1.1.2 Number of programmes where syllabus revision was carried out during the year

DEPARTMENT OF MICROBIOLOGY

- It is the practice of the Institution to revise the curriculum and syllabi once in 2 years based on duration of programme.
- The minutes of all the academic council meetings are enclosed herewith.
- Revisions were carried out once in every year as per the recommendation of the respective Boards of Studies.
- The minutes of all the BOS are enclosed herewith.

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SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF MICROBIOLOGY

DEPARTMENT ACADEMIC COMMITTEE MEETING CIRCULAR

Date: 13-07-2020

There will be a Department Academic Committee Meeting on 17-07-2020 at 2 pm in the staff room. All the staff members are requested to attend the meeting.

Agenda:

Curriculum

Feedback

Academic Calendar

Department Activities

Workload

Time table

Others

HOD

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SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF MICROBIOLOGY

MINUTES OF THE DEPARTMENT ACADEMIC COMMITTEE MEETING

Date: 17-07-2020

The Department Academic Committee Meeting was held on 17-07-2020 at 2 pm in the staff room.

HOD welcomed the committee members. Members analyzed the feedbacks from the stakeholders and the follow up actions taken. The committee carefully reviewed the curriculum in detail and proposed no changes in it. Staff members were asked to propose activities for the department like seminars, guest lectures, extension activity, co-curricular activity and extra-curricular activity. HOD proposed to prepare the academic calendar. Workload was discussed and courses were allotted to the staff members.

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SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF MICROBIOLOGY

BOARD OF STUDIES COMMITTEE MEETING CIRCULAR

Date: 023.07.2020

There will be a Board of StudiesMeeting on 30.07.2020at 10.00 am Video ConferenceMedia:ZOOM, PRIST University, Thanjavur. All the staff members are requested to attend the meeting. Link: https://us04web.zoom.us/j/

Agenda:

Curriculum
Feedback
Academic Calendar
Department Activities
Workload
Time table
Others

HOD
DR. Bakrudeen Ali Ahamed

Signature

1 DR. Bakrudeen Ali Ahamed

2 DR.L.Chinnappa

3 Dr. C. Sundar

4 Dr. T. Ushadevi

5 Dr. R.Sathya 

6 Dr. P. Mathan Periyasamy 

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SCHOOL OF ARTS AND SCIENCE
DEPARTMENT OF MICROBIOLOGY

Minutes of Board of Studies Meeting

The Board of Studies meeting for the department of Microbiology is held on 30.07.2020 at 10 a.m. Video ConferenceMedia:ZOOM, PRIST Deemed to be University, Thanjavur under the chairmanship of Dr. A.Bakrudeen Ali Ahamed.

The following members were present:

2. Dr. Bakrudeen Ali AhamedProfessor (Chairman , BOS)
3. Dr. L.Chinnappa / Dean (EX-Offico)
4. Dr. C. Sundar Associate Professor, (Member, BOS)
5. Dr. T. Ushadevi, Associate Professor (Member, BOS)
6. Dr. R.Sathya Assistant Professor, (Member, BOS)
7. Dr. P. Mathan Periyasamy Assistant Professor, (Member, BOS)
8. Dr. P. Anantharaman Professor, CAS in Marine Biology, Annamalai University (External Member, BOS)
9. Dr. Rajkumar, Managing Director, Cell Zyme Biotech, Chennai, External Member, BOS)

The Chairman (BOS) welcomed all the members and presented the feedbacks about existing curriculum received from various Stack holders and also from the department academic advisory committee. chennai

The members of the Board have unanimously discussed and carefully reviewed the existing syllabus for (B.Sc Microbiology, M.Sc Microbiology and M.Phil) in detail and made the necessary changes in upcoming (B.Sc Microbiology, M.Sc Microbiology and M.Phil) as mentioned below.

1. **Resolved to introduce the following Audit Courses in the B.Sc. (Microbiology) programme curriculum with effect from 2020-21**

   Semester I: Universal Human Values - 2 credits

   Semester II : Communication Skills- 2 credits

   Semester III: Office automation- 2 credits

   Semester IV: Leadership and Management Skills- 2 credits

   Semester V: Professional Skills- 2 credits

Further resolved to approve the syllabus copy for the above mentioned Audit Courses as given in **Annexure-I**

2. **Resolved to introduce the following Audit Courses on Soft Skills in the B.Sc.(Microbiology) programme curriculum with effect from 2020-21**

   Year I: Basic Behavioral Etiquette: 2 Credits

   Year II : General Aptitude and Quantitative Ability: 2 Credits

   Year III: Interview Skills Training and Mock Test: 2 Credits

   Further resolved to approve the syllabus copy for the above mentioned Audit Courses on Soft Skills as given in **Annexure-II**

3. **Resolved to introduce Audit Course on "Community Engagement" with one credit in the 3rd year of B.Sc. (Microbiology) programme curriculum with effect from 2020-21 Annexure-I**

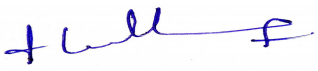
4. **Resolved to drop the courses on Communicative English Laboratories, Skill Based Elective Courses and Course on Extension Activities from the existing curriculum of B.Sc.(Microbiology) programme with effect from 2020-21.**

5. **Resolved to introduce** “Cell Biology /20116AEC34” and “Cell Biology Lab /20116AEC36L” in **B.Sc III semester Annexure-III**
6. **Resolved to introduce** “Biostatistics and Bioinformatics /20116AEC44” and and “Biostatistics and Bioinformatics Lab /20116AEC47L” in **B.Sc IV semester Annexure-III**
7. Resolved to modify the Molecular Biology/20116AEC52 syllabus in Unit I,II,III,IV and V in B.Sc V semester **(Annexure III)**
8. Resolved to continue with the existing curriculum and syllabi for M.Sc Microbiology program without any change for the year 2020-21
9. **Resolved to introduce a course on “Research and Publication Ethics” with 2 credits in the M.Phil.(Microbiology) programme curriculum with effect from 2020-21. Further resolved to approve the syllabus for the same as given in Annexure-IV**

Members of the Board updated the panel of examiners and submitted the same to the Academic Counsel for its approval. **Annexure-V**

The Meeting concluded with thanks from Board of Studies Chairman.

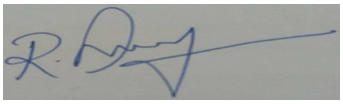
Signature of the Chairman & Members

1 DR. Bakrudeen Ali Ahamed 

2 DR.L.Chinnappa 

3 Dr. C. Sundar 

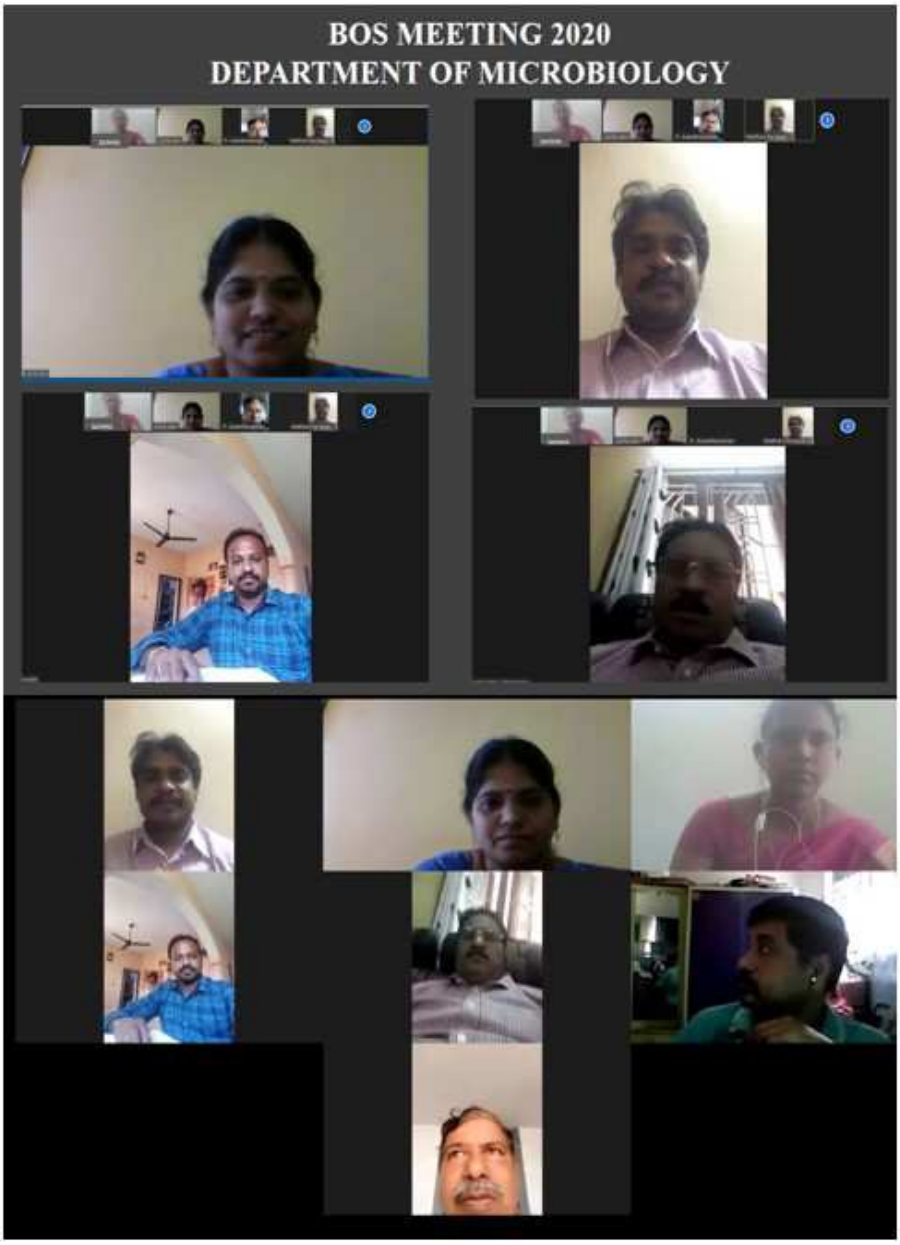
4 Dr. T. Ushadevi 

5 Dr. R.Sathya 

6 Dr. P. Mathan Periyasamy 

7 Dr. P. Anantharaman

8 Dr. Rajkumar, 



Board of Studies Meeting - July 30, 2020

Annexure-I

PRIST DEEMED TO BE UNIVERSITY
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SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF MICROBIOLOGY
B. Sc., MICROBIOLOGY-REGULATION 2020

COURSE STRUCTURE

SEMESTER I

Course Code	Course Title	L	T	P	C
THEORY					
20110AEC11/ 20111AEC11/ 20132AEC11/ 20135AEC11	Language-I (Tamil-I/ Advanced English-I/ Hindi-I/ French-I	4	0	0	2
20111AEC12	English-I	4	0	0	2
20116AEC13	Fundamentals of Microbiology	6	1	0	5
20115AEC14B	Bio Chemistry I	6	1	0	4
PRACTICAL					
20116AEC15L	Fundamentals of Microbiology Lab	0	0	3	2
20115AEC16BL	Bio Chemistry I Lab	0	0	3	2
	Total	**20**	**2**	**6**	**17**
AUDIT COURSE					
201ACLSICN	Indian Constitution	-	-	-	2
201ACLSUHV	Universal Human Values	-	-	-	**2**

SEMESTER – II

Course Code	Course Title	L	T	P	C
THEORY					
20110AEC21/ 20111AEC21/ 20132AEC21/ 20135AEC21	Language-II (Tamil-II/ Advanced English-II / Hindi-II/ French-II)	4	0	0	2
20111AEC22	English-II	4	0	0	2
20116AEC23	Microbial Physiology	6	1	0	5
20115AEC24	Bio Chemistry II	6	1	0	4
PRACTICAL					
20116AEC25L	Microbial Physiology Lab	0	0	3	2
20115AEC26L	Bio Chemistry II Lab	0	0	3	2
RESEARCH SKILL BASED COURSE					
20116RLC27	Research Led Seminar	-	-	-	1
	Total	**20**	**2**	**6**	**18**
AUDIT COURSES					
201ACLSCOS	Communication Skills	-	-	-	**2**
201ACSSBBE	Basic Behavioral Etiquette	-	-	-	**2**

SEMESTER – III

Course Code	Course Title	L	T	P	C
THEORY					
20110AEC31/ 20111AEC31/ 20132AEC31/ 20135AEC31	Language-III (Tamil-III/ Advanced English-III / Hindi-III/ French-III)	4	0	0	2
20111AEC32	English-III	4	0	0	2
20116AEC33	Immunology	4	1	0	4
20116AEC34	Cell Biology	4	1	0	5
PRACTICAL					

20116AEC35L	Immunology Lab	0	0	3	2
20116AEC36L	Cell Biology Lab	0	0	3	2
	RESEARCH SKILL BASED COURSE				
20116RMC37	Research Methodology	2	0	0	2
	Total	**18**	**2**	**6**	**19**
	AUDIT COURSE				
201ACLSOAN	Office Automation	-	-	-	**2**

SEMESTER – IV

Course Code	**Course Title**	**L**	**T**	**P**	**C**
	THEORY				
20110AEC41/ 20111AEC41/ 20132AEC41/ 20135AEC41	Language-IV (Tamil-IV/ Advanced English-IV/ Hindi-IV/ French-IV)	4	0	0	2
20111AEC42	English-IV	4	0	0	2
20116AEC43	Virology	4	1	0	4
20116AEC44	Biostatistics and Bioinformatics	5	1	0	5
201ENSTU45	Environmental studies	2	0	0	2
	PRACTICAL				
20116AEC46L	Virology Lab	0	0	3	2
20116AEC47L	Biostatistics and Bioinformatics Lab	0	0	3	2
	Total	**19**	**2**	**6**	**19**
	AUDIT COURSE				
201ACLSLMS	Leadership and Management Skills	-	-	-	**2**
201ACSSAQA	General Aptitude and Quantitative Ability	-	-	-	**2**

SEMESTER – V

Course Code	**Course Title**	**L**	**T**	**P**	**C**
	THEORY				
20116AEC51	Food and Dairy Microbiology	4	1	0	4

20116AEC52	Molecular Biology	4	1	0	3
20116AEC53	Agricultural and Environmental Microbiology	4	1	0	4
20116DSC54__	Discipline Specific Elective -I	4	1	0	3
PRACTICAL					
20116AEC55L	Food and Dairy Microbiology and Molecular Biology Lab	0	0	3	2
20116AEC56L	Agricultural and Environmental Microbiology Lab	0	0	3	2
RESEARCH SKILL BASED COURSE					
20116BRC57	Participation in Bounded Research	-	-	-	1
	Total	**16**	**4**	**6**	**19**
AUDIT COURSE					
201ACLSPSL	Professional Skills	-	-	-	**2**

SEMESTER – VI

Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
20116AEC61	Industrial Microbiology	4	1	0	4
20116SEC62	Clinical Microbiology	4	1	0	5
20116DSC63_	Discipline Specific Elective - II	4	1	0	3
201—OEC (2 DIGIT COURSE Name)	Open Elective	4	0	0	2
PRACTICAL					
20116AEC64L	Industrial Microbiology Lab	0	0	3	2
20116SEC65L	Clinical Microbiology Lab	0	0	3	2
20116PRW66	Project Work	-	-	-	4
20116PROEE	Program Exit Examination	-	-	-	1
	Total	**16**	**3**	**6**	**23**
AUDIT COURSE					

201ACSSIST	Interview Skills Training and Mock Test	-	-	-	**2**
201ACLSCET	Community Engagement	-	-	-	**1**
Total Credits -Programme					**115**
Total Credits - Audit Courses					**19**

Discipline Specific Electives

Semester	**Discipline Specific Elective Courses-I**
V	a) 20116DSC54A - Proteomics b) 20116DSC54B - Bioinoculants
	Discipline Specific Elective Courses-I
VI	a) 20116DSC63A-Recombinant DNA Technnology b) 20116DSC63B - Bioethics

Open Electives

Semester	**Open Elective Courses**
VI	➢ 201TNOEC-Tamil Ilakkiya Varalaru ➢ 201ENOEC-Journalism ➢ 201MAOEC-Development of Mathematical Skills ➢ 201PHOEC-Instrumentation ➢ 201CEOEC-Food and Adulteration ➢ 201CSOEC – E-Learning ➢ 201CAOEC-Web Technology ➢ 201CMOEC-Banking service

Credit Distribution

Sem	AEC	SEC	DSC	OEC	Research	Others	Total
I	17	-	-	-	-	-	17
II	17	-	-	-	1	-	18
III	17	-	-	-	2	-	19
IV	17	-	-	-	-	2	19
V	15	-	3	-	1	-	19
VI	6	7	3	2	4	1	23
Total	**89**	**7**	**6**	**2**	**8**	**3**	**115**

HOD **DEAN**

School of Arts and Science
M. Sc. Microbiology Syllabus-Regulation 2020

Course Code	Course Title	L	T	P	C
	SEMESTER I				
20216SEC11	Prokaryotic Microbiology	6	1	0	5
20216SEC12	Eukaryotic Microbiology	6	1	0	5
20216SEC13	Microbial Physiology	6	1	0	4
20216SEC14L	Fundamentals of Microbiology Lab	0	0	4	2
20216DSC15_	Discipline Specific Elective I	5	0	0	4
20216RLC16	Research Led Seminar	-	-	-	1
	Total	**23**	**3**	**4**	**21**
	SEMESTER II				
20216SEC21	Industrial Microbiology	5	1	0	5
20216SEC22	Environmental and Agricultural Microbiology	5	1	0	5
20216SEC23	Clinical Microbiology	5	0	0	4
20216SEC24L	Industrial, Clinical and Environmental and Agricultural Microbiology Lab	0	0	4	2
20216DSC25_	Discipline Specific Elective II	5	0	0	4
20216RMC26	Research Methodology	3	0	0	2
20216BRC27	Participation in Bounded Research	-	-	-	2
	Total	**23**	**2**	**4**	**24**
	SEMESTER III				

20216SEC31	Microbial Genetics	6	1	0	6
20216SEC32	Microbial Biotechnology	6	1	0	6
20216SEC33L	Microbial Genetics and Biotechnology Lab	0	0	5	3
20216DSC34_	Discipline Specific Elective III	5	0	0	4
202_OEC	Open Elective	4	0	0	4
20216SRC35	Design/Socio technical research	-	-	-	2
	Total	**21**	**2**	**5**	**24**
	SEMESTER IV				
20216SEC41	Pharmaceutical Microbiology	6	1	0	6
20216SEC42	Biostatistics and Bioinformatics	6	1	0	6
20216SEC43L	Pharmaceutical Microbiology Lab	0	0	5	3
20216DSC44_	Discipline Specific Elective IV	5	0	0	4
20216PRW45	Project Work	-	-	-	6
20216PEE	Programme exit examinations	-	-	-	2
	Total	**17**	**2**	**5**	**27**
	Total Credits for the Program				**96**

Discipline specific Electives

Semester	**Discipline specific Elective Courses-I**
I	a) 20216DSC15A- Immunotechnology b)20216DSC15B-Bioremediation and Waste Management
	Discipline specific Elective Courses-II

II	a)20216DSC25A-Biomolecules b)20216 DSC25B- Genomics and Proteomics
	Discipline specific Elective Courses-III
III	a)20216DSC34A- Plant Tissue Culture b)20216DSC34B-Nanotechnology
	Discipline specific Elective Courses-IV
IV	a)20216DSC44A- Bioethics and IPR b)20216DSC44B-Molecular Immunology

Open Electives

Semester	**Open Elective Courses**
III	➢ 202ENOEC-Writing for the media ➢ 202MAOEC-Applicable Mathematics Techniques ➢ 202PHOEC-Bio-Medical Instrumentation ➢ 202CHOEC-Green Chemistry ➢ 202CSOEC – M-Marketing ➢ 202CMOEC- Financial Services

Credit Distribution:

Sem	**SEC**	**DSC**	**GEC**	**RSB cources**	**Others**	**Total**
I	16	4	-	1	-	21
II	16	4	-	4	-	24
III	15	4	3	2	-	24
IV	15	4	-	6	2	27

Total	**62**	**16**	**3**	**13**	**02**	**96**

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DEPARTMENT OF MICROIOLOGY

M.PHIL MICROBIOLOGY SYLLABUS - REGULATION 2020

COURSE STRUCTURE

SEMESTER - I					
COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**C**
203RMG11 (Common Paper)	Research Methodology	6	0	0	4
203MBC12	Advanced Microbiology	6	0	0	4
203MBE13_	A. Microbial Biotechnology B .Bioprocess and Enzyme Engineering	6	0	0	4
(Common Paper) 203RPE14	Research and Publication Ethics	0	0	0	2
	Total	**18**	**0**	**0**	**14**
SEMESTER - II					
203MBD21	**Dissertation - (Topic selected should be relevant to the topic of the In-depth paper**				10

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Annexure-II

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SCHOOL OF ARTS AND SCIENCE

Department of Microbiology

B.Sc. Microbiology Syllabus

[Regulation 2020]

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School of Arts and Science

Department of Microbiology

B. Sc., Syllabus-Regulation 2020

Bachelor of Science in Microbiology

Our curriculum is intended to educate our majors in a diversity of significant microbiological disciplines, as well as to inspire and improve Language and communicative skills and capabilities that take persistent value beyond the teaching space.

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**

Educational Objectives-PEO

- PEO1-To gain and apply knowledge of microorganisms concept to solve the problems.
- PEO2-To identify, analyse and understand the problems related to microbes.
- PEO3-Ability to design and develop solution to environment using the microbes.
- PEO4-Ability to design performs experiments, analyse, and interpret data for investigating complex problems.
- PEO5-To decide and apply appropriate tools and techniques for manipulations.

Programme Specific Outcomes (PSOs)

- PSO –Expose input practical skills/competencies in working through microbes for study and use in the laboratory as well as outside,

with the use of good microbiological practices.

- PSO – obtain information and understanding of the microbiology perception as appropriate to various areas such as medical, industrial, environment, genetics, agriculture, food and others.
- PSO- proficient enough to use microbiology knowledge and skills to study problems involving microbes, clear these with peers/ team members/ other stake holders, and undertake remedial measures/ studies etc.
- PSO - Developed a broader standpoint of the regulation of Microbiology to facilitate individual to identify challenging societal troubles and plan them professional career to build up novel decision for such problems

B. Sc Programme Outcome-PO

- PO1-Vital Thinking: Able to acquire knowledgeable actions and give the impression of being at our thoughts and assessments (academic, organizational and individual) from diverse perception.
- PO2-Precious communication: Able to speak, read, write and listen noticeably in person and throughout electronic media in English and in one Indian language and build meaning of the globe by connecting people, thoughts books, media and technology.
- PO3-Effectual citizenship: Able to reveal empathetic social concern and fairness centred national progress and the capability to act with and take part in civic life through volunteering
- PO4- Ethics: Be aware of diverse value systems including the individual, under the ethical dimensions of personal choice, and believe responsibility for them.
- PO5- Environment and Sustainability: Able to analyze the importance of microbes for environmental clean-up and sustainable development.
- PO6- Self directed and life-long learning: Able to gain the talent to employ in self-determining and life-long learning in the broadest circumstance socio technological transforms.
- PO7- Economic liberty and employability potential: Attain the ability to be concerned in economically sustainable opening and pound entrepreneurial skill.

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SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF MICROBIOLOGY

B. Sc., MICROBIOLOGY-REGULATION 2020

COURSE STRUCTURE

SEMESTER I					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
20110AEC11/ 20111AEC11/ 20132AEC11/ 20135AEC11	Language-I (Tamil-I/ Advanced English-I/ Hindi-I/ French-I	4	0	0	2
20111AEC12	English-I	4	0	0	2
20116AEC13	Fundamentals of Microbiology	6	1	0	5
20115AEC14B	Bio Chemistry I	6	1	0	4
PRACTICAL					
20116AEC15L	Fundamentals of Microbiology Lab	0	0	3	2
20115AEC16BL	Bio Chemistry I Lab	0	0	3	2
	Total	**20**	**2**	**6**	**17**
AUDIT COURSE					
201ACLSICN	Indian Constitution	-	-	-	2
201ACLSUHV	Universal Human Values	-	-	-	**2**
SEMESTER – II					
Course Code	**Course Title**	**L**	**T**	**P**	**C**

THEORY					
20110AEC21/ 20111AEC21/ 20132AEC21/ 20135AEC21	Language-II (Tamil-II/ Advanced English-II / Hindi-II/ French-II)	4	0	0	2
20111AEC22	English-II	4	0	0	2
20116AEC23	Microbial Physiology	6	1	0	5
20115AEC24	Bio Chemistry II	6	1	0	4
PRACTICAL					
20116AEC25L	Microbial Physiology Lab	0	0	3	2
20115AEC26L	Bio Chemistry II Lab	0	0	3	2
RESEARCH SKILL BASED COURSE					
20116RLC27	Research Led Seminar	-	-	-	1
	Total	**20**	**2**	**6**	**18**
AUDIT COURSES					
201ACLSCOS	Communication Skills	-	-	-	**2**
201ACSSBBE	Basic Behavioral Etiquette	-	-	-	**2**
SEMESTER – III					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
20110AEC31/ 20111AEC31/ 20132AEC31/ 20135AEC31	Language-III (Tamil-III/ Advanced English-III / Hindi-III/ French-III)	4	0	0	2
20111AEC32	English-III	4	0	0	2
20116AEC33	Immunology	4	1	0	4
20116AEC34	Cell Biology	4	1	0	5
PRACTICAL					
20116AEC35L	Immunology Lab	0	0	3	2
20116AEC36L	Cell Biology Lab	0	0	3	2
	RESEARCH SKILL BASED COURSE				
20116RMC37	Research Methodology	2	0	0	2

	Total	**18**	**2**	**6**	**19**
	AUDIT COURSE				
201ACLSOAN	Office Automation	-	-	-	**2**
SEMESTER – IV					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
20110AEC41/ 20111AEC41/ 20132AEC41/ 20135AEC41	Language-IV (Tamil-IV/ Advanced English-IV/ Hindi-IV/ French-IV)	4	0	0	2
20111AEC42	English-IV	4	0	0	2
20116AEC43	Virology	4	1	0	4
20116AEC44	Biostatistics and Bioinformatics	5	1	0	5
201ENSTU45	Environmental studies	2	0	0	2
PRACTICAL					
20116AEC46L	Virology Lab	0	0	3	2
20116AEC47L	Biostatistics and Bioinformatics Lab	0	0	3	2
	Total	**19**	**2**	**6**	**19**
AUDIT COURSE					
201ACLSLMS	Leadership and Management Skills	-	-	-	**2**
201ACSSAQA	General Aptitude and Quantitative Ability	-	-	-	**2**
SEMESTER – V					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
20116AEC51	Food and Dairy Microbiology	4	1	0	4
20116AEC52	Molecular Biology	4	1	0	3
20116AEC53	Agricultural and Environmental Microbiology	4	1	0	4
20116DSC54__	Discipline Specific Elective -I	4	1	0	3
PRACTICAL					

20116AEC55L	Food and Dairy Microbiology and Molecular Biology Lab	0	0	3	2
20116AEC56L	Agricultural and Environmental Microbiology Lab	0	0	3	2
RESEARCH SKILL BASED COURSE					
20116BRC57	Participation in Bounded Research	-	-	-	1
	Total	**16**	**4**	**6**	**19**
AUDIT COURSE					
201ACLSPSL	Professional Skills	-	-	-	**2**
SEMESTER – VI					
Course Code	**Course Title**	**L**	**T**	**P**	**C**
THEORY					
20116AEC61	Industrial Microbiology	4	1	0	4
20116SEC62	Clinical Microbiology	4	1	0	5
20116DSC63_	Discipline Specific Elective - II	4	1	0	3
201—OEC (2 DIGIT COURSE Name)	Open Elective	4	0	0	2
PRACTICAL					
20116AEC64L	Industrial Microbiology Lab	0	0	3	2
20116SEC65L	Clinical Microbiology Lab	0	0	3	2
20116PRW66	Project Work	-	-	-	4
20116PROEE	Program Exit Examination	-	-	-	1
	Total	**16**	**3**	**6**	**23**
AUDIT COURSE					
201ACSSIST	Interview Skills Training and Mock Test	-	-	-	**2**
201ACLSCET	Community Engagement	-	-	-	**1**
Total Credits -Programme					**115**

Total Credits - Audit Courses	19

Discipline Specific Electives

Semester	Discipline Specific Elective Courses-I
V	a) 20116DSC54A - Proteomics b) 20116DSC54B – Bioinoculants
	Discipline Specific Elective Courses-I
VI	a) 20116DSC63A-Recombinant DNA Technnology b) 20116DSC63B – Bioethics

Open Electives

Semester	Open Elective Courses
VI	a) 201TNOEC-Tamil Ilakkiya Varalaru b) 201ENOEC-Journalism c) 201MAOEC-Development of Mathematical Skills d) 201PHOEC-Instrumentation e) 201CEOEC-Food and Adulteration f) 201CSOEC – E-Learning g) 201CAOEC-Web Technology h) 201CMOEC-Banking service

Credit Distribution

Sem	AEC	SEC	DSC	OEC	Research	Others	Total
I	17	-	-	-	-	-	17
II	17	-	-	-	1	-	18
III	17	-	-	-	2	-	19
IV	17	-	-	-	-	2	19
V	15	-	3	-	1	-	19
VI	6	7	3	2	4	1	23
Total	**89**	**7**	**6**	**2**	**8**	**3**	**115**

