytics Using R lab	0	0	3	3
23120PRW65	Project	8	0	0	4
23120SEC66	Professional Competency Skill General awareness for competitive examination	2	0	0	2
23120EXACT	Extension Activity	-	-	-	1
AUDIT COURSE					
231ACSIKWS	Indian Knowledge System	-	-	-	2
	Total	25	2	3	23
Total Credits-Programme					**140**
Total Credits-Audit Courses					**07**
Total Credits					**147**

Discipline Specific Electives

Semester	**Discipline Specific Elective Courses-I**
III	a) 23120DSC34A- Image Processing b)23120DSC34B- Big Data Analytics c)23120DSC34C-Natural Language Processing
	Discipline Specific Elective Courses-II
IV	a)23120DSC44A- Agile Project Management b)23120DSC44B- Analytics for Service Industry c)23120DSC44C-Computational Intelligence
V	**Discipline Specific Elective Courses-III**
	a)23120DSC54A-Introduction to Data science b)23120DSC54B- RDBMS with PL/SQL c)23120DSC54C- Cloud Computing
	Discipline Specific Elective Courses-IV
	a)23120DSC55A-Disaster Management b)23120DSC55B- Artificial Neural Network c)23120DSC55C-Cryptography
	Discipline Specific Elective Courses-V
VI	a)23120DSC63A-Robotics and its Applications b)23120DSC63B- Virtual Reality c)23120DSC63C-Mobile Adhoc Network

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Credit Distribution for UG Programme

Consolidated Semester wise Credit distribution

SEM	AEC	SEC	GEC	DSC	AECC	Research	others	Total
I	9	7	6	-	2	-	1	25
II	9	7	6	-	2	-	1	25
III	10	7	-	3	-	2	1	23
IV	9	7	-	3	2	2	1	24
V	11	5	-	8	-	-	3	27
VI	8	5	-	3	-	4	3	23
Total	**56**	**38**	**12**	**17**	**6**	**8**	**10**	**147**

AUDIT COURSE CREDIT DISTRUBUTION

Sem	Audit
I	1
II	1
III	1
IV	1
V	1
VI	2
Total	7

HOD **DEAN**

இக்கால இலக்கியம்

23110AEC11

முதல் பருவம்

பாட நோக்கங்கள்

1. இக்காலதமிழ்இலக்கியவகைகளின்மாதிரிகளைகற்பித்தல்.
2. தமிழின்இனிமையையுணரச்செய்தல்
3. தமிழின்ஈடுபாட்டையும்சுவைக்கும்திறனையும்ஏற்படுத்துதல்.
4. கவிதை எழுதும் திறனை உருவாக்குதல்
5. **படைப்பாளர்களாக உருவாக்கும் திறனை** ஏற்படுத்துதல்.

பயன்கள்

- மொழி ஆளுமைத்திறன் பெறுதல்.
- சமூக சிந்தனையை வளர்த்துக் கொள்ளுதல்.
- **படைப்பாளர்களாக உருவாகும் திறனைப் பெறுதல்**.
- இலக்கியங்களின் அறிவை மேம்படுத்துதல்.
- கவிதைஎழுதும் முறையை புரிந்துக்கொள்ளுதல்

அலகு -1 மரபுக்கவிதை

1. பாரதியார்--விடுதலை, வந்தே மாதரம் ,காற்று

2.பாரதிதாசன் - அழகின்சிரிப்பு , தமிழனுக்கு வீழ்ச்சி இல்லை

3.கவிமணிதேசியவிநாயகம்பிள்ளை—தொழிலாளியின் முறையீடு

4.நாமக்கல்கவிஞர்—தருணம் இதுவே ,

5.கண்ணதாசன்-- அனுபவம்

அலகு -2புதுக்கவிதைகள்

1.அப்துல்ரகுமான் -வெற்றி

2.அறிவுமதி-நட்புக்காலம்

3.வைரமுத்து- ருசி, சிற்பி- ஓடுஓடுசங்கிலி

4.மு.மேத்தா- வெளிச்சம் வெளியே இல்லை

அலகு -3நாட்டுப்புறவியல்

1.பழமொழிகள்

2. விடுகதைகள்

3. தொழில்பாடல்

அலகு- 4 சிறுகதை

1. தடயம்- மா. ஜெயபிரகாசம்

2. எதார்த்தம் - சு. தமிழ்ச்செல்வி

3.நீதி-- பூமணி

அலகு- 5இலக்கியவரலாறு

1. கவிதை
2. சிறுகதை
3. நாட்டுப்புறவியல்

பொதுக்கட்டுரை –மனிதநேயம், வாழ்வியல்அறங்கள்

மனப்பாடப்பகுதி : பாரதியார் கவிதை- வேண்டும்,பாரதிதாசன் கவிதை- செந்தாமரை

பார்வை நூல்கள் :

1. பாரதியார் கவிதைகள் - மணிவாசகர் பதிப்பகம் சென்னை

2.**பாரதிதாசன்கவிதைகள் - பாரிநிலையம், சென்னை**

3. தமிழ் இலக்கிய வரலாறு - முவரதராஜன் சாகித்திய அகாதெமி,சென்னை.

4. நாட்டுப்புறவியல் - முனைவர். ஆறு. ராமநாதன் ,மணிவாசகர்பதிப்பகம், சென்னை.

5.**தமிழ்சிறுகதையும்தோற்றம்வளர்ச்சி – தமிழ் புத்தக நிலையம், சென்னை.**

இணையதளம் -www.tamilvu.org
www.noolulagam.com

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

FIRST YEAR - SEMESTER I

PAPER II –GENERAL ENGLISH

Subject Code	Category	L	T	P	C	Inst. Hours	Marks		
							CIA	External	Total
23111AEC12	Part II	3	1	-	3	6	25	75	100

Learning Objectives	
LO1	To enable learners to acquire the linguistic competence necessarily required in various life situations.
LO2	To help them understand the written text and able to use skimming, scanning skills
LO3	To assist them in creative thinking abilities
LO4	To enable them become better readers and writers
LO5	To assist them in developing correct reading habits, silently, extensively and intensively

Unit No.	Unit Title & Text	No. of Periods for the Unit
I	**Poetry** 1.1 A Patch of Land - Subramania Bharati 1.3 A Nation's Strength – Ralph Waldo Emerson 1.4 Love Cycle - Chinua Achebe	20
II	**Prose** 2.1 JRD - Harish Bhatt 2.2 Us and Them - David Sedaris From Dress Your Family in Corduroy and Denim	20
III	**Short Stories** 3.1 The Faltering Pendulum- Bhabani Bhattacharya 3.2 How I Taught my Grandmother to Read- Sudha Murthy 3.3 The Gold Frame- R.K. Laxman	20
IV	**Language Competency** 4.1 Vocabulary : Synonyms, Antonyms, Word	15

	Formation 4.2 Appropriate use of Articles and Parts of Speech 4.3 Error correction	
V	**English for Workplace** 5.1 Self - introduction, Greetings 5.2 Introducing others 5.3 Listening for General and Specific Information 5.4 Listening to and Giving Instructions / Directions	15

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Develop and integrate the use of the four language skills i.e. Reading, Listening, Speaking and Writing	PO1
CO2	Understand the total content and underlying meaning in the context.	PO1,PO2
CO3	Form the habit of reading for pleasure and for information	PO4,PO6
CO4	Comprehend material other than the prescribed text	PO4,PO5,PO6
CO5	Develop the linguistic competence that enables them, in the future, to present the culture and civilization of their nation.	PO3,PO8

	Text books (Latest Editions)
1	Steel Hawk and other stories by Bhattacharya, Bhabani, New Delhi: Sahitya Academy, 1967
2	How I taught my Grandmother to Read and other Stories, Murthy, Sudha,Penguin Books, India, 2004

Web Resources	
1	A patch of land by Subramania Bharati translated by Usha Rajagoplan : https://books.google.co.in/books?id=iSHvOmXuvLMC&printsec=frontcover&dq=subramania+bharati+poems&hl=en&newbks=1&newbks_redir=0&source=gb_mobile_search&sa=X&redir_esc=y#v=onepage&q=subramania%20bharati%20poems&f=false
2	The Sparrow by Paul Laurence Dunbar https://poets.org/poem/sparrow-0
3	A Nation's Strength by Emerson https://poets.org/poem/nations-strength
4	Love cycle by Chinua Achebe : https://www.best-poems.net/chinua-achebe/love-cycle.html
5	JRD by Harish Bhatt https://www.tata.com/newsroom/heritage/coffee-tea-jrd-tata-stories
6	Us and Them by David Sedaris From Dress Your Family in Corduroy and Denim https://legacy.npr.org/programs/morning/features/2004/jun/sedaris/usandthem.html
7	Uncle Podgier Hangs a Picture: http://rosyhunt.blogspot.com/2013/01/uncle-podger-hangs-picture.html
8	The Gold Frame: https://fybaenglish.blogspot.com/2018/12/the-gold-frame-r-k-laxman.html

Reference Books

(Latest Editions, and the style given must be strictly adhered to)

1.	English in use - A textbook for College Students (English, Paper back, - T.Vijay Kumar, K Durga Bhavani, YL Srinivas.
2	Practical English Usage - 4th Edition By Michael Swan
3.	**The Art of Civilized Conversation: A Guide to Expressing Yourself with Style and Grace -Shepherd, Penny**, Sharon Hogan, 2005.

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

Mapping with Programme Specific Outcomes:

CO /PO	PS O1	PS O2	PS O3	PS O4	PS O5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

CORE PAPER

Subject Code	Subject Name	Category	L	T	P	C		Marks		
								CIA	Exter	Total
23120AEC13	Python programming	**Core**	4	1	0	3		25	75	100

Learning Objectives	
LO1	To make students understand the concepts of Python programming.
LO2	To apply the OOPs concept in PYTHON programming.
LO3	To impart knowledge on demand and supply concepts
LO4	To make the students learn best practices in PYTHON programming
LO5	To know the costs and profit maximization

UNIT	**Contents**	**No. of Hours**
I	**Basics of Python Programming:** History of Python-Features of Python-Literal-Constants-Variables - Identifiers–Keywords-Built-in Data Types-Output Statements – Input Statements-Comments – Indentation- Operators-Expressions-Type conversions. **Python Arrays:** Defining and Processing Arrays – Array methods.	**15**
II	**Control Statements:** Selection/Conditional Branching statements: if, if-else, nested if and if-if-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. **Jump Statements:** break, continue and pass statements**.**	**15**
III	**Functions:** Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement. **Function Arguments**: Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments- Recursion. **Python Strings:** String operations-Immutable Strings - Built-in String Methods and Functions - String Comparison. **Modules**: import statement- The Python module – dir() function – Modules and Namespace – Defining our own modules.	**15**
IV	**Lists:** Creating a list -Access values in List-Updating values in Lists-Nested lists -Basic list operations-List Methods. Tuples: Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples– Difference between lists and tuples. **Dictionaries:** Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries.	**15**
V	**Python File Handling:** Types of files in Python - Opening and Closing files-Reading and Writing files: write() and writelines() methods-append() method – read() and readlines() methods – with keyword – Splitting words – File methods - File Positions- Renaming and deleting files.	**15**
	TOTAL HOURS	**75**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Learn the basics of python, Do simple programs on python, Learn how to use an array.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Develop program using selection statement, Work with Looping and jump statements, Do programs on Loops and jump statements.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Concept of function, function arguments, Implementing the concept strings in various application, Significance of Modules, Work with functions, Strings and modules.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Work with List, tuples and dictionary, Write program using list, tuples and dictionary.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of File handlings in python, Concept of reading and writing files, Do programs using files.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	ReemaThareja, "Python Programming using problem solving approach", First Edition, 2017, Oxford University Press.	
2	Dr. R. NageswaraRao, "Core Python Programming", First Edition, 2017, Dream tech Publishers.	
Reference Books		
1.	VamsiKurama, "Python Programming: A Modern Approach", Pearson Education.	
2.	Mark Lutz, "Learning Python", Orielly.	
3.	Adam Stewarts, "Python Programming", Online.	
4.	Fabio Nelli, "Python Data Analytics", APress.	
5.	Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication.	
Web Resources		
1.	https://www.programiz.com/python-programming	
2.	https://www.guru99.com/python-tutorials.html	
3.	https://www.w3schools.com/python/python_intro.asp	
4.	https://www.geeksforgeeks.org/python-programming-language/	
5.	https://en.wikipedia.org/wiki/Python_(programming_language)	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	15	14	15	15	13	14

FIRST YEAR - SEMESTER I

COMPUTER SCIENCE-ALLIED MATHEMATICS
PAPER-1 NUMERICAL METHODS

Subject Code	Category	L	T	P		C	Inst. Hours	Marks		
								CIA	External	Total
23120GEC14		3	1	0		3		25	75	100

Learning Objectives	
LO1	To introduce the various topics in Numerical methods.
LO2	To make understand the fundamentals of algebraic equations.
LO3	To apply interpolation and approximation on examples.
LO4	To solve problems using numerical differentiation and integration.
LO5	To solve linear systems, numerical solution of ordinary differential equations

UNIT	DETAILS
I	**FUNDAMENTALS OF ALGEBRAIC EQUATION**: Solution of algebraic and transcendental equations-Bisection method – Fixed point iteration method – Newton Raphson method –linear system of equations – Gauss elimination method – Gauss Jordan method .
II	**ITERATIVE, INTERPOLATION AND APPROXIMATION:** Iterative methods - Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by Power method and Jacobi's method for symmetric matrices. Interpolation with unequal intervals – Lagrange's interpolation – Newton's divided difference interpolation
III	**INTERPOLATION WITH EQUAL INTERVAL:** Difference operators and relations. -Interpolation with equal intervals – Newton's forward and backward difference formulae.
IV	**NUMERICAL DIFFERENTIATION AND INTEGRATION:** Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule
V	**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS:** Single step methods – Taylor's series method – Euler's method – Modified Euler's method – Runge-Kutta method for solving(first, second , Third and 4th) order equations – Multi step methods

Course Outcomes		
CO1	Know how to solve various problems on numerical methods	PO1
CO2	Use approximation to solve problems	PO1,PO2
CO3	Differentiation and integration concept are applied	PO4,PO6
CO4	Apply , direct methods for solving linear systems	PO4,PO5, PO6
CO5	Numerical solution of ordinary differential equations	PO3,PO8

Text Books (Latest Editions)	
1	Charles Dierbach, "Introduction to Computer Science using Python - A computational Problem solving Focus", Wiley India Edition, 2015.
2	Wesley J. Chun, "Core Python Applications Programming", 3rd Edition , Pearson Education, 2016
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	Mark Lutz, "Learning Python Powerful Object Oriented Programming", O'reilly Media 2018, 5th Edition.
2	Timothy A. Budd, "Exploring Python", Tata MCGraw Hill Education Private Limited 2011, 1 st Edition.
Web Resources	
1	https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	2	3	3	3	2	1	3
CO2	2	1	3	1	3	3	3	2	1	2
CO3	3	2	3	1	3	3	3	2	1	3
CO4	1	2	3	2	3	3	3	2	1	1
CO5	3	1	2	3	3	3	3	2	1	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

COMPUTER SCIENCE-ALLIED MATHEMATICS
PAPER-2 STATISTICS

Subject Code	Category	L	T	P		C	Inst. Hours	Marks		
								CIA	External	Total
23120GEC15		3	1	0		3		25	75	100

Learning Objectives	
LO1	Distinguish among different scales of measurement and their implications for solving problems
LO2	Create tables and graphs to format, organize, and interpret data; summarize and present data
LO3	Calculate and analyze numerical descriptive measures for a given data set
LO4	Apply concepts of sample space and probability to solving problems
LO5	Calculate measures of central tendency and variation; use statistical software to analyze

UNIT	DETAILS
I	**Data:** quantitative and qualitative, attributes, variables, Scales of measurement: nominal, ordinal, interval and ratio, Measures of Central Value: Meaning, Need for measuring central value. Characteristics of an ideal measure of central value. Types of averages - mean, median, mode, harmonic mean and geometric mean. Merits, Limitations and Suitability of averages.
II	**Correlation Analysis:** Meaning and significance. Correlation and Causation, Types of correlation, Methods of studying simple correlation - Scatter diagram, Karl Pearson's coefficient of correlation, Spearman's Rank correlation coefficient.
III	**Regression Analysis:** Meaning and significance, Regression vs. Correlation, Simple Regression model: Linear Regression, Conditions for simple linear regression
IV	**Time Series :**Analysis of Time Series, Methods of measuring trend and seasonal variations
V	**Index Numbers:** Consumers price index and cost of living indices

Course Outcomes		
CO1	The learners will apprehend the basics of data science and data analysis like Averages and forecasting techniques.	PO1
CO2	The learners will comprehend the basics of data science and data analysis like Averages and forecasting techniques.	PO1,PO2
CO3	The learners will understand use of Time series and Index numbers in management decisions.	PO4,PO6
CO4	The learners will be able to understand the business implications and probabilities of every decision being made.	PO4,PO5, PO6
CO5	Gain entrance into careers as well as in graduate or professional school.	PO3,PO8

Text Books (Latest Editions)	
1	P A Navanitham (2006): Business Mathematics and Statistics
2	Gupta S.P. (2017) : Statistical Methods, Sultan Chand & Sons, 45h Revised Edition
	Levin, R. and Rubin, D. (2017). Statistics for Management. 8thed. New Delhi: Pearson

References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	Harald Cramér ***Mathematical Methods of Statistics,*** Princeton Mathematical Series, vol. 9. Princeton University Press, Princeton, N. J., 1946. xvi+575 pp
2	S.C.Gupta, Business Statistics
Web Resources	
1	*https://www.ascdegreecollege.ac.in/wp-content/uploads/2020/12/Business-Statistics-by-Gupta.pdf*

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	2	3	3	3	2	1	3
CO2	2	1	3	1	3	3	3	2	1	2
CO3	3	2	3	1	3	3	3	2	1	3
CO4	1	2	3	2	3	3	3	2	1	1
CO5	3	1	2	3	3	3	3	2	1	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Subject Code	Subject Name	Category	L	T	P		C	Marks		
								CIA	External	Total
23120SEC16L	Python Programming Lab	Core	0	0	3		3	25	75	100

Learning Objectives	
LO1	Be able to design and program Python applications.
LO2	Be able to create loops and decision statements in Python.
LO3	Be able to work with functions and pass arguments in Python.
LO4	Be able to build and package Python modules for reusability.
LO5	Be able to read and write files in Python.

LAB EXERCISES	Required Hours
1. Program using variables, constants, I/O statements in Python. 2. Program using Operators in Python. 3. Program using Conditional Statements. 4. Program using Loops. 5. Program using Jump Statements. 6. Program using Functions. 7. Program using Recursion. 8. Program using Arrays. 9. Program using Strings. 10. Program using Modules. 11. Program using Lists. 12. Program using Tuples. 13. Program using Dictionaries. 14. Program for File Handling.	**60**

Course Outcomes	
On completion of this course, students will	
CO1	Demonstrate the understanding of syntax and semantics of PYTHON language
CO2	Identify the problem and solve using PYTHON programming techniques.
CO3	Identify suitable programming constructs for problem solving.
CO4	Analyze various concepts of PYTHON language to solve the problem in an efficient way.
CO5	Develop a PYTHON program for a given problem and test for its correctness.

