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 BIOTECHNOLOGY

B.Sc. BIOTECHNOLOGYCURRICULUM

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 solution to Biotechnological problems by applying appropriate tools while keeping in mind safety and ethical factor 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 doing 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 team to survive in multidisciplinary environment.
- **PSO4 -** If students will engage themselves in the process of effective learning, it will give opportunities to utilize acquired knowledge for the 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 environment and their implementation for finding sustainable solution to issues pertaining to 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 relevancies 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 system 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 do 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

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
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 23117DSC54G – Biophysics 23117DSC54H – Biomolecules 23117DSC54I – Microbial genetics 23117DSC54J – Biofertilizers and Biopesticides
	Discipline specific Elective courses -II
II	23117DSC63A - Marine Biotechnology 23117DSC63B - Food Technology 23117DSC63C – Basic Fermentation Techniques 23117DSC63D – Computational Biology 23117DSC63E - Plant Tissue culture 23117DSC63F – Advances in Biotechnology

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, கலைக்கும் 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- ஒடு ஒடு சங்கிலி
4.மு.மேத்தா- வெளிச்சம் வெளியே இல்லை

அலகு - 3 நாட்டுப்புறவியல்

1.பழமொழிகள்
2.விடுகதைகள்
3.தொழில் பாடல்

அலகு- 4 சிறுகதை

1.தடயம்- மா. ஜெயிரகாசம்
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 Language Pure 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, scanningskills
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

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**

Course Outcomes

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 andDenim 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 functionalaspects 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: PracticalManual.
3. Gilbert, S.F. 2016.Developmental Biology, 11th edition. Sinauer AssociatesInc. 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 theDiscovery 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 AgeInternational 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

	PO1	PO2	PO3	PO4	PO5	PO6	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

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 Publishinghouse,
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, Goodheart-Wilcox publishing.
5. Dr. M. Swaminathan, 2018. Hand Book of Food & Nutrition, Second editionBangalore press.

Reference Books

1. Joshi, V.K. and Singh, R.S., A. (2013), *Food Biotechnology- Principles andpractices,* 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*, SpecialIndian 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, 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? 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 nonviolence
- Narratives and anecdotesaboutnon-violence from history,and literature including local folklore
- Practicingnon-violence: What will learners learn/gain if they practice nonviolence? 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 ordisaster.
- 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-restrainand 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 practiceit?
- Sharing learners' individual and/or group experience(s)
- Simulated situations
- Case studies

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Learn to introduce about Love and compassion and inter-relatedness	PO1
CO2	Know about universal human values and understand the importance of values in individual, social circles, career path, and national life.	PO1
CO3	Learn from case studies of lives of great and successful people who followed and practiced human values and achieved self-actualisation.	PO5,PO7
CO4	Become conscious practitioners of human values.	PO11, PO13
CO5	Realize their potential as human beings and conduct themselves properly in the ways of the world.	PO5,PO9

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(இனமை 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 சபாபதி சந்திர போஸ், இயல் வெளியீடு, தஞ்சாவூர்
4. தமிழ் நாவல் இலக்கியம் -கா கைலாசபதி- தமிழ் புத்தகநிலையம், 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 verbalresponsiveness; 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 Outcomes	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 UniversityPress, 2000
2.	Descriptive English. SP Bakshi, Richa Sharma · 2019, Arihant Publications(India) Ltd.
3.	The Reading Book: A Complete Guide to Teaching Reading. SheenaCameron, Louise Dempsey, S & L. Publishing, 2019.
4.	Skimming and Scanning Techniques, Barbara Sherman, Liberty UniversityPress, 2014
5.	Brilliant Speed Reading: Whatever you need to read, however ...PhilChambers, 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 healthhazards; water and airborne diseases. Radiation hazards: Mobile Cell tower andelectronic. 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, Importanceof 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 andtheir preventive measures.

Unit V

Health Services Organizations: World Health Organization (WHO), United Nations International Children's Emergency Fund (UNICEF) and Indian RedCross (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 inunderstanding 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

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 beyondlanguage.