HOD **DEAN**

Course Code	Course Title	L	T	P	C
17110AEC11	Tamil-I	4	0	0	2

பிரிஸ்ட் நிகர்நிலைப் பல்கலைக்கழகம்- வல்லம், தஞ்சாவூர்

பாடகுறியாடு:

தமிழ் முதல் பருவம்

முதலாம் ஆண்டு

இக்காலஇலக்கியம் - செய்யுள், சிறுகதை, நாடகம், இலக்கியவரலாறு

அலகு: 1.செய்யுள்

1. தாயுமானவசுவாமிகள் - ஆதாரபுவனம் - சிதம்பரரகசியம் - 40 அடிகள்

2. இராமலிங்கஅடிகள் - திருவருட்பா- கருணைவிண்ணப்பம் - 40 அடிகள்

3. கவிமணிதேசிகவிநாயகம் பிள்ளை- மலரும் மாலையும் - 52 அடிகள்

4. பாரதியார் - புதுமைப்பெண் - 40 அடிகள்

5. பாரதிதாசன் - பாரதிதாசன் கவிதைகள் ,தமிழ் இனிமை, தமிழ் உணவு

அலகு: 2. செய்யுள்:

6 . நாமக்கல் கவிஞர் - தமிழ் தேன் - தமிழ் வளர்க்கசபதம் செய்வோம் , 40 அடிகள்

7. ந.பிச்சமூர்த்தி- வழித்துணை- கவிதைகருடன் , 42 அடிகள்

8.சுரதா- தேன்மழை, கலப்பை, 22 அடிகள்

9. கண்ணதாசன் - இலக்கியம் , ஒருபானையின் கதை, 54 அடிகள்

10. அப்துல் ரகுமான் - சொந்தசிறகுகள், குப்பையைகிளறும் சிறகுகள், 80 அடிகள்

அலகு: 3. சிறுகதை:

11. சு.சமுத்திரம் - வேரில் பழுத்தபலா

அலகு: 4. நாடகம் :

12. கு. வெ. பாலசுப்பிரமணியன் , கௌதமபுத்தர் (உரைநடைநாடகம்)

அலகு: 5. இலக்கியவரலாறு

13. சிறுகதை, புதினம், நாடகம் உரைநடை, கவிதை, புதுக்கவிதை

Course Code	Course Title	L	T	P	C
20111AEC11	Advanced English-I	4	0	0	2

Aim:

1. To improve the knowledge of English

Course Objective:

- To familiarize with the glossary terms, figures of speech
- To enhance vocabulary
- To learn how to edit and proof read
- To know the comparison and contrast and cause and effect forms
- To understand the impact of the speeches of famous people

Course Outcome:

- Develop vocabulary
- Learn to edit and do proof reading
- Read and comprehend literature

UNIT –I

Glossary of grammar terms, Figures of speech

UNIT – II

Foreign words and phrases, British and American Vocabulary

UNIT – III

Comparison and contrast, Cause and effect

UNIT – IV

Editing , Proof reading

UNIT – V

Speeches of famous people:

Mahatma Gandhi-Abraham Lincoln-Swami Vivekananda-John F. Kennedy

Reference book:

Author	**Title of the book**	**Edition / Year**	**Publisher**
Wren and Martin	English Grammar	2009	S.Chand& Company Ltd
Meenakshi Raman & 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**
20111AEC12	English-I	4	0	0	2

Aim:

- To acquaint with learning English through literature

Objective:

- To improve English delightfully through simple poems, essays
- To throw light on fiction
- To read and comprehend literature

Outcome:

- Read and comprehend literature
- Appreciate the different types of poetry and prose

UNIT –I

Because I could not Stop for Death -Emily Dickinson

Stopping by Woods on a Snowy Evening -Robert Frost

UNIT – II

Enterprise -Nissim Ezekiel

Love poem for a wife -A.K Ramanujam

UNIT –III

The Art of Reading - Lin Yutang

An Eco-Feminist Vision -Aruna Gnanadason

UNIT –IV

The Merchant of Death -Nanda Kishore Mishra & John Kennet

She Spoke for all Nature -Young world 'The Hindu'

UNIT –V

Oliver Twist -Charles Dickens

Text book:

Author	**Title of the book**	**Edition / Year**	**Publisher**
S.Murugesan/ Dr.K.Chellappan	The Art of Reading/ Experiencing Poetry	Reprint 2004	Emerald Publishers

Course Code	**Course Title**	**L**	**T**	**P**	**C**
20116AEC13	Fundamentals of Microbiology	6	1	0	5

Aim

- To impart the basic principles and applications of microorganism

Objectives

- To provide a essential informations of microorganism for progressive and applied reforms in biological sciences for human welfare

Out Comes

CO1 – To Describe the characteristics of microorganisms and classification

CO2 – To Understand the concepts of growth and reproduction of microbes

CO3 – To explain the beneficial and detrimental effects of microorganisms

CO4 - To Gather theoretical background of microbial cultivation

Unit – I

Introduction – definition, scope and history of microbiology, differences between the prokaryotic and eukaryotic microorganisms. Classification of microorganisms – general principles and

nomenclature – Haeckel's three kingdom concept, Whittaker's five kingdom concept – Classification and characterization of bacteria according to Bergey's manual of Systematic Bacteriology. Basic understanding of classification of viruses, algae, fungi and protozoa.

Unit – II

Microscopy: Principles and application of simple, compound, bright field, dark field, phase contrast, fluorescent and Electron microscopy. Principles of staining: Nature of dyes, types of staining – simple, differential, negative and spore staining. Sterilization: Principles and methods – physical and chemical.

Unit – III

General characteristics and nature of archacbacteria, Eubacteria, Cyanobacteria, Ricketsiae, Chlamydiae, Spirochaetes, Actinomycetes, Protozoa, Viruses including phages, Mycoplasmas, Algae and fungi.

Unit – IV

Microbial Cell: Ultrastructure of bacteria, subcellular structures and cell envelope – slime, capsule, cell wall, pili, flagella, cell inclusions, biosynthesis of bacterial cell wall, cell membrane – Biomembrane, liposomes – membrane transport – diffusion, active and passive transport and osmoregulation

Unit – V

Culture techniques: types of media simple, defined, enriched and transport media with specific examples for each type. Methods of maintenance and preservation of cultures

Text book:

S. No	Author Name	Title of the Book	Edition/year	Publisher
1.	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5th /1993	Tata McGraw-Hill, Inc, Newyork

Reference Book:

1. Stainer R.Y., Ingraham J.L. Wheelia M.L. and Painter P.R. (1986). General Microbiology, Macmillan Education Ltd, London.
2. Fundamental of Microbiology (2005) By Purohit, Agrobios Publishers, Meerut

Course Code	Course Title	L	T	P	C
20115AEC14B	Bio Chemistry I	6	1	0	4

Aim

- To provide the basic of biochemistry and its application.

Objectives

- It serves as good research techniques and the ability to combine and analyzeinformation.

Outcomes

CO1 – To Develop fundamental knowledge about various biomolecules

CO2 - To Understand the basic concepts related to enzymes

CO3 - To Know various biochemical pathway

CO4 - To Understand the concept of microbial metabolism.

Unit I

Carbohydrates: Definition, Classification and Properties; Structural Elucidation of Glucose and fructose; Biological Functions of Glucose, fructose, starch, Cellulose, Chitin and Heparin.

Unit II

Amino acids: Structure, Classification, Properties.

Peptides: Amides and Peptides, Peptide bond, Peptide synthesis, Biologically important Peptides.

Proteins: Biological importance, Classification, properties; Structural orders; Protein stability; Separation and purification of proteins.

Unit III

Nucleotides and Polynucleotides; Terminology –Components.DNA and RNA – Composition, Structure, their biological importance.

Unit IV

Lipids: Biological Significance, Classification of lipids. Analysis of oils – Iodine Number, Saponification Value, Acid number, Acetyl value and Reichert-Meisel value; Qualitative Tests for Lipids.

Unit V

Vitamins: Source, Structure of Biological Role requirement, deficiency manifestation of fat soluble (A, D, E and K) and water soluble (B complexes and C) vitamins.

References:

1. Fundamentals of Biochemistry – O.P.Agarwal
2. Essentials of Biochemistry – M.C.Pant
3. Essentials of Biochemistry – A.J.Jain
4. Principles of Biochemistry – Lehninger.
5. Text book of Biochemistry – West & Todd.
6. Harper's Biochemistry , 25th edn., McGraw Hill.

Course Code	Course Title	L	T	P	C
20116AEC15L	Fundamentals of Microbiology Lab	0	0	3	2

Aim

- To understand the basic principles of Microbiology laboratory.

Objectives

- Microbiology laboratory guidelines and necessary equipment
- Isolation methods for microorganisms.
- Various staining techniques for the observation of microbes.

Outcomes

CO1 – To Develop basic skills in aseptic techniques formicrobiology practical.

CO2 – To gain Hands on experience in handling ofvarious important instruments.

CO3 - Able to perform basic experiments to grow and study microorganism in laboratory

CO4 - To Develop knowledge on identification of microorganisms.

1 Microscope and its operation

2 Cleaning of glassware's and sterilization methods – autoclaving and hot air oven
3 Preparation of culture media

4 Experimental demonstration of ubiquitous nature of microorganisms.
5 Quantitative estimation of microorganisms**.**

6 Observation of permanent slides to study the structural characteristics of algae**(***Anabaena, Nostoc, Scytonema, Spirulina, Oscillatoria,)* Fungi (*Pythium*, *Rhizopus*, Saccharomyces, Penicillium, Aspergillus, Agricus) and protozoa (*Entamoeba hystolytica* and *Plasmodium* Spp*)*
7 Isolation of microorganisms from soil, water and air.
8 Test for motility of bacteria – Hanging drop method and semi solid media inoculation
9 Staining techniques – simple staining. Gram's staining, Spore staining, Capsular staining

Course Code	Course Title	L	T	P	C
20115AEC16BL	Bio Chemistry I Lab	0	0	3	2

Aim

- To make students familiar with practical techniques used for studying biochemical structure and analysis of biochemical methods.

Objectives

- To familiarize the students with the basic cellular processes at molecular level

Outcomes

CO1 - To gain Practical knowledge about various techniques used in Biochemistry

CO2 - To Exhibit the well practical knowledge about estimation of carbohydrates, protein.

CO3 – To Learn the quantitative and qualitative estimation biochemical analysis.

1. Qualitative Analysis of Carbohydrate.
2. Qualitative Analysis of Proteins.
3. Colour Reactions for Amino Acids.

Course Code	Course Title	L	T	P	C
201ACLSICN	Indian Constitition	-	-	-	2

Objectives:

1. To make the students understand about the democratic rule and parliamentarian administration

2. To appreciate the salient features of the Indian constitution

3.To know the fundamental rights and constitutional remedies

4. 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.

Outcome

CO1- To gain Democratic values and citizenship Training

CO2- To know the Awareness on fundamental Rights are established

CO3- To learn the functions of union Government and State Government

CO4- To learn the Power and functions of the Judiciary thoroughly

CO5- To learn the Appreciation of Democratic Parliamentary Rule

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
201ACLSUHV	Universal Human Values	-	-	-	2

Aim:

This course aims at making learners conscious about universal human values in an integralmanner, 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:

1. Know about universal human values and understand the importance of values in individual, social circles, career path, and national life.
2. Learn from case studies of lives of great and successful people who followed and

practised human values and achieved self-actualisation.

3. Become conscious practitioners of human values.
4. Realise their potential as human beings and conduct themselves properly in the ways of the world.

Unit I

- Introduction:What is love? Formsoflove—forself, parents, family, friend, spouse, community, nation, humanity and other beings, both for living and non-living
- Love and compassion and inter-relatedness
- Love, compassion, empathy, sympathy and non-violence
- Individuals who are remembered in history for practicing compassion and love.
- Narratives and anecdotes from history, literature including local folklore
- Practicing love and compassion: What will learners learn gain if they practice love and compassion? What will learners lose if they don't practice love and compassion?
- Sharing learner's individual and/or group experience(s)
- Simulated Situations
- Casestudies

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 thisvalue
- Narratives and anecdotes from history, literature including localfolklore
- Practicing Truth: What will learners learn/gain if they practice truth? What will learners lose if they don't practiceit?
- Learners' individual and/or group experience(s)
- Simulated situations
- Casestudies

Unit III

- Introduction: What is non-violence? Its need. Love, compassion, empathy sympathy for others as pre-requisites for non-violence
- Ahimsa as non-violence and non-killing
- Individuals and organisations that are known for their commitment to non-violence

- Narratives and anecdotesaboutnon-violence from history,and literature including local folklore

- Practicingnon-violence: What will learners learn/gain if they practice non- violence? What will learners lose if they don't practice it?
- Sharing learner's individual and/or group experience(s) about non-violence
- Simulated situations
- Casestudies

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
- Casestudies

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
- Simulatedsituations
- Casestudies

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

- Practicingservice: 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
- Casestudies

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
- Casestudies

SEMESTER II

SEMESTER II

Course Code	Course Title	L	T	P	C
20110AEC21	Tamil-II	4	0	0	2

பிரிஸ்ட் நிகர்நிலைப் பல்கலைக்கழகம்- வல்லம், தஞ்சாவூர்

பாடகுறியாடு:

தமிழ்இரண்டாம்பருவம்

முதலாம்ஆண்டு

செய்யுள், பக்திஇலக்கியம், சிற்றிலக்கியம், இலக்கியவரலாறு

அலகு: 1. செய்யுள்:

1. திருஞானசம்பந்தர்தேவாரம்- கோளறுபதிகம்
2. திருநாவுக்கரசர்தேவாரம்- தனிக்குறுந்தொகை

3. சுந்தரர்தேவாரம்- திருநொடித்தான்மலை

4. மாணிக்கவாசகர்- திருவாசகம்- தருப்பொன்ஊசல்

அலகு: 2 . செய்யுள்:

5. குலசேகராழ்வார்- பெருமாள்திருமொழி

6. நம்மாழ்வார்திருவாய்மொழி- இரண்டாம்பத்து- உலகிற்குஉபதேசம்

7. ஆண்டாள்- நாச்சியார்திருமொழி- திருமணக்கனவைஉரைத்தல்

8. திருமங்கைஆழ்வார்- சிறியதிருமடல்

அலகு: 3 . செய்யுள்:

9 . திருமூலர்- மூன்றாம்திருமுறை

10 . குமரகுருபரர்- மானாட்சியம்மைப்பிள்ளை- தமிழ்வருகைப்பருவம்

11 . திரிகூடராசப்பக்கவிராயர்- குற்றாலக்குறவஞ்சி- குறத்திநாட்டுவளங்கூறுதல்

12 . வீரமாமுனிவர் - திருக்காவலூர்க் கலம்பகம்

அலகு: 4 . புதினம்

13 . கு.வெ. பாலசுப்ரமணியன்- காளவாய்

அலகு: 5 . இலக்கியவரலாறு

14 . சைவவைணவஇலக்கியங்கள், சிற்றிலக்கியங்கள், (பள்ளு- பிள்ளைத்தமிழ்,- பரணி)

Course Code	Course Title	L	T	P	C
20111AEC21	Advanced English-II	4	0	0	2

Aim:

- To improve the knowledge of English

Objective:

- To understand the format of e-mail, fax and memos
- To write itinerary, checklist, invitation, circular, instruction, recommendations
- To know the impact of the biographies of famous people

Outcome:

- Develop technological skill
- Able to write in a variety of formats
- Read biographies and develop personality

UNIT –I

E-mail

Fax

Memos

UNIT – II

Itinerary

Checklist

UNIT – III

Invitation

Circular

UNIT – IV

Instruction

Recommendations

UNIT – V

Biographies of famous people:

Mother Teresa-Madam Curie-Charles Chaplin-Vikram Sarabhai

Text Book

Author	Title of the book	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
20111AEC22	English-II	4	0	0	2

Aim:

- To acquaint learners with different trends of writing

Objective:

- To acquire language skills through literature
- To enable the students to appreciate literature
- To develop the conversational skills through one act plays

Outcome:

- Appreciate different forms of literature
- Enhance language skills through literature
- Broaden the horizon of knowledge

UNIT – I

Ecology	-A.K. Ramanujan
Gift	-Alice Walker
The First Meeting	-Sujata Bhatt

UNIT –II

Fueled	-Marcie Hans
Asleep	-Ernst Jandl
Buying and selling	-Khalil Gibran

UNIT –III

The End of living and The Beginning of Survival	- Chief Seattle
My Wood	- E.M.Forster
The Meeting of Races	- Rabindranath Tagore

UNIT – IV

The Refugee	-K.A. Abbas
I Have a Dream	-Martin Luther king
Those People Next Door	-A.G. Gardiner

UNIT – V

Marriage is a private Affair	-Chinua Achebe
The Fortune Teller	-Karel Capek
Proposal	-Anton Chekov

Text book:

Author	**Title of the book**	**Edition / Year**	**Publisher**
Gowri Sivaraman	Gathered Wisdom	Reprint 2010	Emerald Publishers

Course Code	Course Title	L	T	P	C
20116AEC23	Microbial Physiology	6	1	0	5

Aim

- To instruct the importance of microbial metabolism and energetics for regulation and application of microbes in industry.

Objectives

- To understand the microbial growth and nutritional requirements.
- Studying the comprehensive awareness on metabolic process involved in prokaryotic and eukaryotic microorganisms.

Outcomes

CO1- To Determining the growth features of the microbes with various environmental factors.
CO2– To Analysis the essential nutrients ensuring microbial growth.

CO3 - To understand the significance of microbial surveillance

CO4- To know the Electron transport and metabolic pathway of living systems

Unit – I

Nutrition and growth of microorganisms: Nutritional types of microorganisms, nutritional requirements. Factors influencing the growth of microorganisms temperature, pH, Osmotic pressure, moisture, radiations and different chemicals. Physiology of growth – significance of various phases of growth - Growth Measurements – batch, continuous and synchronous

Unit – II

Enzymes and co –enzymes: classification and nomenclature of enzymes, active site, Lock and key Machanism and induced fit hypothesis, Enzyme kinetics- negative and positive co-operatively, enzyme inhibition: Reversible – Competitive, Noncompetitive, uncompetitive, Irreversible inhibition.

Unit – III

Metabolism of carbohydrates: Anabolism – photosynthesis – oxygenic –anoxygenic, synthesis of carbohydrate – catabolism of glucose – Embden Mayer – Hoff – Parnas pathway – Pentose pathway, Kreb's cycle (TCA) – electron transport system and ATP production.

Unit – IV

Metabolism of protein – metabolic pathways of nitrogen utilization (urea cycle), synthesis of amino acids, peptides, proteins

Unit – V

Anaerbic – Respiration and fermentations. Anabolic and catabolic processes of lipids - Reproductive physiology of microorganisms.

Text Book:

S. No	Author Name	Title of the Book	Edition/year	Publisher
1	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5th /1993	Tata McGraw-Hill, Inc, Newyork

Reference Book:

1. Holt J.S., Krieg N.R., Sneath P.H.A and Williams S.T.(1994). Bergey's Menual of Determinative Bacteriology(9th Edition) – Williams & Wilkins, Baltimore.
2. Brige E.A.(1992) Modern Microbiology – Wrn.C. Brown Publishers, Deubque, USA
3. Goodfellow M. and O'Dennell A.C.(1994) Chemical methods of prokaryote systematic – John Wiley & Sons, New York
4. Murray R.K., Cranner M.D., Mayea P.A. and Rodwell V.W.(1990). Biochemistry-prentice Hall International Inc., London
5. Bryant D.A. (1994). The molecular Biology of Cyan Bacteria – Khrwer Academic Publisher, London.

Course Code	Course Title	L	T	P	C
20115AEC24	Bio Chemistry II	6	1	0	4

Aim

- To provide the basic of biochemistry and its application.

Objectives

- It serves as good research techniques and the ability to combine and analyzeinformation.

Outcomes

CO1- To Develop a very good understanding of various biomolecules

CO2 - To gain knowledge about lipids and fatty acids

CO3- To gain knowledge about multifarious function of proteins

CO4- To understand about metabolism.

Unit I

Organization of Life. Water – Physical Properties, Structure of Water, Weak Interactions in aqueous environment; Role of Water in life.

Bioenergetics – Laws of thermodynamics; Free energy concepts; ATP and ADP cycles; ATP as energy currency of cells.

Unit II

Release of energy into cells - Major metabolic pathways – Glycolysis, TCA cycle, Glycogenolysis, Gluconeogenesis, Fatty acid oxidation, ETC and Oxidative phosphorylation.

Unit III

Composition and functions of plant and bacterial cell wall. Biological membrane – Fluid mosaic model; Transport across membranes. Phytohormones – Auxin, Gibberllin and cytokinin.

Unit IV

Cell and cell organelles – Structure and functions of cell organelles – Nucleus, Mitochondria, Chloroplast - Photosynthesis, Golgi apparatus, Endoplasmic reticulum and Micro bodies.

Unit V

Enzymes – Classification, Nomenclature, Mechanism of enzyme action; factors influencing enzyme action – pH and Temperature; Specific activity; MM equation and its significances.

References:

1. Principles of Biochemistry – Lehninger.
2. Cell Biology – DeRobertis and DeRobertis
3. Cell Biology – Rastogi
4. Cell Biology – C.B.Powar.

5. Biophysical Chemistry – Principles and techniques – Upadhayay, Upadhyay and Nath.
6. Principles and techniques of practical Biochemistry – Wilson & Walker.

Course Code	Course Title	L	T	P	C
20116AEC25L	Microbial Physiology Lab	0	0	3	2

Aim

- To study the nutritional requirement of microbes.

Objectives

- To study the growth patten of bacteria
- To test the biochemical characterization of microbes.

Outcomes

CO1- To Understand and predict the various metabolic reactions in microbial cell.

CO2- To Predict the intermediate products which can be employed in industrial production.

CO3- To know the Environmental growth kinetics of microorganism.

1. Bacterial culture / isolation techniques, a streaking method, b.Pour plate method
2. Isolation and cultivation of fungi
3. Bacterial growth curve: cell count / viable count / absorbance (total count)
4. Carbohydrate fermentation test:
    a. Glucose
    b. Lactose,
    c. Maltose
    d. Sucrose
    e. Mannitol

5. Biochemical test for identification of Bacteria:
    a. Indole test
    b. Methyl red
    c. Voges – Proskaur test
    d. Citrate utilization
    e. TSI agar test
    f. Urease
    g. Catalase
    h. Oxidase

Text Books:

1. Pelezar Jr. M.J. Chan E.C.S. and Kroig N.R.(1993). Microbiology – Mcgraw Hill Inc., New York

2 Stainer R.Y., Ingraham J.L. Wheelia M.L. and Painter P.R. (1986). General Microbiology, Macmillan Education Ltd, London

Pelczar, Jr. M.J.

3 Bucker, J.M. Caldwell, G.A., Zachgo, E.A. 1990. A Laboratory Course, Academic Press

4 Harold J.Benson, 1994. Microbial Applications, WM.C. Brown Publishers

Course Code	Course Title	L	T	P	C
20115AEC26L	Bio Chemistry II Lab	0	0	3	2

Aim

- To make students familiar with practical techniques used for studying biochemical structure and analysis of biochemical methods.

Objectives

- To familiarize the students with the basic cellular processes at molecular level

Outcomes

CO1- To demonstrate an understanding of fundamental biochemical principles

CO2-To learn the structure/function of biomolecules, metabolic pathways, and regulation

CO3- Students are able to make buffers, study enzyme kinetics

1. Estimation of reducing sugar by Benedict's Quantitative Method.
2. Estimation of Ascorbic acid by Titrimetric Method.
3. Estimation of Amino Acid by Formal Titration.
4. Estimation of RNA by Orcinol Method.
5. Estimation of DNA by Diphenylamine method.
6. Determination of Acid Number of edible oil.
7. Separation of amino acids by paper chromatography.
8. Separation of amino acids by TLC.
9. Separation of plant pigments by column chromatography.

References:

1. Manuals in Biochemistry – J.Jayaraman
2. Manual in Biochemistry – S,Ramakrishnan
3. Practical Biochemistry – Plummer

Course Code	Course Title	L	T	P	C
201ACLSCOS	Communication Skills	**-**	**-**	**-**	**2**

Aim:

Course Objectives :

This course has been developed with the following objectives:

1. Identify common communication problems that may be holding learnersback
2. Identify what their non-verbal messages are communicating toothers
3. Understand role of communication in teaching-learningprocess

4. Learning to communicate through the digitalmedia
5. Understand the importance of empatheticlistening
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 effectivelistening
- Listening andcomprehension
- Probing questions
- Barriers tolistening

Unit II

- Pronunciation
- Enunciation
- Vocabulary
- Fluency
- CommonErrors

Unit III

- Techniques of effectivereading
- Gathering ideas and information from a giventext
    i. Identify the main claim of thetext
    ii. Identify the purpose of thetext
    iii. Identify the context of thetext
    iv. Identify the conceptsmentioned
- Evaluating these ideas andinformation
    i. Identify the arguments employed in thetext
    ii. Identify the theories employed or assumed in thetext
- Interpret thetext
    i. To understand what a textsays
    ii. To understand what a textdoes
    iii. To understand what a textmeans

Unit IV

- Clearly state theclaims
- Avoid ambiguity, vagueness, unwanted generalisations and over simplification of issues

- Provide backgroundinformation
- Effectively argue theclaim
- Provide evidence for theclaims
- Use examples to explainconcepts
- Followconvention
- Be properlysequenced
- Use proper signpostingtechniques
- Be well structured

i. Well-knit logicalsequence
ii. Narrativesequence
iii. Categorygroupings

- Different modesofWriting -
  i. E-mails
  ii. Proposal writing for HigherStudies
  iii. Recording the proceedings ofmeetings
  iv. Any other mode of writing relevant forlearners

Unit V

- Role of Digital literacy in professionallife
- Trends and opportunities in using digital technology inworkplace
- InternetBasics
- Introduction to MS Officetools
  i. Paint
  ii. Office
  iii. Excel
  iv. Powerpoint

Unit VI

- Introduction to social mediawebsites
- Advantages of socialmedia
- Ethics and etiquettes of socialmedia
- How to use Google searchbetter
- Effective ways of using SocialMedia
- Introduction to DigitalMarketing

Unit VII

- Meaning of non-verbalcommunication
- Introduction to modes of non-verbalcommunication
- Breaking the misbeliefs
- Open and Closed Bodylanguage
- Eye Contact and FacialExpression
- HandGestures
- Do's andDon'ts
- Learning fromexperts
- Activities-BasedLearning

Reference:

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

SEMESTER – III

Course Code	Course Title	L	T	P	C
20110AEC31	Tamil-III	4	0	0	2

பிரிஸ்ட் நிகர்நிலைப் பல்கலைக்கழகம்- வல்லம், தஞ்சாவூர்

பாடகுறியாடு:

தமிழ்மூன்றாம்பருவம்

இரண்டாம்ஆண்டு

செய்யுள், காப்பியங்கள்இலக்கியவரலாறு

செய்யுள்

அலகு: 1

1. சிலப்பதிகாரம்- மனையறம்படுத்தகாதை
2. மணிமேகலை- ஆதிரைபிச்சையிட்டகாதை
3. சீவக சிந்தாமணி - விமலையார் இலம்பகம்

அலகு:2

4. பெரியபுராணம்- இளையான்குடிமாறநாயனார்புராணம்
5. கம்பராமாயணம்- கைகேயிசூழ்வினைப்படலம்

அலகு:3

6. சீறாப்புராணம் - நபி அவதாரப் படலம் - 24 வரிகள்
7. தேம்பாவணி- வாமன்ஆட்சிபடலம்- முதல்5 பாடல்கள்

அலகு:4

8. நளவெண்பா- சுயம்வரகாண்டம்(20 - 51)

அலகு. 5 : இலக்கியவரலாறு

9. காப்பியங்கள், ஐஞ்சிறுகாப்பியங்கள், புராணங்கள், இதிகாசங்கள்

Course Code	Course Title	L	T	P	C
20111AEC31	Advanced English-III	4	0	0	2

Aim:

- To improve the knowledge of English

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

Outcome:

- Understand phonetics
- Develop writing skill
- Able to develop creative writing

UNIT –I

The organs of speech

Classification of speech sounds

Vowels and Diphthongs

UNIT –II

Consonants

Consonant cluster

UNIT – III

Syllable

Word accent

Intonation

UNIT – IV

Idiom

Interpretation of graphics

UNIT – V

Slogan writing

Writing advertisement

Reference books:

Author	**Title of the book**	**Edition / Year**	**Publisher**
T.B. Balasubramaniyan	A text book of Phonetics for Indian Students	Reprint 2008	Macmillian
Meenakshi Sharma & Sangeetha Sharma	Technical Communication	2011	Oxford University Press

Course Code	**Course Title**	**L**	**T**	**P**	**C**
20111AEC32	English-III	4	0	0	2

Aim:

- To acquaint with learning English through literature

Objective:

- To sensitize language use through prescribed text
- To develop the conversational skills through one act plays

Outcome:

- Appreciate different types of prose
- Develop the conversational skills through one act plays
- Enhance the skill of making grammatically correct sentences.