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	1	3	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	15	15	13	15	13	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	C	Inst. hours		Marks		
									CIA	External	Total
23120SEC17	**Fundamentals of Information Technology**	Skill Enha. Course (SEC)	2	0	0	2	2		25	75	100

Learning Objectives

LO1		Understand basic concepts and terminology of information technology.
LO2		Have a basic understanding of personal computers and their operation
LO3		Be able to identify data storage and its usage
LO4		Get great knowledge of software and its functionalities
LO5		Understand about operating system and their uses

UNIT		Contents	No. Of. Hours
I		**Introduction to Computers:** Introduction, Definition, .Characteristics of computer, Evolution of Computer, Block Diagram Of a computer, Generations of Computer, Classification Of Computers, Applications of Computer, Capabilities and limitations of computer	**6**
II		**Basic Computer Organization:** Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, Output Units: Monitors and its types. Printers: Impact Printers and its types. Non Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers.	**6**
III		**Storage Fundamentals:** Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives	**6**
IV		**Software:** Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w	**6**
V		**Operating System:** Functions, Measuring System Performance, Assemblers, Compilers and Interpreters .Batch Processing, Multiprogramming, MultiN Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.	**6**
		TOTAL HOURS	**30**

	Course Outcomes	Programme Outcomes
CO	On completion of this course, students will	
O1	Learn the basics of computer, Construct the structure of the required things in computer, learn how to use it.	PO1, PO2, PO3, PO4, PO5, PO6
O2	Develop organizational structure using for the devices present currently under input or output unit.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Concept of storing data in computer using two header namely RAM and ROM with different types of ROM with advancement in storage basis.	PO1, PO2, PO3, PO4, PO5, PO6
O4	Work with different software, Write program in the software and applications of software.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of Operating system in information technology which really acts as a interpreter between software and hardware.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1		Anoop Mathew, S. KavithaMurugeshan (2009), "Fundamental of Information Technology", Majestic Books.
2		Alexis Leon, Mathews Leon," Fundamental of Information Technology", 2nd Edition.
3		S. K Bansal, "Fundamental of Information Technology".

Reference Books

1.		Bhardwaj Sushil Puneet Kumar, "Fundamental of Information Technology"
2.		GG WILKINSON, "Fundamentals of Information Technology", Wiley-Blackwell
3.		A Ravichandran , "Fundamentals of Information Technology", Khanna Book Publishing

Web Resources

1.		https://testbook.com/learn/computer-fundamentals
2.		https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html
3.		https://www.javatpoint.com/computer-fundamentals-tutorial
4.		https://www.tutorialspoint.com/computer_fundamentals/index.htm
5.		https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	2	3
CO 5	3	3	2	3	3	2
Weightage of course contributed to each PSO	15	15	14	15	14	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120SEC18	**Problem Solving Techniques**	FC	2	-	-	2		2	25	75	100

Learning Objectives	
LO1	Familiarize with writing of algorithms, fundamentals of C and philosophy of problem solving.
LO2	Implement different programming constructs and decomposition of problems into functions.
LO3	Use data flow diagram, Pseudo code to implement solutions.
LO4	Define and use of arrays with simple applications
LO5	Understand about operating system and their uses

UNIT	Contents	No. Of. Hours
I	**Introduction:** History, characteristics and limitations of Computer. Hardware/Anatomy of Computer: CPU, Memory, Secondary storage devices, Input Devices and Output devices. Types of Computers: PC, Workstation, Minicomputer, Main frame and Supercomputer. Software: System software and Application software. **Programming Languages:** Machine language, Assembly language, High-level language,4 GL and 5GL-Features of good programming language. Translators: Interpreters and Compilers.	**6**
II	**Data:** Data types, Input, Processing of data, Arithmetic Operators, Hierarchy of operations and Output. Different phases in Program Development Cycle (PDC).**Structured Programming: Algorithm:** Features of good algorithm, Benefits and drawbacks of algorithm. **Flowcharts:** Advantages and limitations of flowcharts, when to use flowcharts, flowchart symbols and types of flowcharts.**Pseudocode:** Writing a pseudo code. Coding, documenting and testing a program: Comment lines and types of errors. **Program design:** Modular Programming.	**6**
III	**Selection Structures:** Relational and Logical Operators - Selecting from Several Alternatives – Applications of Selection Structures. **Repetition Structures:** Counter Controlled Loops –Nested Loops– Applications of Repetition Structures.	**6**
IV	**Data:** Numeric Data and Character Based Data. **Arrays:** One Dimensional Array - Two Dimensional Arrays – Strings as Arrays of Characters.	**6**

V	**Data Flow Diagrams:** Definition, DFD symbols and types of DFDs. **Program Modules:** Subprograms-Value and Reference parameters- Scope of a variable - Functions – Recursion. **Files:** File Basics-Creating and reading a sequential file- Modifying Sequential Files.	**6**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Study the basic knowledge of Computers. Analyze the programming languages.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Study the data types and arithmetic operations. Know about the algorithms. Develop program using flow chart and pseudo code.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Determine the various operators. Explain about the structures. Illustrate the concept of Loops	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Study about Numeric data and character-based data. Analyze about Arrays.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Explain about DFD Illustrate program modules. Creating and reading Files	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	**Stewart Venit,** "Introduction to Programming: Concepts and Design", Fourth Edition, 2010, Dream Tech Publishers.

Web Resources	
1.	https://www.codesansar.com/computer-basics/problem-solving-using-computer.htm
2.	http://www.nptel.iitm.ac.in/video.php?subjectId=106102067
3.	http://utubersity.com/?page_id=876

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	2	3	3	3	3
CO 4	3	3	2	3	3	3
CO 5	3	3	3	3	3	2
Weightage of course contributed to each PSO	15	14	14	15	15	14

S-Strong-3 M-Medium-2 L-Low-1

Ability Enhancement Compulsory Course

INDIAN CONSTITUTION

Subject Code	Category	L	T	P		C	Inst. Hours	Marks		
								CIA	External	Total
231AECCINC	AECC	2	0	0		2	2	25	75	100

Learning Objectives	
LO1	To make the students understand about the democratic rule and parliamentarian administration
LO2	To appreciate the salient features of the Indian constitution
LO3	To know the fundamental rights and constitutional remedies
LO4	To make familiar with powers and positions of the union executive, union parliament and the Supreme Court
LO5	To exercise the adult franchise of voting and appreciate the electoral system of Indian democracy

UNIT	DETAILS
I	**The making of Indian constitution:** The constitution assembly organization - character - work salient features of the constitution- written and detailed constitution - socialism -secularism-democracy and republic.
II	**Fundamental rights and fundamental duties of the citizens:** Right of equality - right of freedom- right against exploitation -right to freedom of religion- cultural and educational rights -right to constitutional remedies -fundamental duties.
III	**Directive principles of state policy:** Socialistic principles - Gandhi an principles-liberal and general principles -differences between fundamental rights and directive principles
IV	**The union executive, union parliament and Supreme Court :** Powers and positions of the president - qualification - method of election of president and vice president -prime minister - Rajya Sabah - Lok Sabah .the supreme court - high court -functions and position of supreme court and high court
V	**State council -election system and parliamentary democracy in India:** State council of ministers -chief minister -election system in India-main features election commission-features of Indian democracy.

Course Outcomes		
CO1	Students can know about constitution our fundamental rights and duties	PO1
CO2	Students can get knowledge of the Indian administrative systems.	PO1,PO2
CO3	Students will be able to understand the Nature of Indian Politics	PO4,PO6
CO4	Students will be able to understand the Indian constitution and Fundamental rights and Duties.	PO4,PO5, PO6
CO5	Integrate knowledge of the diversity of cultures and peoples.	PO3,PO8

Text Books (Latest Editions)	
1	India's Constitution by M.V.Pylee., 16th edt.,S.Chand & Company Ltd, Ram Nagar, New Delhi-110055.
2	Introduction to the Constitution of India by Durga Das Basu · 2015,. LexisNexis publication,SBN:9789351434467, 935143446X.
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	Palekar.s.a. Indian constitution government and politics, ABD publications, India
2	Aiyer, alladikrishnaswami, Constitution and fundamental rights 1955.
3	Markandan. K.c.directive Principles in the Indian constitution 1966.
Web Resources	
	https://www.google.co.in/books/edition/India_s_Constitution_16th_Edition/yjJlDwAAQBAJ?hl=en&gbpv=1&dq=indian+constitution+pdf&printsec=frontcover

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

FIRST YEAR - SEMESTER I
Part-IV
Audit Course
UNIVERSAL HUMAN VALUES

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
231LSCUV	AC	-	-	-	1		-	25	75	100

Learning Objectives	
LO1	The present course deals with meaning, purpose, and relevance of universal human values and how to inculcate and practice them consciously to be a good human being and realize one's potentials

UNIT	DETAILS
I	Introduction: What is love? Forms of love for self, parents, family, friend, spouse, community, nation, humanity and other beings, both for living and non-living Love and compassion and inter-relatedness Love, compassion, empathy, sympathy and non-violence Individuals who are remembered in history for practicing compassion and love. Narratives and anecdotes from history, literature including local folklore Practicing love and compassion: What will learners learn gain if they practice love and compassion? What will learners lose if they don't practice love and compassion? Sharing learner's individual and/or group experience(s) Simulated Situations Case studies
II	Introduction: What is truth? Universal truth, truth as value, truth as fact(veracity, Sincerity, honesty among others) Individuals who are remembered in history for practicing this value Narratives and anecdotes from history, literature including local folklore Practicing Truth: What will learners learn/gain if they practice truth? What will learners lose if they don't practice it? Learners' individual and/or group experience(s) Simulated situations Case studies
III	Introduction: What is nonviolence? Its need. Love, compassion, empathy sympathy for others as pre-requisites for non-violence Ahimsa as non-violence and non-killing Individuals and organizations that are known for their commitment to non-violence Narrativesandanecdotesaboutnon-violencefromhistory,andliteratureincluding local folklore Practicing on-violence:What will learners learn/gain if they practice non- violence? What will

	learners lose if they don't practice it? Sharing learner's individual and/or group experience(s) about non-violence Simulated situations Case studies
IV	Introduction: What is righteousness? Righteousness and *dharma*, Righteousness and Propriety Individuals who are remembered in history for practicing righteousness Narratives and anecdotes from history, literature including local folklore Practicing righteousness: What will earners learn/gain if they practice righteousness? What will learners lose if they don't practice it? Sharing learners' individual and/or group experience(s) Simulated situations Case studies
V	Introduction: What is peace? Its need, relation with harmony and balance Individuals and organizations that are known for their commitment to peace Narratives and Anecdotes about peace from history, and literature including local folklore Practicing peace: What will learners learn/gain if they practice peace? What will learners lose if they don't practice it? Sharing learner's individual and/or group experience(s) about peace Simulated situations Case studies
VI	Introduction: What is service? Forms of service, for self, parents, family, friend, spouse, community, nation, humanity and other beings—living and non-living, persons in distress or disaster. Individuals who are remembered in history for practicing this value. Narratives and anecdotes dealing with instances of service from history, literature including local folklore Practicing service: What will earners learn/gain gain if they practice service? What will learners lose if they don't practice it? Sharing learners' individual and/or group experience(s) regarding service Simulated situations Case studies

VII	Introduction: What is renunciation? Renunciation and sacrifice. Self-restrain and Ways of overcoming greed. Renunciation with action as true renunciation Individuals who are remembered in history for practicing this value. Narratives and anecdotes from history and literature, including local folklore about individuals who are remembered for their sacrifice and renunciation. Practicing renunciation and sacrifice: What will learners learn/gain if they practice Renunciation and sacrifice? What will learners lose if they don't practice it? Sharing learners' individual and/or group experience(s) Simulated situations Casestudies

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	2	2
CO2	3	3	3	2	3	3	3	2	3	2
CO3	2	3	3	3	2	3	3	2	2	2
CO4	3	3	3	3	3	3	3	2	3	2
CO5	3	2	3	3	3	3	3	2	2	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

II -SEMESTER

பக்தி இலக்கியம் - 23110AEC21

இரண்டாம்பருவம்

பாட நோக்கங்கள்

- காலந்தோறும் பக்தி இலக்கியம் வளர்ந்துள்ள தன்மையைக் கற்பித்தல்.
- நாயன்மார்கள், ஆழ்வார்களின் பக்திச்சிறப்பைஅறியசெய்தல்.
- ஆழ்வார்களின் பக்தி உணர்வை ஊட்டுதல்
- பாடல்களில் இசை இன்பம், ஓசை நயம் ஆகியவற்றை உணரச்செய்தல்
- குழந்தைப் பருவத்தின் தன்மையை உணர்த்துதல்

பயன்கள்

- **நாயன்மார்கள் பக்திச்சிறப்பை அறிதல்**.
- ஆழ்வார்களின் பக்திநெறியை உணர்தல்.
- பக்தி இலக்கியம்காலம் தோறும் வளர்ந்ததை அறிதல்.
- பாடல்களில் இசை இன்பம், ஓசை நயம் அறிதல்.
- குழந்தைப் பருவத்தின் தன்மையை உணர்தல்.

அலகு- 1 பன்னிருதிருமுறைகள்

1. திருஞானசம்பந்தர்– திருத்தில்லைப்பதிகம்
2. திருநாவுக்கரசர் - திருநீற்றுப்பதிகம்
3. சுந்தரர் - திருவெண்ணைநல்லூர்
4. திருமூலர்- திருமந்திரம்(இளமைநிலையாமை)

அலகு- 2 பன்னிருஆழ்வார்கள்

1. ஆண்டாள் - திருப்பாவை
2. பெரியாழ்வார்- மூன்றாம்திருமுறை(பத்துபாடல்கள்)
3. மதுரகவியாழ்வார் - கண்ணின்நுண்சிறுதாம்பு

அலகு- 3சிற்றிலக்கியங்கள்

1. மீனாட்சியம்மைப்பிள்ளைத்தமிழ்– செங்கீரைபருவம், அம்புலிபருவம்
2. நந்திக்கலம்பகம்
3. குற்றாலகுறவஞ்சி- குறத்திநகர்வளம்கூறுதல்
4. காளமேகப் புலவர் பாடல்கள்

அலகு- 4 புதினம

1. நா .பார்த்தசாரதியின்- குறிஞ்சிமலர்

அலகு-5 தமிழ் இலக்கிய வரலாறு

1. பக்திஇலக்கியங்கள்
2. சைவமும்தமிழும்
3. வைணவசமயம்போற்றிவளர்த்ததமிழ்
4. சிற்றிலக்கியங்கள்
5. நாவல்இலக்கியம்

பார்வைநூல்கள் :

1. தேவாரம் - மணிவாசகர்பதிப்பகம்சென்னை

2. நாலாயிரதிவ்ய பிரபந்தம் - வர்த்தமான பதிப்பகம் சென்னை.

3. தமிழ்இலக்கியவரலாறு - முனைவர்சசுபாஷ்சந்திரபோஸ், இயல்வெளியீடு ,தஞ்சாவூர

4. தமிழ் நாவல் இலக்கியம் -காகைலாசபதி- தமிழ் புத்தக,நிலையம், சென்னை

இணையதளம் -www.tamilvu.org , www.noolulagam.com

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

FIRST YEAR - SEMESTER II

PAPER II –GENERAL ENGLISH

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
23111AEC22	**Part II**	3	1	0	3		6	25	75	100

Learning Objectives	
LO1	To introduce learners to the essential skills of communication in English
LO2	To enable them use these skills effectively in academic and non-academic contexts
LO3	To help them identify and eliminate common mistakes in writing and speaking
LO4	To enable them use various business communication strategies and to use advanced vocabulary
LO5	To familiarize them in writing descriptive essays and respond to arguments orally and in writing

Unit No.	Unit Title & Text	No. of Periods for the Unit
I	**Poetry** 1.1Very Indian Poem in Indian English - Nissim Ezekiel 1.2 Still I Rise - Maya Angelou 1.3 On Killing a Tree - Gieve Patel	20
II	**Prose** 2.1 If You Are Wrong Admit it- Dale Carnegie 2.2 Kindly Adjust Please - Shashi Tharoor 2.3 The Spoon-fed Age- W.R. Inge	20
III	**Fiction** Alchemist - Paulo Coelho	20
IV	**Language Competency** 4.1 Homonyms, Homophones, HomographsPortmanteau words 4.2 Subject Verb Agreement	15
V	**English in the Workplace** 5.1 Reading for General and Specific information [charts, tables, schedules, graphs etc] 5.2 Reading news and weather reports 5.3 Writing paragraphs 5.4 Taking and making notes	15

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Learn to introduce themselves and talk about everyday activities confidently	PO1
CO2	Be able to write short paragraphs on people, places and events	PO1, PO2
CO3	Identify the purpose of using various tenses and effectively employ them in speaking and writing	PO4, PO6
CO4	Gain knowledge to write subjective and objective descriptions	PO4, PO5,PO6
CO5	Identify and use their skills effectively in formal contexts.	PO3,PO8

Textbooks(Latest Editions)	
1	The Alchemist - Paulo Coelho Harper – 2005
References Books **(Latest editions, and the style as given below must be strictly adhered to)**	
1	Advanced English Grammar. Martin Hewings. Cambridge University Press, 2000
2	Descriptive English. SP Bakshi, Richa Sharma · 2019, Arihant Publications (India) Ltd.
3	The Reading Book: A Complete Guide to Teaching Reading. Sheena Cameron, Louise Dempsey, S & L. Publishing, 2019.
4	Skimming and Scanning Techniques, Barbara Sherman, Liberty University Press, 2014
5	Brilliant Speed Reading: Whatever you need to read, however ...Phil Chambers, Pearson, 2013.
6	The Archer, Paulo Coelho. Penguin Viking, 2020.
Web Resources	
1	Very Indian poem by Nissim Ezekiel http://econtent.in/pacc.in/admin/contents/40_%20_2020103001102714.pdf
2	Still I Rise by Maya Angelou https://www.poetryfoundation.org/poems/46446/still-i-rise
3	The Flower by Tennyson: https://www.poemhunter.com/poem/the-flower-2/
4	On Killing a tree by Gieve Patel: https://www.poemhunter.com/poem/on-killing-a-tree/

5	If you are wrong, admit it: https://www.tbr.fun/if-youre-wrong-admit-it/
6	Kindly Adjust please - Shashi Tharoor https://www.theweek.in/columns/shashi-tharoor/2018/05/25/kindly-adjust-to-our-english.html?fbclid=IwAR3IhtdXqvuV4ySECn9S7SA6HmCEYISyd1QHd3BlwKgiNKKwdkeSg3qWp-U/
7	The Spoon Fed Age: https://www.nrkacademy.com/2016/04/spoon-feeding-by-wringe .html
8	The Alchemist: https://www.youtube.com/watch?v=lxBYpmxjeDU

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes:

CO /PO	PS O1	PS O2	PS O3	PS O4	PS O5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Semester II

Title of the Course/ Paper	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120AEC23	**DATA STRUCTURE AND ALGORITHMS**	Core	4	1	0	3		5	25	75	100

Learning Objectives	
LO1	To understand the concepts of ADTs
LO2	To learn linear data structures-lists, stacks, queues
LO3	To learn Tree structures and application of trees
LO4	To learn graph structures and application of graphs
LO5	To understand various sorting and searching

UNIT	**Contents**	**No. of Hours**
I	Abstract Data Types (ADTs) - List ADT-array-based implementation-linked list implementation singly linked lists-circular linked lists-doubly-linked lists-applications of lists-Polynomial Manipulation- All operations-Insertion-Deletion-Merge-Traversal.	15
II	Stack ADT-Operations- Applications- Evaluating arithmetic expressions – Conversion of infix to postfix expression-Queue ADT-Operations-Circular Queue- Priority Queue- deQueue applications of queues.	15
III	Tree ADT-tree traversals-Binary Tree ADT-expression trees-applications of trees-binary search tree ADT- Threaded Binary Trees-AVL Trees- B-Tree-B+ Tree – Heap-Applications of heap.	15
IV	Definition- Representation of Graph- Types of graph-Breadth first traversal – Depth first traversal-Topological sort- Bi-connectivity – Cut vertex- Euler circuits-Applications of graphs.	15
V	Searching- Linear search-Binary search-Sorting-Bubble sort-Selection sort-Insertion sort-Shell sort-Radix sort-Hashing-Hash functions-Separate chaining- Open Addressing-Rehashing Extendible Hashing.	15
	Total	**75**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation	PO1,PO6
CO2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO2
CO3	Describe the hash function and concepts of collision and its resolution methods	PO2,PO4
CO4	Solve problem involving graphs, trees and heaps	PO4,PO6
CO5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO5,PO6
Text Book		
1	1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education 2014, 4th Edition.	
2	Reema Thareja, "Data Structures Using C", Oxford Universities Press 2014, 2nd Edition	
Reference Books		
1.	Thomas H.Cormen,ChalesE.Leiserson,RonaldL.Rivest, Clifford Stein, "Introduction to Algorithms", McGraw Hill 2009, 3rd Edition.	
2.	Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education 2003	
Web Resources		
1.	https://www.programiz.com/dsa	
2.	https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	1	3	3	3
CO 3	3	3	3	2	3	2
CO 4	3	2	3	2	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each	15	14	13	13	15	14

FIRST YEAR - SEMESTER II
COMPUTER SCIENCE-ALLIED MATHEMATICS
PAPER-III OPERATIONS RESEARCH

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
23120GEC24		3	1	0	3			25	75	100

Learning Objectives	
LO1	To understand the methodology of OR problem solving and formulate linear programming problem.
LO2	To develop formulation skills in transportation models and finding solutions
LO3	To understand the basics in the field of game theory and assignment problems
LO4	To know how project management techniques help in planning and scheduling a project
LO5	To know the basics of dynamic programming and simulation

UNIT	DETAILS
I	Definition of operations research, models of operations research, scientific methodology of operations research, scope of operations research, importance of operations research in decision making, role of operations management, limitations of OR
II	Linear Programming: Introduction – Mathematical formulation of a problem – Graphical solutions, standard forms the simplex method for maximization and minimization problems. Method application to management decisions.
III	Transportation problem – Introduction – Initial basic feasible solution - NWC method – Least cost method – Vogel's method – MODI – moving towards optimality – solution procedure without degeneracy
IV	Assignment problem – Algorithm – Hungarian method – simple problems.
V	Network models and simulation. Network models for project analysis CPM; Network construction and time analysis; cost time trade off, PERT – problems

Course Outcomes		
CO1	To recognize the importance and value of Operations Research and linear programming in solving practical problems in industry	PO1
CO2	Interpret the transportation models' solutions and infer solutions to the real-world problems..	PO1,PO2
CO3	To know, how to transport a thing in minimum cost.	PO4,PO6
CO4	Gain knowledge about the assigning process	PO4,PO5, PO6
CO5	Gain knowledge of drawing project networks for	PO3,PO8

Text Books (Latest Editions)	
1	Kalavathy, Operations Research
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	Kanti Swarup, Gupta.P.K. & Man Mohan, operations Research, S.Chand & Sons
2	Taha.H.A, operation Research: An Introduction, McMillan publishing Co., 1982. 7 th ed.
Web Resources	
	https://rccmindore.com/wp-content/uploads/2015/06/Operations-Research.pdf

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	2	3	3	3	2	1	3
CO2	2	1	3	1	3	3	3	2	1	2
CO3	3	2	3	1	3	3	3	2	1	3
CO4	1	2	3	2	3	3	3	2	1	1
CO5	3	1	2	3	3	3	3	2	1	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

FIRST YEAR - SEMESTER II
COMPUTER SCIENCE-ALLIED MATHEMATICS
PAPRER-IV DISCRETE MATHEMATICS

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
23120GEC25		3	1	0	3			25	75	100

Learning Objectives	
LO1	Use mathematically correct terminology and notation.
LO2	Apply logical reasoning to solve a variety of problems.
LO3	Construct correct direct and indirect proofs
LO4	Use division into cases in a proof.
LO5	Use counterexamples.