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
- 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 textInterpret the text
- To understand what a text says
    i. To understand what a text does
    ii. To understand what a text means

Unit IV

- Clearly state the claims
- Avoid ambiguity, vagueness, unwanted generalisations 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 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. Powerpoint
- 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 VI

- 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:

SenMadhucchanda (2010), An Introduction to Critical Thinking,Pearson,Delhi
Silvia P. J. (2007), How to Read a Lot, American Psychological Association, Washington DC

Course Code	Course Title	L	T	P	C
231SSCBE	BASIC BEHAVIOURAL ETIQUETTE	-	-	-	1

Aim:

Aim of this program is eliminating negative thought, developing enriching habits, unlocking individual potentials and well versed communication

Course 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.

Course Content:

The module consists of

- Communication Skills
- Goal Setting
- Career Planning
- Reaching your Potential
- Time Management
- Stress Management
- Grooming and Discipline
- Learning skills
- Listening Skills
- Team Building

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 cluster, syllable, 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-B y-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 ofMonoclonal 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	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
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”(7^{th} 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 ININDUSTRIES	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

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

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

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

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

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 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 andgraphic 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- Preposition-Interjection-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

Author	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 Adviceor 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.pf
	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 R DNA 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-mechanismof 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 structureprediction method.
- Demonstrate the basic methods of data collection, graph construction and samplingtechniques and Calculate measures of central tendency
- Correlate and analyze biological data through various statistical methods andinterpret 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 geneticquestions.

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 ofmolecular 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 PvtLtd, 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 adomain 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 MSEXCEL
6. Calculation of dispersion – Mean deviation, quartile deviation and standarddeviation 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 tofunction. Viva books Pri. Ltd.
2. Maleolm and Goosfship. J. 2001. Genotype to phenotype, 2ndedition. BiosScientific 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. BlackwellScience.

Reference Books

6. Durbin, R., Eddy, S., Krogh, A. and Mitchison, G. 1998. Biological sequenceanalysis. Cambridge University Press.
7. Friedman, C.P. and Wyatt. J.C. 1997. Computers and Machine: Evaluationmethods 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 FoundationBooks 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, NewDelhi.
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

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

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

Biodegradation- Definition- Process-role of microorganisms in biodegradation - biodegradable plastics-advantages- Bio weapons- introduction- history- potential agents- delivery methods- harmful effects.

Unit III

Biodegradation- Definition- Process-role of microorganisms in biodegradation - biodegradable plastics-advantages- Bio weapons- introduction- history- potential agents- delivery methods- harmful effects.

Unit IV

Antibiotics- Definition- Introduction and history of antibiotics- sources- classification- spectrum- production of penicillin- definition of antibiotic resistance.

Unit V

Transgenic plants – Definition of transgene and transgenesis - BT Cotton, Flavr-Savr tomato and Golden rice- history – importance, applications, advantages anddisadvantages.

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 for participation in environment protection and improvement.

Objectives:

1. Creating the 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 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 about environmental pollutions, preventive measures.
2. Student will gain information related to societal issues in concern with environment.
3. Students should have out line 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 thefollowing ecosystem:
a) 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,

aestheticand 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 — wildlifeconflicts.

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
231LCSCLS	LEADERSHIP & MANAGEMENT SKILLS	-	-	-	1

Course Objectives:

CO 1: Help students to develop essential skills to influence and motivate others

CO 2 : Inculcate emotional and social intelligence and integrative thinking for effective leadership

CO 3: Create and maintain an effective and motivated team to work for the society

CO 4: Nurture a creative and entrepreneurial mindset

CO 5: Make students understand the personal values and apply ethical principles in professional land social contexts

Course Content:

UNIT I:

Leadership Skills

a. Understanding Leadership and its Importance

- ❖ What is leadership?
- ❖ Why Leadership required?
- ❖ Whom do you consider as an idealleader?

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
- ❖ Teamwork
- ❖ 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

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
   - ❖ 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 do 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

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Examine various leadership models and understand/assess their skills, strengths and abilities that affect their own leadership style and can create their leadership vision	**PO1**
CO2	Learn and demonstrate a set of practical skills such as time management,self management, handling conflicts, team leadership, etc.	**PO1,PO2**
CO3	Understand the basics of entrepreneurship and develop business plans	**PO4,PO6**
CO4	Apply the design thinking approach for leadership	**PO4,PO5, PO6**
CO5	Appreciate the importance of ethics and moral values for making a balanced personality.	**PO3,PO8**