UNIT – 1

The Doctor's World - R.K. Narayan

The Postmaster - Rabindranath Tagore

Princess September - E.Somerest Maugham

UNIT – II

The Price of Flowers -Prabhat Kumar Mukhopadhyay

The Open Window -Saki

The Model Millionaire -Oscar Wilde

UNIT –III

My Brother My Brother - Norah Burke

Uneasy Home Coming - Will F. Jenkins

Resignation - Premchand

UNIT –IV

The Referee -W.H. Andrews & Geoffrey Dreamer

The Case of the Stolen Diamonds -Farrell Mitchell

UNIT – V

The Dear Departed -Stanley Houghton

The Princess and the Wood Cutter -Alan Alexander Milne

Text book:

Author	**Title of the book**	**Edition / Year**	**Publisher**
Steuart H.King	Nine Short Stories	Reprint 2001	Blackie Books

T.Prabhakar	One – Act Play		Emerald

Course Code	Course Title	L	T	P	C

20116AEC33	Immunology	4	1	0	4

Aim:

- Intended to impart the basic and essential information on immune system.

Objectives

- This course focuses on the concepts of immune system in human body.
- To create awareness on immunity
- To give knowledge on antigen and antibody
- To learn human diseases and vaccine

Outcomes

CO1- To understand theory linked to cells and organs related to immune system.
CO2- Able to know Immune response and immune mechanism.
CO3- To Understand the mechanism of Immunological disorders.
CO4- To Learn the importance and precautions of Immunodeficiency syndromes

Unit I

Introduction- History of immunology-scope of immunology. Immunity and their types- Innate and Acquired immunity, Active and Passive immunity. Immune response- Humoral and Cell mediated immune response.

Unit II

Lymphoid organs- primary and secondary lymphoid organs and their role. Cells of the immune system – Stem cell, Lymphocytes, T and B lymphocytes. Plasma cell, T Helper cell, T suppressor cell, T-cytotoxic cell, Null cells, Killer cell, Macrophages, Blood cells and platelets.

Unit III

Antigen- types, chemical nature and essential factors of antigen, Hapten, Adjuvants, Immunoglobulin - Structure, classes, properties and functions. Antigen- antibody reactions.

Unit IV

Complement- Salient features, complement activation, Classical pathway, Alternative pathway, Biological function of complement system. Major Histocompatability complex (MHC)- Types and functions.

Unit V

Monoclonal antibodies, Hypersensitivity reactions, Immunoprophylaxis, Vaccines – types, Toxoid and antitoxin, Immunoelectrophoresis, HLA typing, ELISA and RIA

Text Books

S. No	Author Name	Title of the Book	Edition/year	Publisher
1.	Kuby	Immunology	4^{th} / 2000	W.H. Frumen and Company

Reference Book:

1. Abul. K. Abbas, Andrew H.Lichtman, Jordan S.Pobar 1994. Cellular and Molecular Immunology. II edition. W.B.Saunders, U.S.A.
2. William E.Paul 1993. Fundamental Immunology. II edition, Raven press, New York.
3. Topley & Wilson's 1990. Principles of Bacteriology, Virology and Immunity VIII edition Vol.I General Microbiology and Immunity. Edward Arnold, London.
4. Lesile Hudson, Frank C.Hay, 1989. III edition. Practical Immunology. Blackwell Scientific Publication.
5. Helen Chapel, Mansel Haeney. 1986. Essentials of clinical Immunology . ELBS.
6. Mackett M. and Wiliamson J.D.1995. Human vaccines and vaccination. BIOS Scientific Publishers.
7. Bernard R.Glick and Jack J.Pasternak 1994. Molecular Biotechnology – Principles and Applications of Recombinant DNA. ASM Press, Washington.

Course Code	Course Title	L	T	P	C
20116AEC34	Cell Biology	4	1	0	5

Aim:

- Students will understand the cellular basis of life and their importance.

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:

- To grasp the significance of cell and its components in living systems
- To understand the and describe the structures and basic components of prokaryotic and eukaryotic cells
- To understand the cyclical events of cell division and types of cell division
- To acquire the knowledge of cell biology for understanding various physiological process
- To understand the synthesis of cellular compounds and cell signaling

Unit - I

History of cell biology, cell as basic unit of life, cell theory, protoplasm theory and organismal theory, broad classification of cell types, Bacteria, Archaea (prokaryotic) and eukaryotic cells and their similarities and differences.

Unit - II

Cell Organelles- Nucleus, Endoplasmic Reticulum(link is external), Golgi Apparatus, Mitochondria(link is external), Chloroplast(link is external), Lysosome, Peroxisome – Protein Sorting & Transport – Cytoskeleton(link is external) & Cell Movement – The Plasma Membrane

Unit - III

Biogenesis of Cellular organelles – Biosynthesis of mitochondria, chloroplast, ER, Golgi complex; Biosynthetic process in ER and golgi apparatus; Protein synthesis and folding in the cytoplasm; Degradation of cellular components.

Unit - IV

Cell cycle - An overview of cell cycle; Components of cell cycle control system; Intracellular and Extra-cellular control of cell division, Programmed cell death (Apoptosis), intrinsic & extrinsic pathways of cell death, Apoptosis in relation with Cancer and Viral disease

Unit - V

Cell communication – overview – types of cell signaling – signal molecules – signal amplification – receptor types – quorum sensing.

REFERENCES

- Verma P.S. and Agarwal V.K. (2016) Cell Biology (Cytology, Biomolecules,Molecular Biology), Paperback, S. Chand and Company Ltd.

- 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

- The Cell, A Molecular Approach(link is external) – 6th Edition – Geoffrey M.Cooper/Robert E.Hausman- Sinauer Associates, Inc.

- KumarP. and Mina U. (2014) Life Sciences: Fundamentals and Practice, Part-I, 4thEdn. Pathfinder Publication. p.582.

Course Code	Course Title	L	T	P	C
20116AEC35L	Immunology Lab	0	0	3	2

Aim

- To learn the immunological techniques in disease diagnosis.

Objectives

- Acquire knowledge on antigen antibody reactions.
- Styding the immunology tests and their interpretations.

Outcomes

CO1- Able to know about principles and techniques Blood grouping
CO2- To Understand the immunological experiments for clinical field
CO3- To know the methods of Counting of RBC, WBC and platelets

Lab work

1. ABO Blood Grouping
2. Rh typing
3. WIDAL Test
4. White Blood Cell Count
5. Red Blood Cell Count
6. Antigen preparation
7. Radial Immunodiffusion
8. Double Immunodiffusion
9. Demonstration of ELISA
10. Demonstration of RIA

References

1. O'Gorman, Manrice RG and Albert David Donnenberg. Hand book of human Immunology. Boca Raton, FL: CRC press, Francis.2008.
2. Rajan S and Selvi Christy R. Experiments in Microbiology. Anjana Books House, Chennai. 2015.

Course Code	Course Title	L	T	P	C

20116AEC36L	Cell Biology Lab	0	0	3	2

Aim:

- Students will understand the cellular basis of life and their importance.

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:

- To grasp the significance of cell and its components in living systems
- To understand the and describe the structures and basic components of prokaryotic and eukaryotic cells
- To understand the cyclical events of cell division and types of cell division

1. Separation of nucleic acid bases by paper chromatography
2. Mitosis in onion root
3. Meiosis in flower bud
4. Normal human karyotyping
5. preparation of polytene chromosome
6. Isolation of chloroplast from spinach leaves
7. Isolation of protoplast
8. Life cycle of Drosophila
9. Culture of Human, Plant & Animal cells
10. Identification and study of cancer cells- Slides/Photomicrographs

REFERENCE:

- Experimental procedures in Life Sciences, S.Rajan and R. Selvi Christy, 2010, Anjanaa book house.
- Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc.

Course Code	Course Title	L	T	P	C
19116RMC37	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 and graphic works required for quality research

Outcomes:

CO1- To Understand research questions and tools

CO2- To gain Experience in scientific writings

CO3- To Practice in various aspects of scientific publications

CO4- To understand Inculcation of research ethics

Prerequesties:

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 treatises – Monographs.

UNIT IV: Database Survey

Database search – NIST – MSDS – PubMed – Scopus – Science citation index – Information about a specific search.

UNIT V:

Basic Principles of Laboratory 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
201ACLSOAN	OFFICE AUTOMATION	-	-	-	2

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 with IT.

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
20110AEC41	Tamil-IV	4	0	0	2

பிரிஸ்ட் நிகர்நிலைப் பல்கலைக்கழகம்- வல்லம், தஞ்சாவூர்

பாடகுறியாடு:

தமிழ்.

நான்காம்பருவம்

இரண்டாம்ஆண்டு

செய்யுள், சங்கஇலக்கியம், அறஇலக்கியம், செம்மொழி, இலக்கியவரலாறு

அலகு. 1 : பண்டையஇலக்கியம்- நற்றிணை;

1. நெய்தல்- தோழிகூற்று- பாடல்எண். 11

2. குறிஞ்சி- தலைவிகூற்று- பாடல்எண். 64

3. முல்லை- தலைவன்கூற்று- பாடல்எண்.142

4. பாலை- நற்றாய்கூற்று- பாடல்எண். 29

5. மருதம்- தலைவிகூற்று- பாடல்எண். 70

பண்டையஇலக்கியம்குறுந்தொகை

1 . குறிஞ்சி- தோழிகூற்று- பாடல்எண்.1

2. முல்லை- செவிலித்தாய்கூற்று- பாடல்எண்.167

3. மருதம்- தலைவிகூற்று- பாடல்எண். 181

4. நெய்தல்- தலைவிகூற்று- பாடல்எண். 290

5. பாலை- தலைவன்கூற்று- பாடல்எண். 347

பண்டையஇலக்கியம்ஐங்குறுநூறு

1. மருதம்- கள்வன்பத்து- முதல்இரண்டுபாடல்கள்

2. நெய்தல் - தோழிக்குரைத்த பத்து - முதல் இரண்டு பாடல்கள்

3. குறிஞ்சி- குன்றக்குறவன்பத்து- முதல்இரண்டுபாடல்கள்

4. பாலை- இளவேனிற்பத்து- முதல்இரண்டுபாடல்கள்

5. முல்லை- பாசறைப்பத்து- முதல்இரண்டுபாடல்கள்

அலகு. 2 : கலிந்தொகை

1 . பாலை- பாடல்எண். 2

2. குறிஞ்சி- பாடல்எண். 37

அகநானூறு

1 . பாலை- பாடல்எண். 5

2. மருதம்- பாடல்எண். 6

புறநானூறு

பாடல்எண்: 6 ,121, 41, 153 ,172 191, 223, 246, 284, 358.

பதிற்றுப்பத்து

இரண்டாம்பத்துபாடல்எண். 4 (நிலம் நீர் வளி விசும்பு)

அலகு.3;

1 . பட்டினப்பாலை- முதல்105 வரிகள்

2. திருக்குறள்- 1.மருந்து2.ஊக்கமுடைமை3.உழவு

அலகு. 4 : செம்மொழிவரனறு;

(மொழி - விளக்கம், மொழிக்குடும்பங்கள், உலகச்செம்மொழிகள், இந்தியச்செம்மொழிகள், செம்மொழித்தகுதிகள், வரையறைகள், வாழும்தமிழ்செம்மொழி, தொன்மை, தமிழின்சிறப்புகள், தமிழ்செம்மொழிநூல்கள்)

அலகு. 5 : இலக்கியவரலாறு

சங்கஇலக்கியங்கள், பதினெண்கீழ்க்கணக்கு நூல்கள்.

Course Code	Course Title	L	T	P	C
20111AEC41	Advanced English-IV	4	0	0	2

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

Outcome:

- Develop writing skill
- Comprehend and describe poems
- Learn interviewing skills

UNIT –I

Interviews

Objectives, types, ten success factors, ten failure factors - Planning and preparation –Presentation– Type of questions – Answering techniques.

UNIT – II

Flowchart

Proposals

UNIT – III

Discourse markers

Review

UNIT IV

Grammatical forms

Paraphrasing

UNIT –V

Definition

Writing for and against a topic.

Reference books:

Author	**Title of the book**	**Edition / Year**	**Publisher**
Rajendra Pal & J.S Korlahalli	Essentials of Business Communication	2015	Sultan Chand & Sons
Meenakshi Raman & Sangeetha Sharma	Technical Communication	2011	Oxford University Press
Wren & Martin	English Grammar & Composition	2009	S.Chand

Course Code	Course Title	L	T	P	C
20111AEC42	English-IV	4	0	0	2

Aim:

- To learn English through literature

Objective:

- To explore learners to the standard literary texts
- To impart wisdom through morally sound poems and essays
- To introduce Shakespeare to non-literature students

Outcome:

- Improve their ability to read and understand
- Know the genius of Shakespeare
- Express one's views in writing

UNIT –I

My Last Duchess -Robert Browning

The Toys -Coventry Patmore

I, too -Langston Hughes

UNIT –II

How to be a Doctor -Stephen Leacock

My Visions for India -A.P.J. Abdul Kalam

Woman, not the weaker sex -M.K. Gandhi

UNIT –III

The Best Investment I ever made-A.J.Cronin

The Verger -W.S Maugham

A Willing Slave -R.K.Narayan

UNIT –IV

Macbeth

As You Like It

UNIT –V

Henry IV

Tempest

Text book:

Author	Title of the book	Edition / Year	Publisher
Devaraj	English for Enrichment		Emerald Publishers
Board of Editors	Selected Scenes from Shakespeare Book I & II	2012	Emerald Publishers

Course Code	Course Title	L	T	P	C
20116AEC43	Virology	4	1	0	4

Aim:

- To study the characteristics of viruses and viral infections.

Objectives

- To study general aspects of classification and structure of viruses.
- Studyin the viral infections, their diagnosis and treatment strategies.

Outcomes

CO1- To Understand the characteristic features of viruses.

CO2– To Gain the knowledge about the biology of bacteriophages.

CO3– To Learn therange of plant viruses and animal viruses.

CO4 -To know the role of viruses in causing of cancer

.

UNIT – I

Introduction – Definition, History of virology. General properties of Viruses classification of Viruses – cultivation of Viruses – Structure and replications Viruses.

UNIT – II

Bacterial Viruses – structure of bacteriophage, The Lytic life cycle (T-Even coliphages) – Lysogenic life cycle (*Escherchia coli*, Phage Lambda) noninteractive lysogeny (*Escheirchia coli*).

UNIT – III

Plant Viruses, Common plant viral diseases: Tobacco Mosaic **Virus** (TMV), Bunchy top of banana, satellite virus. Cucumber Mosaic **Virus** (CMV), Cauliflower Mosaic **Virus** (CaMV). Bacteriophages, Viroids.

UNIT – IV

Animal viruses: Morphology, pathogenesis and laboratory diagnosis of Prions, Animal viruses Rinder pest, Blue tongue, Raniket dion, Foot and Mouth Disease. Human Viruses – Herpes, HIV, Hepatitis Viruses. Viral Vaccines. Prevention and treatment of viral diseases. Antiviral agents.

UNIT - V

Virus: Assay, purification and characterization of Viruses, Separation and characterization of viral components and quantification of Viruses. Immune responses to viruses, Interferon and other cytokines, Antiviral therapy.

Text books:

S. No	Author Name	Title of the Book	Edition/year	Publisher
1	Nester, E.W, D.G. Anderson, C. Erans Roberts, N.N. Pearsan, M.T. Nester	Introduction Microbiology	4th / 2004	Mc Graw Hill Hyher Education
1.	R. C. Dubey, D.K. Maheswari	A Text Book of	3rd / 2003	Chand Publishing

		Microbiology		

Reference Book:

1. Conrat, H.F.Kimball, P.C. and Levy, J.A.(1988). Virology. II Edition. Prentice Hall, Englewood cliff, New Jersey.
2. Harold J.Benson. 1994. Microbiological Applications. Wm.C.Brown Publishers, Melbourne, Austrialia.
3. James, C.Cappuccino. 1996. Microbiology. The Benjamin/Cummings Pub. Co. Calfornia.

Course Code	**Course Title**	**L**	**T**	**P**	**C**
20116AEC44	Biostatistics and Bioinformatics	5	1	0	5

Aim

- To introduce the basic knowledge on Biostatistics and Bioinformatics tools and its applications

Objective

- The basic objective is to give students an introduction to the biostatistics and bioinformatics.
- Emphasis will be given to the application of biostatistics, bioinformatics and biological databases to problem solving in real research problems.

Outcome

- To understand the importance of principal concepts about biostatistics
- To know the knowledge about statistics and its relation with other science and research aspects
- To obtain the knowledge on bioinformatics databases, perform text- and sequence-based searches
- To become familiar with the use of a wide variety of internet applications, biological database and will be able to apply these methods to research problems.

Unit I

Concepts in statistics, Types of Data, presentation of data, types of graphics, relative frequency, cumulative frequency, Measurement of central tendency, Measures of variation, coefficient of variation, Measures of Skewness and Kurtosis, Probability and its applications, Laws of Addition and Multiplication, Compound probability, Baye's Theorem.

Unit II

Random Variables and Distributions. Binomial, Poisson, Exponential and Normal Distributions and their applications. Samples and Sampling Distribution, Standard Error, significance level, Degrees of freedom, Tests of significance, tests for proportion, t and F tests Confidence. Correlation: Simple, Partial and Multiple Correlation. Regression Analysis. Analysis of variance for one and two way classification

UNIT III

Biological Databases: Structure, Sequence and literature databases. Protein sequence database - PIR, SWISS-PROT, MIPS. Protein structure database - PDB, SCOP. DNA sequence databases – Gen Bank, ENBL, MBL, DDBJ. Literature data base – Med Line, PubMed. Patterns, motifs and profile Databases: Metabolic Pathway Databases.

UNIT IV

Sequence Alignment and Analysis: Local and Global alignment. Scoring matrices. Database Similarity Searches: BLAST, FASTA, PSI-BLAST algorithms; Pair wise sequence alignment - NEEDLEMAN and Wunsch, Smith Waterman algorithms; Multiple sequence alignments - CLUSTAL, PRAS; Patterns, motifs and Profiles in sequences.

UNIT V

Important parameters in Drug Discovery and the role of computational methods. Process of drug discovery – Target identification, target validation, lead identification, lead optimization and preclinical pharmacology and toxicology. Computer Aided Drug Design (CADD). Molecular docking - Concept of receptor and target. Receptor binding and activation. Ligand-receptor interaction, non-covalent bonds. Ligand into the binding site.

References

Andreas D. Baxevanis And B. F. Francis Ouellette. 2001. **Bioinformatics.**A Practical Guide to the Analysis of Genes and Proteins (Second Edition). John Wiley & Sons, Inc.

Arthur M. LESK, 2003 Introduction to Bioinformatics Oxford University Press

Attwood T. K. And Parry-Smith D. J. 2003. Introduction to Bioinformatics. Pearson Education (Singapore) Pvt. Ltd.

Balasubramanian, D., Bryce, C. F. A., Dharmalingam, K., Green, J. And Kunthala Jayaraman. 1996. Concepts in Biotechnology (Edts.) University Press (India) Ltd.

Basu, O., S.K. Thukral. 2007. Bioinformatics-Databases, Tools and Algorithms. Oxford University Press, New Delhi.

Bryan Bergeron, M.D. 2006. Bioinformatics Computing. 2006. Prentice Hall of India Pvt Limited, New Delhi.

Gautham, N. 2006. Bioinformatics- Databases and Algorithms, Narosa Publishing House Hall of India Pvt. Ltd, New Delhi.

Ignacimuthu, S.S.J. 2005. Basic Bioinformatics, Narosa Publishing House, India.

Lesk, A.M. 2006. Introduction to Bioinformatics. (2nd Edition). Oxford University Press, New Delhi.

Course Code	Course Title	L	T	P	C
201ENSTU45	Environmental studies	2	0	0	2

Objectives:

- Creating the awareness about environmental problems among people.
- Imparting basic knowledge about the environment and its allied problems.

- Developing an attitude of concern for the environment.
- Motivating public to participate in environment protection and environment improvement.
- Acquiring skills to help the concerned individuals in identifying and solving environmental problems.
- Striving to attain harmony with Nature.

Outcome

CO1- To Understand eco-system

CO2- To Know social issues and the environment

CO3- To Learn keep the environment eco-friendly

1. Nature of Environmental Studies

Definition, scope and importance.
Multidisciplinary nature of environmental studies
Need for public awareness.

2. Natural Resources and Associated Problems.

a) Forest resources: Use and over — exploitation, deforestation, dams and their effects on forests and tribal people.
b) Water resources: Use and over — utilization Of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources.
d) Food resources: World food problem, changes caused by agriculture effect of modern agriculture, fertilizer — pesticide problems.
e) Energy resources: Growing energy needs, renewable and non — renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy.
f) Land resources: Solar energy, Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification,

Role of an individuals in conservation of natural resources.

3. Ecosystems

Concept of an ecosystem.
Structure and function of an ecosystem.
Producers, consumers and decomposers.
Energy flow in the ecosystem.
Ecological succession.
Food chains, food webs and ecological pyramids.
Introduction, types, characteristics features, structure and function of the following ecosystem:
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, aesthetic and option values.

India as a mega — diversity nation.

Western Ghat as a biodiversity region.

Hot— spot of biodiversity.

Threats to biodiversity habitat loss, poaching of wildlife, man — wildlife conflicts.

Endangered and endemic species of India.

Conservation of biodiversity: In — situ and Ex — situ conservation of biodiversity.

5. Environmental Pollution

Definition: Causes, effects and control measures of: Air pollution, Water pollution, soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards.

Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of a individual in prevention of pollution.

6. Social Issues and the Environment

Disaster management: floods, earthquake, cyclone, tsunami and landslides.

Urban problems related to energy Water conservation, rain water harvesting, watershed management

Resettlement and rehabilitation of people; its problems and concerns.

Environmental ethics: Issue and possible solutions.

Global wanTling, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation.

Consumerism and waste products.

7. Environmental Protection

From Unsustainable to Sustainable development.

Environmental Protection Act.

Air (Prevention and Control of Pollution) Act.

Water (Prevention and control of Pollution) Act.

Wildlife Protection Act.

Forest Conservation Act.

Population Growth and Human Health, Human Rights.

8. Field Work

Visit to a local area to document environmental assets — River / Forest / Grassland / Hill / Mountain.

or

Visit to a local polluted site — Urban / Rural *I* lad Listrial / Agricultural.

or

Study of common plants, insects, birds.

or

Study of simple ecosystems -— ponds, river, hill slopes, etc.

References:

1) Agarwal, K.C,200l, Environmental Biology, Nidi Pub. Ltd., Bikaner.

2) Bharucha Erach, The l3iodiversity of India, Mapin Publishing Pvt, Ltd., Ahmedabad 380013, India, Email: rn4pin@icenet.net (R)

3) Brunner R.C., 1989, 1-lazardous Waste Incineration, McGraw Hill Inc. 480p

4) Clank R.S., Marine Pollution, Clanderson Press Oxford (TB)

5) Cunningham, W.P. Cooper, T.H. Gorhani, E. & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Pub. Mumbai, Il96p

6) De A.K., Environmental Chemistry, Wiley Wastern Ltd.

7) Down to Earth, Centre for Science and Environment, New Delhi. (R)

8) Gleick, H., 1993, Water in crisis, Pacific Institute for studies in Dcv., Environment & Security. Stockholm Env Institute. Oxford Univ. Press 473p

9) Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bompay (R)

10) Heywood, V.K. & Watson, R.T.1995, Global Biodiversity Assessment, Crnbridge Univ. Press 1140 p.

11) Jadhav, H. and Bhosale, VJvI. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi 284p.

12) Mickinney, M.L. and School. R.M. 1196, Environmental Science Systems and Solutions, Web enhanced edition, 639p.

13) Miller T.G. Jr. Environmental Science. Wadsworth Publications Co. (TB).

14) Odum, E.P. 1971, Fundamentals of Ecology, W.B. Saunders Co. USA,574zp.

15) Rao M.N. and Dana, A.K. 1987, Waste Water Treatment, Wxford & IBH Publ. Co. Pvt. Ltd., 345p

16) Sharma B.K., 2001, Environmental Chemistry, Gokel PubI. Hkouse, Meerut

17) Survey of the Environment, The Hindu (M)

18) Townsend C., Harper, J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)

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,

23) Paryavaran Sahastra — Gharapure

(M) Magazine

(R) Reference

(TB) Textbook

Learning Outcomes:

Students who graduate with a major in environmental science will be able to:

1. Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale;
2. Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment;
3. Demonstrate ecology knowledge of a complex relationship between predators, prey, and the plant community;
4. Apply their ecological knowledge to illustrate and graph a problem and
5. describe the realities that managers face when dealing with complex issues; and
6. Understand how politics and management have ecological consequences.

Course Code	Course Title	L	T	P	C
20116AEC46L	Virology Lab	0	0	3	2

Aim:

- To study the isolation and cultivation methods for viruses.

Objectives

- Cultivation of viruses and various methods of propagation.

Outcomes

CO1- To Know the structure of plants, animal, bacteria and viruses.

CO2- To grasp the significance of isolation, propagation of various viruses

CO3- To build clinical laboratory testing devices

Lab work

1. Isolation of coliphage from sewage.
2. Determining Bacteriophage Titers
3. Cultivation of viruses in embryonated egg.
4. Chicks Embryo Fibroblast technique for virus cultivation

Demonstrations

1. Isolation of microorganisms from Phyllosphere.
2. Study of the following viral diseases: Tobacco mosaic; Cucumber Mosaic Virus.
3. Demonstrations of some plant, animal & human viruses (photographs, diagram etc.).

Course Code	Course Title	L	T	P	C
20116AEC47L	Biostatistics and Bioinformatics Lab	0	0	3	2

Aim

- To introduce the basic knowledge on Biostatistics and Bioinformatics tools and its applications

Objective

- The basic objective is to give students an introduction to the biostatistics and bioinformatics.
- Emphasis will be given to the application of biostatistics, bioinformatics and biological databases to problem solving in real research problems.

Outcomes

CO1: To Read and learn statistical measures individually.

CO2- To analysis the data from experiments and interpretation of the *results*

CO3- To study the multivariate analysis in biostatistics

CO4 - To understand the nucleotide sequence data of the given species using NCBI / EMBL / DDBJ.

CO5 - To identify the protein sequence of the species using PIR and Swissprot / UniProt

1. Mean and Standard deviation using biological samples
2. Chi – Square test, Student 't' test and Correlation coefficient
3. Regression Coefficient and regression lines
4. Pairwise alignment using FASTA, BLAST.
5. Multiple alignments using Clustal W.
6. Study of internet resources in Bioinformatics – NCBI, ENBL, EBI.

Course Code	Course Title	L	T	P	C

201ACLSLMS	Leadership and Management Skills	-	-	-	2

Aim:

The aim of the course cultivatingandnurturingtheinnateleadershipskillsofthe youthsothattheymaytransformthesechallengesintoopportunitiesandbecometorchbearersof the future by developing creativesolutions.

Course Objective:

The Module is designed to**:**

- Help students to develop essential skills to influence and motivateothers
- Inculcate emotional and social intelligence and integrative thinking for effective leadership
- Create and maintain an effective and motivated team to work for thesociety
- Nurture a creative and entrepreneurialmindset
- Make students understand the personal values and apply ethical principles inprofessional and social contexts.

Course Outcomes :

Upon completion of the course students will be able to:

1. Examine various leadership models and understand/assess their skills, strengthsand abilities that affect their own leadership style and can create their leadership vision
2. Learnanddemonstrateasetofpracticalskillssuchastimemanagement,selfmanagement, handling conflicts, team leadership, etc.
3. Understand the basics of entrepreneurship and develop businessplans
4. Apply the design thinking approach forleadership
5. Appreciate the importance of ethics and moral values for making of a balanced personality.

UNIT I-LeadershipSkills

a. Understanding Leadership and itsImportance

- What isleadership?
- Why Leadershiprequired?
- Whom do you consider as an idealleader?

b. Traits and Models ofLeadership

- Are leaders born ormade?
- Key characteristics of an effectiveleader
- Leadership styles
- Perspectives of differentleaders

c. Basic LeadershipSkills

- Motivation
- Teamwork
- Negotiation
- Networking

UNIT II -Managerial Skills

a. Basic ManagerialSkills

- Planning for effectivemanagement
- How to organiseteams?
- Recruiting and retainingtalent
- Delegation oftasks
- Learn tocoordinate
- Conflictmanagement

b. Self ManagementSkills

- Understanding selfconcept
- Developingself-awareness
- Self-examination
- Self-regulation

UNIT III -EntrepreneurialSkills

a. Basics ofEntrepreneurship

- Meaning ofentrepreneurship
- Classification and types ofentrepreneurship
- Traits and competencies ofentrepreneur

b. Creating BusinessPlan

- Problem identification and ideageneration
- Ideavalidation
- Pitchmaking

UNIT IV - Innovative Leadership andDesignThinking

a. Innovative Leadership

- Concept of emotional and socialintelligence
- Synthesis of human and artificialintelligence
- Why does culture matter for today's globalleaders

b. DesignThinking

- What is designthinking?
- Key elements of designthinking:
  - Discovery
  - Interpretation
  - Ideation
  - Experimentation
  - Evolution.
- How to transform challenges intoopportunities?
- How to develop human-centric solutions for creating socialgood?