UNIT	DETAILS
I	**SET THEORY:** Introduction- set and Its Element – Set Description (Roster, Set Builder and cardinal number method) Types of Sets- Set Operations and Laws of set Theory. Partition of sets. Countable and uncountable set. Algebra of sets and Duality
II	**MATHEMATICAL LOGIC:** Basic Logic and Proof, logical operations – Logic Propositional equivalence, Predicates and Quantities, Tautology-Contradiction-Methods of proofs (Direct and Indirect) - Function- Definition-Notation- Types of Function-Composition of Functions
III	**NUMBER THEORY:** The Integers and Division, Integers and Algorithms, (Multiplication, Addition and Division -Sequences and Summations, Recursive algorithms, Program correctness
IV	**RELATIONS:** Relations – Relations and their properties, Representing Relations, Closures of relations, Equivalence relations, Partial orderings-Recurrence Relations Binary Relations
V	**MATRIX, DETERMINANT OF MATRIX AND ITS APPLICATION:** Introduction, definitions, Types of Matrix, Properties of matrix, operations on matrix, Inverse of matrix, Cayley Hamilton of matrix-applications

Course Outcomes		
CO1	To gain knowledge on set theory	PO1
CO2	Able to understand different mathematical logics and functions	PO1,PO2
CO3	To get an idea on Permutations and Combinations	PO4,PO6
CO4	Understanding the different form of number theory	PO4,PO5, PO6
CO5	Able to understand Relations and its applications	PO3,PO8

Text Books (Latest Editions)	
1	Rosen K.H. Discrete Mathematics and its Applications, 5th edition, Tata McGraw – Hills,2003
2	J.K Sharma "DISCRETE MATHEMATICS" 3 rd Edition Macmillan Reprint2011
References Books (Latest editions, and the style as given below must be strictly adhered to)	
1	Johnson Baugh R, and Carman R, Discrete mathematics, 5th edition, Person Education, 2003.
2	Kolman B, Busoy R.C, and Ross S.C, Discrete Mathematical Structures, 5th edition, Pretitice – Hall, 2004.
Web Resources	
1	Web resources from NDL Library, E-content from open-source libraries

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	2	3	3	3	2	1	3
CO2	2	1	3	1	3	3	3	2	1	2
CO3	3	2	3	1	3	3	3	2	1	3
CO4	1	2	3	2	3	3	3	2	1	1
CO5	3	1	2	3	3	3	3	2	1	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution	3.0	3.0	3.0	3.0	3.0

Title of the Course/ Paper	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120AEC26L	DATA STRUCTURE AND ALGORITHMS LAB [Note: Practical's may be offered through C / C++ / Python]	Core	0	0	3	3		4	25	75	100

Learning Objectives	
LO1	To understand the concepts of ADTs
LO2	To learn linear data structures-lists, stacks, queues
LO3	To learn Tree structures and application of trees
LO4	To learn graph structures and application of graphs
LO5	To understand various sorting and searching

Sl. No	Contents	No. of Hours
1.	Write a program to implement the List ADT using arrays and linked lists.	60
2.	Write a programs to implement the following using a singly linked list. • Stack ADT • Queue ADT	
3.	Write a program that reads an infix expression, converts the expression to postfix form and then evaluates the postfix expression (use stack ADT).	
4.	Write a program to implement priority queue ADT.	
5.	Write a program to perform the following operations: • Insert an element into a binary search tree. • Delete an element from a binary search tree. • Search for a key element in a binary search tree.	
6.	Write a program to perform the following operations • Insertion into an AVL-tree • Deletion from an AVL-tree	
7.	Write a programs for the implementation of BFS and DFS for a given graph.	

8	Write a programs for implementing the following searching methods: • Linear search • Binary search.	
9.	Write a programs for implementing the following sorting methods: • Bubble sort Selection sort Insertion sort Radix sort.	
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation	PO1,PO4,PO5
2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO1, PO4,PO6
3	Describe the hash function and concepts of collision and its resolution methods	PO1,PO3,PO6
4	Solve problem involving graphs, trees and heaps	PO3,PO4
5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO1,PO5,PO6

Text Book	
1	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education 2014, 4th Edition.
2	ReemaThareja, "Data Structures Using C", Oxford Universities Press 2014, 2nd Edition
Reference Books	
1	Thomas H.Cormen,ChalesE.Leiserson,RonaldL.Rivest, Clifford Stein, "Introduction to Algorithms", McGraw Hill 2009, 3rd Edition
2.	Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education 2003
Web Resources	
1.	https://www.programiz.com/dsa
2.	https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	3
CO 2	3	3	1	3	2	3
CO 3	3	3	3	3	2	3
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each Ps	15	15	13	15	13	15

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120SEC27	**Quantitative Aptitude**	Skill Enha. Course (SEC)	2	-	-	2		2	25	75	100

Learning Objectives	
LO1	To understand the basic concepts of numbers
LO2	Understand and apply the concept of percentage, profit & loss
LO3	To study the basic concepts of time and work, interests
LO4	To learn the concepts of permutation, probability, discounts
LO5	To study about the concepts of data representation, graphs

UNIT	**Contents**	**No. of Hours**
I	Numbers-HCF and LCM of numbers-Decimal fractions-Simplification-Square root and cube roots - Average-problems on Numbers.	6
II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership-Chain rule.	6
III	Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms - Area-Volume and surface area -races and Games of skill.	6
IV	Permutation and combination-probability-True Discount-Bankers Discount – Height and Distances-Odd man out & Series.	6
V	Calendar - Clocks - stocks and shares - Data representation - Tabulation – Bar Graphs- Pie charts-Line graphs.	6
	Total	**60**
		Programme Outcome

Course Outcomes		
CO	On completion of this course, students will	
CO1	understand the concepts, application and the problems of numbers	PO1
CO2	To have basic knowledge and understanding about percentage, profit & loss related processing.	PO1, PO2
CO3	To understand the concepts of time and work	PO4, PO6
CO4	Speaks about the concepts of probability, discount	PO4, PO5
CO5	Understanding the concept of problem solving involved in stocks & shares, graphs	PO3, PO6
Text Book		
1	"Quantitative Aptitude", R.S.AGGARWAL.,S.Chand & Company Ltd.,	
Reference Books		
1.		
Web Resources		
1.	https://www.javatpoint.com/aptitude/quantitative	
2.	https://www.toppr.com/guides/quantitative-aptitude/	

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**2**	**2**	**2**
CO2	**2**	**3**	**1**	**3**	**2**	**2**
CO3	**1**	**3**	**1**	**1**	**3**	**1**
CO4	**1**	**2**	**1**	**1**	**3**	**1**
CO5	**1**	**2**	**1**	**1**	**3**	**3**
Weightage of course contributed to each PSO	**8**	**12**	**5**	**8**	**13**	**9**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120SEC28	**Advanced Excel**	Skill Enha. Course (SEC)	2	0	0	2		2	25	75	100

Learning Objectives	
LO1	Handle large amounts of data
LO2	Aggregate numeric data and summarize into categories and subcategories
LO3	Filtering, sorting, and grouping data or subsets of data
LO4	Create pivot tables to consolidate data from multiple files
LO5	Presenting data in the form of charts and graphs

UNIT	Contents	No. of Hours
I	Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells- Working with Functions - Writing conditional expressions - logical functions - lookup and reference functions- VlookUP with Exact Match, Approximate Match- Nested VlookUP with Exact Match- VlookUP with Tables, Dynamic Ranges- Nested VlookUP with Exact Match- Using VLookUP to consolidate Data from Multiple Sheets	6
II	Data Validations - Specifying a valid range of values - Specifying a list of valid values- Specifying custom validations based on formula - Working with Templates Designing the structure of a template- templates for standardization of worksheets - Sorting and Filtering Data -Sorting tables- multiple-level sorting- custom sorting- Filtering data for selected view - advanced filter options- Working with Reports	6
III	Creating Pivot tables Formatting and customizing Pivot tables- advanced options of Pivot tables- Pivot charts- Consolidating data from multiple sheets and files using Pivot tables- external data sources- data consolidation feature to consolidate data- Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot- Creating Slicers.	6

IV	More Functions Date and time functions- Text functions- Database functions- Power Functions - Formatting Using auto formatting option for worksheets- Using conditional formatting option for rows, columns and cells- What If Analysis - Goal Seek- Data Tables- Scenario Manager.	6
V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together- Secondary Axis in Graphs- Sharing Charts with PowerPoint / MS Word, Dynamically- New Features Of Excel Spark lines, Inline Charts, data Charts- Overview of all the new features.	6
	Total	**30**
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Work with big data tools and its analysis techniques.	PO1
CO2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
CO3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
CO4	Perform analytics on data streams.	PO4, PO5, PO6
CO5	Learn No-SQL databases and management.	PO3, PO8
Text Book		
1	**Excel 2019 All**	
2	**Microsoft Excel 2019 Pivot Table Data Crunching**	
Reference Books		
1	Excel 2019 All-in-One for Dummies, Greg Harvey, 1st edition	
Web Resources		
1.	https://www.simplilearn.com	

2	https://www.javatpoint.com
3	https://www.w3schools.com

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	2	3	3	3
CO2	3	2	2	3	3	3
CO3	3	3	2	3	3	3
CO4	3	2	2	3	3	3
CO5	3	2	2	3	3	3
Weightage of course contributed to each PSO	15	12	10	15	15	15

Strong-3 M-Medium-2 L-Low-1

SEMESTER II
Part-IV
Ability Enhancement Compulsory Course
SOFT SKILL -2-COMMUNICATION SKILL

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
231AECCCMS	AECC	2	0	0	2		2	25	75	100

Learning Objectives	
LO1	Identify common communication problems that may be holding learners back.
LO2	Identify what their non-verbal messages are communicating to others.
LO3	Understand role of communication in teaching-learning process.
LO4	Learning to communicate through the digital media.
LO5	Understand the importance of empathetic listening.
LO6	Explore communication beyond language.

UNIT	DETAILS
I	**Listening** • Techniques of effective listening. • Listening and comprehension. • Probing questions. • Barriers to listening.
II	**Speaking** • Pronunciation • Enunciation • Vocabulary • Fluency • Common Errors
III	**Reading** • Techniques of effective reading • Gathering ideas and information from a given text i Identify the main claim of the text ii Identify the purpose of the text iii Identify the context of the text

	iv. Identify the concepts mentioned • Evaluating these ideas and information i. Identify the arguments employed in the text ii. Identify the theories employed or assumed in the text • Interpret the text i. To understand what a text says ii. To understand what a text does iii. To understand what a text means
IV	**Writing and different modes of writing** • Clearly state the claims • Avoid ambiguity, vagueness, unwanted generalizations and oversimplification of issues • Provide background information • Effectively argue the claim • Provide evidence for the claims • Use examples to explain concepts • Follow convention • Be properly sequenced • Use proper signposting techniques • Be well structured i. Well-knit logical sequence ii. Narrative sequence iii. Category groupings • Different modes of Writing - i. E-mails ii. Proposal writing for Higher Studies iii. Recording the proceedings of meetings iv. Any other mode of writing relevant for learners
V	**Digital Literacy** • Role of Digital literacy in professional life • Trends and opportunities in using digital technology in workplace • Internet Basics • Introduction to MS Office tools i. Paint ii. Office iii. Excel iv. PowerPoint

VI	**Effective use of Social Media** • Introduction to social media websites • Advantages of social media • Ethics and etiquettes of social media • How to use Google search better • Effective ways of using Social Media • Introduction to Digital Marketing
VII	**Non-verbal communication** • Meaning of non-verbal communication • Introduction to modes of non-verbal communication • Breaking the misbelieves • Open and Closed Body language • Eye Contact and Facial Expression • Hand Gestures • Do's and Don'ts • Learning from experts • Activities-Based Learning

Course Outcomes		
CO1	By the end of this program participants should have a clear understanding of what good communication skills are and what they can do to improve their abilities.	PO1
References Books (Latest editions, and the style as given below must be strictly adhered to)		
1	Sen Madhuc chanda (2010), *An Introduction to Critical Thinking*, Pearson, Delhi	
2	Silvia P. J. (2007), *How to Read a Lot*, American Psychological Association, Washington DC	

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	3	3	3	3	3	3	3	2	2	2
CO3	2	3	3	3	2	3	3	2	2	2
CO4	3	3	3	2	3	3	3	2	3	2
CO5	3	2	3	3	3	3	3	2	2	3

3 – Strong, 2 – Medium, 1 – Low Mapping with Programme Specific Outcomes

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

SEMESTER-III

காப்பிய இலக்கியம் - 23110AEC31
மூன்றாம் பருவம்

பாடநோக்கங்கள்

- தமிழ்க்காப்பியங்களை அறிமுகப்படுத்துதல்.
- காப்பியங்கள் கூறும் வாழ்வியல் அறங்களை உணர்த்துதல்.
- காப்பிய இலக்கியங்களில் இலக்கியச் சுவையை பயிற்றுவித்தல்.
- நாடக இலக்கியத்தின் தனித்துவத்தைக்கற்பித்தல்.
- புராணச் செய்திகளை மேம்படுத்திக்கொள்ளச்செய்நல்.

பயன்கள்

- இலக்கியங்களின் சிறப்புகளை அறிவர்.
- காப்பியக்கதைகள்வழிஅறச்சிந்தனைபெறுவர்
- பல்வேறு காப்பியவடிவங்களை பற்றிய அறிவுபெறுவர் .
- நாடக படைப்பாக்கத்திற்கான தூண்டுதலைப் பெறுவர்
- புராணச் செய்திகள் வழி தமிழ்கலாச்சாரத்தை அறிவர்.

அலகு-1 காப்பியங்கள்

1.சிலப்பதிகாரம் - மதுரைகாண்டம் (வழக்குரைகாதை)]

2.மணிமேகலை - விழாவறைகாதை

3.சீவகசிந்தாமணி - குணமாலையார்இலம்பகம்

அலகு-2 காவியங்கள்

1.கம்பராமாயணம்- மந்தரைசூழ்ச்சிபடலம்

2.மகாபாரதம் - ஆரண்யபருவம்

அலகு-3புராணங்கள்

1. பெரியபுராணம்- இளையான்குடிமாறநாயனார்புராணம்
2. சீறாப்புராணம் - ஈத்தங்குழைவரவழைத்தப்படலம்
3. தேம்பாவணி- பிரிந்தமகனைகாண்படலம்

அலகு-4 நாடகம் - சாபம்? விமோசனம்

அலகு-5 இலக்கியவரலாறு

1. காப்பியங்கள்
2. இரட்டைக்காப்பியங்கள்

3. நாடகஇலக்கியம்

பார்வை நூல்கள் :

1. காப்பியத்திறன்- மணிவாசகர்நூலகம், சிதம்பரம்.

2 . தமிழ்காப்பியங்கள் - கி. வா .ஜெகன்ஜெகநாதன் , அமுதநிலையம், சென்னை.

3 .நவீனநாடகஉருவாக்கம் - கோபழனி , தமிழ்பல்கலைக்கழகம், தஞ்சாவூர்.

4.இணையதளம் -www.tamilvu.org , www.noolulagam.com

5. சாபம்? விமோசனம்

மு.இராமசுவாமி,

செண்பகம்இராமசுவாமி,

பாவைபதிப்பகம்,ஜானிஜான்சாலை,சென்னை – 14

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

SECOND YEAR - SEMESTER III

PAPER II –GENERAL ENGLISH [23111AEC32]

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
23111AEC32	Part II	3	1	0	3		6	25	75	100

Learning Objectives	
LO1	To enhance the level of literary and aesthetic experience of students and to help them respond creatively.
LO2	To sensitize them to the major issues in the society and the world.
LO3	To provide them with an ability to build and enrich their communication skills
LO4	To equip them to utilize the digital knowledge resources effectively for their chosen fields of study
LO5	To help them think and write imaginatively and critically.