References Books	
1	*Elkington, J., &Hartigan, P. (2008). The Power of Unreasonable People: How Social Entrepreneurs Create Markets that Change the World. Harvard Business Press.*
2	*GolemanD. (1995). Emotional Intelligence. Bloomsbury Publishing India PrivateLimited*
3	*Kalam A. A. (2003). Ignited Minds: Unleashing the Power within India. Penguin BooksIndia*
4	*Kelly T., Kelly D. (2014). Creative Confidence: Unleashing the Creative Potential WithinUs All.WilliamCollins*
5	*KurienV.,& Salve G. (2012). I Too Had a Dream. Roli Books PrivateLimited*
6	*Livermore D. A. (2010). Leading with cultural intelligence: The New Secret to Success. New York: American ManagementAssociation*
7	*McCormackM.H.(1986).WhatTheyDon'tTeachYouatHarvardBusinessSchool:NotesFromA Street-Smart Executive. RHUS*
8	*O'Toole J. (2019) The Enlightened Capitalists: Cautionary Tales of Business Pioneers Who Tried to Do Well by Doing Good.Harpercollins*
9	*SinekS. (2009). Start with Why: How Great Leaders Inspire Everyone to Take Action.Penguin*
10	*Sternberg R. J., Sternberg R. J., &BaltesP. B. (Eds.). (2004). International Handbook of Intelligence. Cambridge UniversityPress.*

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

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

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

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 seedproduction. Secondary metabolite production.

Unit IV

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

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

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

Types of cell culture- Primary, Secondary, Organ culture and cell lines. Role of feederlayers 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

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

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

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 PublishingCo. 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, 3rdedition. 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 waste water 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

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

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

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

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

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 ofmicroorganism, 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 ScienceLtd
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
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
AVERAG E	3	2.6	2.5	1.9	-	2	3	3	3

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.

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. 6thedition.W.H. Freeman & Company.	
5	Jeremy M Berg, Stryer, L. 2015. Biochemistry, 8th edition. Macmillan Learning.	

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
23217DSE54G	BIOPHYSICS	4	0	0	3

Course Objectives:

- Understanding Fundamental Principles – Introduce the core concepts of biophysics, including its scope, applications, and fundamental physics principles relevant to biological systems,
- Exploring Biomolecular Structures – Provide an in-depth understanding of protein structures (primary to quaternary), protein folding mechanisms, and their role in biological functions, Cell Physiology and Transport Mechanisms
- Explain the biophysical principles of cell membrane potentials, ion transport mechanisms, osmosis, and the regulation of cell volume, along with key cell signaling pathways, Biomechanical Applications
- Analyze the mechanics of muscle contraction (sliding filament theory), cellular and organismal movement (flagellar/ciliary motility), and the mechanical properties of biomaterials and tissues, Neurobiophysics and Bioelectricity
- Study the electrical properties of the nervous system, including action potential generation, propagation, synaptic transmission, and neurotransmitter release.

Unit-1: Introduction to Biophysics

What is biophysics, - its scope and applications, Basic principles of physics

Unit-2: Biomolecular

Structure and Dynamics, - Protein structure - (primary, secondary, tertiary, quaternary) and protein folding,

Unit-3: Cell Physiology and Transport

Cell membrane potential and ion transport mechanisms, Osmosis and regulation of cell volume - Signal transduction pathways and cell signaling

Unit-4: Biomechanics

Muscle contraction and mechanics (sliding filament theory), Movement of cells and organisms (flagellar and ciliary motility), Biomaterials and tissue mechanics

Unit-5: Neurobiology and Bioelectricity

Action potential generation and propagation in neurons, Synaptic transmission and neurotransmitter release, and Electrical properties of the nervous system.

Course Outcomes:

CO1: Students knows physical laws describing the flow of liquids and factors affecting the vascular resistance of blood flow.
CO2: Students knows natural and artificial sources of ionizing radiation and its interaction with matter.
CO3: Students knows the physical basis of non-invasive imaging methods.
CO4: Students knows the physical basis of selected therapeutic techniques, including ultrasound and irradiations

Reference Book:

1. Ackerman E.A. Ellis, L.E.E. & Williams L.E. (1979), Biophysical Science, Prentice-Hall Inc.
2. Barrow. C. (1974), Physical Chemistry For Life Sciences, McGraw-Hill.
3. Berns M.W. (1982), Cells, Holt Sounders International Editors.
4. Bloomfield V.A. and Harrington R.E. (1975), Biophysical chemistry, W.A.Freeman and CO.
5. Cantor C.R. and Schimmel P.R. (1980), Biophysical chemistry, W.A.Fremman and Co.
6. Casey E.J. (1967), Biophysics, concepts and mechanisms. Affiliated East west press.