UNIT V- EthicsandIntegrity

a. Learning throughBiographies

- What makes an individualgreat?
- Understanding the persona of a leader for deriving holisticinspiration
- Drawing insights forleadership
- How leaders sail through difficultsituations?

b. Ethics andConduct

- Importance ofethics
- Ethical decisionmaking
- Personal and professional moral codes ofconduct
- Creating a harmoniouslife

Bibliography and Suggested Readings :

Books

- Ashokan, M. S. (2015). *Karmayogi: A Bbiography of E. Sreedharan*. Penguin,UK.
- Brown, T. (2012). *Change by Design.* HarperBusiness

- Elkington, J., & Hartigan, P. (2008). *The Power of Unreasonable People: How Social Entrepreneurs Create Markets that Change the World*. Harvard Business Press.
- Goleman D. (1995). *Emotional Intelligence*. Bloomsbury Publishing India PrivateLimited
- Kalam A. A. (2003). *Ignited Minds: Unleashing the Power within India*. Penguin BooksIndia
- Kelly T., Kelly D. (2014). *Creative Confidence: Unleashing the Creative Potential WithinUs All*. WilliamCollins
- Kurien V., & Salve G. (2012). *I Too Had a Dream*. Roli Books PrivateLimited
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- O'Toole J. (2019) *The Enlightened Capitalists: Cautionary Tales of Business Pioneers Who Tried to Do Well by Doing Good*.Harpercollins
- Sinek S. (2009). *Start with Why: How Great Leaders Inspire Everyone to Take Action*.Penguin
- Sternberg R. J., Sternberg R. J., & Baltes P. B. (Eds.). (2004). *International Handbook of Intelligence*. Cambridge UniversityPress.

E-Resources

- Fries,K.(2019).8EssentialQualitiesThatDefineGreatLeadership.*Forbes*.Retrieved2019-02-15 from https://www.forbes.com/sites/kimberlyfries/2018/02/08/8-essential-qualities-that-define-great-leadership/#452ecc963b63.
- HowtoBuildYourCreativeConfidence,TedTalkbyDavidKelly-https://www.ted.com/talks/david_kelley_how_to_build_your_creative_confidence
- India's Hidden Hot Beds of Invention Ted Talk by Anil Gupta - https://www.ted.com/talks/anil_gupta_india_s_hidden_hotbeds_of_invention
- Knowledge@Wharton Interviews Former Indian President APJ Abdul Kalam - . "A Leader Should Know How to Manage Failure"https://www.youtube.com/watch?v=laGZaS4sdeU
- Martin, R. (2007). How Successful Leaders Think. *Harvard Business Review*, *85*(6):60.

- NPTEL Course on Leadership -https://nptel.ac.in/courses/122105021/9

SEMESTER V

Course Code	Course Title	L	T	P	C
20116AEC51	Food and Dairy Microbiology	4	1	0	4

Aim:

- To learn the role of microbes in food production, food spoilage and food borne illness.

Objectives

- To learn about factors involed in microbial food spoilage
- Understanding the food preservation methods
- To make aware of food borne diseases

Outcomes

CO1– To identify the role of microorganisms in the production of food

CO2– To know the milk and foods quality test for detecting microorganisms

CO3– To Gain the knowledge regarding food preservation

UNIT – I

Introduction: Importance of food and dairy Microbiology – Types of microorganisms in food – Source of contamination (primary sources) – Factors influencing microbial growth in foods (extrinsic and intrinsic).

UNIT – II

Food fermentations: Cheese, bread, wine, fermented vegetables – methods and organisms used. Food and enzymes from microorganisms – single cell protein, production of enzymes.

UNIT – III

Contamination, spoilage and preservation of different kinds of foods, cereals and cereal products – sugar and sugar products – vegetable and fruits – meat and meat products – fish and other sea foods – eggs and poultry – dairy and fermentative products (ice cream/milk/bread/wine).

UNIT – IV

Food Poisoning: food borne infections (a) Bacterial: *Staphylococcal*, *Brucella*, *Bacillus*, *Clostridium*, *Escherichia*, *Salmonella* (b) Fungal: Mycotoxins including aflatoxins, (c) Viral: Hepatitis, (d) Protozoa – Amoebiasis.

UNIT – V

Food preservation: Principles of food preservation – methods of preservation. a. Physical (irradiation, drying, heat processing, chilling and freezing, high pressure and modification of atmosphere) b. Chemical (Sodium benzoate Class I & II). Food Sanitation: Good manufacturing practices – Hazard analysis, Critical control points, Personnel hygiene.

Text Books

S. No	Author Name	Title of the Book	Edition/year	Publisher
1.	W.C. Frazier, D.C. Westhoff	Food Microbiology	4th /1988	TATA McGraw Hill Publishing company ltd

Reference Book:

1. Banwart, G.J.1989. Basic Food Microbiology, Chapman & Hall New York.
2. Board, R.C.1983. A Modern Introduction to Food Microbiology, Blackwell Scientific Publications, Oxford.
3. Robinson, R.K.1990. Dairy Microbiology, Elsevier Applied Science, London.
4. Hobbs, B.C. and Roberts, D.1993. Food Poisiong and Food Hygiene, Edward Arnold (A division of Hodder and Stoughton), London.

Course Code	Course Title	L	T	P	C
20116AEC52	Molecular Biology	4	1	0	3

Aim:

- To introduce the molecular basis of biological system.

Objectives

- To learn the basic principles of biomolecules.
- To understand the relationships between molecule/cell level phenomena.
- Studying the concepts and mechanism of central dogma.

Outcomes

CO1 - To understand Concept of central dogma of the cell and gene regulation.

CO2 - To know the Principles and applications of various molecular mechanisms.

CO3 - To grasp the significance of Concept of replication, transcription and translation.

CO4 - To understand the process of mutation and its impact

UNIT – I

Historical and conceptual background - Discovery of DNA as genetic material, Griffith's experiment, Hershy and Chase warring blender experiment, Chargaff's rule. Structures of DNA and RNA: Types of genetic material. DNA Structure: Salient features of double helix, types of DNA. RNA Structure. Denaturation and renaturation, cot curves. DNA topology: linking number, topoisomerases. DNA organization in prokaryotes, viruses, eukaryotes

UNIT – II

DNA replication in prokaryotes: Replicons – models of DNA replication – origin and termination of replication – rolling circle replication – proof for semi conservative replication (Meselson and Stahl Experiment) – enzymes and proteins involved in DNA replication (nucleases, polymerases, ligases, helicases, gyrases, single strand binding protein, replisome and primosome) – mechanism of semi discontinuous replication.

UNIT – III

Transcription: Steps involved in transcription of prokaryotes, promoters, transcription factors, RNA polymerases I, II and III – ribosomal RNA transcription and processing – genetic code, deciphering the genetic code, characteristics of genetic code, Wobble hypothesis, central dogma of life and reversal of central dogma.

UNIT – IV

Translation: Steps involved in translation of prokaryotes – role of proteasomes in protein degradation – mechanism of action of antibiotics on protein synthesis (puromycin, chloramphenicol and streptomycin). Regulation of gene expression in prokaryotes – polycistronic mRNA and operons (lac operon and trp operon and attenuation mechanism).

UNIT – V

Mutation: spontaneous and induced mutations – UV and X - rays – mechanism of action of base analogues, alkylating agents, intercalating agents and teratogens – reversion suppressor mutations and mutation rate – repair of damaged DNA - excision repair, SOS, photoreactivation – CRISPR and their role in genome stability

Text Books

S. No	Author Name	Title of the Book	Edition/year	Publisher
1.	U. Sathyanarayana	Biotechnology	2010	Arunabha Sen Books and Allied (P)Ltd
2	Dr. P. Asokan	Molecular Biology	2006	Chinnaa Publications
3	U. Sathyanarayana	Biotechnology	2010	Arunabha Sen Books and

				Allied (P)Ltd

References

1. Maloy SR, Cronan Jr.JE, Freifelder D.1994. Microbial Genetics. Jones and Bartlett Publishers.
2. Eckstein F, Lilley DM. 1992 Nucleic acids and Molecular Biology – Springer – Verlag.
3. Blackburn CM, Gait MJ. 1996. Nucleic acids in Chemistry and Biology – Oxford University Press.
4. Stryer L.1995. Biochemistry. W.H.Freeman and company.
5. Eckstein F, Lilley DM.1996 Catalytic RNA – Springer – Verlag.
6. Frieldberg EC, Walker GC, Siede W.1995. DNA repair and Mutagenesis. ASM press.
7. Gardner EJ, Simmons MJ, Snustad DP, 1991. Principles of Genetics. John Wiley & Sons.
8. Singer M, Berg P.1991. Genes and Genomes. University Science Books.

Course Code	Course Title	L	T	P	C
20116AEC53	Agricultural and Environmental Microbiology	4	1	0	4

Aim:

- To learn about microorganisms in the environment and their importance in agriculture.

Objectives

- To know the microbes in various environments like soil, water and air.
- Importance of microbes in agricultute and waste treatment.

Outcome

CO1 - To acquire the information about microbes

CO2 - To Know about microbes and its role in environment.

CO3 - Able to understand about microbes in agriculture and environmental practice.

UNIT – I

Classification of soils. Physical and chemical characteristics and microflora of various soil types. Interactions among microorganisms: Symbiosis – mutualism – commensalisms – competition – amensalism – synergism – parasitism – predation. Biogeochemical cycles. Carbon, nitrogen, phosphorus and sulphur.

UNIT – II

Biofertilizers. Symbiotic nitrogen fixation – (*Rhizobium, Frankia*) –Symbiotic nutrient mobilizers – Endomycorrhizae and Ectomycorrizae – Non symbiotic microbes – *Azotobacter* – *Azospirillum* – Cyanobacteria (*Nostoc. Gloeocapsa Anabaena).*

UNIT – III

Microbial Association with higher plants – Rhizosphere – *Rhizobium* – infection – inoculation – nodule formation. Phylloplane association with animals. A brief account of the symptoms, etiology, life-cycle and management of bacterial (blight of paddy, citrus canker) and fungal (late blight of potato and red rot of sugarcane) diseases.

UNIT – IV

Microbiology of air – organisms in air, distribution and sources. Droplet nuclei, aerosol, assessment of air quality. Types of aquatic ecosystems: fresh water – ponds, lakes, streams. Marine habitats – estuaries, mangroves, deepsea, hydrothermal vents, saltt pans, coral reefs. Zonations – upwelling – eutrophication – food chain. Potability of water – microbial assessment of water quality – water purification – brief account of water - borne diseases.

UNIT – V

Types of wastes – characterization of solid and liquid wastes. Solid waste treatment – saccharification – gasification – composting, Utilization of solid wastes – food (SCP, mushroom, yeast); fuel (ethanol, methane, hydrogen); fertilizers (composting). Liquid waste treatment. Treatment methods –

primary –secondary (anaerobic – methanogenesis; aerobic- trickling activated sludge – oxidation pond – tertiary treatment.

Text Books

S. No	Author Name	Title of the Book	Edition/year	Publisher
1.	K.C. Agarwal	Environmental Biology	1998	Agro Botanica
2.	P. Rajendran, P. Gunasekaran	Microbial Bioremediation	2007	MJP Publishers
3.	R. C. Dubey, D.K. Maheswari	A Text Book of Microbiology	3rd / 2003	Chand Publishing
4.	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5th /1993	Tata McGraw-Hill, Inc, Newyork

References

1. Ec Eldowney, S., Hardman, D.J. and Waite, S. 1993. Pollution: Ecology and Biotreatment – Longman Scientific Technical
2. Baker, W.C. and Herson, D.S.1994. Bioremediations – McGraw Hill Inc., New York
3. Ernest, W.C.1982. The Environment of the Deep sea, Vol II, J. G. Morin Rubey.
4. Rheinmer, G.1977. Microbial Ecology of Brackish Water environment: Ecological Studies – Vol-25, Springer – Verlag Nerlin – Heidellberg New York.
5. Norris, J.R and Pettipher, G.L.(1987). Essays in Agricultural and Food Microbiology, John wiley and Sons, Singapore.
6. Harold J.Benson, 1994. Microbiological applications. Wm.C.Brown Publishers, Melbourne, Australia.
7. Burges, A. and Raw, F. 1967. Soil Biology. Academic Press, London.
8. Martin Alexander Wiley. 1961. Introduction to Soil Microbiology. International Edn., New York.
9. Vanghan, D. and Malcolm, R.E.1985. Soil Organic Matter and Biological Activity. Martinus Nighoff W.Junk Publishers.

Course Code	Course Title	L	T	P	C
20116AEC55L	Food and Dairy Microbiology and Molecular Biology Lab	0	0	3	2

Aim:

- To analyze microbiological quality of food samples.

Objectives

- Microbiological tests used in the food industry.
- To study and characterize the foor borne microorganisms.

Outcome

CO1 - To Analyze the microbes in food and dairy industry products

CO2 - To understand the Production methods of Food and dairy products using microbes

CO3 - To gain Knowledge about Molecular Genome analysis and quantification

CO4 - To understand the Isolation of DNA and amplification using PCR technique.

CO5 - To know about Protein and DNA separation technique

Lab work

1. Assessment of milk quality by methylene blue reduction test
2. Wet mount preparation of fungal organism from spoiled bread, tomato, grapes, potato.
3. Observation of food samples to *study Leuconostoc sp. Lactobacillus sp., Streptococcus lacti* and *Saccharomyces*
4. Preparation of yoghurt
5. Determination of thermal death time (TDT) and thermal death point (TIP) of microorganisms from spoiled foods

6. Direct microscopic examination of milk by standard plate count(SPC) method
7. Isolation of plasmid DNA from bacteria by Spectrophotometric assay.
8. Isolation of chromosomal DNA from bacteria by Spectrophotometric assay.
9. Development of competent cells in ***E. coli***.
10. Isolation of antibiotic resistant auxotropic mutants.
11. Protoplast and Spheroplast isolation

Demonstration

1. Fermenting ability of yeast
2. Antibiotic resistance – plasmid mediated – chromosomal mediated – Gel Electrophoretic methods.
3. Principles and applications of agarose gel electrophoresis and plasmid sepearation in agarose gel.

Discipline Specific Elective -I

Course Code	Course Title	L	T	P	C
20116DSC54A	Proteomics	4	1	0	3

Aim

To understand the proteome present in the living system and their interactions.

Objectives

- To illustrate creative use of modern biology linked with proteomics.
- To expose students to importance of proteomics
- To learn different approach and types of proteomics.

Outcome

CO1- To acquire knowledge in protein functional and expressions.

CO2- To get Knowledge about 3-D structural prediction of proteins

CO3- To Study the protein purification with various chromatograpy techniques.

CO4- To Know about MALDI-TOF (Matrix assisted laser Desorption and Ionization)

Unit I

Introduction to protein structure, Chemical properties of proteins. Physical interactions that determine the property of proteins. Short-range interactions, electrostatic forces, Van der Waal interactions, hydrogen bonds, hydrophobic interactions.

Unit II

Proteomics: structural, functional, expression, interaction proteomics. Importance of proteomics. Determination of protein sizes (Sedimentation analysis, gel filteration, SDS-PAGE); Native PAGE,

Unit III

Protein-protein interactions, gel based proteomic tools e.g. 2D, DIGE, Non-gel based proteomic tools, Gel based proteomics, LC-based proteomics.

Unit IV

Protein array, Protein Identification and data evaluation, Identification of post-translational modifications: Phosphorylation, Glycosylation, Acetylation

Unit V

Mass Spectrometry-Fundamental parameters: Mass accuracy, Resolution, Sensitivity, Ion sources: Electrospray ionization, Matrix assisted laser desorption and ionization. Peptide mass finger printing, Tandem mass spectrometry

Reference Book

1. Hartl, Daniel L., Jones, Elizabeth W. "Genetics: Analysis of Genes and Genomes". Jones and Bartlett Publishers: Boston, 2005.
2. Weaver, Robert F. "Molecular Biology, 2nd Edition". McGraw Hill: Boston, 2002.
3. Colinge, Jacques and Keiryn L. Bennett. "Introduction to Computational Proteomics". PLoS Comput Biol. 2007 July; 3(7): e114.
4. Graves, P. R., T. A. J. Haystead. "Molecular Biologist's Guide to Proteomics". Microbiology and Molecular Biology Reviews: Vol.66 No.1, 2002.

5. van Wijk, K. J. "Challenges and Prospects of Plant Proteomics". Plant Physiol. 2001 June; 126(2): 501-508.

Course Code	Course Title	L	T	P	C
20116DSC54B	Bioinoculants	4	1	0	3

Aim:

- To study the importance of microbes as bioinoculants/biofertilizers.

Objectives

- To give an overview about role of microorganisms for the cycle of carbon, nitrogen, phosphorus and sulphur in the nature with a special focus on agrosystems.
- Importance of microorganisms for agricultural production and commercial composts.

Outcomes

CO1- To acquire knowledge in microbial products

CO2- To know the Separation techniques of primary and secondary metabolites

CO3- To grasp the Applications of value added products

CO4- To know the microbial inoculants in agricultural practices

UNIT – I

General account of the microbes used as a biofertilizersmfor crop plants and their advantages. Symbiotic N2 fixers: Rhizobium- Isolation, characterization, identification, classification, inoculum, production and field application. Frankia- Isolation, characterization- actinorrhizal nodules-non-leguminous crop symbiosis.

UNIT – II

Non-symbiotic N2 fixers-Azospirillum-Free living-Azotobacter-free isolation, characterization, mass inoculum production and field application.

UNIT – III

Symbiotic N2 fixers- Cyanobacteria, Azolla- Isolation, characterization, mass multiplication- role in rice cultivation- Crop response- field application- immobilization.

UNIT – IV

Phosphate solubilizers- phosphate solubilizing microbes- Isolation, characterization, mass inoculum production, field application- Phosphate solubilization mechanism.

UNIT – V

Mycorrhizal bioinoculants- classification- importance of mycorrizal Ectomycorrhizae- Endomycorrhizae- Ectendo mycorrhizae- Taxonomy of mycorrhizae- Isolation of VA mycorrhizae- quantification and assessment of VAM in roots- Mass inoculum production VAm- field applications of Ectomycorrhizae and VAM.

Reference:

Kannaiyan, S. (2003). Biotecnology of Biofertilizers, CHIPS, Texas.

Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth press, Inc. New York.

Reddy, S. M. et al. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.

Subba rao N. S (1995). Soil microorganisms and plant growth. Oxford and IBH publishing co. Pvt. Ltd. New delhi.

Subba rao N. S (1998). Biofertilizers in Agriculture and forestry. Oxford and IBH publishing co. Pvt. Ltd. New delhi.

Course Code	Course Title	L	T	P	C
20116AEC56L	Agricultural and Environmental Microbiology Lab	0	0	3	2

Aim:

- Understanding the techniques to study the environmental / agriculture microorganisms.

Objectives

- Isolation and characterization of agriculture important microbes.
- To study the environmental microbes and their impact.

Outcome

CO1 - To acquire the information about microbes role in agriculture

CO2 - To Learn about Biofertilizer production

CO3 - To Know about microbes and its role in environment

Lab work

1. Isolation and culturing of *Rhizobium* from root nodules.
2. Isolation and culturing of *Azospirillum* from grassplant.
3. Isolation and culturing of *Azotobacter* from paddy field
4. Isolation and culturing of *Phosphobacter* from paddy field
5. Isolation and culturing of Blue Green Algae from paddy field
6. Isolation and identification of air-borne bio-particles using Open plate method
7. Effects of high salt concentration on microbial growth
8. Microbial flora of polluted water – Microbial flora of sewage
9. Bacterial examination of drinking water by membrane filter technique and MPN

Course Code	Course Title	L	T	P	C
201ACLSPSL	Professional Skills	-	-	-	2

Aim:

Course Objectives :

The Objectives of the course are to help students/candidates:

1. Acquire career skills and fully pursue to partake in a successful careerpath
2. Prepare good resume, prepare for interviews and groupdiscussions
3. Explore desired career opportunities in the employment market in consideration ofan

individual SWOT.

Course Outcomes :

At the end of this course the students will be able to:

1. Preparetheirresumeinanappropriatetemplatewithoutgrammaticalandothererrorsand using proper syntax
2. Participate in a simulatedinterview
3. Actively participate in group discussions towards gainfulemployment
4. Capture a self - interview simulation video regarding the job roleconcerned
5. Enlist the common errors generally made by candidates in aninterview
6. Perform appropriately and effectively in groupdiscussions
7. Explore sources (online/offline) of careeropportunities
8. Identify career opportunities in consideration of their own potential andaspirations
9. Usethenecessarycomponentsrequiredtoprepareforacareerinanidentifiedoccupation (as a case study).

Unit I:ResumeSkills

Resume Skills : Preparation andPresentation

- Introduction of resume and itsimportance
- Difference between a CV, Resume and Biodata
- Essential components of a goodresume

ii. Resume skills : commonerrors

- Common errors people generally make in preparing theirresume
- Prepare a good resume of her/his considering all essentialcomponents

Unit II: InterviewSkills

i. Interview Skills : Preparation andPresentation

- Meaning and types of interview (F2F, telephonic, video,etc.)
- Dress Code, Background Research, Do's andDon'ts
- Situation,Task,ApproachandResponse(STARApproach)forfacingan interview
- Interview procedure (opening, listening skills, closure,etc.)
- Importantquestionsgenerallyaskedinajobinterview(openandclosed ended questions)

ii. Interview Skills :Simulation

- Observation of exemplaryinterviews
- Comment critically on simulatedinterviews

iii. Interview Skills : CommonErrors

- Discuss the common errors generally candidates make ininterview
- Demonstrate an idealinterview

Unit III: GroupDiscussionSkills

Meaning and methods of GroupDiscussion

- Procedure of GroupDiscussion
- Group Discussion-Simulation
- Group Discussion - CommonErrors

Unit IV: ExploringCareer Opportunities

Knowing yourself – personalcharacteristics

- Knowledge about the world of work, requirements of jobs includingself-employment.
- Sources of careerinformation
- Preparing for a career based on their potentials and availability ofopportunities

SEMESTER VI

Course Code	Course Title	L	T	P	C

20116AEC61	Industrial Microbiology	4	1	0	4

Aim:

- Understanding the industrial importance of microorganisms and their products.

Objectives

- To study the development of industrial microbiology and microbes of industrial prominence.
- To aquire knowledge on design of fermentors and its types.
- Industrial production of various pharmaceutical and commercial products using microbes.

Outcomes

CO1- To understand the vital role of various substrate used in fermentation.

CO2- To Learn the different types of reactors or fermenters.

CO3- To gain knowledge about upstream and downstream processing

Co4 - To acquire the knowledge on different product production

UNIT – I

Historical development of Industrial Microbiology, Industrially important microorganisms, Primary and secondary screening and preservation of industrially important strains. Microbial strains improvement. Primary and secondary metabolites.

UNIT – II

Fermenter: Design, types and basic functions of fermenter. Fermentation media formulation strategies, Essential factors (pH and temperature, incubation), carbon, nitrogen, vitamin and mineral sources, role of buffers, precursors, inhibitors, inducers and antifoams, types of fermentation.

UNIT – III

Downstream processing: Product recovery and purification (intracellular and extracellular), cell disruption, precipitation, filtration, centrifugation, solvent recovery, chromatography, ultrafiltration, drying, Enzyme and cells immobilizations and its applications.

UNIT – IV

Microbial products of pharmaceutical value – raw materials, organism and Industrial processes involved in the production of Pencillin, Streptomycin, Vitamin B12, Riboflavin and rabies vaccine.

UNIT – V

Microbial products of Industrial value – Raw materials, organism and Industrial processes involved in the production of ethanol, vinegar, amylase, protease, glutamic acid. Recycling and safe disposal of Industrial wastes through microbes.

Text Book

1. Stanbury, P.F.Whitaker, A.Hall, S.J. 1995. Principles of Fermentation Technology, Pergamon Press.
2. Sikyta, B.1983. Methods in Industrial Microbiology, Ellis horwood limited.
3. Click, B.R.Pasternak, J.J.1994. Molecular Biotechnology – ASM Press.

Reference:

1. Demain A.L.Solomon, N.A.1986. Mannuall of Industrial Microbiology and Biotechnology. ASM Press
2. Reed. G. 1982. Prescott and Dunn's Industrial Microbiology. Macmillian Publishers.
3. Prave, P.Faust, V, Sitting, W., Sukatsch, DA. 1987. Fundamentals of Biotechnology. ASM Press.
4. Malik V.S.Sridhar, P.1992. Industrial Biotechnology. Oxford & IBH.
5. Venkataraman, L.V.1983. A Monograph on Spirulina platensis. CFTRI, Mysore.

Course Code	Course Title	L	T	P	C
20116SEC62	Clinical Microbiology	4	1	0	5

Aim:

- To understand the clinical significance of microorganisms.

Objectives

- To study virulance of pathogenic microbes.
- To understand the pathogenesis and treatment methods of various diseases
- To understand the various diagnostic techniques.

Outcomes

CO1- To Understood the basic and general concepts of Normal flora of the human body

CO2 –To Understand the sources of infectious diseases and transmission

CO3 - To Study the pathogenicity of bacterial, fungal, protozoa and viral diseases

CO4- To Understand the preventive measures of Hospital acquired infections

UNIT – I

Basics in Medical microbiology - Infectious diseases overview. Medically important microbes. Normal microbial flora of the human body, Host-microbe interactions – virulence factors of microbes. Invasiveness and pathogenicity. Immunity of microbial diseases

UNIT – II

Diagnostic Microbiology – collection and transport of specimen for Microbiological examination – General methods for isolation and identification of bacteria. Typing of bacterial isolates. Sero-diagnosis.

UNIT – III

Clinical symptoms. Epidemiology, pathogenesis, laboratory diagnosis, prevention and treatment of the following bacterial infections (a) Streptococcal infections, (b) Staphylococcal infections, (c) Meningits, (d) Tuberculosis, (e) Leprosy, (f)Gastrointestinal disorders – typhoid, cholera, bacillary dysentery, (g) Sexually transmitted diseases – syphilis, gonorrhea. (h) Anerobic wound infection – tetanus, gas gangrene.

UNIT – IV

Clinical symptoms. Epidemiology, pathogenesis, laboratory diagnosis, prevention and treatment of the following viral infections (a) Respiratory infections, common cold, influenza, measles, mumps and rubella. (b) neurological infection – encephalitis (Dengue, Japanese encephalitis), Rabies (c) Liver diseases : Hepatitis A,B,C,D & E (d) Immunodeficiency diseases, AIDS, CMV (Cytomegaloviruses) Herpes simplex viruses.

UNIT – V

Clinical symptoms. Epidemiology, pathogenesis, laboratory, prevention and treatment of the following fungal and protozoan infections (a) Fungal – superficial, subcutaneous and systemic mycoses, (b) Protozoan: Amoebiasis, Malaria, Leishmaniasis, (c) Helminths – Filariasis, Ascariasis, Zoonotic diseases, Hospital acquired infections.

Text Book

1. Schaechter, M.Medoff, G. and Eisenstein, B.C.(1993). Mechanism of Microbial Diseases. 2nd edition. Williams & Wilkins, Baltimore.
2. J.C. Collee, J.P., Duguid, A. C. Fraser, B.P. and Marimon (1989). Mackie and Mc Carteny Practical Medical Microbiology – 13th Edition, Churchill Livingstone.

Reference:

1. Ronald M.Atias (1989). Microbiology, Fundamentals and Applications. II edition. Maxwell Macmillan International editions.
2. E.Joan Stokes, G.L.Ridgway and M.W.D.Wren(1993). Clinical Microbiology. 7th edition. Edward Arnold. A division of Hodder and Stoughton.

3. David Greenwood, Richard C.B.Stack and John Forrest Peutherer. (1992). Medical Microbiology. 14th edition. ELBS with Churchill Livingstone.
4. Huge W.B. and Russell A.D.(1989). Pharmaceutical Microbiology. IV edition. Blackwell Scientific Publicaiton, Oxford.
5. Topley / Wilson's (1990). Principles of Bacteriology, Virology and Immunity, VIII edition, Vol.III Bacterial Diseases, Edward Arnold, London.

Discipline Specific Elective - II

Course Code	Course Title	L	T	P	C
20116DSC63A	**Recombinant DNA Technology**	4	1	0	3

Aim

To explain principles and applications of recombinant DNA technology.

Objectives

- To illustrate creative use of modern tools and techniques for manipulation and analysis of genomic sequences
- To expose the application of recombinant DNA technology for current research.
- To train students in methodologies employed in genetic engineering techniques.

Outcome

CO1- To acquire knowledge in desired DNA and proteinseparation.

CO2- To Learn the gene and operon concept

CO3- To gain Knowledge about gene cloning and cDNA library

CO4- To Learn the blotting techniques.

Unit -I

History and achievements of rDNA technology. Nomenclature, classification of Restriction Endonucleases - ligases, types - gene cloning in prokaryotes - Expression and cloning strategies. Construction of genomic library and cDNA library.

Unit II

Restriction enzymes - restriction analysis of genomes- restriction sites- cloning of blunt end DNA, adapters. DNA analysis: labeling of DNA and RNA probes. Southern and fluorescence *insitu* hybridization, DNA fingerprinting, chromosome walking.

Unit- III

Gene transfer Techniques - Physical - Biolistic method, Chemical - Calcium chloride and DEAE methods, Biological invitro pakage method - Screening and selection of recombinants.

Unit-IV

Microbial synthesis of commercial products - Insulin, Interferons, Human growth hormone, antibiotics, biopolymers.

Unit- V

Transgenic Plants - Ti plasmid, insect resistant plant. Transgenic animal - mice - retroviral method- DNA microinjection method. PCR methods and its applications.

REFERENCES

1. Mitra (2005). Genetic engineering. Published by Macmillan India Ltd., Chennai.

2. JogdandSN (2005). Gene biotechnology. Himalaya Publishing House, Mumbai.

3. Satyanarayana (2005). Biotechnology. First edition, Books and Allied (P) Ltd., Kolkata.

4. Preeti Joshi (2002). Genetic engmeermg and its application. First edition, Agrobios (India).

5. Dubey RC (2005). A Text of Biotechnology. Multicolour Illustrative edition, S.Chand and Company Ltd., New Delhi.

Course Code	Course Title	L	T	P	C
20116DSC63B	Bioethics	4	1	0	3

Aim:

- To recognise and understand ethical concepts in biological research.