Unit No.	Unit Title & Text	No. of Periods for the Unit
I	**Poetry:** 1.1 The Voice of the Mountains - Mamang Dai 1.2 A Song of Hope - Oodgeroo Noonuccal 1.3 In an Artist's Studio - Christina Rossetti	20
II	**Scenes From Shakespeare:** 2.1 Romeo & Juliet -The Balcony Scene 2.2 Macbeth-Banquet Scene 2.3 Julius Caesar - Murder Scene	20
III	**Speeches of Famous personalities** 3.1 Yes, We Can-Barack Obama 3.2 You've Got to Find What You Love-Steve Jobs	20
IV	**Language Competency** 4.1 Writing letters and emails 4.2 Writing and messaging in social media platforms [blogs, twitter, instagram.facebook. 4.3 Learning netiquette, email etiquette	15
V	**English for Workplace** 5.1 Data Interpretation and Reporting 5.2 Data Presentation and analysis 5.3 Meeting Etiquettes - language, dress code, voice modulation. Online Meetings - Terms and expressions used	15

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Broaden their outlook and sensibility and be acquainted with cultural diversity and divergence in perspectives.	PO1
CO2	Be updated with basic informatics skills and attitudes relevant to the emerging knowledge society	PO1,PO2
CO3	Produce grammatically and idiomatically correct language.	PO4,PO6
CO4	Gain knowledge in writing techniques to meet academic and professional needs.	PO4,PO5, PO6
CO5	Be equipped with sufficient practice in Vocabulary, Grammar, Comprehension and Remedial English from the perspective of career oriented tests.	PO3,PO8

Text Books (Latest Editions)	
1	**Arden Shakespeare Complete works by Shakespeare (Author), William (Author), Bloomsbury, 2011)**
References Books (Latest Editions, and the style as given below must be strictly adhered to)	
1	The Shakespeare Book: Big Ideas Simply Explained, Stanley Wells et al. DK Publishing, 2015
3	Famous Speeches by Mahatma Gandhi, Create space Independent Publishing Platform, 2016
4	How to Build a Professional Digital Profile Kindle Edition by Jeanne Kelly Bernish, Bernish Communications Associates, LLC; 1st edition (May 29, 2012)
5	Keys to Teaching Grammar to English Language Learners, Second Ed.: A Practical Handbook by Keith S Folse, Michigan Teacher Training, 2016.
6	Role Play-Theory and Practice.Krysia M Yardley-Matwiejczuk, SAGE publications ltd, 1997

Web Resources	
1	The Voice of the Mountains by Mamang Dai: https://www.scribd.com/document/558838656/The-Voice-of-the-Mountain-By-Mamang-Dai-Adivasi-Resurgence
2	A song of Hope by Kath Walker: http://www.wordslikethis.com.au/a-song-of-hope/
3	In an artist's studio by Christina Rossetti: https://www.poetryfoundation.org/poems/146804/in-an-artist39s-studio
4	Sita by Toru Dutt: https://www.poetrynook.com/poem/s%E2%94%9C%C2%ABta
5	Tryst with Destiny: https://www.cam.ac.uk/files/a-tryst-with-destiny/index.html#:~:text=Jawaharlal%20Nehru%2C%20delivering%20his%20Tryst%20with%20Destiny%20speech.&text=%22Long%20years%20ago%20we%20made,awake%20to%20life%20and%20freedom.
6	Yes, We Can: https://www.englishspeecheschannel.com/english-speeches/barack-obama-speech/
7	You've got to find what you love: https://www.businessbusinessbusiness.com.au/steve-jobs-youve-got-to-find-what-you-love/#:~:text=Steve%20Jobs%2C%20in%20his%20commencement,emphasizes%20on%20believing%20in%20oneself.

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes:

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO 5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

SEMESTER III

Subject Code	Subject Name	Category	L	T	P	C		Inst.	Marks		
									CIA	External	Total
23120AEC33	**Microprocessor and Microcontroller**	Core	5	1	0	4		5	25	75	100

Learning Objectives	
LO1	To introduce the internal organization of Intel 8085 Microprocessor.
LO2	To know about various instruction sets and classifications
LO3	To enable the students to write assembly language programs using 8085.
LO4	To interface the peripheral devices to 8085 using Interrupt controller and DMA interface.
LO5	To provide real-life applications using microcontroller.

UNIT	**Contents**	**No. of Hours**
I	Digital Computers - Microcomputer Organization-Computer languages – Microprocessor Architecture and its operations – Microprocessor initiated operations and 8085 Bus organization – Internal Data operations and 8085 registers - Peripheral or External initiated operations.	15
II	8085 Microprocessor – Pin out and Signals – Functional block diagram - 8085 Instruction Set and Classifications.	15
III	BCD to Binary and Binary to BCD conversions - ASCII to BCD and BCD to ASCII conversions - Binary to ASCII and ASCII to Binary conversions. BCD Arithmetic - BCD addition and Subtraction – Multibyte Addition and Subtraction - Multiplication and Division.	15
IV	The 8085 Interrupts – RIM AND SIM instructions-8259 Programmable Interrupt Controller-Direct Memory Access (DMA) and 8257 DMA controller.	15
V	Introduction to Microcontroller - Microcontroller Vs Microprocessor - 8051 Microcontroller architecture - 8051 pin description. Timers and Counters – Operating Modes- Control Registers. Interrupts – Interrupts in 8051 -	15
	Total	**75**

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
CO1	Remember the Basic binary codes and their conversions. Binary concepts are used in Microprocessor programming and provide a good understanding of the architecture of 8085o introduce the internal organization of Intel 8085 Microprocessor.	PO1
CO2	Understanding the 8085 instruction set and their classifications, enables the students to write the programs easily on their own using different logic	PO1,PO2
CO3	Applying different types of instructions to convert binary codes and analyzing the outcome. The instruction set is applied to develop programs on multibyte arithmetic operations.	PO4,PO6
CO4	Analyze how peripheral devices are connected to 8085 using Interrupts and DMA controller.	PO4,PO5,PO6
CO5	An exposure to create real time applications using microcontroller.	PO3,PO6
Text Book		
1	R. S. Gaonkar- "Microprocessor Architecture- Programming and Applications with 8085"- 5th Edition- Penram International Publications, 2009. [For unit I to unit IV]	
2	Soumitra Kumar Mandal -"Microprocessors and Microcontrollers – Architectures, Programming and Interfacing using 8085, 8086, 8051", Tata McGraw Hill Education Private Limited. [For unit V].	
Reference Books		
1.	Mathur- "Introduction to Microprocessor"- 3rd Edition- Tata McGraw-Hill -1993.	
2.	Raj Kamal - "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education, 2005.	
3.	Krishna Kant, "Microprocessors and Microcontrollers – Architectures, Programming and System Design 8085, 8086, 8051, 8096", PHI, 2008	
Web Resources		
1.	E-content from open source libraries	
2.	https://www.bing.com/, https://theopennotes.in/	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	2
CO2	3	3	3	2	3	2
CO3	3	3	3	3	3	2
CO4	3	3	3	3	3	2
CO5	3	3	3	2	3	2
Weightage of course contributed to each PSO	15	15	14	12	14	10

S-Strong-3 M-Medium-2 L-Low-1

Discipline Specific Elective-I

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120DSC34A	**Image Processing**	Elective	5	1	0	3		4	25	75	100

Learning Objective	
LO1	To learn fundamentals of digital image processing.
LO2	To learn about various 2D Image transformations
LO3	To learn about various image enhancement processing methods and filters
LO4	To learn about various classification of Image segmentation techniques
LO5	To learn about various image compression techniques

UNIT	Contents	No. of Hours
I	Digital Image Fundamentals: Image representation - Basic relationship between pixels, Elements of DIP system -Applications of Digital Image Processing - 2D Systems - Classification of 2D Systems - Mathematical Morphology- Structuring Elements- Morphological Image Processing - 2D Convolution - 2D Convolution Through Graphical Method -2D Convolution Through Matrix Analysis	12
II	2D Image transforms: Properties of 2D-DFT - Walsh transform - Hadamard transform- Haar transform- Discrete Cosine Transform- Karhunen-Loeve Transform -Singular Value Decomposition	12
III	Image Enhancement: Spatial domain methods- Point processing- Intensity transformations - Histogram processing- Spatial filtering- smoothing filter- Sharpening filters - Frequency domain methods: low pass filtering, high pass Filtering- Homomorphic filter.	12
IV	Image segmentation: Classification of Image segmentation techniques - Region approach – Clustering techniques - Segmentation based on thresholding - Edge based segmentation - Classification of edges- Edge detection - Hough transform- Active contour.	12

V	Image Compression: Need for compression -Redundancy- Classification of image- Compression schemes- Huffman coding- Arithmetic coding- Dictionary based compression -Transform based compression,	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the fundamental concepts of digital image processing.	PO1
2	Understand various 2D Image transformations	PO1, PO2
3	Understand image enhancement processing techniques and filters	PO4, PO6
4	Understand the classification of Image segmentation techniques	PO4, PO5, PO6
5	Understand various image compression techniques	PO3, PO5

Text Book	
1	S Jayaraman, S Esakkirajan, T Veerakumar, Digital image processing ,Tata McGraw Hill, 2015
2	Gonzalez Rafel C, Digital Image Processing, Pearson Education, 2009

Reference Books	
1.	1. Jain Anil K , Fundamentals of digital image processing: , PHI,1988
2.	Kenneth R Castleman , Digital image processing:, Pearson Education,2/e,2003
3.	Pratt William K , Digital Image Processing: , John Wiley,4/e,2007

Web Resources	
1.	https://kanchiuniv.ac.in/coursematerials/Digital%20image%20processing%20-Vijaya%20Raghavan.pdf
2.	http://sdeuoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20-%20R.%20Gonzalez%2C%20R.%20Woods-ilovepdf-compressed.pdf
3.	https://dl.acm.org/doi/10.5555/559707
4.	https://www.ijert.org/image-processing-using-web-2-0-2

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**2**	**3**	**2**	**2**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**3**	**2**	**2**
CO5	**3**	**3**	**2**	**3**	**2**	**2**
Weightage of course contributed to each PSO	**15**	**14**	**11**	**15**	**10**	**10**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120DSC34B	**Big Data Analytics**	Elective	5	1	0	3		4	25	75	100

Course Objective	
C1	Understand the Big Data Platform and its Use cases, Map Reduce Jobs
C2	To identify and understand the basics of cluster and decision tree
C3	To study about the Association Rules, Recommendation System
C4	To learn about the concept of stream
C5	Understand the concepts of No SQL Databases

UNIT	Contents	No. of Hours	Course Objective
I	Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value -Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — Map Reduce and YARN — Map Reduce Programming Model	12	
II	Advanced Analytical Theory and Methods: Overview of Clustering — K-means — Use Cases — Overview of the Method — Determining the Number of Clusters — Diagnostics — Reasons to Choose and Cautions .- Classification: Decision Trees — Overview of a Decision Tree — The General Algorithm — Decision Tree Algorithms — Evaluating a Decision Tree — Decision Trees in R — Naïve Bayes — Bayes Theorem — Naïve Bayes Classifier.	12	
III	Advanced Analytical Theory and Methods: Association Rules — Overview — Apriori Algorithm — Evaluation of	12	

	Candidate Rules — Applications of Association Rules — Finding Association& finding similarity — Recommendation System: Collaborative Recommendation- Content Based Recommendation — Knowledge Based Recommendation- Hybrid Recommendation Approaches.	
IV	Introduction to Streams Concepts — Stream Data Model and Architecture — Stream Computing, Sampling Data in a Stream — Filtering Streams — Counting Distinct Elements in a Stream — Estimating moments — Counting oneness in a Window — Decaying Window — Real time Analytics Platform(RTAP) applications — Case Studies — Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics	12
V	NoSQL Databases : Schema-less Models : Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores — Tabular Stores — Object Data Stores — Graph Databases Hive — Sharding —Hbase — Analyzing big data with twitter — Big data for E-Commerce Big data for blogs — Review of Basic Data Analytic Methods using R.	12
	Total	**60**
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO5
4	Perform analytics on data streams.	PO3, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO4
Text Book		
1	AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge	

	University Press, 2012.
Reference Books	
1.	David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013
2.	EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
Web Resources	
1.	https://www.simplilearn.com
2.	https://www.sas.com/en_us/insights/analytics/big-data-analytics.html

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**14**	**11**	**15**	**15**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Marks		
								CIA	External	Total
23120DSC34C	**NATURAL LANGUAGE PROCESSING**	**Elective**	5	1	0	3		25	75	100

Learning Objectives	
LO1	To understand approaches to syntax and semantics in NLP.
LO2	To learn natural language processing and to learn how to apply basic algorithms in this field.
LO3	To understand approaches to discourse, generation, dialogue and summarization within NLP.
LO4	To get acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, pragmatics etc.
LO5	To understand current methods for statistical approaches to machine translation.

UNIT	Contents	No. Of. Hours
I	**Introduction :** Natural Language Processing tasks in syntax, semantics, and pragmatics – Issue- Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.	**12**
II	**Word level and Syntactic Analysis:** Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency-Parsing-Probabilistic Parsing.	**12**
III	**Semantic analysis and Discourse Processing:** Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution-Discourse Coherence and Structure.	**12**
IV	**Natural Language Generation:** Architecture of NLG Systems-Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation. Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.	**12**
V	**Information retrieval and lexical resources:** Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame Net Stemmers- POS Tagger- Research	**12**

	Corpora SSAS.	
Total hours		**60**
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Describe the fundamental concepts and techniques of natural language processing. Explain the advantages and disadvantages of different NLP technologies and their applicability in different business situations.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each Use NLP technologies to explore and gain a broad understanding oftext data.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions. Use NLP methods to analyse sentiment of a text document.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Analyze large volume text data generated from a range of real-world applications. Use NLP methods to perform topic modelling.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness. Determine the framework in which artificial intelligence and the Internet of things may function, including interactions with people, enterprise functions, and environments.	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	Daniel Jurafsky, James H. Martin, “Speech & language processing”, Pearson publications.	
2	Allen, James. Natural language understanding. Pearson, 1995.	
Reference Books		
1.	Pierre M. Nugues, “An Introduction to Language Processing with Perl and Prolog”,Springer	
Web Resources		
1.	https://en.wikipedia.org/wiki/Natural_language_processing	
2.	https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP	

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120SEC35L	**Microprocessor and microcontroller Lab**	Core	0	0	3	3		4	25	75	100
Learning Objectives											
LO1	To introduce the internal organization of Intel 8085 Microprocessor.										
LO2	To know about various instruction sets and classifications										
LO3	To enable the students to write assembly language programs using 8085.										
LO4	To interface the peripheral devices to 8085 using interrupt controller and DMA interface.										
LO5	To provide real-life applications using microcontroller.										
	Details										**No. of Hours**
	List of Exercises:										
	Addition and Subtraction 1. 8 - bit addition 2. 16 - bit addition 3. 8 - bit subtraction 4. BCD subtraction II. Multiplication and Division 1. 8 - bit multiplication 2. BCD multiplication 3. 8 - bit division III. Sorting and Searching 1. Searching for an element in an array. 2. Sorting in Ascending and Descending order. 3. Finding the largest and smallest elements in an array. 4. Reversing array elements. 5. Block move.										60

	IV. Code Conversion 1. BCD to Hex and Hex to BCD 2. Binary to ASCII and ASCII to binary 3. ASCII to BCD and BCD to ASCII V. Simple programs on 8051 Microcontroller 1. Addition 2. Subtraction 3. Multiplication 4. Division 5. Interfacing Experiments using 8051 1. Realisation of Boolean Expression through ports. 2. Time delay generation using subroutines. 3. Display LEDs through ports	
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	Remember the Basic binary codes and their conversions. Binary concepts are used in Microprocessor programming and provide a good understanding of the architecture of 8085o introduce the internal organization of Intel 8085 Microprocessor..	PO1
CO2	Understanding the 8085 instruction set and their classifications, enables the students to write the programs easily on their own using different logic	PO1,PO2
CO3	Applying different types of instructions to convert binary codes and analyzing the outcome. The instruction set is applied to develop programs on multibyte arithmetic operations.	PO4,PO6
CO4	Analyze how peripheral devices are connected to 8085 using Interrupts and DMA controller.	PO4,PO5, PO6
CO5	An exposure to create real time applications using microcontroller.	PO3,PO5

Text Book	
1	R. S. Gaonkar- "Microprocessor Architecture- Programming and Applications with 8085"- 5th Edition- Penram International Publications, 2009. [For unit I to unit IV]
2	Soumitra Kumar Mandal -"Microprocessors and Microcontrollers – Architectures, Programming and Interfacing using 8085, 8086, 8051", Tata McGraw Hill Education Private Limited. [For unit V].
Reference Books	
1.	Mathur- "Introduction to Microprocessor"- 3rd Edition- Tata McGraw-Hill -1993.
2.	Raj Kamal - "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education, 2005.
3.	Krishna Kant, "Microprocessors and Microcontrollers – Architectures, Programming and System Design 8085, 8086, 8051, 8096", PHI, 2008
Web Resources	
1.	E-content from open source libraries
2.	https://www.bing.com/

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	2	3	3	3	2	3
CO 3	3	3	3	3	3	3
CO 4	3	2	3	3	2	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	14	14	15	15	13	15

SKILL ENHANCEMENT COURSE

Subject Code	Subject Name	Category	L	T	P	C		Marks		
								CIA	External	Total
23120SEC36	INTRODUCTION TO HTML	Skill Enha. Course (SEC)	3	0	0	2		25	75	100

Learning Objectives	
LO1	Insert a graphic within a web page.
LO2	Create a link within a web page.
LO3	Create a table within a web page.
LO4	Insert heading levels within a web page.
LO5	Insert ordered and unordered lists within a web page. Create a web page.

UNIT	Contents	No. Of. Hours
I	Introduction: Web Basics: What is Internet–Web browsers–What is Web page –HTML Basics: Understanding tags?	6
II	Tags for Document structure(HTML, Head, Body Tag).Block level text elements: Headings paragraph(<p> tag)–Font style elements:(bold,italic,font,small,strong,strike,bigtags)	6
III	Lists: Types of lists: Ordered, Unordered– Nesting Lists–Other tags: Marquee, HR, BR-Using Images –Creating Hyperlinks.	6
IV	Tables: Creating basic Table, Table elements, Caption–Table and cell alignment–Rowspan, Colspan–Cell padding.	6
V	Frames: Frameset–Targeted Links–No frame–Forms: Input, Text area, Select, Option.	6
	TOTAL HOURS	**30**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Knows the basic concept in HTML Concept of resources in HTML	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Knows Design concept. Concept of Meta Data Understand the concept of save the files.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand the page formatting. Concept of list	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Creating Links. Know the concept of creating link to email address	PO1, PO2, PO3, PO4, PO5, PO6
	Concept of adding images	PO1, PO2, PO3, PO4, PO5, PO6

CO5	Understand the table creation.	

Textbooks	
1	"Mastering HTML5 and CSS3 Made Easy", Teach Comp Inc., 2014.
2	**Thomas Michaud, "Foundations of Web Design: Introduction to HTML & CSS"**
Web Resources	
1.	https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf
2.	https://www.w3schools.com/html/default.asp

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	2	3	3	3
CO 3	2	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	2	3	3
Weightage of course contributed to each PSO	14	15	14	14	15	15

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120SEC37	**Cloud Computing**	Elective	2	0	0	2		4	25	75	100

Course Objective	
LO1	Learning fundamental concepts and Technologies of Cloud Computing.
LO2	Learning various cloud service types and their uses and pitfalls.
LO3	To learn about Cloud Architecture and Application design.
LO4	To know the various aspects of application design, benchmarking and security on the Cloud.
LO5	To learn the various Case Studies in Cloud Computing.

UNIT	**Contents**	**No. of Hours**
I	Introduction to Cloud Computing: Definition of Cloud Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud-based Services and Applications. Cloud Concepts and Technologies: Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Software Defined Networking – Network Function Virtualization – Map Reduce – Identity and Access Management – Service Level Agreements – Billing.	12
II	Cloud Services Compute Services: Amazon Elastic Computer Cloud - Google Compute Engine - Windows Azure Virtual Machines Storage Services: Amazon Simple Storage Service - Google Cloud Storage - Windows Azure Storage Database Services: Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure SQL Database - Windows Azure Table Service **Application Services:** Application Runtimes and Frameworks - Queuing Services - Email Services - Notification Services - Media Services	12

	Content Delivery Services: Amazon Cloud Front - Windows Azure Content Delivery Network **Analytics Services:** Amazon Elastic Map Reduce - Google Map Reduce Service - Google Big Query - Windows Azure Hindsight. **Deployment and Management Services:** Amazon Elastic Bean stack - Amazon Cloud Formation **Identity and Access Management Services:** Amazon Identify and Access Management - Windows Azure Active Directory Open Source Private Cloud Software: CloudStack – Eucalyptus – Open Stack.	
III	**Cloud Application Design:** Introduction – Design Considération for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and upgradassions – Performance – Reference Architectures for Cloud Applications – Cloud Application Design Méthodologies: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services – Data Storage Approches: Relationnel Approach (SQL), Non-RelationalApproach (NoSQL).	12
IV	**Cloud Application Benchmarking and Tuning:** Introduction to Benchmarking – Steps in Benchmarking – Workload Characteristics – Application Performance Metrics – Design Consideration for Benchmarking Methodology – Benchmarking Tools and Types of Tests – Deployment Prototyping. **Cloud Security:** Introduction – CSA Cloud Security Architecture – Authentication (SSO) – Authorization – Identity and Access Management – Data Security : Securing data at rest, securing data in motion – Key Management – Auditing.	12
V	**Case Studies:** Cloud Computing for Healthcare – Cloud Computing for EnergySystems - Cloud Computing for Transportation Systems - Cloud Computing for Manufacturing Industry - Cloud Computing for Education.	12

	Total	60
Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO 1	Understand the fundamental concepts and Technologies in Cloud Computing.	PO1
CO 2	Able to understand various cloud service types and their uses and pitfalls.	PO1, PO2
CO 3	Able to understand Cloud Architecture and Application design.	PO4, PO5
CO 4	Understand the various aspects of application design, benchmarking and security in the Cloud.	PO4, PO5, PO6
CO 5	Understand various Case Studies in Cloud Computing.	PO3, PO6
Text Book		
1	ArshdeepBahga, Vijay Madisetti, *Cloud Computing – A Hands On Approach*, Universities Press (India) Pvt. Ltd., 2018	
Reference Books		
1.	Anthony T Velte, Toby J Velte, Robert Elsenpeter, *Cloud Computing: A Practical Approach*, Tata McGraw-Hill, 2013.	
2.	Barrie Sosinsky, *Cloud Computing Bible*, Wiley India Pvt. Ltd., 2013.	
3.	David Crookes, *Cloud Computing in Easy Steps*, Tata McGraw Hill, 2015.	
4.	Dr. Kumar Saurabh, *Cloud Computing*, Wiley India, Second Edition 2012.	
Web Resources		
1.	https://en.wikipedia.org/wiki/Cloud_computing	
2.	https://link.springer.com/chapter/10.1007/978-3-030-34957-8_7	
3.	https://webobjects.cdw.com/webobjects/media/pdf/solutions/cloud-computing/121838-	

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**11**	**15**	**15**	**10**

S-Strong-3 M-Medium-2 L-Low-1

Course Code	Course Title	L	T	P	C
23120RMC38	Research Methodology	2	0	0	2

AIM:

To create a basic appreciation towards research process and awareness of various research publication.