Course Code	Course Title	L	T	P	C
23217DSE54H	BIOMOLECULES	4	0	0	3

Course Objectives: Understanding Carbohydrate Chemistry and Functions – Explore the classification, physicochemical properties, and biological significance of carbohydrates, including polysaccharides, glycoconjugates, and oligosaccharide-lectin interactions in biochemical processes, Comprehending Amino Acids and Proteins – Study the classification, structure, and properties of amino acids, peptide bond formation, biologically important peptides, protein purification, sequencing, and structural organization using Ramachandran plots, Analyzing Lipid Structure and Functions – Understand the classification, structure, and physicochemical properties of lipids, including phospholipids, sphingolipids, fatty acids, fats, and waxes, along with their biological roles, Exploring Bioactive Lipid Molecules – Examine the structure, properties, and functions of eicosanoids (prostaglandins, thromboxanes, leukotrienes), sterols, steroids, bile acids, and bile salts, highlighting their biochemical significance.

Course Outcomes:

CO1: Students will acquire an insight into various biomolecules which constitute the living organisms

CO2: Students will learn the structure and properties of carbohydrates, proteins,lipids, cholesterol, DNA, RNA, glycoproteins, glycolipids and their importance in biological systems CO3: Students will develop perception on the sequencing of proteins and nucleic acids

CO4: Students will gain knowledge on the Structure and properties of Porphyrins.

CO5: Students will gain knowledge on the Physicochemical properties of Nucleic acids Denaturation and Renaturation kinetics of nucleic acids.

Unit – 1: Carbohydrates: Classification, Physicochemical properties; Chemistry, Biological roles and Structural elucidation of polysaccharides - homo and heteropolysaccharides, Peptidoglycans, Glycosaminoglycans; Glycoconjugates – Proteoglycans, Glycoproteins and Glycolipids; Oligosaccharides - Lectin interactions in biochemical processes.

Unit – 2: Amino acids: Classification, Structure and Physicochemical properties; Peptide bond, Peptides of biological importance; Chemical synthesis of peptides – Solid phase peptide synthesis; Proteins – Classification, Isolation, Purification and Characterization of proteins.

Unit – 3: Lipids: Classification; Structure, Properties and Biological roles of Phospholipids and Sphingolipids; Fatty acids and their physicochemical properties; Fats and Waxes - Physicochemical properties and characterization of fats and oils; Structure, Properties and functions of Eicosanoids - Prostaglandins, Prostacyclins, Thromboxanes, Leukotrienes

Unit – 4: Nucleic acids: Bases, Nucleosides, Nucleotides; Nucleotides as Energy carriers, Enzyme cofactors and Chemical messengers; Synthetic nucleotide analogs; Chemical synthesis of oligonucleotides; Structure of DNA and different types of DNA, Supercoiled DNA; Structure of RNA and different types of RNA.

Unit – 5 : Physicochemical properties of Nucleic acids: Denaturation and Renaturation kinetics of nucleic acids - Melting temperature, Cot curves; Sequencing of Nucleic acids – Enzymatic and Chemical methods; Porphyrins – Structure and properties of Porphyrins – Heme, Chlorophylls, Bacteriochlorophylls and Cytochromes.

Reference books:

1. Text book of Biochemistry –E.S.West, W.R.Todd et al., 4th ed.
2. Principles of Biochemistry by Lehninger –D.L.Nelson, M.M.Cox7th ed.
3. Text book of Biochemistry with clinical correlations-Thomas M.Devlin, 7th ed.
4. Harper's review of Biochemistry –D.W. Martin, 19th ed.
5. Biochemistry – J.M.Berg, J.L.Tymoczko, L.Stryer, 5th ed.
6. Biochemistry-Reginald H. Garret, Charles M.Grisham 6th ed.