Objectives

- Understands and can apply the various theories and principles of bioethics

- Can scrutinise and identify health, administrative and public health policies to identify ethical issues
- Bioethics in medicine and clinical research

Outcomes

CO1- To identify ethical issues in a research proposal

CO2- To Understand the Intellectual property Rights (IPR) and patent filling.

CO3- To gain Knowledge about to ensure ethical conduct of biomedical research

CO4- To Describe the basic concepts of legal, ethical, economic, and regulatory measurements.

UNIT – I

General Ethical concerns: the use of nature, Different views of nature, Dynamic nature, interfering with nature, integrity of species; Reducing genetic diversity; Biological warfare; public perception of science.

UNIT – II

Medical ethics; History and culture: The Hippocratic tradition: a profession, Philanthropy, Do no harm, adoption to the oath by western medicine. Competing ethical.

Traditions; Retaining the Hippocratic oath.

UNIT – III

Status of Human embryo: Human Embryonic development; Ethics through embryo development: Fertilization, the fetus and feeling pain; Scientific Research on Human Embryos: Experimental goals of Human Embryo Research, Human Development; How much Embryo experimentation in ethical?

UNIT – IV

Animal Rights: Making new strains of animal: Ethical limits of animal use: Religious views of animal status; Philosophical views of animal status; regulations.

UNIT –V

Human Gene therapy: Ethics of somatic cells gene therapy: Efficiency of treatment; safety of transferred genes; protecting human life; Affect on family life; Economic factors; when we should use Gene therapy?

References:

Nancy, S. Jecker., Albert R. Johnson, Robert A. Pearlman. Bioethics: An Introduction to history, methods and practice (1997). Sudbury, M. A, ; Jones and Barlett Publishers.

Tom, L. Beauchamp., childress, F. Principles of biomedical ethics, 5th edition, Oxford University Press. 2000.

Course Code	Course Title	L	T	P	C
20116AEC64L	Industrial Microbiology Lab	0	0	3	2

Aim:

- To train students for industrial production of microbial products.

Objectives

- Methods for screening of industrial important microbes.
- Production of various commercial products using microorganisms.

Outcomes

CO1- To acquire hands on training various microbes for industrial practices

CO2- To know the Screening of desired microbes

CO3-To Learn the optimization process for scale up process

CO4-To understand the technical knowledge on upstream and downstream processing.

Lab work

1. Whole cell immobilization – alginate –Cyanobacteria
2. Estimation of citric acid - *Aspergillus*
3. Estimation of ethanol - Fruit juice
4. Spawn production - Mushroom
5. Mushroom cultivation
6. Starch hydrolysis

Demonstration

1. Preparation of fermented food –cheese

Course Code	Course Title	L	T	P	C
20116SEC65L	Clinical Microbiology Lab	0	0	3	2

Aim:

- To provide technical knowledge on collection and processing of clinical samples.

Objectives

- To isolate and identify the pathogens present in clinical samples.

Outcomes

CO1- To Get practical knowledge in specimen collection and processing

CO2- To gain Knowledge about cyst and protozoa identification.

CO3- To know the Technical practice on diagnosis of pathogenic infection

CO4- To Determine antimicrobial activity of microorganisms.

Lab work

1. Examination of parastic ova and cysts from faecal samples.
2. Identificaiton of pathogenic organism with a smear, culture and biochemical test
3. *Staphylococcus sp, E.coli, Klebsiella sp,*and *Salmonella typhi*

Demonstration

1. LP Mount - *Trichophyton sp.* *Microsporum sp*

Spotters:

2. Slides of pathogenic bacteria, fungi and parasites:

3. Electron micrographs of viruses – Pox viruses, Herpes simplex virus, HIV, HBV,

- *Staphylococci*

- *Streptococci*

- *Mycobacterium leprae*
- *Tryponema pallidium*
- *Leptospira sp.*
- *Bacillus subtilis*
- *Klebsiella sp.*
- *E.coil.*
- *Clostridium tetani*.
- Permanent mounts of dermatophytes
- *Candida* sp.
- *Cryptococcu*s sp.
- *Maduromycetes*.

Course Code	Course Title	L	T	P	C
201ACLSCET	**Community Engagement**	-	-	-	1

Aim:

Course Objectives:

- To developanappreciationofruralculture,life-styleandwisdomamongst students
- Tolearnaboutthestatusofvariousagriculturalandruraldevelopment programmes
- Tounderstandcausesforruraldistressandpovertyandexploresolutionsforthe same
- To apply classroom knowledge of courses to field realities and therebyimprove quality of Learning

Course Outcomes:

After completing this course, student will be able to

- Gain an understanding of rural life, culture and socialrealities
- Developasenseofempathyandbondsofmutualitywithlocalcommunity
- AppreciatesignificantcontributionsoflocalcommunitiestoIndiansocietyand economy

- Learntovaluethelocalknowledgeandwisdomofthecommunity
- Identify opportunities for contributing to community's socio-economic improvements

UNIT I - Appreciation of Rural Society

Rural life style,rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of"soul of India lies in villages" (Gandhi), ruralinfrastructure.

UNIT II-Understanding rural economy & livelihood

Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets

UNIT IIIRural Institutions

Traditional rural organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration

UNIT IVRural Development Programmes

History of rural development in India, current national programmes: Sarva Shiksha Abhiyan,

Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM AwaasYojana, Skill India,

Gram Panchayat Decentralised Planning, NRLM, MNREGA, etc.

Open Elective

Course Code	Course Title	L	T	P	C
201TNOEC	□□□□□ □□□□□□□ □□□□□□	**4**	**0**	**0**	**2**

Nehf;fk;:

1. khzth;fspd; gilg;Gj;jpwid ntspf;nfhzh;jYk; Nkk;gLj;jYk;.

2. gilg;gpd; ,d;wpaikahikia czh;j;Jjy;.

3. gilg;ghsdpd; gz;G>MSik> jpwik Nghd;wtw;iw mwpar; nra;jy;.

4. gilg;ghsh;fis mioj;Jg; gapyuq;fk; elj;Jjy;.

myF-1

rq;fk; gw;wpa nra;jpfs; - Kr;rq;fq;fs;- rq;f ,yf;fpaq;fs; - ghl;Lk; njhifAk;

myF-2

rq;fk; kUtpa fhyk; - rq;fk; kUtpa fhy ,yf;faq;fs;- ,ul;ilf; fhg;gpaq;fs;

gjpndd;fpo;fzf;F E}y;fs; kw;Wk; tuyhW.

myF-3

Ik;ngUq;fhg;gpaq;fs; - IQ;rpWfhg;gpaq;fs; - fk;guhkhazk; - nghpaGuhzk; -

gpwfhg;gpaq;fs; - rPwhg;Guhzk; - Njk;ghtzp.

myF-4

gf;jp ,yf;fpaq;fs; - rpw;wpyf;fpaq;fs; - gps;isj;jkpo;- fyk;gfk; - cyh - J}J-

guzp- me;jhjp- jdpg;ghly;fs;

.

myF-5

,f;fhy ,yf;fpaq;fs; - kuGf;ftpij - GJf;ftpij - ciueil - rpWfij - Gjpdk;

-ehlfk; - fl;Liu- ,yf;fpak;

ghh;it E}y;;fs;

jkpo,yf;fpatuyhW - K.tujuhrd, rhfpj;jpa mfhlkp □□spaPL.

jkpo,yf;fpatuyhW - r.Rgh□□ re;jpuNgh];> ,ay; gjpg;gfk;.

jkpo,yf;fpatuyhW - Kidth; ghf;aNkhp>NCBH nrd;id.

jkpo,yf;fpatuyhW - Kidth; R.Mde;jd;>NCBH nrd;id

tpisT;fs;

1. jkpo;ehL muRg;gzpf;Fg; gad;gLk;.

2. E}yhuha;r;rpf;F cjTk;.

3. jkpohrphpah; gzpf;Fr; nry;y KbAk

.4. tuyhw;W Muha;r;rpf;F tpj;jpLk;.

5. gd;Kf Ma;Tf;F mbj;jskhf ,Ug;gij mwpa KbAk;.

6. cah;fy;tpf;Fr; nry;y Ntz;Lnkd;w Mh;tk; Vw;gLk;.**7. ,yf;fpatuyhW E}y; vOj Ntz;Lnkd;w ce;Jjy; cz;lhFk;.**

Open Elective

Course Code	Course Title	L	T	P	C
201ENOEC	**Journalism**	**4**	**0**	**0**	**2**

Aim :

- To acquaint with the basic knowledge of journalism

Objective:

- To instil in the minds of students the different aspects of journalism
- To understand the different kinds of news
- To learn the qualities and duties of a reporter, editor and sub-editor
- To familiarize with the style and features of the different sections in a newspaper

Outcome:

- Become a journalist
- Explore the different kinds of news

UNIT- I

Journalism – Definition, Qualities of a journalist, Forms of journalism, Role and elements

UNIT- II

News – Definition, Kinds, Elements, Sources

UNIT- III

Reporters

UNIT- IV

The Editor and the Sub-editor

UNIT –V

Language of Journalism, Style

Qualities of a Writer

Writing a News story, Opinion Pieces, Reviews, Headlines, Editorials

Reference Book:-

Author	**Title of the book**	**Edition / Year**	**Publisher**
Susan	Journalism		
John Hogenberg	Professional Journalism	2012	
M.James Neal	News Writing and Reporting		Surjeet

			Publication
M.V Komath	The Journalist's Handbook		

Course code	Course Title	L	T	P	C
201MAOEC	Development of Mathematics Skills	4	0	0	2

Aim:

- To understand theconcepts from the five branches of mathematics

Objectives

- Knowledge and understanding are fundamental to study mathematics and form the base from which to explore concepts and develop problem-solving skills. Through knowledge and understanding students develop mathematical reasoning to make deductions and solve problems.

- To develop student's ability to apply both conventional and creative techniques to the solution of mathematical problems

Outcomes

- Know and demonstrate understanding of the concepts from the five branches of mathematics (Operations Research, Set Theory, Statistics, Matrices and Business mathematics)
- Use appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts
- Select and apply general rules correctly to solve problems including those in real-life contexts.

Unit I

Simple interest and compound interest

Unit II

Sinking fund – discounting – trade discount – quantity discount – cash discount

Unit III

Set theory – Series

Unit IV

Matrices – Determinants

Unit V

Assignment problems

References

P.A.Navanitham, Business Mathematics & Statistics

Kanti Swarup, P.K.Gupta and Manmohan, "Operations Research"

Course Code	Course Title	L	T	P	C
201PHGEC	Instrumentation	4	0	0	2

Aim:

Making and analyzing measurements is the primary task of the experimental physicist. This includes designing experiments. Most experimental work, whether in bench-top situations, or using

complex instruments. To many physicists this can be as interesting and involving as the basic physics one is trying to do.

Objectives:

- To build the strong foundation in physics of students needed for the field of Instrumentation.
- To prepare student to apply reasoning informed by the contextual knowledge to practice.
- To provide opportunity for students to work as part of teams on multi-disciplinary projects.

UNIT – I: INTRODUCTION

Potentiometer - calibration of volt meter and ammeter, measurement of resistance, Principles of network theorems – Thevenin's and Norton's theorem – Bridges :

AC bridges – Maxwell, Owen, Schering and deSauty's bridges – Wien bridges.

UNIT – II: ELECTRONIC INSTRUMENTS – I

Basic characteristics of instruments – resolution – sensitivity - Audio frequency oscillator, Conversion of galvanometer into voltmeter and ammeter – resistance meter - Amplified D.C. meter – Chopper stabilized amplifier – A.C. Voltmeter using

rectifiers – Electronic multimeter – Differential voltmeter – Digital voltmeters –

Component measuring instruments (quantitative studies)

UNIT – III: ELECTRONIC INSTRUMENTS – II

Signal conditioning systems – DC and AC carrier systems – Instrumentation

amplifiers – Vibrating capacitor amplifier – Analog to digital data and sampling – A/D and D/A convertor (successive approximation, ladder and dual slope converseons).

Unit IV – Recording Devices

Recorders necessity – Recording requirements – Analog recorders – Graphic recorders – strip chart recorders – Galvanometer types recorders – Null type recorders.

Unit V – CRO

CRO – Construction and action – Beam transit time and frequency limitations –

Measurement of potential, current, resistance, phase and frequency – Special purpose oscilloscopes – Sampling storage oscilloscope.

Books for Study

1. Electronic Instrumentation and Measurement techniques – W.D. Cooper and A.D. Helfrick – PHI – Third edn. – 1989

Learning Outcomes:

- Appreciate important practical aspects of theoretical knowledge: how important components work, when to impedance match, non-ideal behaviour of op-amps etc.
- Acquire a sound understanding of the role of noise in measurement systems and know how to apply noise reduction techniques.

Books for Reference:

1. A course in electrical and electronic measurements and Instrumentation – A.K. Sawhmey – DhanpatRai and Sons – 1990.

2. Electronic measurements and instrumentation – Oliver Cage – McGraw Hill – 1975.

Course Code	Course Title	L	T	P	C
201CEOEC	Food and Adulteration	4	0	0	2

Aim:

- To introduce students to food safety and standardization act and quality control of foods.

Objectives:

- To educate about common food adulterants and their detection.
- To impart knowledge in the legislatory aspects of adulteration.
- To educate about standards and composition of foods and role of consumer.

Outcomes:

- The students will have knowledge about different processing and preservation methods and principles involved.

Unit-I Introduction to Food Chemistry

Introduction to Food Chemistry- Water (Structure of water and ice, Physical constants of water, Types of water, Water activity) Composition of Food- Carbohydrates, Proteins, Lipids, Vitamins & Minerals.

Unit- II Food Pigments

Introduction- classification, types of food pigments- chlorophyll, carotenoids, anthocyanins, flavanoids.

Unit – III Food Preservation

Introduction - Importance, principle and Types.

High and low temperatures preservation - Pasteurization - Sterilization- Canning- Freezing- Refrigeration.

Unit – IV Food Additives

Introduction- antioxidants, sequestrants, preservatives, nutrient supplement, emulsifiers, stabilizers and thickening agents, bleaching and maturing agent, sweeteners, humectants and anti -caking agents, coloring and flavoring substance.

Unit-V Food Adulteration

Types of adulterants- intentional and incidental adulterants, methods of detection. Detection of common food adulterants in Spices , Grains, Coffee , Tea, Oil fats , Food colours and Milk. Health hazards and risks.

References:

1. The Food Safety and Standard ACT, 2006 – Seth & Capoor

2. Hand book of Food Adulteration and Safety Laws – Sumeet Malik

3. Food Science – B.Srilakshmi

Course Code	**Course Title**	L	T	P	C
201CSOEC	E Learning	4	0	0	2

COURSE OBJECTIVES

- Learn the basics of E-Learning concepts.
- Learn the content development techniques.

COURSE OUTCOMES

- Develop e – learning application on their own.
- Ability to develop contents for e-learning.
- To perform course management using tools.

UNIT I INTRODUCTION

Introduction – Training and Learning, Understanding elearning, components and models of e- learning, Advocacy of e-learning – benefits, learning styles, criteria for choosing, - Applications of E-learning.

UNIT II CONCEPTS and DESIGN

E-Learning Strategy, the essential elements of elearning strategy, Quality assuring e-learning, suppliers and resources, virtual learning environments, authoring tools, e-assessment, Learning Design Issues – purpose, general principles, designing live e-learning, designing self managed learning.

UNIT III APPLICATIONS

Moodle 2.0 E-Learning Course Development – Features, Architecture, Installation and Configuring Site.

UNIT IV COURSE MANAGEMENT

Creating – Categories, Courses, Adding Static Course Material – Links, Pages, Moodle HTML Editor, Media Files, Interacting with Lessons and Assignments – Evaluating Students – Quizzes and Feedback.

UNIT V ENHANCEMENT

Adding Social Activities - Chat, Forum, Ratings, Blocks – Types, Activities, Courses, HTML, Online Users – Features for Teachers.

REFERENCE BOOKS:

1. Delivering E-Learning: A complete Strategy for Design, Application and Assessment,
Kenneth Fee, Kogan page, 2009.

2. Designing Successful e-Learning, Michael Allen, Pfeiffer Publication, 2007.
3. Moodle 2.0 E-learning Course Development, William Rice, PACKT, 2011.
4. Moodle 2.0 First Look, Mary Cooch, 2010.

Course Code	**Course Title**	L	T	P	C
201CAOEC	Web Technology	4	0	0	2

AIM

To equip the students with basic programming skill in Web Technology.

OBJECTIVE

- To understand the concepts and architecture of the Worldwide Web.
- To understand and practice mark up languages
- To learn Style Sheet and Frames

OUTCOMES:

- Acquire knowledge about functionalities of world wide web
- Explore markup languages features and create interactive web pages using them
- Learn and design Client side validation using scripting languages
- Acquire knowledge about Open source JavaScript libraries
- Able to design front end web page and connect to the back end databases.

UNIT I

Introduction to the Internet: networking- internet – email – Internet Technologies: modem internet addressing .

UNIT II

Internet browsers: Internet Explorer – Netscape navigator- Introduction to HTML: Html document – anchor tag – hyperlink.

UNIT III

Head and body sections: Header section – titles – links- colorful web page – sample html document – Designing the body section: paragraph – tab setting.

UNIT IV

Ordered and unordered lists: list – unordered list – heading in a list- order list- nested list.

UNIT V

Table handling: tables – table creation in html cell spanning multiple rows and columns- coloring cells- sample tables- frames frame set definition- nested frames set.

REFERENCE BOOKS

1.World Wide Web design with HTML – C. Xavier – Tata McGraw – Hill – 2000.

2. Principles of web design – Joel Sklar – Vikas publishing house 2001.

Course Code	Course Title	L	T	P	C
201CMOEC	Open Elective – Banking Service	4	0	0	2

AIM:

To Provide the Bank is financial institution which is involved in borrowing and lending money.

OBJECTIVE:

- To provide a lending money to firms, customers and home buyers.
- To provide keep money for customers
- To provide offering financial advice and related financial services, such as insurance.

UNIT – I

Commercial Banking – An Overview: Banking-Classification- Banking system- Universal Banking-Commercial Banking- functions – Role of Banks in Economic Development

UNIT – II

E-banking –An Overview: Meaning-Service-E-banking and Financial Services –Benefits-Internet Banking –Internet Banking Vs Traditional Banking –Mechanics of Internet Banking-Services

UNIT – III

Mobile Banking and Telephone Banking –An Overview: Meaning-Features- Registration-Services – Security Issues –Banking Facilities- Telephone Banking System – Drawbacks- Call Centers

Unit – IV

ATM and Electronic Money: Concept of ATM-Features-Functions-Strategic importance of ATM-Electronic Money – Categories –Merits – E-Money and Monetary Policy-Policy Issues for the RBI

Unit-V

EFT System and INFINET: Meaning- Steps in EFT- RBI Guidelines-EFT Systems Vs Traditional System - ECS-Features-Factors- Benefits –Handicaps -Applications

OUTCOME:

To help to gather knowledge on banking and financial system in India

To provide knowledge about commercial banks and its products

To create awareness about modern banking services like e-banking-banking and internet banking, ATM System

To introduce recent trends in banking system

To make the student understand the basic concept of banking and financial institutions and expose various types of risk based by banks

REFERENCES:

1. Banking theory law and Practice

2. Banking Theory law and practice -Santhanam

3. Banking Awareness - N.K.Gupta

4. Management of Banking and financial Services-Padmalathasuresh,Justin paul .

Annexure-III

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THANJAVUR – 613 403 - TAMILNADU

SCHOOL OF ARTS AND SCIENCE

Department of Microbiology

M.Sc. Microbiology Syllabus

[Regulation 2020]

PRIST
DEEMED TO BE
UNIVERSITY
NAAC ACCREDITED
THANJAVUR – 613 403 - TAMIL NADU

School of Arts and Science

Department of Microbiology

M. Sc., Syllabus-Regulation 2020

Master of Science in Microbiology

Our curriculum is intended to teach our majors in a diversity of significant microbiological disciplines, as well as to inspire, improve, technological skills and capabilities that take persistent value beyond the teaching space.

M. Sc., Graduate Attributes

- **Capability and motivation for intellectual development.**
- **Research, inquiry and analytical thinking abilities.**
- **Communication in** intra and inter disciplinary
- **Ethical, social and professional understanding**
- **Information literacy in respective discipline**
- **Teamwork, collaborative and management skills in scientific research**

M. Sc Programme Educational Objectives-PEO

- **PEO1**- To provide detailed knowledge of Microbiology and their application fields. To understand the beneficial and harmful role of microorganisms in the environment and in the industries.

- **PEO2**- To understand the fundamentals of physiological reactions including metabolic pathways and biochemical reactions in microorganisms. To understand the fundamental concepts of immunology, biochemistry, biotechnology and genetics etc.
- **PEO3**- To develop human resource and entrepreneurs in microbiology with the ability to independently start their own ventures or small biotech units in the field of biotechnology.
- **PEO4**- Understand modern microbiology - practices and approaches with an emphasis in technology application in pharmaceutical, medical, industrial, environmental and agricultural areas.
- **PEO5**- Gain experience with standard molecular tools and approaches utilized: manipulate genes, gene products and organisms. Become familiar with handling of Laboratory animals for the research purpose. Interpret differences in data distributions via visual displays.

M.Sc Programme Specific Outcomes (PSOs)

- **PSO** -Upon master graduation, Microbiology majors will master a set of advanced skills, which would be useful to function effectively as professionals and to their continued development and learning within the field of Microbiology.
- **PSO** - Able to explain why microorganisms are ubiquitous in nature, inhabiting a multitude of habitats and occupying a wide range of ecological habitats.
- **PSO** -Able to cite examples of the vital role of microorganisms in biotechnology,fermentation, medicine and other industries important to human well-being.
- **PSO** -Able to demonstrate that microorganisms have an indispensible role in the environment, including elemental cycles, biodegradation etc

M. Sc Programme Outcome-PO

- PO1- Vital Thinking: Acquire knowledgeable actions after identifying the hypothesis that frame our idea and dealings, read-through out the degree to which these hypothesis are precise and suitable, and give the impression of being at our thoughts and assessments (academic, organizational and individual) from diverse perception.
- PO2- Effectual citizenship: Reveal empathetic social concern and fairness centred national progress and the capability to act with and take part in civic life through volunteering
- PO3- Ethics: Be aware of diverse value systems including the individual, under the ethical dimensions of personal choice, and believe responsibility for them.

- PO4- Environment and Sustainability: Analyze the importance of microbes for environmental clean-up and sustainable development.
- PO5- Self directed and life-long learning: To gain the talent to employ in self-determining and life-long learning in the broadest circumstance socio technological transforms.
- PO6- Economic liberty and employability potential: attain the ability to be concerned in economically sustainable opening and pound entrepreneurial skill.

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School of Arts and Science

Department of Microbiology

M. Sc., Syllabus-Regulation 2020

Course Code	Course Title	L	T	P	C
	SEMESTER I				
20216SEC11	Prokaryotic Microbiology	6	1	0	5
20216SEC12	Eukaryotic Microbiology	6	1	0	5
20216SEC13	Microbial Physiology	6	1	0	4
20216SEC14L	Fundamentals of Microbiology Lab	0	0	4	2

20216DSC15_	Discipline Specific Elective I	5	0	0	4
20216RLC16	Research Led Seminar	-	-	-	1
	Total	**23**	**3**	**4**	**21**
	SEMESTER II				
20216SEC21	Industrial Microbiology	5	1	0	5
20216SEC22	Environmental and Agricultural Microbiology	5	1	0	5
20216SEC23	Clinical Microbiology	5	0	0	4
20216SEC24L	Industrial, Clinical and Environmental and Agricultural Microbiology Lab	0	0	4	2
20216DSC25_	Discipline Specific Elective II	5	0	0	4
20216RMC26	Research Methodology	3	0	0	2
20216BRC27	Participation in Bounded Research	-	-	-	2
	Total	**23**	**2**	**4**	**24**
	SEMESTER III				
20216SEC31	Microbial Genetics	6	1	0	6
20216SEC32	Microbial Biotechnology	6	1	0	6
20216SEC33L	Microbial Genetics and Biotechnology Lab	0	0	5	3
20216DSC34_	Discipline Specific Elective III	5	0	0	4
202_OEC	Open Elective	4	0	0	4
20216SRC35	Design/Socio technical research	-	-	-	2
	Total	**21**	**2**	**5**	**24**

	SEMESTER IV				
20216SEC41	Pharmaceutical Microbiology	6	1	0	6
20216SEC42	Biostatistics and Bioinformatics	6	1	0	6
20216SEC43L	Pharmaceutical Microbiology Lab	0	0	5	3
20216SEC44_	Discipline Specific Elective IV	5	0	0	4
20216PRW45	Project Work	-	-	-	6
20216PEE	Programme exit examinations	-	-	-	2
	Total	17	2	5	27
	Total Credits for the Program				**96**

Discipline specific Electives

Semester	**Discipline specific Elective Courses-I**
I	a) 20216DSC15A- Immunotechnology b) 20216DSC15B-Bioremediation and Waste Management
	Discipline specific Elective Courses-II
II	a) 20216DSC25A-Biomolecules b) 20216 DSC25B- Genomics and Proteomics
	Discipline specific Elective Courses-III
III	a) 20216DSC34A- Plant Tissue Culture b) 20216DSC34B-Nanotechnology
	Discipline specific Elective Courses-IV

IV	a) 20216DSC44A- Bioethics and IPR b) 20216DSC44B-Molecular Immunology

Open Electives

Semester	Open Elective Courses
III	a) 202ENOEC-Writing for the media b) 202MAOEC-Applicable Mathematics Techniques c) 202PHOEC-Bio-Medical Instrumentation d) 202CHOEC-Green Chemistry e) 202CSOEC – M-Marketing a) 202CMOEC- Financial Services

Credit Distribution:

Sem	SEC	DSC	GEC	RSB cources	Others	Total
I	16	4	-	1	-	21
II	16	4	-	4	-	24
III	15	4	3	2	-	24
IV	15	4	-	6	2	27
Total	**62**	**16**	**3**	**13**	**02**	**96**

SEMESTER I

Course Code	Course Title	L	T	P	C

20216SEC11	Prokaryotic Microbiology	6	1	0	5

AIM :

- Prokaryotic Microbiology introduces basic principles and then applies clinical relevance of many etiological agents responsible for global infectious diseases.

OBJECTIVES :

- The infectious disease cycle of the pathogens enables to solve the epidemics.
- The territory covered by infections and the immune response expands each year; we focus on pathogenic mechanisms in order to foster a student's ability to solve problems in their future clinical career.

COURSE OUTCOME

CO1- Scope and historical importance of microbiology

CO2- Understanding the features and classification of prokaryotes.

CO3- study about isolation and identification of microbes

CO4- Economic value of beneficial bacteria

Unit – I

Microbial classification and diversity of microorganisms – classification based on cellularity, cell and kingdom concepts – Whittaker's classification – major group of prokaryotic microorganisms – their characteristics – microbial diversity of viruses, bacterial and cyanobacteria.

Unit – II

Viruses: Introduction – Classification of viruses – cultivation of viruses, purification and assay, various methods of viral assays. Basic structure of viruses – symmetry – biochemical composition of viruses – Bacteirophages – Ultra structure of T_4 phage – multiplication of bacteriophages – viruses of fungi and algae, slow viruses, viroids, satellite viruses.

Unit – III

Plant viruses: Classification of plant viruses. Tobacco Mosaic Virus – Ultra structure of TMV, Multiplication of TMV. Viruses of various plant hosts / crops and diseases - Plant viruses as gene vectors.

Unit – IV

Bacteriology: Introduction – Diversity of bacterial flora – distribution – morphology of typical bacterial cell – Chemical composition of bacterial cell wall, Reproduction and genetic recombination, Transformation, Conjugation, Transduction, Bacterial growth rate, Bacterial culture methods and culture media for various bacteria. Isolation and enumeration of bacterial cultures, Identification – Gram staining technique, Bacterial diseases of Man.

Unit – V

General characteristics of other Bacteria – Mycobacteria, Myxobacteria, Rickettsia and Chlamydiae and Cyanobacteria – Classification of cyanobacteria – significance of Cyanobacteria in biofertilizers – *Archaeobacteria, Actinomycetes*, *Streptomyces, Actinoplanes*, *Maduramycetes* and their general characters

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5th /1993	Tata McGraw-Hill, Inc, New york
2.	R.C. Dubey, D.K. Maheshwari	A Text Book of Microbiology	3rd/ 2003	Chand Publishing

Reference Book:

1. Fundamental of Microbiology (2005) By Purohit, Agrobios Publishers, Meerut

Course Code	Course Title	L	T	P	C
20216SEC12	Eukaryotic Microbiology	6	1	0	5

AIM

- To gain the knowledge with the various inner and outer structures of prokaryotes and in detail.

OBJECTIVES

- To learn the general principles and applications of microbiology

COURSE OUTCOME

CO1- General Features and taxonomy of eukaryotes

CO2- Knowledge about advanced research in mycology, phycology.