OBJECTIVES:

- To understand the steps in research process and the suitable methods.
- To identify various research communications and their salient features
- To carry out basic literature survey using the common data-based
- To give exposure to MATLAB platform for effective computational and graphic works required for quality research

PREREQUISITIES:

Basic computer skill for working in window environment & conceptual knowledge on basic matrices.

UNIT-I Introduction to Research Methodology

Meaning of research – Objectives of research – Type of research – Significance of research – Research approaches.

UNIT-II Research Methods

Research methods versus Methodology – Research and scientific method – criteria of good research – Problems encountered by researchers in India.

UNIT-III Literature Survey

Articles – Thesis – Journals – Patents – Primary sources of journals and patents – Secondary sources – Listing of titles – Abstracts – Review – General treatises – Monographs.

UNIT-IV Database Survey

Database search – NIST –MSDS –PubMed – Scopus – Science citation index – Information about a specific search.

UNIT-V Introduction to MATLAB:

What is MATLAB? Matrix and its application in different areas: MATLAB approach to environmental modeling; Arithmetic Matrix – Operators; Arithmetic Array – Operators and its applications in MATLAB; Expressions, Opening M-Files; Structure of MATLAB Programming; Programming; Concatenation of strings; Vectorization ; Basic Graphics.

OUTCOME:

Ability to carry out independent literature survey corresponding to the specific publication type and assess basic computation frame works used in mathematical researches.

REFERENCES BOOK:

1. C.R. Kothari, Research Methodology, New Age International publishers. New Delhi,2204.

2. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.

3. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2205.

4. A Guide to MATLAB: For Beginners and experienced Users by Brian R. Hunt (Editor), Ronald L. Lipsman, J. Rosenberg

5. Introduction to MATLAB for Engineers by William J. Palm III.

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
231ACLSOAN	**OFFICE AUTOMATION**	Skill Enha. Course (SEC)	-	-	-	1		2	25	75	100

Learning Objectives		
LO1	Understand the basics of computer systems and its components.	
LO2	Understand and apply the basic concepts of a word processing package.	
LO3	Understand and apply the basic concepts of electronic spreadsheet software.	
LO4	Understand and apply the basic concepts of database management system.	
LO5	Understand and create a presentation using PowerPoint tool.	
UNIT	**Contents**	**No. of Hours**
I	Introductory concepts: Memory unit– CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems & its features: DOS–UNIX–Windows. Introduction to Programming Languages.	6
II	**Word Processing:** Open, Save and close word document; Editing text – tools, formatting, bullets;SpellChecker - Document formatting – Paragraph alignment, indentation, headers and footers,numbering;printing–Preview,options,merge.	6
III	**Spreadsheets:**Excel–opening,enteringtextanddata,formatting,navigating;Formulas–entering,handlingand copying;Charts–creating,formatting and printing,analysistables,preparationoffinancialstatements,introductiontodataanalytics.	6
IV	**Database Concepts:** The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of data files; Understanding Programming environment in DBMS; Developing menu drive applications in query language(MS–Access).	6
V	**Power point:** Introduction to Power point - Features – Understanding slide typecasting &viewing slides – creating slide shows. Applying special object – including objects & pictures –	6

	Slide transition–Animation effects, audio inclusion, timers.	
	Total	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Possess the knowledge on the basics of computers and its components	PO1,PO2,PO3,PO6,PO8
CO2	Gain knowledge on Creating Documents, spreadsheet and presentation.	PO1,PO2,PO3,PO6
CO3	Learn the concepts of Database and implement the Query in Database.	PO3,PO5,PO7
CO4	Demonstrate the understanding of different automation tools.	PO3,PO4,PO5,PO7
CO5	Utilize the automation tools for documentation, calculation and presentation purpose.	PO4,PO6,PO7,PO8
Text Book		
1	Peter Norton, "Introduction to Computers"–Tata McGraw-Hill.	
Reference Books		
1.	Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, "Microsoft 2003", Tata McGrawHill.	
Web Resources		
1.	https://www.udemy.com/course/office-automation-certificate-course/	
2.	https://www.javatpoint.com/automation-tools	

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**14**	**14**	**15**	**15**	**15**

S-Strong-3 M-Medium-2 L-Low-1

சங்க இலக்கியம் - 23110AEC41

நான்காம் பருவம்

பாடநோக்கங்கள்

- இலக்கியங்கள் வாயிலரக சமுதாயக்கருத்தக்களை
- பழந்தமிழ்இலக்கியவளத்தைஉணர்த்துதல்.
- சங்கஅக. புறபாடல்மரபுகளைப்பயிற்றுவித்தல்
- வாழ்வியல்அறங்கள்மற்றும்வரலாற்றுச்செய்திகளை .பயிற்றுவித்தல்
- புறஇலக்கியங்கள்காட்டும்வாழ்வியல்அறங்களைளடுத்துக்கூறுதல்

பயன்கள்

- பழந்தமிழ்இலக்கியமரபைஅறிவர்.
- சங்கஇலக்கியங்களில்உள்ளஅழகியல்கூறுகளைஉணர்வர்.
- வாழ்வியல்அறங்கள்மற்றும்வரலாற்றுச்செய்திகளைஅறிவர்.
- சங்கஅக, புறபாடல்மரபுகளைபுரிந்துக்கொள்வர்.
- புறஇலக்கியங்கள்காட்டும்வாழ்வியல்அறங்களைஉணர்வர்.

அலகு-1

1. குறுந்தொகை– பாடல்எண்: 28,38

2. நற்றிணை– பாடல்எண்: 1,27,28,167,168

3.ஐங்குறுநூறு– பாடல்எண்: இளவேனில்பத்து

அலகு-2

1.கலித்தொகை– பாடல்எண்: 3,7

2.அகநானூறு– பாடல்எண்:5,42,100

3. புறநானூறு– பாடல்எண்: 182,204,41,121

அலகு-3

1 சிறுபாணாற்றுப்படைமுழுவதும்

அலகு-4

1. திருக்குறள்– செய்நன்றிஅறிதல், கூடாநட்பு ,நலம்புனைந்துரைத்தல்.
2.

2. நாலடியார் – பாடல்எண்: 1,172,215,253

அலகு-5

இலக்கியவரலாறு

1.சங்கஇலக்கியம்

2.எட்டுத்தொகை, பத்துப்பாட்டு

3.பதினெண்கீழ்க்கணக்குநூல்கள்

பார்வைநூல்கள்

1.குறுந்தொகை - கழகவெளியீடு,சென்னை.
2.நற்றிணை - கழகவெளியீடு,சென்னை.
3.ஐங்குறுநூறு - கழகவெளியீடு,சென்னை.
4.கலித்தொகை - கழகவெளியீடு,சென்னை.
5.அகநானூறு - கழகவெளியீடு,சென்னை.
6.புறநானூறு - கழகவெளியீடு,சென்னை.
7.திருக்குறள் -பரிமேலழகர்உரை ,கழகவெளியீடு,சென்னை
8.இணையதளம் -www.tamilvu.org , www.noolulagam.com

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CLO1	3	2	3	3	3	2	2	2	3	2	3	2
CLO2	3	3	2	2	2	3	2	3	3	2	2	2
CLO3	3	2	3	3	2	2	2	3	2	3	3	2
CLO4	3	3	3	2	2	2	3	2	3	2	3	3
CLO5	3	3	2	2	2	2	3	2	2	2	3	3

SECOND YEAR - SEMESTER IV

PAPER II –GENERAL ENGLISH [23111AEC42]

Subject Code	Category	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
23111AEC42	Part II	3	0	0-	3		6	25	75	100

Learning Objectives	
LO1	To help learners imbibe the rules of language unconsciously and tune to deduce language structure and usage.
LO2	To enable them use receptive skills through reading and listening to acquire good exposure to language and literature.
LO3	To help them develop style in speech and writing and manipulate the tools of language for effective communication.
LO4	To provide exposure to plays, autobiographies and expose them to value based ideas.
LO5	To enhance their language skills especially in the areas of grammar and pronunciation.

Unit No.	Unit Title & Text	No. of Periods for the Unit
I	**Life Writing** 1.1 I am Malala-Malala Yousafzai - Chapter 1 1.2 My Inventions - Nikola Tesla - Chapter 2	20
II	**One Act Plays** 2.1The Zoo Story- Edward Albee 2.2 The Proposal- Anton Chekhov	20
III	**Interviews** 3.1 Nelson Mandela's Interview with Larry King. 3.2 Rakesh Sharma's Interview with Indira Gandhi from Space 3.3 Lionel Messi with Sid Lowe (Print)	20

IV	**Language Competency** 4.1 Refuting, Arguing & Debating 4.2 Making Suggestions & Responding to Suggestions, Asking for and Giving Advice or Help4.3 Interviews(face to face, telephone and video conferencing)	15
V	**English for Workplace** 5.1 Job Applications: Covering letters, CV and Resume 5.2 Creating a digital profile - LinkedIn 5.3 Filling Forms (Online & Manual): creation of account, railway reservation, ATM,Credit/debit card 5.4 Body Language -Practical Skills for Interviews	15

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Learn to communicate effectively and appropriately in real life situation.	PO1
CO2	Use English effectively for study purpose across the curriculum	PO1,PO2
CO3	Develop interest in and appreciation of Literature	PO4,PO6
CO4	Develop and integrate the use of the four language skills	PO4,PO5,PO6
CO5	Enhance their language skills especially in the areas of grammar and pronunciation.	PO3,PO8

Textbooks(Latest Editions)	
1	I Am Malala The Girl Who Stood Up for Education and Was Shot by the Taliban by Malala Yousafzai, Christina Lamb , Little Brown, 2013.
2	My Inventions by Nikola Tesla Ingram Short title, 2011 Edition
ReferencesBooks **(Latest editions, and the style as given below must be strictly adhered to)**	
1	**Autobiographies, Mary**, Taylor & Francis, 2021

2	One-act Plays for Acting Students: An Anthology of Short Norman A. Bert · 1987 ·
3	The One-Act Play Companion: A Guide to plays, play wrights ... Colin Dolley, Rex Walford · 2015
4	How to Build a Professional Digital Profile Kindle Edition by Jeanne Kelly Bernish, Bernish Communications Associates, LLC; 1st edition (May 29, 2012)
5	Role Play-Theory and Practice.Krysia M Yardley-Matwiejczuk, SAGE publications ltd, 1997

Web Resources	
1	For Readers' Theatre: https://www.youtube.com/watch?v=JaLQJt8orSw&t=469s(the link to the performance; refer scripts by Aaron Shepherd)
2	http://BBC learn English.com
3	http://onestopenglish.com
4	http://hearn-english-today.com
5	http://talkenglish.com
6	The Zoo Story: http://www.lem.seed.pr.gov.br/arquivos/File/livrosliteraturaingles/zoostory.pdf
7	The Proposal: https://www.one-act-plays.com/comedies/proposal.html
8	Nelson Mandela with Larry King Interviews: http://edition.cnn.com/TRANSCRIPTS/0005/16/lkl.00.html
9	Rakesh Sharma with Indira Gandhi Interview : https://www.ndtv.com/offbeat/what-first-indian-astronaut-rakesh-sharma-told-indira-gandhi-about-india-from-space-2204839
10	Lionel Messi with Sid Lowe Interview:https://www.worldsoccer.com/world-soccer-latest/lionel-messi-interview-part-one-338553

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**2**

CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**14**	**11**	**15**	**15**	**10**

S-Strong-3 M-Medium-2 L-Low-1

SEMESTER IV

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	Ext	Total
23120AEC 43	**Java Programming**	Core	5	1	0	3		5	25	75	100

Learning Objectives	
LO1	To provide fundamental knowledge of object-oriented programming
LO2	To equip the student with programming knowledge in Core Java from the basics up.
LO3	To enable the students to use AWT controls, Event Handling and Swing for GUI.
LO4	To provide fundamental knowledge of object-oriented programming.
LO5	To equip the student with programming knowledge in Core Java from the basics up.

UNIT	**Contents**	**No. of Hours**
I	**Introduction:** Review of Object Oriented concepts – History of Java – Java buzzwords – JVM architecture – Datatypes - Variables - Scope and life time of variables - arrays - operators – control statements - type conversion and casting - simple java program - constructors - methods - Static block - Static Data – Static Method String and String Buffer Classes.	15
II	**Inheritance**: Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword. **Packages**: Definition-AccessProtection –Importing Packages. **Interfaces**: Definition–Implementation–Extending Interfaces. **Exception Handling**: *try – catch- throw - throws – finally* – Built-in	15

	exceptions - Creating own Exception classes.	
III	**Multithreaded Programming**: Thread Class - Runnable interface – Synchronization–Using synchronized methods– Using synchronized statement- Interthread Communication –Deadlock. **I/O Streams:** Concepts of streams - Stream classes- Byte and Character stream - Reading console Input and Writing Console output - File Handling.	15
IV	**AWT Controls:** The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Color - Fonts and layout managers. **Event Handling:** Events - Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes	15
V	**Swing:** Introduction to Swing - Hierarchy of swing components. Containers - Top level containers – Frame – Window – Dialog – Panel – Button – J toggle Button – Checkbox – JRadioButton – JLabel,JTextField – JTextArea – JList – JComboBox – JScrollPane.	15
	Total	**75**

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic Object-oriented concepts. Implement the basic constructs of Core Java.	PO1, PO2, PO6
CO2	Implement inheritance, packages, interfaces and exception handling of Core Java.	PO2, PO3, PO8
CO3	Implement multi-threading and I/O Streams of Core Java	PO1, PO3, PO5
CO4	Implement AWT and Event handling.	PO2, PO6
CO5	Use Swing to create GUI.	PO1, PO3, PO6

Text Books:

1. Herbert Scheldt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010

2.	Gary Cornell, *Core Java 2 Volume I – Fundamentals,* Addison Wesley, 1999
References :	
1.	Head First Java, O'Rielly Publications,
2.	Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010
Web Resources	
1.	https://javabeginnerstutorial.com/core-java-tutorial
2.	http://docs.oracle.com/javase/tutorial/
3.	https://www.coursera.org/

Mapping with Programme Outcomes:

S-Strong-3 M-Medium-2 L-Low-1

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**2**	**2**	**3**
CO3	**2**	**2**	**1**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**1**
Weightage of course contributed to each PSO	**14**	**14**	**13**	**14**	**14**	**11**

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	2	3	2
CO2	2	3	3	3	2	3	3	2	2	2
CO3	3	3	3	2	3	3	3	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	3

3 – Strong, 2 – Medium , 1 - Low

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120SEC45L	**Java Programming Lab**	Core	0	0	3	3		4	25	75	100

Learning Objectives	
LO1	To provide fundamental knowledge of object-oriented programming.
LO2	To equip the student with programming knowledge in Core Java from the basics up.
LO3	To enable the students to know about Event Handling.
LO4	To enable the students to use String Concepts.
LO5	To equip the student with programming knowledge in to create GUI using AWT controls.

EXCERCISE	**Details**
1	Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer
2	Write a Java program to multiply two given matrices.
3	Write a Java program that displays the number of characters, lines and words in a text
4	Generate random numbers between two given limits using Random class and print messages according to the range of the value generated.
5	Write a program to do String Manipulation using Character Array and perform the following string operations: a. String length b. Finding a character at a particular position c. Concatenating two strings
6	Write a program to perform the following string operations using String class: a. String Concatenation

	b. Search a substring c. To extract substring from given string	
7	Write a program to perform string operations using String Buffer class: a. Length of a string b. Reverse a string c. Delete a substring from the given string	
8	Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.	
9	Write a threading program which uses the same method asynchronously to print the numbers 1to10 using Thread1 and to print 90 to100 using Thread2.	60
10	Write a program to demonstrate the use of following exceptions. a. Arithmetic Exception b. Number Format Exception c. Array Index Out of Bound Exception d. Negative Array Size Exception	
11	Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes	
12	Write a program to accept a text and change its size and font. Include bold italic options. Use frames and controls.	
13	Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes).	
14	Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divide by	

	zero.	
15	Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with “stop” or “ready” or “go” should appear above the buttons in a selected color. Initially there is no message shown.	
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the basic Object-oriented concepts.Implement the basic constructs of Core Java.	PO1
2	Implement inheritance, packages, interfaces and exception handling of Core Java.	PO1, PO2
3	Implement multi-threading and I/O Streams of Core Java	PO4, PO6
4	Implement AWT and Event handling.	PO4, PO5, PO6
5	Use Swing to create GUI.	PO3, PO6

Text Book	
1	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010.
2.	Gary Cornell, *Core Java 2 Volume I – Fundamentals*, Addison Wesley, 1999.

Reference Books	
1.	Head First Java, O’Rielly Publications,
2.	Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010.

Web Resources	
1.	https://www.w3schools.com/java/
2.	http://java.sun.com
3.	http://www.afu.com/javafaq.html

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6

CO1	**3**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**2**	**2**	**3**
CO3	**2**	**2**	**1**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**14**	**14**	**13**	**14**	**14**	**12**

S-Strong M-Medium L-Low

Discipline Specific Elective-II

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120DSC44A	**Agile Project Management**	Elective	5	1	0	3		4	25	75	100

Learning Objectives	
LO1	Learning of software design, software technologies and APIs.
LO2	Detailed demonstration about Agile development and testing techniques.
LO3	Learning about Agile Planning and Execution.
LO4	Understanding of Agile Management Design and Quality Check.
LO5	Detailed examination of Agile development and testing techniques.