Course Code	Course Title	L	T	P	C
23217DSE54I	MICROBIAL GENETICS	4	0	0	3

Course Objectives: Understand the Fundamentals of Microbial Genetics – Learn the basic concepts of genetics, microbial cell structures, bacterial genomes, plasmids, and bacteriophages, Explore DNA Replication and Repair Mechanisms – Study the molecular mechanisms of bacterial DNA replication, including DNA polymerases, replication fork dynamics, replication fidelity, and repair mechanisms, Analyze Gene Expression and Mutagenesis – Understand transcription and translation processes, gene regulation (e.g., lac operon), genetic code, and protein synthesis, along with types and mechanisms of mutations. Examine Genetic Transfer Mechanisms – Investigate horizontal gene transfer methods in bacteria, including conjugation (plasmid transfer), bacteriophage-mediated transduction, and natural transformation.

Unit-1: Introduction to Microbial Genetics: Basic concepts of genetics and microbial cell structure - The bacterial genome, plasmids, and bacteriophages.

Unit-2: DNA Replication in Bacteria - Mechanisms of DNA replication (DNA polymerases, replication fork, origin of replication) Replication fidelity and repair mechanisms.

Unit-3: Gene Expression: (Transcription and Translation) - RNA polymerase and transcription factors Operons and gene regulation (e.g., lac operon), Genetic code and protein synthesis machinery, Mutation and Mutagenesis - Types of mutations (point mutations, insertions, deletions) Mechanisms of mutagenesis (chemical mutagens, radiation).

Unit-4: Genetic Transfer Mechanisms: Bacterial conjugation (plasmid transfer), Bacteriophage transduction Natural transformation.

Unit-5: Applications of Microbial Genetics - Bacterial pathogenesis and antibiotic resistance, Microbial genomics and metagenomics, Genetic engineering and biotechnology applications (e.g., recombinant protein production).

Course Outcomes:

CO1: Knowledge and Understanding: Explain the structure and organization of bacterial genomes.
CO2: Describe the mechanisms of DNA replication, transcription, and translation in bacteria.
CO3: Identify different types of mutations and their effects on microbial phenotypes.
CO4: Understand the principles of gene regulation in bacteria.
CO5: Discuss the various mechanisms of horizontal gene transfer (conjugation, transduction, transformation).

Reference Books:

1. Molecular Biology of the Gene: by James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander G. Gann, Michael Levine.

2. Microbial Genetics: by Stanley R. Maloy, James E. Cronan, David Freifelder.

3. Essential Genetics: by B.S. Singer, and G.G. Berg.

4. Relevant research articles from journals like Nature, Science, and PNAS.

Course Code	Course Title	L	T	P	C
23217DSE54J	BIOFERTILIZERS AND BIOPESTICIDES	4	0	0	3

Course Objectives: Understand the Role of Microbes in Biofertilizers – Learn about different types of biofertilizers, microbial symbiotic associations (e.g., Rhizobium), their physiology, interactions with host plants, and mass cultivation techniques. Study Nitrogen-Fixing Microorganisms – Explore Frankia, Actinorhizal nitrogen-fixing plants, and free-living nitrogen fixers like Azospirillum, Azotobacter, Azolla, and Anabaena, including their identification, culture methods, and maintenance, Analyze Mycorrhizal Associations – Understand the role of Vesicular Arbuscular Mycorrhiza (VAM), their types, occurrence, methods of collection, isolation, and inoculum production. Learn Large-Scale Biofertilizer Production and Applications – Examine the production process of biofertilizers, their role in organic farming, carrier materials, rhizosphere effects, and microbial products that enhance plant growth.

Unit-1: Biofertilizers – Definition, kinds, microbes as biofertilizers, Symbiotic associates – Rhizobium taxonomy, Physiology, Host cell – Rhizobium interactions, mass cultivation, inoculants and serology.

Unit-2: Frankia woodland and Actinornizal nitrogen fixing plants and its host plants, characteristics, identification, cultural method and maintenance of Azospirillum, Azotobacter, Azolla and anabaena.

Unit-3: Mycorrhiza - VAM association, types, occurrence, Collection, isolation and inoculum production.

Unit-4: Large scale production of biofertilizer, Organic farming Carrier materials, general outline of microbes as fertilizers, Rhizosphere effect microbial products influencing plant growth.

Unit-5: Biopesticides – Definition, kinds and commerce of biopesticide, Bacillus thuringiensis, insect viruses and entomopathogenic fungi – its characteristics, physiology, mechanism of action and application.