CO3- Scope of Algae used as a food

CO4- Economic importance of Lichens and algae

Unit – I

Differentiation of Eukaryotes and Prokaryotes – Salient features of Eukaryotes – Major groups of Eukaryotes – Algae, Fungi, Protozoa and lichens – Classification of Algae, Fungi and Protozoans. Significance of various Algae and fungi in Agricultural Microbiology - Significance of various fungi, algae in environmental biology – biodegradation of Xenobiotics, heavy metals and pesticides, Eukaryotic microbes in Bio pesticides.

Unit – II

Algae: Phycology – Introduction – Distribution of Algae, General features of algae Classification and general characters of prochlorophyta, Rhodophyta, Phaeophyta: Significance of Algae in production.

Unit – III

Biology of Lichens – fungal components and algal component: general characteristics of lichens, physiology of lichens, classification of lichens, Reproduction of lichens, Economic uses of lichens. Single cell protein (SCP) – Spirulina and significance: BGA and significance in agriculture.

Unit – IV

Mycology – Introduction – General characters of Fungi – Structure of fungi – Fungal cell, multiplication of fungi – Fungal diseases of Plants, Animals and Human - Beneficial fungi, VAM – fungi in soil fertility. Predaceus fungi and nematophagous fungi – Fungi in food spilage and food infections.

Unit – V

Protozoans – Classification of Protozoa – General Characters of protozoa – general structure and life cycle of Amoeboid form – Nutrition and Reproduction in protozoans – Protozoan diseases of Animals and Man

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5th /1993	Tata McGraw-Hill, Inc, New york
2	R.C. Dubey, D.K. Maheshwari	A Text Book of Microbiology	3rd/ 2003	Chand Publishing

References

1. Microbiology (1993) Jr. M.J. Peczar, E.C.S. Chan and N.R. Kreig, Mc Graw Hill Inc., NewYork
2. General Microbiology, 1976. Roger Stanier, Fifth Edition,
3. Fundamental of Microbiology (2005) By Purohit, Agrobios Publishers, Meerut

Course Code	Course Title	L	T	P	C
20216SEC13	Microbial Physiology	6	1	0	4

AIM :

- To enable the students to understand the physiology and metabolism of microorganismS.

OBJECTIVES :

- To impart knowledge on metabolic function and biochemical reaction going on inside the microbial cell.
- To teach metabolic pathways, their regulation and engineering, and methods used in their elucidation.
- To teach students about cell cycle, growth and methods to determine microbialgrowth.

COURSE OUTCOME (CO'S):

CO1- Understand the factors influencing the growth of microbes in ecosystem

CO2- Learn about Bioluminescence and their advantages.

CO3- Learn about microorganism to assimilate the nutrients for growth.

CO4- Study about metabolic pathway

Unit – I

Cell structure and function: Biosynthesis of peptidoglycan – Outer membrane, teichoic acid Exopolysacchairdes; Cytoplasmic membrane – Pilli, fimbriae, S-layer, Transport mechanisms – active, passive, facilitated diffusions – uni, sym, antiports. Electron carriers – artificial electron donors, inhibitors, uncouplers – energy bond – phosphorylation.

Unit – II

Microbial growth: Phases of growth cruve – measurement of growth – calculations of growth rate – generation time – synchronous growth – induct on of synchronous growth, synchrony index – factors affecting growth – pH, temperature, substrate and osmotic condition. Survival at extreme environments – starvation – adaptive mechanisms in thermophilic, alkalophilic, osmophilic and psychrophilic-Bioluminescence – mechanism – advantages.

Unit – III

Microbial pigments and carbon assimilation: Autotrophs – Cyanobacteria – photosynthetic bacteria and green algae – heterotrophs – bacteria, fungi, myxotrophs. Brief account of photosynthetic and accessory pigments – chlorophyll – fluorescences, phosphorescenses – bacterochlorophyll – rhodopsin – carotenoids – phycobiliproteins: Carbohydrates – anabolism – autotrophy – oxygenic – anoxygenic photosynthesis – autotrophic generation of ATP; fixation of CO_2 – Calvin cycle – C_3 – C_4 pathways. Chemolithotrophy – sulphur – iron – hydrogen – nitrogen oxidations – Brief account of methanotrophs in relation to CO_2 fixation.

Unit – IV

Microbial respiration and fermentative pathway: Respiratory metabolism – Embden Mayer Hoff pathway – Enter Doudroff pathway – glyoxalate pathway – Krebs cycle – Oxidative and substrate level phosphorylation – reverse TCA cycles – Gluconeogenesis – Pasteur Effect – Fermentation of carbohydrates – homo and heterolactic fermentations. Cell division – endospore – structure – properties – germination.

Unit – V

Spore structure – Function: Cell division – endospore – structure – properties – germination – Microbial development, sporulation and morphogenesis. Hyphae vs yeast forms and their significance. Multicellular organization of selected microbes – Dormancy.

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5th /1993	Tata McGraw-Hill, Inc, Newyork
2.	S. Meenakumari	Microbial physiology	1st / 2006	MJP Publishers

Reference Book:

1. Microbial physiology and metabolism (1995) D.R. Caldwell, Wm. C.Brown, Publishers. USA

2. Microbial Physiology (1988). A.G. Moat and J.W. Foaster, John Wiley & Sons, New York.

Course Code	Course Title	L	T	P	C
20216SEC14L	Fundamentals of Microbiology Lab	0	0	4	2

AIM

- A student undertaking this course will be learning the principles behind the basic techniques

OBJECTIVES

- This course is put forward with the objectives of equipping the candidates with practical knowledge on basic techniques involved in the isolation,
- Characterization and identificationdifferent types of microorganism.

COURSE OUTCOME :

CO1- practical knowledge about isolation and purification of microbes from various sources.

CO2- Training about staining experiments

CO3- Handling on light and compound microscope.

CO4- Learn essential biochemical analysis

EXPERIMENTS

Principles and methods and sterilization – (Wet, dry and cold sterilization)

Direct microscopic observations of bacterial shape – cocci, rods, chains, fungal spores, mycelium, yeast budding.

Preparation of Media: Nutrient broth, Nutrient agar, plates, slants, soft agar. Pure culture technique: Streak plate, spread plate and pour plate methods

Measurement of size of microbes – micrometry method. Motility determination – Hanging drop method.

Isolation and purification of cyanobacteria, actinomycetes, fungi and protozoans.

Staining methods: Simple, Negatives, acid fast, Gram staining, Capusule Metachromatic granular staining, Lactophenol cotton blue staining – Fungal slide preparation.

Measurement of growth – Direct haemocytometer count, viable count – growth curve,

Determination of growth rate and generation time.

Effect of pH, temperature and osmotic pressure on growth of bacteria.

Biochemical test: carbohydrate fermentation – acid – gas production: IMViC test; - Hydrolysis of starch: cellulose, gelatin, casein, catalase test, oxidase, urease test, nitrate reduction – triple sugar iron test, ONPG test, amino acid decarboxylase

Blood grouping

Widal test

Total count of RBC

Total count of WBC

Differential count of WBC

Erythrocyte Sedimentation Rate

Preparation of Buffer; pH measurement (Tris, phosphate, acetate buffer)

Reference:

1. Cappuccino and James, G(1996) Microbiology a laboratory manual, Addison Wesley Publishing company Inc. 4th Edition, England, California
2. Gerhardt. P. Murray, R.G. Wood, W.A. and Kreig, N.R. (1994) Methods of General and Molecular Bacteriology, Ed. Amercian Society for Microbiology, Washington D.C
3. David R. Brooke. Bergey's Manual of Systematic Bacteriology (Vol.I) Eastern Halz, Springer Publication
4. James T. Stanley, Marving, P. Bryant, Bergey's Manual of Systematic Bacterilogy (Vol.II), Nobert pfeming Springer Publishers

Discipline Specific Elective-I

Course Code	Course Title	L	T	P	C
20216DSC15A	Immunotechnology	5	0	0	4

AIM:

- To expose the students with the immune system of human body

OBJECTIVES:

- Objectives The aim of this course is to impart knowledge on the basic concepts of cells and components of immune system and immuno diagnostic techniques

COURSE OUTCOMES (CO'S):

CO1- Learn scope and history of immunology.

CO2- Study about immune system and lymphatic organs.

CO3- Learn tumor immunology

CO4- gain knowledge about various immunological techniques

Unit – I

Introduction: History of immunology – types of immunity – Innate and Acquired – Passive and Active - Humoral and cell Mediated Immunity. Lymphoid organs – autoimmunity, physiology of immune response — Immunohaematology

Unit - II

Antigens and Antibodies: Antigens – structure and properties – types – ISO and allo –haptons; adjuvants – antigen specificity, vaccines and toxoids. Immunoglobulins – structure - heterogeneity – types and subtypes – properties (physico – chemical and biological); theories of antibody production - Complement – structure – components - properties and functions of complement components; complement pathways and biological consequences of complement activation

Unit - III

Major Histocompatibility complex: Structure and function of MHC and the HLA system. Gene regulation and lr – genes. HLA tissue and transplantation – tissue typing methods for organ and tissue transplantation in humans; Graft versus host reaction and rejection. Autoimmunity – diseases-mechanism and disease with their diagnosis

Unit - IV

Tumor Immunology: tumour antigens – immune response to tumors immunodiagnosis of tumors – detection of tumor markers alphafoetal proteins, carcinoembryonic antigen etc. Immunotherapy of malignancy, Hypersensitivity – monoclonal antibody – production and their applications

Unit - V

Immunological techniques and their principles: In vitro of immunological methods – agglutination, precipitation, complement fixation, Immunolfluorescence, ELISA, Radio Immuno Assays. Immunodiffusion, Immunoelectrophoresis, isoelectric focusing – cytotoxicity assay – labeled – antibody technique in light and Electron Microscopy and Immunohistochemistry. Techniques of Immunization – use of adjuvants – separation of lymphocytes – and preparation of Rosette forming cells - In vivo methods – skin tests and immune complex tissue demonstrations - Applications of these methods in diagnosis of microbial diseases.

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication

1.	Ivaitt Roitt, Jonathan Brostoff, David Male	Immunology	3rd/1993	Mosby Inc, St. Louis, MO
2.	R.A. Goldsby, T. J. Kindt, B.A. Osborne, J. Kuby	Immunology	5th/2003	W.H. Freeman and Company
3.	M.S. Aslam	Immunobiology	1st/2000	Campus Book International

References

1. Immunology (2002), C.V Rao, First Edition, Narosa Publications.
2. Essentials of Clinical Immunology (1986) H.Chapel and Halbey, ELBS
3. Essentials Immunology (1994) M.Rolt Blackwell Scientific Publication, Oxford

Course Code	Course Title	L	T	P	C
20216DSC15B	Bioremediation and Waste Management	5	0	0	4

AIM

- To study the water and waste water treatment for recycleing process.

OBJECTIVES:

- To impart knowledge on the management of solid and liquid wastes frommunicipal and industrial sources and principles of remedial measures of recycling,reuse and recover from the wastes.

COURSE OUTCOMES:

CO1- Understanding on the management of solid and liquid wastes

CO2- Learn the principles of remedial measures of recycling, reuse and recover from the wastes.

CO3- Understand the mechanism and role of microbes in the degradation of various pollutants

UNIT – I

Wastes– Classification and Quantification – Solid Waste Management and Disposal: Sources and Generation of Solid Waste – characterization, composition and classification. Hazardous Waste Management: Cyanides, Dioxins, Detergents, Plastics, Nylon and Paper. Waste Minimization approaches – Monitoring and Management strategies. Radioactive Waste: Sources, half life of radioactive elements, modes of decay. Effects on Plants, Animal and Man. Low and High-level Radioactive Waste Management – Waste Minimization and Treatment, Radiation standards.

UNIT - II

Recycling of Wastes – Types – sources – composition of waste – recycling of waste for Industrial, Agricultural and Domestic Purposes; Recycling of Metals, Reuse, recovery and reduction of paper and plastics; Recycling in Food Manufacturing, Beverages, Apparel, Leather, Paper, Pulp, Chemical and other industries; Fly Ash utilization. Waste Disposal Methods – composting, incineration, pyrolysis, medical waste disposal strategies.

UNIT – III

Microbial Activity in Soil and Ground Water, Lithosphere as Microbial habitat, Microorganisms in rock and minerals, Mineral soil and Organic soil. Physiological groups of prokaryotes, Geomicrobial transformations – Biodegradation of carbonates – Biomobilization of silicon, phosphate, nitrogen. Geomicrobiology of fossil fuel, methane, peat, coal and petroleum.

UNIT – IV

Principles of Bioremediation – Rapid growth and Metabolism- Genetic plasticity – Metabolic pathways for the degradation of xenobiotics, hydrocarbons – Microbial site characterization – Biodegradation potential – Bioprocess design, optimization – Microbial removal rates – inherent problems associated with biotreatment studies. Microbiological methodologies – Standard biotreatability protocols – Quantification of biodegradation; Biocleaning -Chernobyl radioactive contaminated area - Phytoremediation.

UNIT – V

Aerobic Bioremediation: Bioremediation of Surface Soils: Fate and transport of contaminants in the Vadose zone – Biodegradation in soil ecosystems – Types of soil treatment systems – Bioreactors. Subsurface Aerobic Bioremedidation: in situ Bioremediation – in situ Bioventing – in situ treatments of Harbour Sediments and Lagoons. Bioremediation in fresh water and marine systems: Bench and Pilot Scale studies – in situ Bioreactor treatment of sediments – in situ treatment in marine ecosystem. Anoxic/Anaerobic Bioremediation: Anoxic/Anaerobic Processes –Fermentation, Degradation of xenobiotics – Anoxic/Anaerobic bioremediation of hydrocarbons, Phenols, Chlorophenolic compounds, Polycyclic Aromatic Hydrocarbons (PAH), Heterocyclic Compounds, Cyanide, dyes,

REFERENCES

1. Microbial Ecology, IV Ed., Atlast, R.M and Bartha,R.,(2000) Addison Wesley Longman Inc.

2. Bioremediation, Baker,K.H. and Herson,D.S., (1994) Mc Graw–Hill Inc, New York.
3. Biology of Microorganisms, VII Ed., Brock,T.D., Madigan,M.T. Martinko,J.M. and Parker, J (1994) Prentice Hall, New Jercy.
4. Geomicrobiology, Ehrlich,H.L (1996) Marcel Dekker Inc., New York.
5. Bioremediation – Principles, Eweis,J.B., Ergas,S.J, Change,D.P.Y and Schroeder, E.D (1998). Mc Graw-Hill Inc.
6. Environmental Engineering, Kiely, G (1998) Irwin/Mc Graw Hill International, U.K.
7. Hazardous Waste Management, II Ed, LaGrega,M.D.,Buckingham,P.L., and Evans, J.C (2001) Mc Graw Hill Inc.

SEMESTER II

Course Code	Course Title	L	T	P	C
20216SEC21	Industrial Microbiology	5	1	0	5

AIM

- To study about the industrially importance microorganisms, fermenter design, fermentation process.

OBJECTIVE

- To give knowledge on strain improvement methods.
- To learn about upstream fermentation process .
- To understand about downstream fermentation process

OUTCOME.

CO1- Students will get knowledge on strainimprovement.

CO2- Enable them to work in fermentationindustry.

CO3- Students will get idea on upstream and downstream fermentationprocess

CO4- Economic importance of Bio products

Unit I

Historical development of industrial microbiology: major classes of products and processes and micro organisms used in industrial processes. Industrially important microbes and their development: Screening methods for industrial microbes –strain selection and improvement – Mutation and recombinant DNA techniques for strain development. Batch culture and continuous culture

Unit – II

Fermenters – Design of a fermenter, and components – asepsis and containment requirements – body construction and temperature control – aeration and agitation systems – sterilization of fermenter, air supply, and medium; aseptic inoculation methods – sampling methods, valve systems –monitoring and control devices and types of fermenters and its basic functions.

Unit – III

Downstream processing – extraction, separation, precipitation, filtration, centrifugation, cell disruptions, liquid-liquid extraction, chromatography, recovery & purification, process and quality control.

Unit – IV

Production of Primary metabolites: Organic acids (citric acid, lactic acid, acetic acid) and Amino acids (glutamic acid, lysine). Production of Vitamins (B2 and B12). Production of Secondary metabolites: Antibiotics: beta-lactams (Penicillins, Cephalosporins), aminoglycosides (streptomycin), macrolides (erythromycin) and Quinones (Tetracycline).

Unit –V

Bio products: Bio-pesticides, bio-fertilizers, natural bio-preservatives (Nisin), High Fructose Corn Syrup, Bioplastics and biopolymers (Poly Lactic acid, Poly Glutamic acid, Poly hydroxyl alkoanates,

Xanthum Gum and Dextran), Biotransformations - steroids and non-steroids. Enzymes - Proteases, amylases, lipases, cellulases, pectinases, glucose isomerase, L-Asparaginase. Production of vaccines and recombinant proteins (Insulin, Streptokinase). Production of Biofuels (Biomethanol, Bioethanol, Biobutanol, Biohydrogen and Biodiesel).

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	L.E. Casida Jr	Industrial Microbiology	1968	Wiley
2.	W. Crueger and A. Crueger	A text book of Industrial microbiology	2^{nd}/1990	Sinauer Associates Incorporated
3.	Prescott and Dunn's	Industrial Microbiology	4^{th}/1987	CBS Publishers and Distributors

References

1 Alexander, M.(1961). Introduction to soil microbiology, Wiley and Sons Inc. New York and London
2 Demain, A.L. and Davies, J.E (1999) Manual of Industrial Microbiology and Biotechnolgy. ASM Press
3 Glick, B.R and Pasternak, JJ(1994) Molecular Biotechnology, ASM Press
4 Stanbury, P.F, Whitaker, A. and Hall, S.J.(1991). Principles of Fermentation Technology, Pergamon Press
5 Glick, B.R and Pasternak, JJ(1998) Molecular Biotechnology, II Edition , ASM Press, New York
6 Mittal, D.P.(1999) Indian Patents Law, Taxmann, Allied Services (P) limited
7 Tortora, G.J., Fernke, .B.R. and Case, C.L.(2001), Microbiology – An Introduction, Benjamin Cummings

Course Code	Course Title	L	T	P	C
20216SEC22	Environmental and Agricultural Microbiology	5	1	0	5

AIM

- To study about the biofertilizers, plant disease and increasing soil fertility.v

OBJECTIVES

- To educate the students about concepts of designs of water distribution systems, sewer networks, working principles and design of various physical, chemical and biological treatment systems of water and wastewater.

COURSE OUTCOME (CO)

CO1- Huge Insights into these precious areas of Environmental microbiology.

CO2- Students able to know detailed idea about biofertilizer production and plantdisease**.**

CO3- Role ofMicrobes in marine and fresh water environment

CO4- Scope of Recycling of Liquid and Solid wastes

Unit I

Aerobiology- Significance of air microflora - Microbial air pollution- sources, biological indicators and effects on plants and human beings. Enumeration of bacteria from air, Air sampling devices, Outline of Airborne diseases (Bacterial, Fungal and Viral), Air sanitation. Biogeochemical cycles -Nitrogen, Carbon,

Phosphorous, Sulphur, Iron and their importance.

Unit II

Microbes in marine and fresh water environment – eutrophication – Water pollution – sources and nature of pollutants in water – sewage – treatment of liquid waste – primary, secondary and tertiary treatment – water borne diseases – Assessment of water quality – BOD and COD. Solid waste treatment – saccarification and pyrolysis.

Unit III

Recycling of Liquid and Solid wastes-Composting-Biogas, Mushroom and SCP production from waste. Biodegradation of complex polymers (Cellulose, Hemicellulose, Lignin, Chitin and Pectin), Bioremediation (*In-situ, Ex-situ*, Intrinsic), Bioaugmentation and Biostimulation. Bioleaching (Copper and Uranium) -Xenobiotics degradation (Heavy metals).

Unit IV

Microbial association with plants - Phyllosphere, Rhizosphere, Mycorrhizae, nitrogen fixing organism – symbiosis, asymbiosis, associate symbiosis – phosphate solubilizers – application of biofertilizers in agriculture. Biology of nitrogen fixation – genes and regulations in *Rhizobium.*

Unit V

Bacterial, viral and fungal plant pathogens. Morphological, physiological changes with reference to disease establishment in plants – plant protection – phenolics – phytoalexins and related compounds. Disadvantages of chemical pesticides. Microbial pesticides- types, mechanisms, advantages and limitations.

Text Books

S. No	Author Name	Title of the Paper	Edition /year	Publication
	B. Nagamani	Soil And Agricultural Microbiology	1st/ 2007	Margham Publications
	Dirk, J., Elasas, V., Trevors, J.T., Wellington	Modern Soil Microbiology	1997	Marcel Dekker INC
	R.R. Mishra	Soil Microbiology	1st/2004	CBS Publication

References

1. Atlas Ronald M, Bartha Richard. Microbial Ecology 2nd Edition. Benjamin/Cummings Publishing Company, California. 1987.

2. Baker WC and Herson DS. Bioremediation – McGraw Hill Inc., New York. 1994.

3. Chatterji AK. Introduction to Environmental Biotechnology. 2005

4. Christon J Hurst, Manual of Environmental Microbiology.2nd edition. American Society for Microbiology, Washington. 2002.

Course Code	Course Title	L	T	P	C
20216SEC23	Clinical Microbiology	5	0	0	4

AIM

- To inculcate on the role of normal flora and pathogenic microbes.

OBJECTIVE

- To understand the pathogenesis of various diseases
- To understand the various clinical microbiological techniques.

OUTCOME

CO1-Learn normal flora of human body

CO2- Get information about various sources ofinfection and transmission

CO3- Epidemiology, pathogenesis and treatment of bacterial, fungal and viral diseases

CO4- Learn Strategy of antimicrobial therapy.

Unit – I

Normal microbial flora of human – Host – parasite interaction: The Process of infection. Infective syndromes and diagnositic procedure - Strategy of antimicrobial therapy – Epidemiology and control of community infections.

Unit – II

General properties, epidemiology, transmission, pathogenesis, Symptoms, laboratory diagnosis, prevention and Treatment of the following Bacterial diseases:a) Pneumonia, b) Whooping-cough, c) Meningitisd) Diphtheriae) Pulmonary Tuberculosis,f) Leprosy, g) Typhoid, h) Cholera i) Tetanus, j) Syphillis, k) Gonorrhoea, d) Dental carries.

Unit - III

Mycobacterium: Mycobacterium tuberculosis, Mycobacterium leprae. Spirochaetes, Mycoplasma, Actinomycetes, Helicobacter, Compylobacter and other miscellaneous bacteria, Rickettsia, Chlamydia.

Unit – IV

General properties, epidemiology, transmission, pathogenesis, Symptoms, laboratory diagnosis, prevention and Treatment of the following viral diseases: Small pox, Influenza, Measles, Poliomyelitis, Common cold(Rhino virus), Hepatitis, Encephalitis, Rabies, AIDS.

Unit – V

Pathogenic Fungal diseases- Superficial, Subcutaneous and systemic mycoses, **Protozoa-** Amoebiasis, Malaria, **Helminthes-**Liverfluke, Filariosis, **Hospital acquired infections:**Hospital infections Principles of control – Committee – functions; Hospital waste disposal – Ethical committee – functions.

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	Sherris	Medical Microbiology	4th/2004	McGraw-Hill Companies, Inc.
2.	V.V. Kale, K.P. Bhusari	Applied Microbiology (Pharmacy and other Bioscience)	1st/2001	Himalaya Publishing House
3.	Jr. M.J. Pelczar, E.C.S. Chan and N.R. Kreig.	Microbiology	5th /1993	Tata McGraw-Hill, Inc, Newyork

References

1 Schachter, M., Med off, G. and Eisenstein, B.C.(1993) mechanism disease, 2nd Edn. Williams and Wilkins Baltimore
2 Ananthanarayan & Paniker's Textbook of Microbiology, 8th Ed., Orient Longsman, India; 2009
3 Smith, C.G.C(1976).Epidemiology and Infections. Medowlealf PressL shildon, England
4 Stokes,J., Ridway, G.L., and Wren, M.W.D.,(1993). Clinical Microbiology 7th Edn. Arnold a division of Hodder and Stoughton.
5 Wistriench, G.A. And lechtonan, M.D.(1988). Microbiology, 5th Edn., Mac publishing company NY
6 Atlas, R.M. (1989) Microbiology – fundamentals and applications 2nd Edn. Maxwell Mac Millan International Edition

Course Code	Course Title	L	T	P	C
20216SEC24L	Industrial, Clinical and Environmental and Agricultural Microbiology Lab	0	0	4	2

AIM

- To provide technical knowledge on collection and processing of clinical samples .

OBJECTIVE

- To prepare them to work in clinical laboratory .
- To learn the technique for isolation and identification of pathogens

OUTCOME

CO1- Get practical knowledge in specimen collection and processing

CO2- Become technically expert which will helpful to work in clinical laboratory

CO3- Learn practical understanding of diagnosis of pathogens.

CO4- Acquire knowledge on fermentation process

CO5- Learn bio fertilizer and inoculants production

Industrial and Clinical Microbiology

1. Citric acid fermentations by *Aspergillus niger*
2. Alcoholic fermentation of fruit juice by yeast (*Saccharomyces cerevisiae).*
3. Immobilization techniques using any microbe- alginate beads
4. Hydrolysis of starch
5. Testing sensitivity of bacteria to antibiotics and Assessing minimum inhibitory concentration(MIC) of antibiotics
6. Isolation and identification of certain pathogenic microbes from urine
7. Hemoglobin content of blood
8. Serum analysis, sugar analysis in blood and urine

Agricultural and Environmental Microbiology

1. Isolation and enumeration of soil microorganisms (fungi, bacteria and actinomycetes)
2. Isolation and staining of vesicular arbuscular mycorrhizae from plant.
3. Isolation and culturing of Rhizobium from root nodules of higher plant
4. Mushroom cultivation
5. Isolation and identification of air-borne microbes
6. Effects of high salt concentration on microbial growth
7. Determintion of BOD and COD of polluted/pond water.
8. Bacterial examination of drinking water by membrane filter technique and MPN

Visit to commercial production units – ethanol, acetic acid, vaccine and Spirulina

Visit to CFTRI/DFRL/FOOD INDUSTRIES and report should be written in the practical record

Reference:

1. Clescri,L.S., Greeberg,A.E., and Eaton, A.D.(1998) Standard Methods for Examination of Water and Waste Water, 20th Edition, Amercian Public Health Association
2. Gerhardt,P., Murray R.G., Wood, W.A. and Kreig, N.R.(1994). Methods for General Land Molecular Bacteriology, ASM Publications, Washington

3. Pactricia Cunning(1995) Official Methods of Analysis, Vol I and II, 16th Edition, Arlington, Virginia, USA, AOAL.
4. Richard G., Burus and Howard Slater (1982) Experimental Microbial Ecology, Blackwell Scientific Publishers
5. Tuffery(1996). Laboratory Animal, an Introduction, II Edition, John Wiley and Sons New York

Discipline Specific Elective-II

Course Code	Course Title	L	T	P	C
20216DSC25A	Biomolecules	5	0	0	4

AIM

To know the functions of Biomolecules

OBJECTIVE :

- To understand the structure and functions of carbohydrates, lipids , proteins and nucleic acids
- To understand the role of nucleic acid in proteins synthesis

OUTCOME

CO1- They acquire knowledge in the quantitative and qualitative estimation of biomolecules
CO2- They study the influence and role of structure in reactivity of biomolecules
CO3- Students have a thorough understanding on the role of biomolecules and their functions.

Unit I

Carbohydrates: Structure and biological functions of Mono, di and Polysaccharides. Types of polysaccharides: Homo polysaccharides -chitin, fructans, mannans, xylans, and galactans. Structure and biological importance of Hetero polysaccharides- Glycoprotein – bacterial cell wall polysaccharides, marine polysaccharides and Lectins.

Unit II

Aminoacids and its general properties. Classification of amino acids. Proteins– classification and general properties. Orders of protein structure, Primary- Secondary structure– the α-helix, β- pleated sheet. Protein sequencing methods.

Unit III

Lipids: Definition and classification of lipids. Biological significance of lipids. Types of Fatty acids-Essential, Non essential. Structure and biological functions of phospholipids, sphingolipids, glycolipids. Steroids – structure and functions of cholesterol, bile acids, sex hormones, ergosterol. Structure and biological role of prostaglandins, thromboxanes and leukotrienes.

Unit IV

Nucleic acid: Structure of purines, pyrimidines, nucleosides and nucleotides. DNA double helical structure. A, B and Z forms of DNA. Properties of DNA- Density, viscosity, hypochromicity, denaturation and renaturation. DNA sequencing– chemical and enzymatic methods. Chemical synthesis of DNA. RNA– types and biological role- Secondary, tertiary structures of RNA.

Unit V

Vitamins: Definition and Classification - Source, Structure and biological role - Daily requirements and deficiency manifestation of fat soluble vitamins and water soluble vitamins.

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	J. L. Jain	Fundamentals of Biochemistry	1st / 2005	S. Chand and Company

References

1. Biochemistry Dubay 4th edition William C.Brown Publication, 1998.
2. Biochemistry. Davidson and Sittmann, NMS 4th ed. Lippincott William's and Wilkins, 1999
3. Biochemistry – Voet and Voet. J O H N WI VP &*Publisher* Kaye Pace Associate Publisher, 2011.
4. Biochemistry Student Companion, by Berg, 7th Edition Berg, Jeremy M. / Tymoczko, John L. / Stryer, Lubert Published by W. H. Freeman, 2011.