UNIT	**Contents**	**No. of Hours**
I	**Introduction: Modernizing Project Management:** Project Management Needed a Makeover – Introducing Agile Project Management. **Applying the Agile Manifesto and Principles:** Understanding the Agile manifesto – Outlining the four values of the Agile manifesto – Defining the 15 Agile Principles – Adding the Platinum Principles – Changes as a result of Agile Values – The Agile litmus test. **Why Being Agile Works Better:** Evaluating Agile benefits – How Agile approaches beat historical approaches – Why people like being Agile.	12
II	**Being Agile** **Agile Approaches:** Diving under the umbrella of Agile approaches – Reviewing the Big Three: Lean, Scrum, Extreme Programming - Summary	12

	Agile Environments in Action: Creating the physical environment – Low-tech communicating – High-tech communicating – Choosing tools. **Agile Behaviors in Action:** Establishing Agile roles – Establishing new values – Changing team philosophy.	
III	**Agile Planning and Execution** **Defining the Product Vision and Roadmap:** Agile planning – Defining the product vision – Creating a product roadmap – Completing the product backlog. **Planning Releases and Sprints:** Refining requirements and estimates – Release planning – Sprint planning. **Working Throughout the Day:** Planning your day – Tracking progress – Agile roles in the sprint – Creating shippable functionality – The end of the day. **Showcasing Work, Inspecting and Adapting:** The sprint review – The sprint retrospective. **Preparing for Release:** Preparing the product for deployment (the release sprint) – Preparing the operational support – Preparing the organization for product deployment - Preparing the marketplace for product deployment	12
IV	**Agile Management** **Managing Scope and Procurement:** What's different about Agile scope management – Managing Agile scope – What's different about Agile procurement – Managing Agile procurement. **Managing Time and Cost:** What's different about Agile time management – Managing Agile schedules – What's different about Agile cost management – Managing Agile budgets. **Managing Team Dynamics and Communication:** What's different about Agile team dynamics – Managing Agile team dynamics – What's different about Agile communication – Managing Agile communication? **Managing Quality and Risk:** What'sdifferent about Agile quality –	12

	Managing Agile quality – What's different about Agile risk management – Managing Agile risk.	
V	**Implementing Agile** **Building a Foundation:** Organizational and individual commitment – Choosing the right pilot team members – Creating and environment that enables Agility – Support Agility initially and over time. **Being a Change Agent:** Becoming Agile requires change – why change doesn't happen on its own – Platinum Edge's Change Roadmap – Avoiding pitfalls – Signs your changes are slipping. **Benefits, Factors for Success and Metrics:** Ten key benefits of Agile project management – Ten key factors for project success – Ten metrics for Agile Organizations.	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	Understanding of software design, software technologies and APIs using Agile Management.	PO1
CO2	Understanding of Agile development and testing techniques.	PO1, PO2
CO3	Understanding about Agile Planning and Execution using Sprint.	PO4, PO5
CO4	Understanding of Agile Management Design, scope, Procurement, managing Time and Cost and Quality Check.	PO4, PO5, PO6
CO5	Analyzing of Agile development and testing techniques.	PO2, PO4

Text Book	
1	Mark C. Layton, Steven J. Ostermiller, Agile Project Management for Dummies, 2nd Edition, Wiley India Pvt. Ltd., 2018.
	Jeff Sutherland, Scrum – The Art of Doing Twice the Work in Half the Time, Penguin,

	2014.
Reference Books	
1.	Mark C. Layton, David Morrow, *Scrum for Dummies*, 2nd Edition, Wiley India Pvt. Ltd., 2018.
2.	Mike Cohn, Succeeding with Agile – Software Development using Scrum, Addison-Wesley Signature Series, 2010.
3.	Alex Moore, Agile Project Management, 2020.
4.	Alex Moore, *Scrum*, 2020.
5.	Andrew Stellman and Jennifer Greene, *Learning Agile: Understanding Scrum, XP, Lean, and Kanban*, Shroff/O'Reilly, First Edition, 2014.
Web Resources	
1.	www.agilealliance.org/resources

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**2**	**2**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**3**	**2**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**14**	**11**	**15**	**11**	**10**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120DSC44B	Analytics for Service Industry	Elective	5	1	0	3		4	25	75	100

Course Objectives:

1. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
2. To become familiar with the processes needed to develop, report, and analyze business data.
3. To learn how to use and apply Excel and Excel add-ins to solve business problems.

I. Overview of Business Analytics • Introduction to Analytics • Davenport article - "Competing on Analytics. The New Path to Value"

II. Visualization/ Data Issues • Organization/sources of data • Importance of data quality • Dealing with missing or incomplete data • Data Classification • Davenport and Harris article - "The Dark Side of Customer Analytics"

III. III. Introduction to Data Mining • Introduction to Data Mining • Data Mining Process • Data mining tool XLMiner • Loveman article – "Diamonds in the Data Mine" • Market Basket Analysis –• Classification and Regression Trees

IV. IV. Introduction to Decision Modeling • Optimization Use of Excel to solve business problems: e.g. marketing mix, capital budgeting, portfolio optimization • Decision Making under Uncertainty Simulation Introduction to Risk

V. Types of problems: inventory management, capital investment analysis, market share estimation, sensitivity analysis.

Reference Books:

1. Data Analysis and Business Modeling by Wayne L. Winston
2. A Data Visualization Guide for Business Professionals by Cole Nussbaumer Knaflic

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120DSC44C	**Computing Intelligence**	Elective	5	1	0	3		4	25	75	100

Learning Objectives	
LO1	To identify and understand the basics of AI and its search.
LO2	To study about the Fuzzy logic systems.
LO3	Understand and apply the concepts of Neural Network and its functions.
LO4	Understand the concepts of Artificial Neural Network
LO5	To study about the Genetic Algorithm.

UNIT	**Contents**	**No. of Hours**
I	**Introduction to AI**: Problem formulation – AI Applications – Problems – State Space and Search – Production Systems – Breadth First and Depth First – Travelling Salesman Problem – Heuristic search techniques: Generate and Test – Types of Hill Climbing.	12
II	**Fuzzy Logic Systems:** Notion of fuzziness – Operations on fuzzy sets – T-norms and other aggregation operators – Basics of Approximate Reasoning – Compositional Rule of Inference – Fuzzy Rule Based Systems – Schemes of Fuzzification – Inferencing – Defuzzification – Fuzzy Clustering – fuzzy rule-based classifier.	12
III	**Neural Networks:** What is Neural Network, Learning rules and various activation functions, Single layer Perceptions, Back Propagation networks, Architecture of Back propagation (BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications	12
IV	**Artificial Neural Networks:** Fundamental Concepts	12

	– Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network.	
V	**Genetic Algorithm:** Introduction – Biological Background – Genetic Algorithm Vs Traditional Algorithm – Basic Terminologies in Genetic Algorithm – Simple GA – General Genetic Algorithm – Operators in Genetic Algorithm	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Describe the fundamentals of artificial intelligence concepts and searching techniques.	PO1
2	Develop the fuzzy logic sets and membership function and defuzzification techniques.	PO1, PO2
3	Understand the concepts of Neural Network and analyze and apply the learning techniques	PO4, PO6
4	Understand the artificial neural networks and its applications.	PO4, PO5, PO6
5	Understand the concept of Genetic Algorithm and Analyze the optimization problems using GAs.	PO3, PO5

Text Book

1	S.N. Sivanandam and S.N. Deep, "Principles of Soft Computing", 2nd Edition, Wiley India Pvt. Ltd.
2	Stuart Russell and Peter Norvig, "Artificial Intelligence - A Modern Approach", 2nd Edition, Pearson Education in Asia.
3	S. Rajasekaran, G. A. Vijayalakshmi, "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications", PHI.

Reference Books

1.	F. Martin, Mcneill, and Ellen Thro, "Fuzzy Logic: A Practical approach", AP Professional, 2000. Chin Teng Lin, C. S. George Lee," Neuro-Fuzzy Systems", PHI
2.	Chin Teng Lin, C. S. George Lee," Neuro-Fuzzy Systems", PHI.

Web Resources	
1.	https://www.javatpoint.com/artificial-intelligence-tutorial
2.	https://www.w3schools.com/ai/

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	1	2	1	2
CO2	3	3	2	2	3	3
CO3	3	3	2	3	3	2
CO4	3	2	3	2	2	3
CO5	3	2	2	2	3	3
Weightage of course contributed to Each PSO	15	12	10	11	12	13

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120SEC46	**PHP PROGRAMMING**	Skill Enha. Course (SEC)	3	0	0	2		2	25	75	100

Learning Objectives	
LO1	To provide the necessary knowledge on basics of PHP.
LO2	To design and develop dynamic, database-driven web applications using PHP version.
LO3	To get an experience on various web application development techniques .
LO4	To learn the necessary concepts for working with the files using PHP.
LO5	To get a knowledge on OOPS with PHP.

UNIT	Contents	No. of Hours
I	Introduction to PHP -Basic Knowledge of websites -Introduction of Dynamic Website -Introduction to PHP -Scope of PHP -XAMPP and WAMP Installation	6
II	PHP Programming Basics -Syntax of PHP -Embedding PHP in HTML -Embedding HTML in PHP. Introduction to PHP Variable -Understanding Data Types -Using Operators -Using Conditional Statements -If(), else if() and else if condition Statement.	6
III	Switch() Statements -Using the while() Loop -Using the for() Loop PHP Functions. PHP Functions -Creating an Array -Modifying Array Elements -Processing Arrays with Loops - Grouping Form Selections with Arrays -Using Array Functions.	6
IV	PHP Advanced Concepts -Reading and Writing Files -Reading Data from a File.	6
V	Managing Sessions and Using Session Variables -Destroying a Session -Storing Data in Cookies -Setting Cookies.	6
	Total	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will know about php.	
CO1	Write PHP scripts to handle HTML forms	PO1,PO4,PO6
CO2	Write regular expressions including modifiers,	PO2,PO5,PO7.

	operators, and meta characters.	
CO3	Create PHP Program using the concept of array.	PO3,PO4,PO5.
CO4	Create PHP programs that use various PHP library functions	PO2,PO3,PO5
CO5	Manipulate files and directories.	PO3,PO5,PO6.
Text Book		
1	Head First PHP & MySQL: A Brain-Friendly Guide- 2009-Lynn mighley and Michael Morrison.	
2	The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL- Alan Forbes	
Reference Books		
1.	PHP: The Complete Reference-Steven Holzner.	
2.	DT Editorial Services (Author), "*HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)*", Paperback 2016, 2nd Edition.	
Web Resources		
1.	Opensource digital libraries: PHP Programming	
2.	https://www.w3schools.com/php/default.asp	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**1**	**2**	**1**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**2**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**12**	**10**	**11**	**12**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120SEC47	**Software Testing**	Skill Enha. Course (SEC)	2	0	0	2		2	25	75	100

Learning Objectives	
LO1	To study fundamental concepts in software testing
LO2	To discuss various software testing issues and solutions in software unit test, integration and system testing.
LO3	To study the basic concept of Data flow testing and Domain testing.
LO4	To Acquire knowledge on path products and path expressions.
LO5	To learn about Logic based testing and decision tables

UNIT	Contents	No. of Hours
I	Introduction: Purpose–Productivity and Quality in Software–TestingVsDebugging–Model for Testing–Bugs–Types of Bugs – Testing and Design Style.	6
II	Flow / Graphs and Path Testing – Achievable paths – Path instrumentation Application Transaction Flow Testing Techniques.	6
III	Data Flow Testing Strategies - Domain Testing: Domains and Paths – Domains and Interface Testing.	6
IV	Linguistic –Metrics – Structural Metric – Path Products and Path Expressions. Syntax Testing–Formats–Test Cases	6
V	Logic Based Testing–Decision Tables–Transition Testing–States, State Graph, State Testing.	6
	Total	**30**

Course Outcomes		**Program Outcomes**
CO	On completion of this course, students will	
CO1	Students learn to apply software testing knowledge and engineering methods	PO1
CO2	Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.	PO1, PO2
CO3	Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.	PO4, PO6

CO4	Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems	PO4, PO5, PO6
CO5	Have an ability to use software testing methods and modern software testing tools for their testing projects.	PO3, PO8
Text Book		
1	B.Beizer,"SoftwareTestingTechniques",IIEdn.,DreamTechIndia,NewDelhi,2003.	
2	K.V.K.Prasad,"SoftwareTestingTools",DreamTech.India,NewDelhi,2005	
Reference Books		
1.	I.Burnstein,2003,"PracticalSoftwareTesting",SpringerInternationalEdn.	
2.	E. Kit, 1995, "Software Testing in the Real World: Improving the Process", PearsonEducation,Delhi.	
3.	R. Rajani,andP.P.Oak,2004,"SoftwareTesting",TataMcgrawHill,New Delhi.	
Web Resources		
1.	https://www.javatpoint.com/software-testing-tutorial	
2.	https://www.guru99.com/software-testing.html	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**1**	**2**	**1**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**2**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**12**	**10**	**11**	**12**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Course Code	Course Title	L	T	P	C
231AECCEVS	Environmental Studies	2	0	0	2

AIM:

To create the awareness about environmental problems among the students.

OBJECTIVE:

- It deals with the study of flow of energy and materials in the environment
- It deals with the study of natural and its function

UNIT–I

The Multidisciplinary Nature of Environmental Studies – Definition, Scope and Importance - Need for public awareness - **Natural Resources: Renewable and Non-Renewable Resources** - Forest resources - Water resources - Mineral resources - Food resources - Energy resources - Land resources.

UNIT-II

Ecosystems - Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids - Types of ecosystem - Forest ecosystem - Grassland ecosystem - Desert ecosystem - Aquatic ecosystems.

UNIT-III

Biodiversity and its Conservation – Definition - Genetic, species and ecosystem diversity - Bio geographical classification of India - Values of biodiversity - Biodiversity at global, National and local levels - India as a mega - diversity nation - Hot-spots of biodiversity - Threats to biodiversity - Endangered and endemic species of India - Conversation of biodiversity.

UNIT-IV

Environmental Pollution – Definition - Air pollution - Water pollution - Soil pollution - Marine pollution - Noise pollution - Thermal pollution - Nuclear hazards - Solid waste Management - Role of an individual in prevention of pollution - Disaster management.

UNIT-V

Social Issues and the Environment - From Unsustainable to Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, watershed management - Environmental ethics - Climate change green house effect and global warming - Ozone depletion - Waste land reclamation - Consumerism and waste products - Environmental Legislation - Issues involved in enforcement of environmental legislation - Public awareness - **Human Population and the Environment**.

REFERENCE BOOK:

1.“ENVIRONMENTAL STUDIES”, K.Kumarasamy, A.Alagappa Moses, M.Vasant

Course Code	Course Title	L	T	P	C
231LCSCLS	Leadership and Management Skills	-	-	-	1

Aim:

The aim of the course cultivating and nurturing the innate leadership skills of the youth so that they may transform these challenges into opportunities and become torch bearers of the future by developing creative solutions.

Course Objective:

The Module is designed to**:**

- Help students to develop essential skills to influence and motivate others
- Inculcate emotional and social intelligence and integrative thinking for effective leadership
- Create and maintain an effective and motivated team to work for the society
- Nurture a creative and entrepreneurial mindset
- Make students understand the personal values and apply ethical principles in professional and social contexts.

Course Outcomes:

Upon completion of the course students will be able to:

1. Examine various leadership models and understand/assess their skills, strengths and abilities that affect their own leadership style and can create their leadership vision
2. Learn and demonstrate a set of practical skills such as time management, self management, handling conflicts, team leadership, etc.
3. Understand the basics of entrepreneurship and develop business plans
4. Apply the design thinking approach for leadership
5. Appreciate the importance of ethics and moral values for making of a balanced personality.

UNIT I- Leadership Skills

a. **Understanding Leadership and its Importance**
- What is leadership?
- Why Leadership required?
- Whom do you consider as an ideal leader?

Traits and Models of Leadership
- Are leaders born or made?
- Key characteristics of an effective leader
- Leadership styles
- Perspectives of different leaders

Basic Leadership Skills
- Motivation
- Team work
- Negotiation
- Networking

UNIT II - Managerial Skills

a. **Basic Managerial Skills**
- Planning for effective management
- How to organize teams?
- Recruiting and retaining talent
- Delegation of tasks
- Learn to coordinate
- Conflict management

Self Management Skills
- Understanding self concept
- Developing self-awareness
- Self-examination
- Self-regulation

UNIT III - Entrepreneurial Skills

a. **Basics of Entrepreneurship**
- Meaning of entrepreneurship
- Classification and types of entrepreneurship
- Traits and competencies of entrepreneur

Creating Business Plan
- Problem identification and idea generation
- Idea validation
- Pitch making

UNIT IV - Innovative Leadership and Design Thinking

a. **Innovative Leadership**

- Concept of emotional and social intelligence
- Synthesis of human and artificial intelligence
- Why does culture matter for today's global leaders

Design Thinking

- What is design thinking?
- Key elements of design thinking:
  - Discovery
  - Interpretation
  - Ideation
  - Experimentation
  - Evolution.

- How to transform challenges into opportunities?
- How to develop human-centric solutions for creating social good?

UNIT V- Ethics and Integrity

a. **Learning through Biographies**

- What makes an individual great?
- Understanding the persona of a leader for deriving holistic inspiration
- Drawing insights for leadership
- How leaders sail through difficult situations?

Ethics and Conduct

- Importance of ethics
- Ethical decision making
- Personal and professional moral codes of conduct
- Creating a harmonious life

Bibliography and Suggested Readings:

Books

- Ashokan, M. S. (2215). Karmayogi: A Bbiography of E. Sreedharan. Penguin, UK.
- Brown, T. (2212). Change by Design. Harper Business
- Elkington, J., & Hartigan, P. (2208). The Power of Unreasonable People: How Social Entrepreneurs Create Markets that Change the World. Harvard Business Press.
- Goleman D. (1995). Emotional Intelligence. Bloomsbury Publishing India Private Limited.
- Kalam A. A. (2203). Ignited Minds: Unleashing the Power within India. Penguin Books India
- Kelly T., Kelly D. (2214). Creative Confidence: Unleashing the Creative Potential Within Us

  All. William Collins

- Kurien V., & Salve G. (2212). I Too Had a Dream. Roli Books Private Limited
- Livermore D. A. (2210). Leading with cultural intelligence: The New Secret to Success. New York: American Management Association
- McCormack M. H. (1986). What They Don't Teach You at Harvard Business School: Notes From A Street-Smart Executive. RHUS
- O'Toole J. (2219) The Enlightened Capitalists: Cautionary Tales of Business Pioneers Who Tried to Do Well by Doing Good. Harpercollins
- Sinek S. (2209). Start with Why: How Great Leaders Inspire Everyone to Take Action. Penguin
- Sternberg R. J., Sternberg R. J., & Baltes P. B. (Eds.). (2204). International Handbook of Intelligence. Cambridge University Press.

E-Resources

- Fries, K. (2219). 8 Essential Qualities That Define Great Leadership. *Forbes*. Retrieved 2219- 02-15 from https://www.forbes.com/sites/kimberlyfries/2218/02/08/8-essential- qualities-that-define-great-leadership/#452ecc963b63.
- How to Build Your Creative Confidence, Ted Talk by David Kelly - https://www.ted.com/talks/david_kelley_how_to_build_your_creative_confidence
- India's Hidden Hot Beds of Invention Ted Talk by Anil Gupta - https://www.ted.com/talks/anil_gupta_india_s_hidden_hotbeds_of_invention
- Knowledge@Wharton Interviews Former Indian President APJ Abdul Kalam - . "A Leader Should Know How to Manage Failure" https://www.youtube.com/watch?=laGZaS4sdeU
- Martin, R. (2207). How Successful Leaders Think. *Harvard Business Review, 85*(6): 60.
- NPTEL Course on Leadership - https://nptel.ac.in/courses/122105021/9

SEMESTER-V

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120AEC51	**Software Engineering**	Core	5	1	0	4		5	25	75	100

Learning Objectives	
LO1	Gain basic knowledge of analysis and design of systems
LO2	Ability to apply software engineering principles and techniques
LO3	Model a reliable and cost-effective software system
LO4	Ability to design an effective model of the system
LO5	Perform Testing at various levels and produce an efficient system.