Course outcomes:

CO1: Explain the Bio fertilizers it's definition and Host cells.
CO 2: Frankia woodland its characteristics and identification.
CO 3: Mycorrhiza - Types and collections.
CO 4: Large scale production of biofertilizer and Organic farming Carrier materials.
CO 5: Biopesticides its definition and its characteristics.

Reference Books

1. Subba Rao, N.S. 2000 Soil Microbiology. Oxford and IBH Publishing.

2. Verma A and Hock B. 1995. Mycorrhiza.Yaacovokan, 1994 - Axospirillum.

3. Wicklow, D.T. and B.E. Soderstrom. 1997, Environmental and microbial relationships.

Course Code	Course Title	L	T	P	C
23117DSC63C	BASIC FERMENTATION TECHNIQUES	4	0	0	3

Course Objectives: Understand the Fundamentals of Fermentation Technology - Explore the history, scope, and evolution of fermentation technology. Learn about industrially important microorganisms and methods for their isolation, screening, and strain improvement, Learn about Fermentation Media and Its Components - Understand the differences between natural and synthetic media. - Study the essential components of fermentation media and their roles, including carbon and nitrogen sources, vitamins, minerals, and anti-foaming agents, Comprehend Fermentor Design and Scale-Up Processes - Study different types of fermentors, including Waldhof, Tower, Deepjet, Cyclone column, Packed tower, and Airlift fermenters. - Learn about scale-up techniques, downstream processing, product recovery, and safety regulations in industrial fermentation.

Course Outcomes:

Co1: Design of various reactors used in Industries.
Co2: Criteria for selection of media for microbial growth.
Co3: Methods for strain improvement and preservation of cultures.
Co4: Upstream as well as downstream processing involved in fermentation industries.
Co5: Industrial Applications: Production of biofuels.

Unit-1: Introduction to Fermentation technology History, Scope and Development of Fermentation technology: Isolation and screening of industrially important microorganisms − primary and secondary screening; Maintenance of Strains; Strain improvement: Mutant selection and Recombinant DNA technology.

Unit-2: Fermentation media Natural and Synthetic media: Basic components of an media (Carbon sources; Nitrogen sources; Vitamins; Minerals; Anti-foaming agents); Role of buffers in media; Process of aeration, and agitation.

Unit-3: Fermentor designBasic designs of Fermentor: Type of fermentors: Waldhof, Tower, Deepjet, Cyclone column, Packed tower and airlift fermenter; Scale up study and Product development; Down-stream processing and Product recovery; Regulation and safety.

Unit-4: Production of Microbial Products Production of alcohol; Organic acid − Citric acid; Antibiotic − Penicillin, Amino acid − Glutamic acid; Vitamin − B1; Single Cell Protein (SCP).

Unit-5: Industrial Applications: Production of biofuels (ethanol, biodiesel) Industrial enzyme production Microbial production of organic acids (citric acid, lactic acid).

Reference Books:

1. Principles of Fermentation Technology" – Peter F. Stanbury, Allan Whitaker & Stephen J. Hall.
2. Fermentation Microbiology and Biotechnology" – E.M.T. El-Mansi, C.F.A. Bryce, Arnold L. Demain & A.R. Allman.
3. Bioprocess Engineering Principles" – Pauline M. Doran.
4. Principles of Fermentation Technology" – Peter F. Stanbury, Allan Whitaker & Stephen J. Hall.
5. Industrial Microbiology" – Michael J. Waites, Neil L. Morgan, John S. Rockey & Gary Higton

Course Code	Course Title	L	T	P	C
23117DSC63D	COMPUTATIONAL BIOLOGY	4	0	0	3

Course Objectives: Understand Computational Approaches in Biology - Learn about genome sequencing, biological databases, sequence alignment techniques, and dynamic programming for molecular sequence analysis. - Explore phylogenetic tree construction methods such as UPGMA and Neighbor-Joining for evolutionary studies, Develop Skills in Protein Structure Analysis and Bioinformatics Tools- Gain knowledge of protein structure modeling, molecular docking, and molecular dynamics simulations for biological research. - Understand the applications of machine learning (ANNs, HMMs) in protein structure prediction, gene finding, and systems biology, Apply Programming for Bioinformatics Data Analysis - Learn Perl programming for handling biological data, pattern matching, and parsing sequence data, Develop computational skills to analyze and interpret biological datasets effectively.