Course Code	Course Title	L	T	P	C
20216DSC25B	Genomics and Proteomics	5	0	0	4

AIM

To know the basic principles of genes and proteins

OBJECTIVES:

To understand the gene functions and its genetic engineering aspects

To understand the protein functions and its genetic engineering aspects

COURSE OUTCOME :

CO1- Students gain the knowledge about the interactions between the proteins
CO2- Get the information to predict cell behavior or develop drug targets.
CO3- Rapidly evolving scientific area into ***genomes***, proteomes and databases
CO4- Learn to store various data NCBI, DDBJ and EMBL

Unit I

Genomics: genetic and physical maps, physical mapping and map-based cloning, choice of mapping population, simple sequence repeat loci, southern and fluorescence in situ hybridization(FSH) for genome analysis, chromosome microdisection, molecular markers in genome analysis

Unit II

Genome sequencing: genome sizes, organelle genomes, genomic libraries, strategies for genome sequencing, packaging, transfection and recovery of clones, application of sequence information for identification of defective genes. Pharmacogenetics, cancer genetics; immunogenetics; mapping of human genome; somatic cell genetics; DNA polymorphism in mapping; structure and function; biochemical genetics; polygenic inheritance

Unit III

Proteomics: Sample preparation, Gel-based proteomics - two-dimensional gel electrophoresis (2-DGE), two-dimensional fluorescence difference in-gel electrophoresis (DIGE), Staining methods, PF-2D, Tandem FPLC, Mass spectroscopy: basic principle, ionization sources, mass analyzers, different types of mass spectrometers (MALDI-TOF Q-TOF, LC-MS).

Unit IV

Nuclear magnetic resonance spectroscopy (NMR), basic principles, chemical shift, spinspin interaction, NOE, 2D-NMR, NOESY,COSEY. X-ray Crystallography: Principle of X-ray diffraction, scattering vector, structure factor, phase problem, reciprocal lattice and Ewald sphere, Miller indices, Zone axes, crystal lattice, Lane Equations, Bragg's law, special properties of protein crystals, model building, refinement and R-factor.

Unit V

Protein Engineering: Protein sources, Industrial and medical application of proteins, different expression of proteins for large scale purifications, protein engineering strategy, rational and random

mutagenesis. Applications of protein engineering-protein in Chemical and Medical Industries: Generation of heat stable, pH stable engymes, application in vaccine development, drug development, sensor development.

References

1. Gupta, P.K. 2004. Biotechnology and Genomics. First edition. Rastogi Publications, Meerut.
2. Miglani, G.S. 2007. Advanced Genetics. New Delhi: Narosa Publishing House.
3. Primrose, S.B. and Twyman, R.M. 2006. Principles of Gene Manipulation and Genomics. Blackwell Publishing, Australia.
4. Singh, B.D. 2009. Biotechnology: Expanding Horizons. Second Edition. Kalyani Publishers, Ludhiana.
5. Singh, B.D. 2009. Plant Biotechnology. Kalyani Publishers, Ludhiana.
6. Thompson, J.D., Schaeffer-Reiss, C., and Ueffing, M. 2008. Functional Proteomics. Methods and Protocols. Humana Press, New York.
7. Twyman, R.M. 2004. Principles of Proteomics. Taylor & Francis.

Course Code	Course Title	L	T	P	C
20216RMC26	Research Methodology	3	0	0	2

AIM:

- The course is to understand the principles and applications of classical and modern techniques in Biology develop skill in preparation of reports, writing research communications and thesis

OBJECTIVES:

- To impart understanding on the concepts of statistics and to improve the Computing knowledge of the statistical methods related to environment

COURSE OUTCOMES:

CO1- Understanding research questions and tools

CO2- Experience in scientific writings

CO3-Practice in various aspects of scientific publications

CO4-Inculcation of research ethics

Unit I

Research Selection of problem-stages in the execution of research: choosing a topic to publication-preparation of manuscript-report writing- format of journals – proof reading – sources of information: Journals, reviews, books, monographs, etc, Bibilograpy. Journal ; standard of research journals – Impact factor.

Unit II:

Statistical method -Measures of dispersion: Universe and population – delimiting population – sampling method – random sampling, stratified random sampling – types of variables: qualitative and quantitative variables – continuous and discontinuous variables – scaling method S- mean – standard deviation – standard error – coefficient of variation.

Unit III

Coparision of means, chisquard test, student test (ANOVA ‘’portioning of variation). F test – model sums on one way ANOVA with interpretation of data – introduction to MANIVA – Statistical and their use – significance test and fixing levels of significance – use of statistical software like COSTAT and STATISTICA. Breif introduction to pie and histograms. Use of LCD.

UNIT IV:

Chromatography – priniciple, operative technique and applications of paper, TLC, adsorption chromatography, GLC and HPLC. Ion-Exchange, molecular sieve, Electrophoretic techniques – principle and technique of gel, SDS, high voltage and discontinuous electrophoresis, Isoelectric focusing, plused field gel electrophoresis and capillary electrophoresis. Spectrometry – Centrifugation techniques.

UNIT V:

X-Rays – X-Ray diffraction, crystals and detectors, quantitative analysis and applications. Radio chemical methods – Basic concepts, counting methods and applications. Autoradiography, detection and measurement of radioactivity, applications of radioisotopes in biology.

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	C. R. Kothari	Research Methodology	2nd / 2004	New age international publishing (p) Ltd.
2.	S. Rajkumar	Research Methodology	1st / 2008	Anuradha Publication
3.	Jerrold H. Zar	Biostatistical Analysis	4th/2003	Pearson Education (Singapore) Pte. Ltd.
4.	D. J. Homie and Hazel Peck	Analytical Biochemistry	3rd / 1998	Longman group

References

1. An introduction to practical biochemistry by David T. Plummer.
2. Physical Biochemistry – Application of Biochemistry and Molecular Biology, David Friefelder, W.H Freeman and Co, 2nd Edition 1999.
3. Experimental Biochemistry, Robert Switzer and Liamgarrity, W.H. Freeman and Co, 3rd 1999.
4. Davis, G.B and C.A Parker, 1997. Writing the doctoral dissertation, Barrons Education series, 2nd edition, Pp 160, ISBN: 081208005
5. Duneary, P. 2003. Authoring a Ph. D thesis: how to plan, draft, write and finish a doctoral dissertation. Plagrave Macmillan, Pp256. ISBN 1403905843.

SEMESTER III

Course Code	Course Title	L	T	P	C
20216SEC31	Microbial Genetics	6	1	0	6

AIM

- The emergence of molecular genetics has revolutionized large areas of modern biological and biochemical research work it has had a huge impact on the biotechnology industry.

OBJECTIVE

- To extend the knowledge on molecular basis of mutation at microbial level
- To focus on gene regulation and expression mechanisms
- To understand the principles role of plasmids and gene transfer methods

OUTCOME

CO1- Understood genome organization of model organisms.

CO2 - Learn molecular mechanisms that underlie mutations.

CO3- Study about transformation,transduction and conjugation.

CO4- Are able to describe the nature of the transposable elements

Unit I

Trends in Gene discovery. Nucleic acids as genetic information carriers: concept of gene – allele, cistron, replicon – origin of mutation – mutagens – physical, chemical and biological agents. Induced mutation types – mechanisms of mutation induction – suppression of mutations – Intergenic and intragenic suppression.

Unit II

Transformation- Griffith experiments, natural or artificial competence transformation in Bacillus, E. coli, ***Haemophilus*** and ***Streptococcus*** – mechanism of recombination – genetic mapping.

Unit III

Bacterial conjugation – F plasmid – structure and functions. Origin of Conjugation – Hfr and F' strains. Interrupted and uninterrupted mating – time map and recombination map. Conjugation in ***E. coli, Pseudomonas.*** Plasmids, F-factors description and their uses in genetic analysis. Colicins and col factors.

Unit IV

Transduction – generalized and specialized transduction – P1 phage – mechanism of gene transfer through lambda and P1 phages. HFT and LFT lysate. Co- transduction – transduction mapping.

Unit V

Regulation of bacterial gene expression – Operon model – lac, ara, trp and his operons, operon concept, catabolite repression, instability of bacterial RNA, positive and negative regulation, inducers and co-repressors. Attenuation – lac and trp operons; Human genetics: pedigree Analysis, Genetic disease through gene map, Micro array techniques, Single nucleotide polymorphisms (SNPs)

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	Larry Snyder, Wendy Champness	Molecular Genetics of Bacteria	1997	American society of Microbiology
2.	David Freifelder	Molecular Biology	2nd/1990	Narosa Publishing House
3.	William S. Klug, Michael R. cummings	Concept of Genetics	7th/2003	Pearson Education(Singapore) Pte. Ltd.

References

1. Siger, M., Berg, P. (1991). Genes and Genomes, University Science Book.

2. Snustad, D., Simmons, J. and Jenkins, B. (1997). Principles of Genetics, First edition, John Wiley and Sons.
3. Watson, J.D., Hopkins, N.H., Roberts, J.W., Stietz, J.A. and Weiner, A.M. (1998). Molecular biology of the gene, 4th edition, Benjamin / Cummings Publishing Company.

Course Code	Course Title	L	T	P	C
20216SEC32	Microbial Biotechnology	6	1	0	6

AIM

To understand the gene and its role in genetic engineering aspects

OBJECTIVES

- To learn the basic principles of nucleic acid and recombinant technology.
- To understand the relationships between molecule/cell level phenomena.
- Studying the concepts and mechanism of central dogma.

COURSE OUTCOME

CO1- Developed an understanding in recombinant DNA technology.

CO2- candidate to recollect the basics of Molecular Genetics and apply a cognitive thinking.

CO3-Possibilities ranging from the treatment of human diseases to develop novel medicines

Unit I:

Nucleic acids – Types- DNA, RNA- structures, functions. Vectors – plasmids (Ti plasmids, pBR322, pSC101, pUC), cosmids, bacteriophages- Structures and functions. DNA replication-process,enzymology and inhibitors of replication. Enzymes-DNA polymerases, RNAses, Ligases, Taq polymerases, Topoisomerases-uses and applications. DNA damage-Types (deamination,oxidative damage, alkylation, pyrimidine dimmers. Repair mechanisms.

Unit II:

Gene-definition, concepts, structure and functions. Cloning techniques, Genomic librarary. RAPD, RFLP, AFLP and SSR marker in molecular studies and its application. Principles and techniques of Nucleic acid hybridization, protein sequencing and blotting techniques, PCR, DNA fingerprinting.

Unit III:

Biotechnology-Definitions, Concepts and Scope, History and achievements. Screening for products from microorganisms – Inoculum development – Long term preservation of microbes. Biological approaches in microbial production of aminoacids, organic acids, antibiotics, vitamins, steroids and sterols.

Unit IV:

Strain improvement – Applications of mutation, Recombination and DNA Technology. Recombinant DNA Technology – Principles and applications, enzymology of process. Restriction enzymes – Types, recognition sites and specificity.

Unit V:

Biotransformation – Strategies and techniques involved in the process. Immobilization methods – advantages, immobilization production of Mabs. Insulin, somatotropin, IFNs, Vaccines by cloning. Microalgal biotechnology – Dunaliella, Biotechnological potentials of microalgae as food, feed, fuel and pharmaceuticals.

Text Books:

1. Benjamin, L (1990). Gene. IV Edn. Oxford Univ. Press, Oxford.
2. Berg. M.M. and Howe, M.M(1989). Mobile DNA. American society for Microbiology, Washington D.C.
3. Brown, T.(1991) Essential Molecular Biology – A Practical approach. Vol.I

Vol II Oxford Univ. Press. Oxford.

Course Code	Course Title	L	T	P	C
20216SEC33L	Microbial Genetics and Biotechnology Lab	0	0	5	3

AIM:

- To facilitate the students to know the biotechnological aspects in plant growth and improvement.

OBJECTIVES

- Genetic laboratory course to introduce the students to learn about prokaryotic and eukaryotic genetic system using modern techniques.

OUTCOMES

- This curse will provide to this students about the mechanics of experimentation methods of genetics.

Experiments

1. Isolation of plasmid DNA from bacteria by Spectrophotometric assay.
2. Isolation of chromosomal DNA from bacteria by Agarose gel electrophoresis.
3. Development of competent cells in ***E. coli***.
4. Separation of protein by SDS PAGE
5. Isolation of antibiotic resistant auxotropic mutants.
6. Separation of proteins using Column chromatographic techniques (Gel filtration).
7. Immobilization techniques – alginate beads.
8. Estimation of citric acid and ethanol.

DEMONSTRATION

1. Gel Electrophoretic methods.
2. UV transillumination

Course Code	Course Title	L	T	P	C
20216SEC34A	Plant Tissue Culture	5	0	0	4

AIM:

- To facilitate the students to know the tissue culture aspects in crop improvement

OBJECTIVES

- To understand the basic principles of tissue culture technique and its applications

OUTCOMES

- To know the basic technique of tissue cultures
- To produce new plants through this tissue culture
- To gain the knowledge about tissue culture in crop improvements.
- To know the applications of tissue culture in various fields.

Unit I

Introduction - history, scope and concepts of basic techniques in plant tissue culture. Laboratory requirements and organisation. Sterilization-filter, heat and chemical. Media preparation - inorganic nutrients, organic supplements, carbon source, gelling agents, growth regulators and compositionofimportantculturemedia(MS,White,sandGamborg'smedia).

Unit II

Cell, tissue and organ culture - Isolation of single cells, selection and types of cells, tissue explants and organs for culture - paper, raft nurse technique, plating method, microchamber techniques, cell suspension cultures - batch, continuous, chemostat culture - synchronization of suspension culture, cellular totipotency, cytological, cytochemical and vascular differentiations - totipotency of epidermal and crown – gallcells.

Unit III

Micropropagation - clonal propagation of elite germplasm, factors affecting morphogenesis and proliferation rate, technical problems in micropropagation. Organogenesis - formation of shoots and roots - role of growth regulators and other factors, somaclonal and gametoclonal variations. Somatic embryogenesis - Process of somatic embryogenesis, structure, stages of embryo development, factors affecting embryogenesis, syntheticseeds.

Unit IV

Haploid production - androgenesis, gynogenesis - techniques of anther culture – segmentation pattern in microspore - isolated pollen culture - plantlets from haploids - diploidisation - factors influencing androgenesis, haploidy through gynogenesis, haploid mutants, utilization of haploids in plant breeding. Protoplast culture: Isolation of protoplasts - mechanical and enzymatic sources, culture of protoplasts, viability. Protoplastfusion - spontaneous, mechanical, induced electrofusion, selection of somatic hybrids, cybrids,importance.

Unit V

Cryopreservation and gene bank - Modes of preservation, preparation of materials for deep freezing, cryopotectors, storage strategies, assessment of successful cryopreservation, application and limitations. Application of tissue culture in forestry, horticulture, agriculture and pharmaceutical industry, transgenicplants.

REFERENCES

1. Bhojwani, S.S. and Razdan, M.K. (1983). *Plant Tissue Culture: Theory and Practice*. Elsevier Science Publishers,Netherlands.
2. Dodds, J.H. and Roberts, I.W. (1985). *Experiments in Plant Tissue Culture*.

Cambridge University Press,UK.

3. Fowler, M.W. (1986). *Industrial Application of Plant Cell Culture. In: Yeoman, M. M. (ed.). Plant Cell Culture Technology*. Blackwell, Oxford, London.
4. Hammoond, J., McGarvey, P. and Yusibov, V. (2000). *Plant Biotechnology*. Springer Verlag, NewYork.
5. Johri, B.M. (1982). *Experimental Embryology of Vascular Plants*. Narosha Publishing House, NewDelhi.
6. Kalyan Kumar, De (1992). *An Introduction to Plant Tissue Culture*. New Central Book Agency,Calcutta.
7. Ramawat, K.G. (2000). *Plant Biotechnology*. S. Chand and Co. Ltd., New Delhi.
8. Razdan, M.K. (2004). *Introduction to Plant Tissue Culture* (2nd ed.). Oxford and IBH Publishing Co. Pvt. Ltd., NewDelhi.
9. Reinert, J. and Bajaj, Y.P.S. (1977). *Plant Cell Tissue and Organ Culture: A Laboratory Manual*. Narosa Publishing House, NewDelhi.

Vasil, I.K. (1986). *Cell Culture and somatic Cell Genetics of Plants* (3 Volumes). Academic PressInc.

Course Code	Course Title	L	T	P	C
20216SEC34B	Nanotechnology	5	0	0	4

Aim

To understand about nanotechnology principles and its applications

Objective:

To gain knowledge about Nanotechnology and its commercial promise

Outcomes:

To understand the basic principles and method of Nanotechnology

To know the applications of Nanotechnology

To understand the groundbreaking innovations in medicine and medical implants, environment and other field

UnitI Introduction to bionanotechnology

Milestones in History – bionanotechnology – concept and future prospects – application in Life Sciences.Terminologies – nanotechnology, bionanotechnology, nanobiomaterials,biocompatibility, nanomedicine, nanowires, quantum Dots, nanocomposite, nanoparticles, nanosensors. Biotechnology to bionanotechnology, natural bionanomachines. Current statusofbionanotechnology.

UnitII Synthesis of nanoparticles

Molecular nanotechnology – nanomachines – collagen. Uses of nanoparticles – cancer therapy – manipulation of cell and biomolecules. Cytoskeleton and cell organelles. Types of nanoparticlesproduction – physical, chemical and biological. Microbial synthesis (bacteria, fungi and yeast) of nanoparticles – mechanism ofsynthesis.

UnitIII Types of nanoparticles and methods ofcharacterization

Nanoparticles – types, functions – Silver, Gold and Titanium. Physical andchemical properties of nanoparticles. Characterization of nanoparticles – UV-Vis spectroscopy, particle size analyzer, Electron Microscopy – HRTEM, SEM, AFM, EDS, XRD. Other tools and techniques required for bionanotechnology:rDNA technology, site directed mutagenesis, fusion proteins, X- Ray crystallography, NMR. Bioinformatics: molecular modeling, docking, computer assisted moleculardesign.

UnitIV Applications of bionanotechnology

Drug and gene delivery – protein mediated and nanoparticle mediated. Uses of nanoparticles in MRI, DNA and Protein Microarrays. Nanotechnology in health sectors.Nanomedicines, Antibacterial activities of nanoparticles. Nanotechnologyinagriculture.Toxicologyinnanoparticles–Dosimetry.

UnitV Merits and demerits ofnanoparticles

Advantages of nanoparticles – drug targeting, protein detection,MRI, development of green chemistry – commercial viability of nanoparticles. Disadvantages– pollutionandhealthrisksassociatedwithnanoparticles.

REFERENCES

1. Parthasarathy BK. Introduction to Nanotechnology, Isha Publication. 2007.
2. Elisabeth Papazoglou and Aravind Parthasarathy. Bionanotechnology. Morgan and Claypool Publishers.2007.
3. Bernd Rehm. Microbial Bionanotechnology: Biological Self-assembly Systems and Biopolymer-based Nanostructures. Horizon Scientific Press. 2006.
4. David E Reisner and Joseph D Bronzino. Bionanotechnology: Global Prospects. CRC Press.2008.
5. Ehud Gazit. Plenty of Room for Biology at the Bottom: An Introduction to Bionanotechnology. Imperial College Press.2006.
6. Kamali Kannangara. Nanotechnology: Basic science and emerging technologies- Mick Wilson, Overseas Press.2005.
7. Mark A Ratner and Bandyopadhyay AK. Nano Materials. Nanotechnology: AgentleintroductiontotheNextBigIdea,NewAgePublishers.2002.
8. Pradeep T. Nano Essentials understanding nanoscience and Nanotechnology. 1st edition. TMH publications.2007.
9. Parag Diwan and Asish Bharadwaj. Nanomedicines, Pentagan Press. 2006.
10. Vladimir P Torchilin. Nanoparticles as Drug Carriers. Imperial College Press, North Eastern University, USA.2006.

OPEN ELECTIVE

Course Code	Course Title	L	T	P	C
202ENOEC	**Writing for the Media**	4	0	0	4

Aim:

- To equip students to enter into the realm of mass media.

Objective:

- To comprehend the intricacies of mass media
- To know about the barriers to mass communication
- To understand the function of mass media
- To learn the different kinds of news
- To enhance the different kinds of writing for media

Outcome:

- Understand the intricacies of mass media
- Learn to write for the media

UNIT-I

Mass communication- Barriers to mass communication and mass culture- Function of mass media - Media effects, Qualities of media men.

UNIT-II

News- Hard and soft news- Expected and unexpected news- Box news- Follow up news-Scoop- Filters- Human interest stories- Recognizing and evaluation news.

UNIT-III

News and views- News analysis, Editorial, Columns, Article, Middle reviews, Letters-Features.

UNIT-IV

Reporting- Crime, Court, Election, Legislature, Sports, Development Investigative, Interpretative depth.

UNIT-V

Writing for Media-Inverted pyramid style-Feature style-TV/Broadcast, New style writing TV/Radio Documentaries- Writing Advertisements-Practical

Reference Book:-

Author	**Title of the book**	**Edition / Year**	**Publisher**
Susan	Journalism		
John Hogenberg	Professional Journalism	2012	

M.James Neal	News Writing and Reporting		Surjeet Publication
M.V Komath	The Journalist's Handbook		
D.S Mehta	Mass Communication & Journalism		

Course Code	Course Title	L	T	P	C
202MAOEC	**Applicable Mathematical Techniques**	4	0	0	4

Aim:

- To acquaint with the basic concept of Interpolation.

Objectives:

- Understand the basic concept of Interpolation.
- To enhance the knowledge about Assignment Problems, Replacement Problems,

Decision Analysis and Game Theory.

Outcomes:

- Students using OR techniques in business tools for decision making
- Students develop Assignment problem and Replacement problems
- Understand the concept of decision analysis and game theory
- Students gets the knowledge about interpolation

UNIT I

Interpolation with unequal intervals: Newton's, Lagrage's, and inverse interpolation

UNIT II

Assignment Problems

UNIT III

Replacement Problems

UNIT IV

Decision Analysis

UNIT V

Game Theory

References

Unit I, "Numerical Methods in Science and Engineering" M.K.Venkatraman

Units II to V, "Operations Research", Kantiswarup, P.K. Gupta and Manmohan

Course Code	Course Title	L	T	P	C
202PHOEC	**Biomedical Instrumentation**	4	0	0	4

Aim:

- To understand the concepts and application of electronic Instrumentation in the Medical field.

Objective:

- Understanding basic principles and phenomena in the area of medical diagnostic instrumentation,
- Theoretical and practical preparation enabling students to maintain medical instrumentation

UNIT – I: BIO ELECTRIC SINGNALS AND ELECTRODES

Fundamentals of medical instrumentation – Sources of biomedical signals – basic medical instrumentation – Intelligent medical instrumentation system – Origin of Bio electric signals – Recording Electrodes – Silver – Silver chloride electrodes – Electrodes for ECG – Electrodes for EEG – Electrodes for EMG.

UNIT – II: RECORDING SYSTEM AND RECORDERS

Basic recording system – General consideration for signal conditions – Preamplifiers – Biomedical signal analysis technique – main amplifier and driver stage – Writing systems – direct writing recorders – the ink jet recorders – Electrocardiograph, Electroencephalograph – Electromyography and other Biomedical recorders.

UNIT – III: MEASUREMENT AND ANALYSIS TECHNIQUES

Electro cardiography – measurements of Blood pressure - measurements of Blood flow and cardiac output, Respiratory therapy Equipment – Origin of EEG – Action Potentials of the brain – evoked potentials – Placement of electrodes – Recording set up – Analysis of EEG.

UNIT – IV: MAGNETIC RESONANCE AND ULTRASONIC IMAGILG SYSTEMS

Principles of NMR Imaging system – Image reconstruction Techniques – Basic NMR components – Biological efforts of NMR Imaging – Advantages of NMR Imaging System – Diagnostic ultra Sound – Physics of ultrasonic waves – metical ultra sound – basic pulse – echo apparatus, A – Scan – echocardiograph(M mode).

UNIT – V: ADVANCED BIO MEDICAL SYSTEMS

Pacemakers – Need for Cardiac pacemaker – External Pace makes – Implantable Pace makers – recent development in Implantable Pacemakers – Pacing system Analyzer – Defibrillator – Pacer – Cardioverter – Physiotherapy and electro therapy equipment – High frequency heat therapy – short wave diathermy – microwave and ultrasonic therapy – pain relief through electrical simulation.

OUTCOMES:

- Define basic medical terms and physical values that can be handled by medical instrumentation,
- Describe methods and implementation of electrical and nonelectrical medical parameters diagnostic,
- demonstrate measuring of basic medical parameters,
- Calculate basic parameters of the equipment for using in electro diagnostic and electro therapy,
- Apply safety standards and select disposal method and procedures for electrical diagnostic equipment.

Books for Study

1. R.S Khandpur, Handbook of Biomedical instrumentation, Tata McGraw Hill publishing company Limited. New Delhi,(2003). (Unit I,II,IV & V)
2. Lestlie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Bio medical instrumentation and measurements, PHI, New Delhi.(Unit-III)

Book for Reference

1. M.Arumugam, Biomedical Instrumentation, Anuradha Agencies, Kumbakonam (2000).

Course Code	Course Title	L	T	P	C
202CHOEC	Open Elective-Green Chemistry	4	0	0	2

Aim:

- To reduce the soil and water pollution in environment.

Objectives:

- To learn about the environmental status, public awareness in evolution, principles involved in green chemistry, bio-catalytic reactions, global warming and its control measures, availability of green analytical methods.

Outcomes:

- To understand the environmental status and evolution.
  - To know about the Pollution and its prevention measures.
  - To familiarize the green chemistry.
  - To learn about the bio-catalytic reactions.
  - To understand about the vitamins and antiobiotics.

Unit I - Introduction

Introduction-Current status of chemistry and the Environment-Evolution of the Environmental movement: Public awareness - Dilution is the solution to pollution-Pollution prevention.

Unit II - Principles

Green Chemistry – Definition – Principles of Green Chemistry - Why is this new area of Chemistry getting to much attention - Why should chemist pursue the Goals of Green Chemistry - The roots of innovation – Limitations.

Unit III - Bio Catalytic Reactions

Green Chemistry Using Bio Catalytic Reactions – Introduction - Fermentation and Bio transformations - Production of Bulk and fine chemicals by microbial fermentation Antibiotics – Vitamins - Bio catalyses synthesis of industrial chemicals by bacterial constructs - Future Tends.

Unit IV - Green House Effect

Green house effect and Global Warming – Introduction - How the green house effect is produced - Major sources of green house gases - Emissions of CO_2 - Impact of green house effect on global climate -

Control and remedial measures of green house effect - Global warming a serious threat - Important points.

Unit V - Green Analytical Methods

Future trends in Green Chemistry - Green analytical methods, Redox reagents, Green catalysts; Green nano-synthesis, Green polymer chemistry, Exploring nature, Biomimetic, Proliferation of solvent-less reactions; Non-covalent derivatization, Biomass conversion, emission control

References:

1. Introduction to Green Chemistry – M.Rayan and M.Tinnes

2. New Trends in Green Chemistry – V.K.Ahluwalia and M.Kidwai

Course Code	Course Title	L	T	P	C
202CSOEC	**M-Marketing**	4	0	0	4

OBJECTIVES

- Understand Mobile Business strategies.
- To understand Mobile marketing tools and techniques.
- To know Mobile technologies.

UNIT I Introduction

Mobile Marketing Campaign, Fortune 500 and Mobile Marketing, consumers engagement with mobile, Terminologies.

UNIT II Businesses Vs mobile marketing

classic mistakes in mobile marketing, laying foundation for successful mobile marketing campaign, understanding technology behind mobile marketing – Android, iOS, Windows Phone.

UNIT III

Strategic thinking about Mobile marketing campaign, Mobile Marketing Tools – setting up mobile website for different firms, using SMS, MMS and apps to drive customers to business and other ways to attract customers.

UNIT IV Location Based Marketing

LBS, NFC, Bluetooth and LBA, 2D codes, Tablet, Other Mobile Applications, Business Firms connecting to customers using Mobile – case study, Mobile Marketing for B2B companies, Mobile E-commerce to Drive Revenue.

UNIT V Mobile Payments

Present and Future Mobile Technology, Mobile Application Development.

OUTCOMES

- Upon Completion of the course, the students should be able to:
- Analyze various mobile marketing strategies.
- Market Mobile based Applications.
- Apply various tools in mobile marketing.

REFERENCE BOOKS:

1. Go Mobile: Location Based Marketing, Apps, Mobile Optimized Ad Campaigns, 2D codes and other Mobile Strategies to Grow your Business, Jeanne Hopkins, Jamie Turner, John Wiley&Sons Inc., 2012.

2. M- Commerce, Paul Skeldon, Crimson Publishing, 2012.

3. M-Commerce Technologies, Services and Business Models, Norman Sadeh , Wiley 2002.

4. Mobile Commerce, Opportunities, Applications and Technologies of Wireless Business, Paul Mary, Tom Jell, Cambridge University Press, 2001.

Course Code	Course Title	L	T	P	C
202CMOEC	Open Elective- Financial Services	4	0	0	2

AIM

To analyze the various financial institutions and their services.

OBJECTIVES

I. To gain knowledge on financial services.

II. To understand importance of various services including banking, insurance, mutual funds.

UNIT – I

Financial system-An Overview: Indian Financial System-Global Financial System-Financial Services Environment- Credit Rating –Factoring and Forfeiting –Leasing

UNIT – II

Financial Markets –An Overview: Definition-Role-Functions-Constituents-Financial Instruments-Capital Market instruments-Indian money and Capital Market-Global Financial Markets.