UNIT	Contents	No. of Hours	Course Objectives
I	**Introduction**: The software engineering discipline, programs vs. software products, why study software engineering, emergence of software engineering, Notable changes in software development practices, computer systems engineering. **Software Life Cycle Models**: Why use a life cycle model, Classical waterfall model, iterative waterfall model, prototyping model, evolutionary model, spiral model, comparison of different life cycle models.	15	
II	**Requirements Analysis and Specification:** Requirements gathering and analysis, Software requirements specification (SRS) **Software Design**: Good software design, cohesion and coupling, neat arrangement, software design approaches, object- oriented vs function-oriented design	15	
III	**Function-Oriented Software Design:** Overview of SA/SD methodology, structured analysis, data flow diagrams (DFD's), structured design, detailed design. **User-Interface design:** Characteristics of a good	15	

	interface; basic concepts; types of user interfaces; component based GUI development, a user interface methodology.	
IV	**Coding and Testing:** Coding; code review; testing; testing in the large vs testing in the small; unit testing; black-box testing; white-box testing; debugging; program analysis tools; integration testing; system testing; some general issues associated with testing.**Software Reliability and Quality Management:** Software reliability; statistical testing; software quality; software quality management system; SEI capability maturity model; personal software process.	15
V	**Computer Aided Software Engineering:** CASE and its scope; CASE environment; CASE support in software life cycle; other characteristics of CASE tools; towards second generation CASE tool; architecture of a CASE environment. **Software Maintenance:** Characteristic of software maintenance; software reverse engineering; software maintenance process models; estimation of maintenance cost.	15
	Total	**75**

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Gain basic knowledge of analysis and design of systems	PO1
CO2	Ability to apply software engineering principles and techniques	PO1, PO2
CO3	Model a reliable and cost-effective software system	PO4, PO6
CO4	Ability to design an effective model of the system	PO4, PO5, PO6
CO5	Perform Testing at various levels and produce an efficient system.	PO3, PO6
Text Books		
1.	Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, Prentice-Hall of India, 2018	
References Books		
1.	Richard Fairley, Software Engineering Concepts, Tata McGraw-Hill publishing company Ltd, Edition 1997	
2.	Roger S. Pressman, Software Engineering, Seventh Edition, McGraw-Hill.	
3.	James A. Senn, Analysis & Design of Information Systems, Second Edition, McGraw-Hill International Editions.	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**3**	**2**	**2**	**3**
CO2	**3**	**2**	**2**	**2**	**1**	**2**
CO3	**3**	**3**	**3**	**2**	**3**	**2**
CO4	**3**	**3**	**3**	**2**	**2**	**2**
CO5	**3**	**3**	**3**	**2**	**2**	**2**
Weightage of course contribute d to each PO/PSO	**15**	**13**	**14**	**10**	**10**	**11**

S-Strong-3 M-Medium-2 L-Low-

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120AEC52	**Database Management System**	Core	5	1	0	3		5	25	75	100

Learning Objectives	
LO1	To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.
LO2	To understood the concepts of data base management system, design simple Database models
LO3	To learn and understand to write queries using SQL, PL/SQL.
LO4	To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.
LO5	To understood the concepts of data base management system, design simple Database models

UNIT	Contents	No. of Hours
I	**Database Concepts:** Database Systems - Data vs Information - Introducing the database -File system - Problems with file system – Database systems. Data models - Importance - Basic Building Blocks - Business rules - Evolution of Data models - Degrees of Data Abstraction	15
II	**Design Concepts:** Relational database model - logical view of data-keys -Integrity rules - relational set operators - data dictionary and the system catalog - relationships -data redundancy revisited -indexes - codd's rules. Entity relationship model - ER diagram	15
III	**Normalization of Database Tables**: Database tables and Normalization – The Need for Normalization –The Normalization Process – Higher level Normal Form. **Introduction to SQL**: Data Definition Commands – Data Manipulation Commands – SELECT Queries – Additional Data Definition Commands – Additional SELECT Query Keywords – Joining Database Tables.	15

IV	**Advanced SQL**: Relational SET Operators: UNION – UNION ALL – INTERSECT - MINUS.SQL Join Operators: Cross Join – Natural Join – Join USING Clause – JOIN ON Clause – Outer Join. **Sub Queries and Correlated Queries**: WHERE – IN – HAVING – ANY and ALL – FROM. SQL Functions: Date and Time Function – Numeric Function – String Function – Conversion Function	15
V	**PL/SQL**:A Programming Language: History – Fundamentals – Block Structure – Comments – Data Types – Other Data Types – Variable Declaration – Assignment operation –Arithmetic operators.**Control Structures and Embedded SQL**: Control Structures – Nested Blocks – SQL in PL/SQL – Data Manipulation – Transaction Control statements. **PL/SQL Cursors and Exceptions**: Cursors – Implicit Cursors, Explicit Cursors and Attributes – Cursor FOR loops – SELECT…FOR UPDATE – WHERE CURRENT OF clause – Cursor with Parameters – Cursor Variables – Exceptions – Types of Exceptions.	15
	Total	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.	PO1
CO2	Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.	PO1, PO2
CO3	Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML)	PO4, PO6

CO4	Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.	PO4, PO5, PO6
CO5	Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions	PO3, PO5
Text Book		
1	Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition	
2	Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016	
Reference Books		
1.	Abraham Silberschatz, Henry F.Korth and S.Sudarshan,"Database System Concepts", McGraw Hill International Publication ,VI Edition	
2.	Shio Kumar Singh , "Database Systems ",Pearson publications ,II Edition	
Web Resources		
1.	Web resources from NDL Library, E-content from open-source libraries	

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**1**	**2**	**1**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**2**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**12**	**10**	**11**	**12**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst. Hours	Marks		
									CIA	External	Total
23120DSC53	**Internet of Things and its applications**	Elective	5	0	0	4		4	25	75	100

Course Objective	
C1	Use of Devices, Gateways and Data Management in IoT.
C2	Design IoT applications in different domain and be able to analyze their performance
C3	Implement basic IoT applications on embedded platform
C4	To gain knowledge on Industry Internet of Things
C5	To Learn about the privacy and Security issues in IoT

UNIT	Details	No. of Hours
I	IoT& Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.	12
II	M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	12
III	IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views	12

IV	IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management	12
V	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO5

Text Book	
1	Vijay Madisetti and Arshdeep Bahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, 1st Edition.
Reference Books	
1.	Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", kindle version.
2.	Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications 2013, 1st Edition,.

3	Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice" 4..CunoPfister, "Getting Started with the Internet of Things", O"Reilly Media 2011
Web Resources	
1.	https://www.simplilearn.com
2.	https://www.javatpoint.com
3.	https://www.w3schools.com

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**2**	**2**	**3**	**3**	**3**
CO3	**3**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**12**	**11**	**15**	**15**	**14**

S-Strong-3 M-Medium-2 L-Low-1

Discipline Specific Elective Courses-III

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
23120DSC54A	**Introduction to Data Science**	Elective	4	-	-	-	3	4	25	75	100

Learning Objectives	
LO1	To learn about basics of Data Science and Big data.
LO2	To learn about overview and building process of Data Science.
LO3	To learn about various Algorithms in Data Science.
LO4	To learn about Hadoop Framework.
LO5	To learn about case study about Data Science.

UNIT	Contents	No. of Hours
I	**Introduction:** Benefits and uses – Facts of data – Data science process – Big data ecosystem and data science	12
II	**The Data science process**: Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building.	12
III	**Algorithms** :Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised	12
IV	**Introduction to Hadoop** :Hadoop framework – Spark – replacing Map Reduce– NoSQL – ACID – CAP – BASE – types	12
V	**Case Study**: Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation	12
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	Understand the basics in Data Science and Big data.	PO1
CO2	Understand overview and building process in Data Science.	PO1, PO2
CO3	Understand various Algorithms in Data Science.	PO3, PO6

CO4	Understand Hadoop Framework in Data Science.	PO4, PO5
CO5	Case study in Data Science.	PO3, PO5
Text Book		
1	Davy Cielen, Arno D. B. Meysman, Mohamed Ali, "Introducing Data Science", manning publications 2016	
Reference Books		
1.	Roger Peng, "The Art of Data Science", lulu.com 2016.	
2.	MurtazaHaider, "Getting Started with Data Science – Making Sense of Data with Analytics", IBM press, E-book.	
3.	Davy Cielen, Arno D.B. Meysman, Mohamed Ali,"Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools", Dreamtech Press 2016.	
4.	Annalyn Ng, Kenneth Soo, "Numsense! Data Science for the Layman: No Math Added", 2017,1st Edition.	
5.	Cathy O'Neil, Rachel Schutt, "Doing Data Science Straight Talk from the Frontline", O'Reilly Media 2013.	
6.	Lillian Pierson, "Data Science for Dummies", 2017 II Edition	
Web Resources		
1.	https://www.w3schools.com/datascience/	
2.	https://en.wikipedia.org/wiki/Data_science	
3.	http://www.cmap.polytechnique.fr/~lepennec/en/post/references/refs/	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**2**	**2**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**3**	**2**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**14**	**11**	**15**	**11**	**10**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	Credits	Inst. Hours	Marks		
								CIA	External	Total
23120DSC54B	RDBMS with PL/SQL	Elective	4	0	0	4	4	25	75	100

COURSE OUTCOMES

1. The purpose of PL/SQL is to combine database language and procedural programming language.

2. The basic unit in PL/SQL is called a block and is made up of three parts: a declarative part, an executable part and an exception-building part.

Unit-1 Introduction to PL/SQL

PL/SQL Overview-Benefits of PL/SQL Subprograms-Overview of the Types of PL/SQL blocks Create a Simple Anonymous Block-Generate Output from a PL/SQL Block

Unit-2 PL/SQL Identifiers

List the different Types of Identifiers in a PL/SQL subprogram-Usage of the Declarative Section to define Identifiers-Use variables to store data-Identify Scalar Data Types-The %TYPE Attribute-What are Bind Variables-Sequences in PL/SQL Expressions.

UNIT-3 Interaction with Server

Invoke SELECT Statements in PL/SQL to Retrieve data-Data Manipulation in the Server Using PL/SQL SQL Cursor concept-Usage of SQL Cursor Attributes to Obtain Feedback on DML-Save and Discard Transactions.

UNIT-4 Composite Data Types

Use PL/SQL Records-The %ROWTYPE Attribute-Insert and Update with PL/SQL Records

Associative Arrays (INDEX BY Tables)-Examine INDEX BY Table Methods-Use INDEX BY Table of Records

UNIT-5 Exception Handling

Understand Exceptions-Handle Exceptions with PL/SQL-Trap Predefined Oracle Server Errors-Trap Non-Predefined Oracle Server Errors-Trap User-Defined Exceptions

Propagate Exceptions-RAISE_APPLICATION_ERROR Procedure.

Reference:

1. RDBMS with PL/SQL -Steven Feuerstein with Bill Priby

Subject Code	Subject Name	Category	L	T	P	Credits	Inst. Hours	Marks		
								CIA	External	Total
23120DSC54C	**Cloud Computing**	Elective	4	0	0	4	4	25	75	100

Course Objective	
LO1	Learning fundamental concepts and Technologies of Cloud Computing.
LO2	Learning various cloud service types and their uses and pitfalls.
LO3	To learn about Cloud Architecture and Application design.
LO4	To know the various aspects of application design, benchmarking and security on the Cloud.
LO5	To learn the various Case Studies in Cloud Computing.

UNIT	**Contents**	**No. of Hours**
I	Introduction to Cloud Computing: Definition of Cloud Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud-based Services and Applications. Cloud Concepts and Technologies: Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Software Defined Networking – Network Function Virtualization – Map Reduce – Identity and Access Management – Service Level Agreements – Billing.	12
II	Cloud Services Compute Services: Amazon Elastic Computer Cloud - Google Compute Engine - Windows Azure Virtual Machines Storage Services: Amazon Simple Storage Service - Google Cloud Storage - Windows Azure Storage Database Services: Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure SQL Database - Windows Azure Table Service Application Services: Application Runtimes and Frameworks -	12

	Queuing Services - Email Services - Notifications Services - Media Services Content Delivery Services: Amazon CloudFront - Windows Azure Content Delivery Network Analytics Services: Amazon Elastic Map Reduce - Google MapReduce Service - Google BigQuery - Windows Azure HDInsight Deployment and Management Services: Amazon Elastic Beanstack - Amazon CloudFormation Identity and Access Management Services: Amazon Identiy and Access Management - Windows Azure Active Directory Open Source Private Cloud Software: Cloud Stack – Eucalyptus – Open Stack.	
III	**Cloud Application Design:** Introduction – Design Considérations for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and Upgradassions – Performance – Reference Architectures for Cloud Applications – Cloud Application Design Méthodologies: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), REST ful Web Services – Data Storage Approaches: Relational Approach (SQL), Non-Relational Approach (NoSQL).	12
IV	**Cloud Application Benchmarking and Tuning:** Introduction to Benchmarking – Steps in Benchmarking – Workload Characteristics – Application Performance Metrics – Design Consideration for Benchmarking Methodology – Benchmarking Tools and Types of Tests – Deployment Prototyping. **Cloud Security:** Introduction – CSA Cloud Security Architecture – Authentication (SSO) – Authorization – Identity and Access Management – Data Security : Securing data atrest, securing data in motion – Key Management – Auditing.	12
V	**Case Studies:** Cloud Computing for Healthcare – Cloud Computing	12

	for Energy Systems - Cloud Computing for Transportation Systems - Cloud Computing for Manufacturing Industry - Cloud Computing for Education.	
	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO 1	Understand the fundamental concepts and Technologies in Cloud Computing.	PO1
CO 2	Able to understand various cloud service types and their uses and pitfalls.	PO1, PO2
CO 3	Able to understand Cloud Architecture and Application design.	PO4, PO5
CO 4	Understand the various aspects of application design, benchmarking and security in the Cloud.	PO4, PO5, PO6
CO 5	Understand various Case Studies in Cloud Computing.	PO3, PO6

Text Book	
1	ArshdeepBahga, Vijay Madisetti, *Cloud Computing – A Hands On Approach*, Universities Press (India) Pvt. Ltd., 2018
Reference Books	
1.	Anthony T Velte, Toby J Velte, Robert Elsenpeter, *Cloud Computing: A Practical Approach*, Tata McGraw-Hill, 2013.
2.	Barrie Sosinsky, *Cloud Computing Bible*, Wiley India Pvt. Ltd., 2013.
3.	David Crookes, *Cloud Computing in Easy Steps*, Tata McGraw Hill, 2015.
4.	Dr. Kumar Saurabh, *Cloud Computing*, Wiley India, Second Edition 2012.
Web Resources	
1.	https://en.wikipedia.org/wiki/Cloud_computing
2.	https://link.springer.com/chapter/10.1007/978-3-030-34957-8_7
3.	https://webobjects.cdw.com/webobjects/media/pdf/solutions/cloud-computing/121838-CDW-Cloud-Computing-Reference-Guide.pdf

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	2
CO2	3	3	2	3	3	2
CO3	3	3	3	3	3	2
CO4	3	3	2	3	3	2
CO5	3	3	2	3	3	2
Weightage of course contributed to each PSO	15	14	11	15	15	10

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	C		Inst.	Marks		
									CIA	External	Total
23120SEC56L	**Database Management System lab**	Core	0	0	3	3		5	25	75	100

Learning Objectives	
LO1	To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.
LO2	To understood the concepts of data base management system, design simple Database models
LO3	To learn and understand to write queries using SQL, PL/SQL.
LO4	To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.
LO5	To understood the concepts of data base management system, design simple Database models

	List of Exercises:	**No. of Hours**	**Course Objective**
II	**I. SQL** 1. DDLCOMMANDS 2. DMLCOMMANDS 3. TCLCOMMANDS **II. PL/SQL** 4. FIBONACCI SERIES 5. FACTORIAL 6. STRING REVERSE 7. SUM OF SERIES 8. TRIGGER **III. CURSOR** 9. STUDENT MARK ANALYSIS USING CURSOR **IV. APPLICATION**		75

	10. LIBRARY MANAGEMENTSYSTEM 11. STUDENT MARK ANALYSIS		
	Total		**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.	PO1
CO2	Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.	PO1, PO2
CO3	Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML)	PO4, PO6
CO4	Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.	PO4, PO5, PO6
CO5	Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions	PO3, PO4

Text Book	
1	Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition
2	Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016
Reference Books	
1.	Abraham Silberschatz, Henry F.Korth and S.Sudarshan,"Database System Concepts", McGraw Hill International Publication ,VI Edition
2.	Shio Kumar Singh , "Database Systems ",Pearson publications ,II Edition
Web Resources	
1.	Web resources from NDL Library, E-content from open-source libraries

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	3	3	3	2
CO2	3	3	1	2	2	2
CO3	2	2	3	3	3	3
CO4	2	2	3	3	3	1
CO5	2	3	3	3	3	3
Weightage of course contributed to each PSO	12	12	13	14	14	11

S-Strong-3 M-Medium-2 L-Low-1

Discipline Specific Elective-IV

Course Code	Course Title	L	T	P	C
23120DSC55A	**Disaster Management**	**4**	**0**	**0**	**4**

AIM: Disaster management aims to reduce, or avoid the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery.

Course Objectives:

1. To provide students an understanding the need for studying the disaster management
2. Develop an understanding about the various types of disasters.
3. To expose students to the risk and vulnerability analysis
4. To create awareness about disaster prevention and risk reduction
5. To establish relationship between disasters and developments.
6. To understand Rehabilitation, Reconstruction and Recovery in the event of Disaster
7. To gain knowledge on Climate Change Adaptation and IPCC Scenario and Scenarios in the context of India.

Course Outcomes:

CO1: Understand the need and significance of studying disaster management

CO2: Understand the different types of disasters and causes for disasters.

CO3: Gain knowledge on the impacts Disasters on environment and society

CO4: Study and assess vulnerability of a geographical area.

CO5: Students will be equipped with various methods of risk reduction measures and risk mitigation.

CO6: Understand the role of Information Technology in Disaster Management

CO7: Understand Geographical Information System applications in Disaster Management

Content of Course
UnitI: Introduction to Disasters
ChapterNo.1 Disaster: Concept, Meaning, and Definition **ChapterNo.2** History of Major Disaster Events in India **ChapterNo.3** Types of Disasters–Natural Disasters: Famine, Drought, Flood, Cyclone, Tsunami, Earthquake
Unit II: Disaster Mitigation and Disaster Management
ChapterNo.4 Man-made Disasters: Riots, Blasts, Industrial, Militancy **ChapterNo.5** Profile, Forms and Reduction of Vulnerability **Chapter No. 6** Disaster Mitigation: Concept and Principles
Unit III: Impact of Disaster
ChapterNo.7 Disaster Management: Concept and Principles **ChapterNo.8** Pre-disaster-Prevention and Preparedness **ChapterNo.9** Physical, Economic, Social, Psycho-socio Aspects, Environmental Impacts
Unit IV: Disaster Process and Intervention
ChapterNo.10 During Disaster-Rescue and Relief **ChapterNo.11** Post-disaster-Rehabilitation and Reconstruction **ChapterNo.12** Victims of Disaster-Children, Elderly, and Women **ChapterNo.1 3**Displacement-Causes,Effectsand Impact
Unit V:DisasterIntervention
ChapterNo.14 Major Issues and Dynamics in the Administration of Rescue, Relief, Reconstruction and Rehabilitation **ChapterNo.15** Components of Rescue, Relief, Reconstruction; Rehabilitation **ChapterNo.16** Disaster Policy in India; Disaster Management Authority-NDMA, SDMA, DDMA; Disaster Management Act, 2005

References:

AnilSinha(2001),DisasterManagement-LessonsDrawnandStrategiesforFuture.New Delhi,

Jain Publications.