Course Outcomes:

Co1: Students will learn on Introduction to computational Biology and sequence analysis.
Co2: Students will learn on Photogenics and its introduction types.
Co3: Students will gain knowledge on Protein Structure and modelling and simulation.
Co4: Students will learn on the Machini learning Machine learning techniques and applications. Co5: Students will learn on Perl for Bioinformatics , Variables, Data types and Programs to handle biological data.

Unit-1: Introduction to computational Biology and sequence analysis - Molecular sequences, Genome sequencing: pipeline and data, Next generation sequencing data, Biological databases: Protein and Nucleotide databases, Sequence Alignment, Dynamic Programming for computing edit distance and string similarity.

Unit-2: Photogenics - Introduction to Phylogenetics, Distance and Character based methods for phylogenetic tree construction: UPGMA, Neighbour joining, Ultrametric and Min ultrametric trees.

Unit-3: Protein Structure and modelling and simulation - Protein Structure Basics, Visualization, Prediction of Secondary Structure and Tertiary Structure, Homology Modeling, Structural Genomics, Molecular Docking principles and applications, Molecular dynamics simulations.

Unit-4: Machini learning - Machine learning techniques: Artificial Neural Networks and Hidden Markov Models: Applications in Protein Secondary Structure Prediction and Gene Finding, Introduction to Systems Biology and its applications.

Unit-5: Perl for Bioinformatics - Variables, Data types, control flow constructs, Pattern Matching, String manipulation, arrays, lists and hashes, File handling, Programs to handle biological data and parse output files for interpretation.

Reference Books:

1. Baldi, P., Brunak, S. Bioinformatics: The Machine Learning Approach, 2nd ed.
2. Baxevanis A.D. and Oullette, B.F.F. A Practical Guide to the Analysis of Genes and Proteins, 2nd ed.
3. Durbin, R. Eddy S., Krogh A., Mitchison G. Biological Sequence Analysis: Probabilistic. Models of Proteins and Nucleic Acids. Cambridge University.
4. Proteomics from protein sequence to function: Edited by S.R.Pennington and M.J.Dunn,Taylor.

Course Code	Course Title	L	T	P	C
23117DSC63E	PLANT TISSUE CULTURE	4	0	0	3

Course Objectives: Understand the Fundamentals and Techniques of Plant Tissue Culture - Learn the history, significance, and basic concepts such as totipotency, dedifferentiation, and redifferentiation. - Gain knowledge of different tissue culture types, including callus culture, protoplast culture, and organ culture, Explore Micropropagation, Genetic Transformation, and Crop Improvement - Study micropropagation techniques, factors influencing clonal propagation, and their applications in commercial plant production. - Understand somatic embryogenesis

Course Outcomes:

Co1: Understand the basic principles and techniques of plant tissue culture and apply them in laboratory settings.

Co2: Demonstrate proficiency in the preparation and maintenance of plant cultures and tissues.

Co3: Perform micropropagation techniques for plant multiplication and apply them in commercial settings.

Co4: Explore and describe the potential applications of plant tissue culture in biotechnology and agriculture.

Co5: Develop skills in somatic embryogenesis and genetic transformation technologies to improve crops.

Unit 1: Introduction to Plant Tissue Culture - Overview of Plant Tissue Culture: Definition, history, significance. Basic Concepts: Totipotency, dedifferentiation, redifferentiation. Types of Tissue Culture: Callus culture, protoplast culture, organ culture.

Unit 2: Techniques in Plant Tissue Culture Sterilization Techniques: Surface sterilization of explants, equipment sterilization, aseptic conditions, Explant Selection and Preparation: Types of explants, preparation of explants for culture, Culture Conditions: Temperature, light, humidity, and pH.

Unit 3: Micropropagation and Clonal Propagation Micropropagation: Principles and methods - Stages of Micropropagation: Initiation, multiplication, rooting, and acclimatization - Factors Influencing Micropropagation: Genetic stability, contamination, hormonal influence - Applications of Micropropagation

Unit 4: Somatic Embryogenesis and Genetic Transformation Somatic Embryogenesis: Mechanism, stages, and applications. Genetic Transformation: Overview of plant genetic engineering, Agrobacterium-mediated transformation, and gene editing (CRISPR). Application in Crop Improvement: Pest resistance, disease resistance, and stress tolerance in plants.

Unit 5: Applications and Future Directions in Plant Tissue Culture Industrial Applications: Production of secondary metabolites, synthetic seed technology, and large-scale production. Biotechnology Applications: Transgenic plants, phytoremediation, plant-based vaccines.