Backer,C.W.andChapman,W.(ed.).(1969),ManandSocietyinDisasters,New Delhi,

Clarke,J.I.,PeterCurson,et.al.(ed.)(1991),PopulationandDisaster,Oxford,Basil Blackwell

23120DSC55B	Artificial Neural Network	4	0	0	4

Learning Objectives		
LO1	**Understand the basics of artificial neural networks, learning process, single layer and multi-layer perceptron networks.**	
LO2	Understand the Error Correction and various learning algorithms and tasks.	
LO3	Identify the various Single Layer Perception Learning Algorithm.	
LO4	Identify the various Multi-Layer Perception Network.	
LO5	Analyse the Deep Learning of various Neural network and its Applications.	
UNIT	**Contents**	**No. of Hours**
I	Artificial Neural Model- Activation functions- Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem - Multilayer Networks. Learning Algorithms- Error correction - Gradient Descent Rules, Perception Learning Algorithm, Perception Convergence Theorem.	12
II	Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation.	12
III	.Single layer Perception: Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, Learning in continuous perception. Limitation of Perception.	12
IV	Multi-Layer Perception Networks: Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm	12
V	Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neocognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzmann Machines, Training of DNN and Applications	12
	Total	**60**

	Programme Outcome

23120DSC55B	Artificial Neural Network	4	0	0	4

Course Outcomes		
CO	On completion of this course, students will	
CO1	Students will learn the basics of artificial neural networks with single layer and multi-layer perception networks.	PO1
CO2	Learn about the Error Correction and various learning algorithms and tasks.	PO1, PO2
CO3	Learn the various Perception Learning Algorithm.	PO4, PO5
CO4	Learn about the various Multi-Layer Perception Network.	PO4, PO5, PO6
CO5	Understand the Deep Learning of various Neural network and its Applications.	PO3, PO5
Text Book		
1	Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill- Second Edition.	
2.	"Neural Network- A Comprehensive Foundation"- Simon Haykins, Pearson Prentice Hall, 2nd Edition, 1999.	
Reference Books		
1.	Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998.	
Web Resources		
1.	https://www.w3schools.com/ai/ai_neural_networks.asp	
2.	https://en.wikipedia.org/wiki/Artificial_neural_network	
3.	https://link.springer.com/chapter/10.1007/978-3-642-21004-4_12	

23120DSC55C	**CRYPTOGRAPHY**	4	0	0	4

Learning Objectives		
LO1	To understand the fundamentals of Cryptography	
LO2	To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.	
LO3	To understand the various key distribution and management schemes.	
LO4	To understand how to deploy encryption techniques to secure data in transit across data networks.	
LO5	To design security applications in the field of Information technology	
UNIT	**Contents**	**No. Of. Hours**
I	**Introduction:** The OSI security Architecture – Security Attacks – Security Mechanisms – Security Services – A model for network Security.	**12**
II	**Classical Encryption Techniques:** Symmetric cipher model – **Substitution Techniques:** Caesar Cipher – Mono alphabetic cipher – Play fair cipher – Poly Alphabetic Cipher – Transposition techniques – Stenography	**12**
III	**Block Cipher and DES:** Block Cipher Principles – DES – The Strength of DES –**RSA:** The RSA algorithm.	**12**
IV	**Network Security Practices**: IP Security overview - IP Security architecture – Authentication Header. **Web Security**: Secure Socket Layer and Transport Layer Security – Secure Electronic Transaction.	**12**
V	Intruders – Malicious software – Firewalls.	**12**
	TOTAL HOURS	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Apply the different cryptographic operations of public key cryptography	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Apply the various Authentication schemes to simulate different applications.	PO1, PO2, PO3, PO4, PO5, PO6

CO5	Understand various Security practices and System security standards	PO1, PO2, PO3, PO4, PO5, PO6
Textbooks		
1	**William Stallings,** "Cryptography and Network Security Principles and Practices".	
Reference Books		
1.	**Behrouz A. Foruzan,** "Cryptography and Network Security", Tata McGraw-Hill, 2007.	
2	**AtulKahate**, "*Cryptography and Network Security*", Second Edition, 2003,TMH.	
3	**M.V. Arun Kumar**, "*Network Security*", 2011, First Edition,USP.	
	Web Resources	
1	https://www.tutorialspoint.com/cryptography/	
2	https://gpgtools.tenderapp.com/kb/how-to/introduction-to-cryptography	

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	2	3	2
CO 2	3	2	3	2	3	3
CO 3	3	3	3	2	3	3
CO 4	2	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	14	13	15	12	14	14

S-Strong-3 M-Medium-2 L-Low-1

Course Code	Course Title	L	T	P	C
231ACLSPSL	Professional Skills	-	-	-	1

Aim: Course Objectives:

The Objectives of the course are to help students/candidates:

1. Acquire career skills and fully pursue to partake in a successful career path
2. Prepare good resume, prepare for interviews and group discussions
3. Explore desired career opportunities in the employment market in consideration of an Individual SWOT.

Course Outcomes:

At the end of this course the students will be able to:

1. Prepare their resume in an appropriate template without grammatical and other errors and using proper syntax
2. Participate in a simulated interview
3. Actively participate in group discussions towards gainful employment

Unit I: Resume Skills

Resume Skills: Preparation and Presentation

- Introduction of resume and its importance
- Difference between a CV, Resume and Bio data
- Essential components of a good resume

Resume skills: common errors

- Common errors people generally make in preparing their resume
- Prepare a good resume of her/his considering all essential components

Unit II: Interview Skills

i. **Interview Skills : Preparation and Presentation**

- Meaning and types of interview (F2F, telephonic, video, etc.)
- Dress Code, Background Research, Do's and Don'ts
- Situation, Task, Approach and Response (STAR Approach) for facing an interview

- Interview procedure (opening, listening skills, closure, etc.)
- Important questions generally asked in a job interview (open and closed ended questions)

Interview Skills: Simulation

- Observation of exemplary interviews
- Comment critically on simulated interviews

Interview Skills: Common Errors

- Discuss the common errors generally candidates make in interview
- Demonstrate an ideal interview

Unit III: Group Discussion Skills

Meaning and methods of Group Discussion

- Procedure of Group Discussion
- Group Discussion- Simulation
- Group Discussion - Common Errors

Unit IV: Exploring Career Opportunities

Knowing yourself – personal characteristics

- Knowledge about the world of work, requirements of jobs including self-employment.
- Sources of career information
- Preparing for a career based on their potentials and availability of opportunities

SEMESTER-VI

23120AEC61	**COMPUTER NETWORKS**	5	1	0	4

Course Objective		
LO1	To learn the basic concepts of Data communication and Computer network	
LO2	To learn about wireless Transmission	
LO3	To learn about networking and data link layer.	
LO4	To study about Network communication.	
LO5	To learn the concept of Transport layer	
UNIT	**Contents**	**No. of Hours**
I	Introduction – Network Hardware – Software – Reference Models – OSI and TCP/IP Models – Example Networks: Internet, ATM, Ethernet and Wireless LANs - Physical Layer – Theoretical Basis for Data Communication - Guided Transmission Media	15
II	Wireless Transmission - Communication Satellites – Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues – Error Detection and Correction.	15
III	Elementary Data Link Protocols - Sliding Window Protocols – Data Link Layer in the Internet - Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols – Bluetooth.	15
IV	Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms – IP Protocol – IP Addresses – Internet Control Protocols.	15
V	Transport Layer - Services - Connection Management - Addressing, Establishing and Releasing a Connection – Simple Transport Protocol – Internet Transport Protocols (ITP) - Network Security: Cryptography	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	To Understand the basics of Computer Network architecture, OSI and TCP/IP reference models	PO1

CO2	To gain knowledge on Telephone systems using wireless network	PO1, PO2
CO3	To understand the concept of MAC	PO4, PO6
CO4	To analyze the characteristics of Routing and Congestion control algorithms	PO4, PO5, PO6
CO5	To understand network security and define various protocols such as FTP, HTTP, Telnet, DNS	PO3, PO4
Text Book		
1	A. S. Tanenbaum, "Computer Networks", 4th Edition, Prentice-Hall of India, 2008.	
Reference Books		
1.	B. A. Frozen, "Data Communications and Networking", Tata McGraw Hill, 4th Edition, 2017	
2.	F. Halsall, "Data Communications, Computer Networks and Open Systems", Pearson Education, 2008	
3.	D. Bertsekas and R. Gallagher, "Data Networks", 2nd Edition, PHI, 2008.	
4.	Lamarca, "Communication Networks", Tata McGraw- Hill, 2002	
Web Resources		
1.	https://en.wikipedia.org/wiki/Computer_network	
2.	https://citationsy.com/styles/computer-networks	

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	To Understand the basics of Computer Network architecture, OSI and TCP/IP reference models	PO1
CO2	To gain knowledge on Telephone systems using wireless network	PO1, PO2
CO3	To understand the concept of MAC	PO4, PO6
CO4	To analyze the characteristics of Routing and Congestion control algorithms	PO4, PO5, PO6
CO5	To understand network security and define various protocols such as FTP, HTTP, Telnet, DNS	PO3, PO4
Text Book		
1	A. S. Tanenbaum, "Computer Networks", 4th Edition, Prentice-Hall of India, 2008.	
Reference Books		
1.	B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th	

	Edition, 2017
2.	F. Halsall, "Data Communications, Computer Networks and Open Systems", Pearson Education, 2008
3.	D. Bertsekas and R. Gallagher, "Data Networks", 2nd Edition, PHI, 2008.
4.	Lamarca, "Communication Networks", Tata McGraw- Hill, 2002
Web Resources	
1.	https://en.wikipedia.org/wiki/Computer_network
2.	https://citationsy.com/styles/computer-networks

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	2	3
CO2	3	2	2	2	2	2
CO3	3	2	3	3	2	3
CO4	3	2	2	2	2	2
CO5	3	2	2	2	2	3
Weightage of course contributed to each PSO	15	11	11	12	10	13

S-Strong-3 M-Medium-2 L-Low-1

23120AEC62	Data Analytics Using R	5	1	0	4

Course Objective		
C1	To understand the problem solving approaches	
C2	To learn the basic programming constructs in R Programming	
C3	To learn the basic programming constructs in R Programming	
C4	To use R Programming data structures - lists, tuples, and dictionaries.	
C5	To do input/output with files in R Programming.	
UNIT	**Contents**	**No. of Hours**
I	Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value -Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — Map Reduce and YARN — Map Reduce Programming Model	15
II	CONTROL STRUCTURES AND VECTORS - Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations	15
III	LISTS- Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List	15

23120AEC62	Data Analytics Using R	5	1	0	4

	Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations	
IV	FACTORS AND TABLES - Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions R PROGRAMMING .	15
V	OBJECT-ORIENTED PROGRAMMING S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation	15
	Total	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO3
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO2, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO5, PO6
Text Book		
1	Roger D. Peng," R Programming for Data Science ", 2012	

23120AEC62	Data Analytics Using R	5	1	0	4

2	Norman Matloff,"The Art of R Programming- A Tour of Statistical Software Design", 2011
Reference Books	
1.	1. Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations" , 1st Edition, 2014
2.	Venables ,W.N.,andRipley,"S programming", Springer, 2000.
Web Resources	
1.	https://www.simplilearn.com

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3
CO2	3	3	2	3	2	2
CO3	3	2	3	3	3	2
CO4	3	2	3	2	3	3
CO5	2	3	3	3	3	3
Weightage of course contributed to each PSO	14	13	14	14	14	13

S-Strong-3 M-Medium-2 L-Low-1

Discipline Specific Elective Courses-V

23120DSC63A	**Robotics and its Applications**	5	0	0	3

Learning Objectives			
LO1	To understand the robotics fundamentals		
LO2	Understand the sensors and matrix methods		
LO3	Understand the Localization: Self-localizations and mapping		
LO4	To study about the concept of Path Planning, Vision system		
LO5	To learn about the concept of robot artificial intelligence		
UNIT	**Details**	**No. of Hours**	**Course Objective**
I	Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.	12	
II	Actuators and sensors :Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot	12	
III	Localization: Self-localizations and mapping - Challenges in localizations – IR based	12	

23120DSC63A	**Robotics and its Applications**	5	0	0	3

	localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.	
IV	Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations	12
V	Application: Ariel robots-collision avoidance robots for agriculture-mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-assembly operation-cleaning-etc.	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Describe the different physical forms of robot architectures.	PO1
CO2	Kinematically model simple manipulator and mobile robots.	PO1, PO2
CO3	Mathematically describe a kinematic robot system	PO4, PO6
CO4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and	PO4, PO5, PO6

23120DSC63A	**Robotics and its Applications**	5	0	0	3

	uncertainty.	
CO5	Program robotics algorithms related to kinematics, control, optimization, and uncertainty.	PO3, PO8
Text Book		
1	RicharedD.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001	
2	SaeedB.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011	
Reference Books		
1.	Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008	
2.	Robotics technology and flexible automation by S.R.Deb, THH-2009	
Web Resources		
1.	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm	
2.	https://www.geeksforgeeks.org/robotics-introduction/	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage of course contributed to each PSO	**15**	**14**	**11**	**15**	**15**	**10**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	L	T	P	C		Inst. Hours	Marks		
								CIA	External	Total
23120DSC63B	**Virtual Reality**	**5**	**0**	**0**	**3**		**4**	**25**	**75**	**100**

Learning Objectives		
LO1	To provide knowledge on basic principles of virtual & augmented reality	
LO2	To have the ability to use its technology as a platform for real-world applications.	
Unit	**Contents**	**No. of Hours**
I	Virtual Reality: The Three I's of VR – History – Early commercial VR Technology – Components of a VR System –Input Devices: Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces	12
II	Output Devices: Graphics Displays – Sound Displays – Haptic Feedback - Computer Architecture for VR: The Rendering Pipeline- PC Graphics Architecture - VR Programming: Toolkits and Scene Graphs – Traditional and Emerging Applications of VR	12
III	Augmented Reality: Introduction – Augmented Reality Concepts: Working Principle of AR –Concepts related to AR- Ingredients of an Augmented Reality Experience	12
IV	Augmented Reality Hardware– Augmented Reality Software– Software to create content for AR Application – Tools and Technologies	12
V	Augmented Reality Content: Introduction- Creating Content for Visual, Audio, and other senses – Interaction in AR - Mobile Augmented Reality: Introduction – Augmented Reality Applications Areas- Collaborative Augmented Reality	12
	Total Hours	**60**
CO	**Course Outcomes**	
CO1	Outline the basic terminologies, techniques and applications of VR and AR	
CO2	Describe different architectures and principles of VR and AR systems	
CO3	Use suitable hardware and software technologies for different varieties of virtual and	

	augmented reality applications	
CO4	Analyze and explain the behavior of VR and AR technology relates to human perception and cognition	
CO5	Assess the importance of VR/AR content and interactions to implement for the real-world problem	
Text books		
1.		Grigore C. Burdea and Philippe Coiffet, "Virtual Reality Technology", Wiley Student Edition , Second Edition (Unit I: Chapter 1,2 & Unit II: Chapter 3,4,6,8 & 9)
2.		Alan B. Craig(2013), "Understanding Augmented Reality: Concepts and Applications"(Unit III: Chapter 1, 2, Unit IV : Chapter 3, 4 & Unit V: Chapter 5,6,8)
3.		Jon Peddie (2017), "Augmented Reality: Where We Will All Live", Springer, Ist Edition (Unit IV: Chapter 7 (Tools & Technologies)
Reference Books		
1.		Alan Craig & William R. Sherman & Jeffrey D. Will, Morgan Kaufmann(2009), "Developing Virtual Reality Applications: Foundations of Effective Design", Elsevier(Morgan Kaufmann Publishers)
2.		Paul Mealy (2018), "Virtual and Augmented Reality", Wiley
3.		Bruno Arnaldi & Pascal Guitton & Guillaume Moreau(2018), "Virtual Reality and Augmented Reality: Myths and Realities", Wiley
NOTE: Latest Edition of Textbooks May be Used		
Web Resources		
1.		http://msl.cs.uiuc.edu/vr/
2.		http://www.britannica.com/technology/virtual-reality/Living-in -virtual-worlds
3.		https://mobidev.biz/blog/augmented-reality-development-guide

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	2
CO2	3	3	2	3	3	2
CO3	3	3	3	3	3	2
CO4	3	3	2	3	3	2
CO5	3	3	2	3	3	2
Weightage of course contributed to each PSO	15	14	11	15	15	10

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L		T	P	C		Inst. Hours	Marks		
										CIA	External	Total
23120SEC64L	**Data analytics using R Lab**	Core	0		0	3	3		4	25	75	100

	Course Objective		
C1		To understand the problem solving approaches	
C2		To learn the basic programming constructs in R Programming	
C3		To practice various computing strategies for R Programming -based solutions to real world problems	
C4		To use R Programming data structures - lists, tuples, and dictionaries.	
C5		To do input/output with files in R Programming.	
Sl. No		**Contents**	
1.		Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.	
2.		Program, to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.	
3.		Write a program to find list of even numbers from 1 to n using R-Loops.	
4.		Create a function to print squares of numbers in sequence.	**60**
5.		Write a program to join columns and rows in a data frame using cbind() and rbind() in R.	
6.		Implement different String Manipulation functions in R.	

7.		Implement different data structures in R (Vectors, Lists, Data Frames)	
8		Write a program to read a csv file and analyze the data in the file in R.	
9		Create pie chart and bar chart using R.	
10		10. Create a data set and do statistical analysis on the data using R.	
11		Program to find factorial of the given number using recursive function	
12		Write a R program to count the number of even and odd numbers from array of N numbers.	
		Total	**60**

		Course Outcomes	**Programme Outcome**
CO		On completion of this course, students will	
1		Acquire programming skills in core R Programming	PO1,PO4,PO5
2		Acquire Object-oriented programming skills in R Programming.	PO1, PO4,PO6
3		Develop the skill of designing graphical-user interfaces (GUI) in R Programming	PO1,PO3,PO6
4		Acquire R Programming skills to move into specific branches	PO3,PO4
5			PO1,PO5,PO6

	Text Book	
1		Roger D. Peng," R Programming for Data Science ", 2012
2		Norman Matloff,"The Art of R Programming- A Tour of Statistical Software Design", 2011
	Reference Books	
1		Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations" , 1st Edition, 2014
2.		Venables ,W.N.,andRipley,"S programming", Springer, 2000.
	Web Resources	
1.		https://www.simplilearn.com

Course Code	Course Title	L	T	P	C
231ACSIKWS	**INDIAN KNOWLEDGE SYSTEM**	-	-	-	2

Course Objectives:

The course design seeks to address the following issues:

• To introduce to the students the overall organization of IKS

• To develop an appreciation among the students the role and importance of Veda, Vedangas, Upa Vedas and Puraṇas.

• To show case the multi-dimensional nature of IKS and their importance in the contemporary society

• To motivate the students to take up a detailed study of some of these topics and explore their application potential

Course Outcomes:

CO1: Explain the historicity of Indian Knowledge System and the broad classification of Indian philosophical systems

CO2: Explain the potential of Sanskrit in natural language processing

CO3: Explain the features of Indian numeral system and its role in science & technology advancement

CO4: Illustrate the basic elements of the Indian calendar and the components of Indian Panchanga

CO5: Outline the science, engineering & technology heritage of ancient and medieval India

Unit I:

Introduction to Indian Knowledge System (IKS), Definition, Concept and Scope of IKS (4)

Definition, Concept and Scope of IKS

IKS based approaches on Knowledge Paradigms

IKS in ancient India and in modern India

Unit II: IKS and Indian Scholars, Indian Literature (8)

1. PhilosophyandLiterature(MaharishiVyas,Manu,Kanad,Pingala,Parasar,Banabhatta,Nagarjuna

and Panini)

2. MathematicsandAstronomy(Aryabhatta,Mahaviracharya,Bodhayan,Bhashkaracharya, Varahamihira and Brahmgupta)
3. Medicineand Yoga(Charak,Susruta,Maharishi Patanjaliand Dhanwantri)
4. Sahitya(Vedas,Upvedas,Upavedas(Ayurveda,Dhanurveda,Gandharvaveda)
5. PuranandUpnishad)andshaddarshan(Vedanta,Nyaya.Vaisheshik,Sankhya,Mimamsa, Yoga, Adhyatma and Meditation)
6. Shastra(Nyaya,vyakarana,Krishi,Shilp,Vastu,Natya and Sangeet)

Unit III: Indian Traditional/tribal/ethnic communities, their livelihood and local wisdom (6)

1. Geophysical aspects, Resources and Vulnerability
2. Resource availability, utilization pattern and limitations
3. Socio-Cultural linkages with Traditional Knowledge System
4. Tangible and intangible cultural heritage.

Unit IV: Unique Traditional Practices and Applied Traditional Knowledge (8)

1. Myths, Rituals, Spirituals, Taboos and Belief System, Folk Stories, Songs, Proverbs, Dance, Play, Acts and Traditional Narratives
2. Agriculture, animal husbandry, Forest, Sacred Groves, Water Mills, Sacred Water Bodies, Land, water and Soil Conservation and management Practices
3. Indigenous Bio-resource Conservation, Utilization Practices and Food Preservation Methods, Handicrafts, Wood Processing and Carving, -Fiber Extraction and Costumes
4. Vaidya(traditional health care system), Tantra-Mantra, Amchi Medicine System
5. Knowledge of dyeing, chemistry of dyes, pigments and chemicals.

Unit V: Protection, preservation, conservation and Management of Indian Knowledge System (4)

1. Documentation and Preservation of IKS
2. Approaches for conservation and Management of nature and bio-resources
3. Approaches and strategies to protection and conservation of IKS