References books:

1. Plant Tissue Culture: Techniques and Experiments" by Roberta H. Smith
2. Plant Biotechnology and Plant Tissue Culture" by S.S. Purohit
3. Introduction to Plant Tissue Culture" by M.K. Razdan
4. Plant Cell and Tissue Culture" by R. G. H. Vasil
5. Plant Biotechnology" by H.S. Chawla

Course Code	Course Title	L	T	P	C
23117DSC63F	ADVANCES IN BIOTECHNOLOGY	4	0	0	3

Course Objectives: Gain a Comprehensive Understanding of Biotechnology Applications - Explore medical, environmental, and industrial biotechnology, including gene therapy, bioremediation, biofuel production, and enzyme-based bioprocessing. Develop Knowledge of Molecular and Cellular Mechanisms - Learn protein engineering techniques, genetics principles, microbial physiology, and genetic engineering methods for research and industrial applications. Apply Biotechnology in Research and Industry - Understand cell biology, stem cell applications, tissue engineering, and microbial fermentation for advancements in healthcare, agriculture, and industrial biotechnology.

Course Outcomes:

Co1: To understand principles of animal culture, media preparation
Co2: To explain Invitro fertilization and embryo transfer technology.
Co3: To explain genome organization in higher organisms.
Co4: To describe kinetic classes of DNA and Gene families.
Co5: To understand the steps involved in recombinant cell Biology.

Unit-1: Applied Biotechnology: Medical Biotechnology: Gene therapy, drug delivery, diagnostics, tissue engineering Environmental Biotechnology: Bioremediation, wastewater treatment, biofuel production Industrial Biotechnology: Enzyme production, biocatalysis, food processing.

Unit-2: Protein Engineering: Protein structure and function, Protein purification techniques, Site-directed mutagenesis, Protein folding and stability, and Antibody engineering.

Unit-3: Genetics: Mendelian genetics, Linkage and crossing over, Population genetics, Gene mapping and sequencing, and Genetic engineering and cloning techniques.

Unit-4: Microbiology: Microbial physiology and metabolism, Bacterial genetics and molecular biology, Microbial diversity and taxonomy, Sterilization and disinfection techniques, and Industrial microbiology (fermentation processes).

Unit-5: Cell Biology: Cell structure and function, Cell signaling pathways, Cell cycle regulation, Stem cell biology, and Tissue engineering.

Reference Books:

1. Principles and Applications of Recombinant DNA" by Bernard R. Glick and Jack J. Pasternak.
2. A Textbook of Industrial Microbiology" by William J. Thieman and Michael A. Palladino.
3. Protein Engineering: Principles and Practice" by G. H. Patel.
4. Prescott's Microbiology" by Joanne Willey, Linda Sherwood, and Christopher J. Woolverton

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 usingturbidometry.
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 beincluded 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.

	P O 1	P O 2	P O 3	P O 4	P O 5	P O 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

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

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

Vermicomposting–Earthworms-Ecologicaltypes-Vermiculture-Compostpit-Vermibed-a pplications. Sericulture-Mulberrycultivation-SilkwormRearing-Economicsofsilkworm Production-Chawki Rearing-Sericulture in India.

Unit IV

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.

Unit V

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

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

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

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

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

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**

Course Code	Course Title	L	T	P	C
23117PRW64	Project & Viva Voice	8	0	0	4

Projects enable students to get hands-on training in microbiological techniques needed for research. Thus the students can share diverse perspectives resulting in pooling of knowledge and skills. Group work may approach tasks and solve problems in novel, interesting ways, thereby converting established theoretical concepts to practical skills. If structured properly, it will promote team work and collaboration. Group projects also will help students to choose a research design, solve real life problems and benefit the society at large. Thus group project facilitates the students to convert ideas to practice thereby creating a research culture among students.

Guidelines for group project:

- ✓ A research problem needs to be selected based on creative ability and scientific thought.
- ✓ A brief description of the problem needs to be given.
- ✓ Hypothesis statements should be framed.
- ✓ Objectives by which the project work is to be carried out should be clearly stated.
- ✓ Methodology has to be designed to test the hypothesis.
- ✓ Results obtained need to be replicable.
- ✓ Documented report has to be submitted on completion of the project.