UNIT – III

Money Market –An Overview: Definition-Characterstistics-Objectives-Imporatance-Functions-Segment-Financial Institutions-Indian Money Market-Global Money Market

Unit – IV

Capital Market: Money Market-Characteristics-Functions-New financial Instruments-measures of Investor Protection-Indian Capital Market-Major Issues

Unit-V

Stock Exchange: History of Stock Exchange-Functions-Indian Stock Exchanges-Organization structure-Regulations of Stock Exchange –Recent Developments

OUTCOME

To introduces meaning and functions of Financial Intermediaries

To understand the role of merchant bank and its services

To provide information regarding management of mutual funds and Regulations

To understand the role and functions of financial services Marketing

To know the structure and types of debt Instruments

To realize Foreign Exchange Market

REFERENCE BOOKS

1. Gordon , Natarajan – Financial Market and Services.
2. Dr. S. Gurusamy – Financial services and Market.
3. Kucchol S.C. – Financial Management
4. Pandey I.M. – Financial Management.

SEMESTER IV

Course Code	Course Title	L	T	P	C
20216SEC41	Pharmaceutical Microbiology	6	1	0	6

AIM

- The information gained will help the students to formulate novel drugs.

OBJECTIVES:

- To facilitate the students to know the definite path of metabolism of drugs and drug discovery

OUTCOMES:

- This course gives information on drug designing, novel techniques in drug discovery and the role of biotechnology in pharmaceutics.

Unit – 1 Antibiotics and synthetic antimicrobial agents

Antibiotics and synthetic antimicrobial agents, Antifungal antibiotics, antitumor substances.Peptide antibiotics, Chloramphenicol, Sulphonamides and Quinolinone antimicrobial agents.Chemical disinfectants, antiseptics and preservatives.

Unit – 2 Mechanism of action of antibiotics

Mechanism of action of antibiotics (inhibitors of cell wall synthesis, nucleic acid and protein synthesis). Molecular principles of drug targeting.Drug delivery system in gene therapy Bacterial resistance to antibiotics. Mode of action of non – antibiotic antimicrobial agents. Penetrating defenses – How the antimicrobial agents reach the targets (cellular permeability barrier, cellular transport system and drug diffusion).

Unit – 3 Microbial production and Spoilage of pharmaceutical Products

Microbial contamination and spoilage of pharmaceutical products (sterile injectibles, non injectibles, ophthalmic preparations and implants) and their sterilization.

Manufacturing procedures and in process control of pharmaceuticals.

Other pharmaceuticals produced by microbial fermentations (streptokinase, streptodornase). New vaccine technology, DNA vaccines, synthetic peptide vaccines, multivalent subunit vaccines. Vaccine clinical trials.

Unit – 4 Regulatory practices, biosensors and applications in Pharmaceuticals

Financing R&D capital and market outlook. IP, BP, USP. Government regulatory practices and policies, FDA perspective. Reimbursement of drugs and biologicals, legislative perspective. Rational drug design. Immobilization procedures for pharmaceutical applications (liposomes). Macromolecular, cellular and synthetic drug carriers. Biosensors in pharmaceuticals.Application of microbial enzymes in pharmaceuticals.

Unit – 5: Quality Assurance and Validation

Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in pharmaceutical industry. Regulatory aspects of quality control. Quality assurance and quality management in pharmaceuticals ISO, WHO and US certification. Safety in microbiology laboratory.

BOOKS/REFERENCE

1. Pharmaceutical Microbiology – Edt. by W.B.Hugo & A.D.Russell Sixth edition. Blackwell scientific Publications.

Course Code	Course Title	L	T	P	C
20216SEC42	Biostatistics and Bioinformatics	6	1	0	6

Unit I – Definitions

Scope of Biostatistics, probability analysis – variables in Biology, collection, classification and tabulation of data – Graphical and diagrammatical representation – scale diagrams – Histograms – frequency polygan – frequency curves. Measures of central tendency – arithmetic Mean, Median and Mode – calculation of mean, median, mode in series of individual observations, discrete series, continuous open – end classes. Measure of dispersion – Standard Deviation and Standard curves, Measures of central tendency on Variance.

Unit II – Correlation and regression

Simple correlation – Correlation coefficient – Regression simple linear regression. Basic ideas of significance test – Hypothesis testing level of significance – Test based on student ‘t’ ‘chi’ square and goodness of fit. ‘F’ test – ANOVA.

Unit III – Databases

Biological resource databases – Examples and application – Sequence Analysis – protein and nucleic acid.

Unit IV – Genomics and proteomics

Sequencing genomes – sequence assembly – genome on the web – annotating and analyzing genome sequences. Proteomics pathway databases.

Unit V – Sequence analysis

Pair wise sequence comparison, protein data bank, SWISS-PROT, Genbank – sequence queries against biological databases – BLAST and FASTA – multifunctional tools for sequence analysis, multiple sequence alignments, phylogenetic alignment – profiles and motifs.

Text Books

S. No	Author Name	Title of the Paper	Edition/year	Publication
1.	D.R. Westhead, J. Howard Parish and Richard M. Twymans	Bioinformatics	1st /2003	Viva Books Private Limited
2.	S. Sundara Rajan, R. Balaji	Introduction to Bioinformatics	1st /2002	Himalaya Publishing House
3.	Rashidi, H.H. and Bvehler, L.K	Bioinformatics Basics: Applications in Biological Science and Medicine	2002	CRC Press, New York.

References

1. Cynthia Gibas and Per Jambek (2001) Developing Bioinformatics Computer Skills, Shroff Publishers and Distributions Pvt. Ltd., O'reilly, Mumbai.
2. Misener, S. and Krawetz, S.A. (2000). Bioinformatics Methods and protocols, Human Press Totowa, New Jessey.
3. Rashidi, H.H. and Bvehler, L.K. (2002). Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, New York.
4. Cynthia Gibas and Per Jambek (2001) Developing Bioinformatics Computer Skills, Shroff Publishers and Distributions Pvt. Ltd., O'reilly, Mumbai.
5. Misener, S. and Krawetz, S.A. (2000). Bioinformatics Methods and protocols, Human Press Totowa, New Jessey.

Course Code	Course Title	L	T	P	C
20216SEC43L	Pharmaceutical Microbiology Lab	5	0	0	4

Aim

To provides knowledge and understanding with regards to the significance of the presence of bacteria, yeasts, moulds, viruses and toxins in **pharmaceutical** raw materials, intermediates, new products and **pharmaceutical** production.

Objective

Culture and identification of important human pathogens, microbial growth conditions, effect of antimicrobial agents, development of resistance against antimicrobial agents, sterilization and disinfection, bacterial virulence factors, production and control of vaccines.

Course outcome

CO1 - Aseptic condition relevance to healthcare and the pharmaceutical industry.
CO2 - Knowledge and understanding of the practical aspects of pharmaceutical microbiology.
CO3 - Perform practicals on antimicrobial activity

CO4- Learn the production of antibiotics from microbes.

Lab Work

2. Introduction to equipment and glassware used in microbiology laboratory (BOD, Incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, etc.,)
3. Study of morphology of different microbes
4. Preparation of various culture media (Determination of microbial colony characteristics)
5. Isolation of pure cultures by streak plate, spread plate & pour plate techniques.
6. Enumeration of bacteria by direct microscopic count.
7. Motility test by Hanging drop method
8. Microbiological assay of antibiotics by cup plate method and other methods
9. Characterization of microbes through Bio chemical reactions (IMViC)
10. Evaluation of any disinfectant by phenol coefficient test
11. Study of Oligodynamic action (of metals on bacteria)
12. Preservation of microorganisms (slant and stab cultures)
13. Sterility testing of Pharmaceuticals
14. Microbiological Analysis of Water.
15. Production of antibiotics using microbes

Course Code	Course Title	L	T	P	C

20216SEC44A	Bioethics and IPR	5	0	0	4

Aim

To understand the basic principles of Bioehtics and IPR

Objective

Students will gain awareness about Bioethics and Intellectual Property Rights (IPRs) to take measure for the protecting their ideas

Outcome

To know about Bioethics and Intellectual Property Rights (IPRs)

They will able to devise business strategies by taking account of IPRs

They will be able to assists in technology upgradation and enhancing competitiveness.

They will acquire adequate knowledge in the use of genetically modified organisms and its effect on human health

They will gain more insights into the regulatory affairs.

UnitI

Bioethics Concept,philosophicalconsiderations,epistemologyofscience,ethicalterms, principlesandtheoriesandrelevancetobiotechnology.Ethicsandthelaw issues-geneticengineering,stemcells,cloning,medicaltechniques, transhumanismandbioweapons.Researchconcerns-animalrights,ethicsof humancloning,reproductionandstemcellresearch.

UnitII

Emergingissues- biotechnology'simpactonsociety,DNAonthewitnessstandanduseofgenetic evidenceincivilandcriminalcourtcases.Challengestopublicpolicy, regulations,improvingpublicunderstandingofbiotechnologyproductsto correctmisconceptions.

UnitIIIIntroductiontoIPR&LegalProtection

Basicsofpatents,typesofpatents,IndianPatentAct1970,recent amendments,filingpatentapplication,precautionsbeforepatenting– disclosureandnon-disclosure.WIPOtreaties,Budapesttreaty,PCTand implications,roleofacountrypatentofficeandprocedureforfilingaPCT application.TypesofIP-patents,trademarks,copyright&relatedrights, industrialdesign,traditionalknowledge,geographicalindicationsand internationalframeworkfortheprotectionofIP.Introductiontohistoryof GATT,WTO,WIPOandTRIPS.GlobalscenarioofpatentsandIndianposition, patentingofbiologicalmaterials.IPasafactorinR&DandIPrelevanceto Biotechnology.

UnitIVPatentFilingandInfringement

Patentapplication-formsandguidelines,feestructureandtimeframes.Types ofpatentapplications,provisionalandcompletespecifications,PCTand conventionpatentapplications.Internationalpatenting-requirement, proceduresandcosts.Financialassistanceforpatentingandintroductionto existingschemes.Publicationofpatents-gazetteofIndia,statusinEuropeand US.Patentingbyresearchstudents,lecturersandscientists. University/organizationalrulesinIndiaandabroad,creditsharingbyworkers andfinancialincentives.Patentinfringement-meaning,scope,litigation,case studiesandexamples.

UnitVBiosafety

Introductionandhistoricalbackground.Introductiontobiologicalsafety cabinets,primarycontainmentforbiohazards,biosafetylevels,biosafetylevels ofspecificmicroorganisms,recommendedbiosafetylevelsforinfectiousagents andinfectedanimals.BiosafetyguidelinesbyGovernmentofIndia.Definition ofGMOsandLMOs.RolesofInstitutionalBiosafetyCommittee,RCGM,GEAC etc.forGMO’sapplicationsinfoodandagriculture.Environmentalreleaseof GMOs,riskassessment;riskmanagementandcommunication.Overviewof nationalregulationsandrelevantinternationalagreementsincluding Cartagenaprotocol.

ImportantLinks

1.Bioethics-byEllenFrankelPaul,FredD.Miller,JeffreyPaul,FredDycus MillerCambridgeUniversityPress,2002.

2.Bioethics&Science,JohnA.Bryant,LindaBaggottlaVelle,JohnF.Searle

–2002.

3.http://www.w3.org/IPR/

4.http://www.wipo.int/portal/index.html.en

5.http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html

6.www.patentoffice.nic.in

7.www.iprlawindia.org/-31k-Cached-Similarpage

Course Code	Course Title	L	T	P	C
20216SEC44B	Molecular Immunology	5	0	0	4

Aim:

- This subject considers immune responses at the molecular level and covers the role of immuno receptors on immune cells in the initiation of immune responses

Objective:

- To understand the immune response in molecular level

Outcome

- To describe the structure and function of immunological receptors and apply this information towards building a comprehensive understanding of the initiation of immune responses at the molecular level
- To describe the various stages of immune cell development and compare this with abnormal development in a range of immunodefficiency conditions
- To explain how immunoregulation occurs and relate it to the overall function of the immune system in the healthy host as well as in immune disease states

UnitIFundamentalConceptsandAnatomyoftheImmuneSystem

Terminology–Antigen,immunogen,hapten,allergen,tolarogen,super antigens,antibody,immunoglobulin,antigenigity,immunogenicity.Self&

nonself,innate&acquiredimmunity.Haematopoesis.Organs,tissues,cells andmediatorsofimmunesystem-primarylymphoidorgans,secondary lymphoidtissues,lymphocytes,cytokinesandlymphokines.Lymphaticsystem, lymphocytecirculationandlymphocytehoming.MucosalandGutassociated lymphoidtissue(MALT&GALT)andmucosalimmunity.Principlesofcell signaling.

Unit-IIImmuneResponsesGeneratedbyBandTlymphocytes

Bcell: Bcelldevelopment,maturation,activationanddifferentiation.Bcell receptoranddeterminants.Bcellsubsets.Immunoglobulins-basicstructure, classes&subclassesofimmunoglobulins,antigenicdeterminants,multigene organizationofimmunoglobulingenesandimmunoglobulinsupergenefamily. Generationofantibodydiversity.

Tcell: Tcelldevelopment,maturation,activationanddifferentiation.Tcell receptoranddeterminant.Tcellsubsets.TCRcomplex.Antigenprocessing andpresentation-endogenousantigens,exogenousantigens,non-peptide bacterialantigensCelltocellco-operationandhapten-carriersystem.

Unit-IIIImmuneResponse

Recognition&response:NonspecificandSpecific.**Nonspecific**:Natural built-inbarrier,phagocytosis.Complements,naturalkilling,inflammatory response.**Specific:**HI&CMI.Antigenrecognitionandresponse.Major HistocompatibilityComplex-MHCgenes,MHCinimmuneresponsivenessand diseasesusceptibility.HLAtyping.Kineticsofimmuneresponseandmemory. **Unresponsiveness:**tolerance,suppressionandpotentiation.

Unit-IVVaccinology

Active,passiveandcombinedimmunization.Live,killed,attenuated,plasma derived,subunit,recombinantDNA,proteinbased,plant-based,peptide,anti-idiotypicandconjugatevaccines–production&applications.Roleand propertiesofadjuvants&ISCOMS.Antibodygenesandantibodyengineering-chimericandhybridmonoclonalantibodies,catalyticantibodiesandgeneration ofimmunoglobulingenelibraries.

Unit-VClinicalImmunology

Immunitytoinfection,bacteria,viral,fungalandparasiticinfections(with examplesfromeachgroup).Hypersensitivity–TypeI,II,IIIandIV.

Autoimmunityandtypesofautoimmunediseases.MechanismandroleofCD4^{+} Tcells,MHCandTCRinautoimmunity.Treatmentofautoimmunediseases. Transplantation–immunologicalbasisofgraftrejection,clinical transplantationandimmunosuppressivetherapy.Tumorimmunology,tumor antigens,immuneresponsetotumorsandtumorevasionoftheimmune system.Cancerimmunologyandimmunotherapy.Immunodeficiency-primary immuno-deficiencies,acquiredorsecondaryimmuno-deficiencies.

TextBooks

1.Peter J. Delves,Seamus J. Martin,Dennis R. BurtonandIvan M. Roitt.

2011.EssentialImmunology12th Edition.Wiley-Blackwell.

2.CharlesAJaneway,Jr.PaulTravers,MarkWalport,andMarkJ Shlomchik.1999.Immunobiology.4th Edition.JournalofCurrentBiology publications.

2.D.M.WeirandJohnStewart.1997.Immunology.8th Edition.Churchill Livingstone.

3.P.J.Delves,IS.J.Artin,ID.R.BurtonandI.M.Roitt.2006.Essential Immunology.11th Edition.Wiley-Blackwell.

4.RichardM.Hyde.2012.MicrobiologyandImmunology.3rd Edition.Springer Science&BusinessMedia.

ReferenceBooks

1.BrostoffJ,SeaddinJK,MaleDandRoittIM.,2002.ClinicalImmunology.6th Edition.GowerMedicalPublishing.

2.PaulWilliamE.1999.FundamentalofImmunology.4th Edition.Lippencott Raven.

3.ERoitt.2011.EssentialImmunology.12th Edition.BlackwellPublication.

Annexure-IV

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DEPARTMENT OF MICROIOLOGY

M.PHIL MICROBIOLOGY SYLLABUS - REGULATION 2020

COURSE STRUCTURE

SEMESTER - I					
COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**C**
203RMG11 (Common Paper)	Research Methodology	6	0	0	4
203MBC12	Advanced Microbiology	6	0	0	4
203MBE13_	A. Microbial Biotechnology B .Bioprocess and Enzyme Engineering	6	0	0	4
203RPE14	Research and Publication Ethics	0	0	0	2
	Total	**18**	**0**	**0**	**14**
SEMESTER - II					
203MBD21	**Dissertation - (Topic selected should be relevant to the topic of the In-depth paper**				10

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SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF MICROBIOLOGY

M.PHIL., MICROBIOLOGY SYLLABUS

REGULATION 2020

25/2/21

25/2/21

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DEPARTMENT OF MICROBIOLOGY

M.PHIL., MICROBIOLOGY

PROGRAM OUTCOME

PO 1 - Recognize and think critically towards the science curricula with sound knowledge and theoretical skills by questioning and plausible explanations.

PO2 - Motivate themselves and develop an interest in planning and implementation of research

PO 3 - Handle equipments needed for material preparation, characterization and to analyze and interpret the data with theoretical background and software.

PO 4 -Practice the teaching-learning process by being the proponent in classroom and laboratory experience

PO 5 - Apply the scientific context to develop innovative ideas, products and methods for the benefits of biosphere

PO 6 - Adopt changes in the environment with high integrity and transpire ethical professionals

PO 7 - Recognize and integrate life-long learning skills to become pro-active in personal and professional live

PO 8 - Opt for careers demanding writing and communicative skills locally and globally

PROGRAMME SPECIFIC OUTCOME

PSO 1 - Critically evaluate the basic information and ideas from various fields of microbiology.

PSO 2 - Developing skilled persons in the sector of Disease diagnosis, treatment and prevention.

PSO 3 - To integrate the knowledge microbes and improving the quality of life through sustainable microbiological applications.

PSO 4 - To train the students to develop, design and apply research projects independently to accommodate them in research.

PSO 5 -To encourage the students to do original research that ends up in new technological or process application.

PSO 6 -To enrich the Graduates with solid fundamentals of microbiology and advanced technologies.

PSO 7 - To equip the students to identify, define and solve the emerging problem.

PSO 8 - Make the student to understand complex ethical and professional issues to accommodate them in Industry and/or Institutes, to better placement.

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DEPARTMENT OF MICROIOLOGY

M.PHIL MICROBIOLOGY SYLLABUS - REGULATION 2020

COURSE STRUCTURE

SEMESTER - I					
COURSE CODE	**COURSE TITLE**	**L**	**T**	**P**	**C**
203RMG11 (Common Paper)	Research Methodology	6	0	0	4
203MBC12	Advanced Microbiology	6	0	0	4
203MBE13_	A. Microbial Biotechnology B .Bioprocess and Enzyme Engineering	6	0	0	4
(Common Paper) 203RPE14	Research and Publication Ethics	0	0	0	2
	Total	**18**	**0**	**0**	**14**
SEMESTER - II					
203MBD21	**Dissertation - (Topic selected should be relevant to the topic of the In-depth paper**				10

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Unit – IV:

Computer packages and Internet: Word Basics – Creating and working with documents – working with text and tables – Using Mail Merge. Using Excel: Working with worksheets – creating chart – working with Formula and Functions. Using Power Point: Working with power point – User Interfaces – Using templates and wizard (slide Presentation) - - Creating chart and Tables. Internet and World Wide Web (WWW) – Electronic Main (E-mail) – Intranet and Extranet.

Unit – V:

Descriptive statistics – tabulation, graphical representation – bar diagram – and pie diagrams – various measures of variance, measures of central tendency and normal distribution. Differential statistics "t" test, Chi – square test, "F" test (ANOVA) co -variance (ANCOVA) correlation and multiple regression analysis - Introduction to SPSS.

References:

- Thesis and Assignment writing by Janarthan Anderson and others – Wiley – Eastern Ltd, 1970. Part I Sections 1,2,3,4. Part II Sections 5,6,9,10.
- Research Methodology by C.R. Kothari, Chapter 1,2,3.
- Microsoft Office 2003 – Edward C. Willet. First Edition 2004, Wiley Publications, USA , (Chapters 2,3,4,5,6,12,14,15,26,28,29)

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PAPER II - ADVANCED MICROBIOLOGY

Course Code	Course Title	L	T	P	C
203MBC12	Advanced Microbiology	6	0	0	4

Course Outcome

CO1: To learn about microbial taxonomy and molecular characterization of microbes
CO2: To Learn about applications of microbes in research aspects
CO3: To Gain the knowledge about biotechnological engineering concept in research
CO4: To Learn immune system and its mechanism
CO5: To gain knowledge about nanotechnology and synthesis of nano-particles from microbes.

Unit I:

Prokaryotic and eukaryotic microbial diversity – bacteria, cyanobacteria, microalgae, microfungi, Habitats, nutrition, ultrastructure and mode of reproduction. Isolation, cultivation and preservation of microorganisms. Classification - Haeckel's three kingdom concept. Whittaker's five kingdom concept. Three domine concept of Carl Woese. Classification of bacteria according to Bergey's manual of determinative bacteriology. Criteria for classification and identification of microorganisms – morphological, physiological & biochemical. Numerical taxonomy. Phage typing. Nomenclature – bacteriological code. Introduction - DNA finger printing – RFLP, Plasmid profiles, G+C content. Importance of 16S rRNA in taxonomy & phylogeny.

Unit II:

Basic concepts in medium design – design procedure growth limiting nutrient in designed medium – cell growth and product formation – immobilization and cell culture – cell immobilization – enzyme immobilization. Microbes involved in biodegradation of organic wastes and xenobiotic compounds – heavy metals, pesticides, insecticides. Bioinsecticides – BT toxin. Microbial leaching – Extraction of metals from ores. Biofuels, Microbial hydrogen production, biodegradation of oils and petroleum products.

Unit III:

Diagnostic Imumunology- methods for immunoglobulin determination – Quantative and qualitative antigen and antibody reactions. Agglutination – precipitation Immunoflourescence, Immunoblotting, Immunometric methods, Immunology of transplantation and malignancies. Enzyme immunoassays, flow cytometry- Assessment of human allergic diseases-Molecular methods- HLA typing- Immunohaematology- transfusion and compatibility testing, Transfusion reactions. Chemiluminescent detection of proteins.

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Unit IV:

Introduction to molecular biology – DNA and RNA – composition and structure. DNA replication, Recombination and repair – Transcription and Translation, Regulation of gene expression. PCR based finger printing – RT PCR, 16S rDNA amplification, cloning, transformation, DNA sequencing. RAPD, STRR & LTRR, Blotting and hybridization. DNA Microarrays/Chips. Genome sequence comparison, alignment and data base searching. GenBank – NCBI, EMBL & DDBJ – retrieving sequences. Tools used for phylogenetic analysis – Ribosomal Database Project, FASTA, BLAST, Phylip. RNA structure prediction, Restriction enzyme patterns. Designing primers & probes. DNA barcoding. Submission of rDNA sequences – Bankit & Sequin guidelines.

Unit V:

History of nanobiotechnology; Terminologies of nanobiotechnolgy; Nanoparticals; Nanotubes; Nanowires; Silver nanoparticles. Protein functions at the cellular level. biosensors; drug delivery, and tissue engineering. Microbial growth response to inorganic nanoparticles; Nanoparticle internalization and cytotoxicity; Nano curcumin(Polymeric nanoparticle-encapsulated curcumin) – a novel strategy for human cancer;Therapeutic application of gold nanoparticles.

References:

1. Danial Lim ,1998,Microbiology, McGrawHill Companies , New York
2. Stanbury, P.F., A.Whitaker and S.J.Hall. 1995. Principles of fermentation technology-Elsevier Publications
3. Edward A. Birge ,1992, Modern Microbiology, Principles and application. Wm.C.Brown Publishers,USA.
4. HH Rashidi & LK Buehler (2002). Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London
5. Nanobiotechnology II: More Concepts and Applications (2007) by Chad A. Mirkin, Christof M. Niemeyer 1st edition Wiley-VCH Publisher.
6. NanoBiotechnology Protocols (Methods in Molecular Biology) (2005) by Sandra J Rosenthal, David W. Wright Humana press publisher.
7. Nanobiotechnology Molecular Diagnostics: Current Techniques and Applications (Horizon Bioscience) (2006) by K.K. Jain Taylor & Francis 1st edition. Taylor & Francis Publication.

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PAPER III - MICROBIAL BIOTECHNOLOGY

Course Code	Course Title	L	T	P	C
203MBE13A	Microbial Biotechnology	6	0	0	4

Course Outcomes

CO1: To gain Knowledge about isolation, purification and preservation of microorganisms.
CO2: To learn about the molecular tools of genetic engineering
CO3: To Know about the production of value added products
CO4: To gain the knowledge about industrial production from microbes.
CO5: To learn the methods of biofertilizer and biofuels production

Unit I:

Historical development of microbial technology. Products obtained from microorganism through recombinant techniques. Introduction to genetic engineering. Molecular tools of genetic engineering-vectors-Methods of gene transfer. Gene cloning strategies. Basic techniques in genetic engineering.

Unit II:

Biotechnology & Bioprocess Engineering, steps in bioprocess development, Microbial culture, Screening and selection for fermentation processes; Preservation and improvement of industrially important microorganisms, Strain development. Fermentation Material and Energy balance, Microbial growth kinetics: Microbial growth cycle, measurement of growth, Batch culture, continuous culture, fed-batch culture, applications and examples. . Bioinstrumentation and computer control of fermentation processes. Bioreactors - Solid State fermentation - Submerged fermentation. Downstream processing of industrial products

Unit III:

Bacteriology and starter rotations, improving starter cultures for food fermentation by genetic manipulation, recombination technology. Genetic improvement of lactic starters to enhance their technological functions for industrial applications e.g. acid, flavour, EPS, probiotic functions, Metabolic engineering of lactic acid bacteria, Production of recombinant dairy / food enzymes / proteins e.g. Chymosin, lactoferrin, lysozyme, lipases, proteases, etc. Single Cell Protein

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PAPER III - BIOPROCESS AND ENZYME ENGINEERING

Course Code	Course Title	L	T	P	C
203MBE13B	Bioprocess and Enzyme Engineering	6	0	0	4

Course Outcome

CO 1- To understand different fundamentals concepts and specialized knowledge of different applied microbiology area
CO 2 - To apply the knowledge gained in developing industrial enzyme products.
CO 3- To become an entrepreneur through this industrial based learning strategies
CO 4 -To start an independent research and can contribute in solving new problems faced in current science

Unit-I

Bioprocesses- batch, fed-batch and continuous cultivation, sterile operations, design of experiment for bioprocess optimization, industrial synthetic biology, high throughput bioprocess design, bioseparation and downstream processing- membrane separation techniques, chromatographic separation techniques, water purification etc., interactions and integration of microorganisms, bioreactor and downstream processing, experimental basis and methods for biosystems analysis, modelling of bioreactors, dynamic behaviour of bioprocesses, analysis, modelling and simulation of biological networks.

Unit-II

Development of reactors and processes for stabilization of organic and industrial wastes, miniaturisation of bioreaction systems, miniplant technology for integration of biosynthesis and downstream processing, technical and economic assessment of bioproduction processes, application of bioinformatics for development of bioprocesses, biocatalysis for the sustainable synthesis of chemicals and pharmaceuticals from renewable resources, rational engineering of biological systems for sustainable bioprocessing, small mimics, microfluidics and mathematical models for process understanding, scale-translation.

Unit-III

Strain improvement – Applications of mutation, Recombination and DNA Technology.– Principles and applications, enzymology of process. Industrial enzymes production - Proteases, amylases, lipases, cellulases, pectinases, glucose isomerase, L-Asparaginase.

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methods, protein engineering by combinatorial methods.

Unit - IV

Kinetics of enzyme reactions, biochemical characterization of enzymes, graphical analysis of kinetic data, pH and temperature dependence, development of recombinant clones for overproduction of enzymes and metabolites, development of expression systems in bacteria and yeasts, bioenergetics and biological molecular machines, protein conformation study and structure-function relationship using biophysical methods, protein engineering by combinatorial methods.

Unit-V

Enzyme engineering and design: substitution, insertion, hybrid proteins, genes for novel enzymes Aequorin and Enviropig, directed evolution and site directed mutagenesis approaches to improve industrial enzymes, engineering more stable enzymes, analysis and design of microbial and enzyme reactors for production of industrially important products such as biofuels, industrial enzymes, biopolymers, etc., development of bio-sensors for detection of various analytes, development of cell culture techniques for cultivation of plant and animal cells in specialized reactors for production of therapeutic compounds.

Reference

Yoo YJ et al (2017) Fundamentals of Enzyme Engineering, Springer 2.

Stanbury et al (2003) Principle of Fermentation technology, Butter worth-Heinemann

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PAPER IV - RESEARCH AND PUBLICATION ETHICS

Course Code	Course Title	L	T	P	C
203RPE14	Research and publication ethics	0	0	0	2

THEORY

Unit I: PHILOSOPHY AND ETHICS (3 hours)

1. Introduction to philosophy, definition, nature and scope, concept, braches.
2. Ethics: definition, moral philosophy, nature of moral judgements and reactions.

Unit II: SCIENTIFIC CONDUCT (5 hours)

1. Ethics with respect to science and research.
2. Intellectual honesty and research integrity.
3. Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing.
5. Selective reporting and misrepresentation of data.

Unit III : PUBLICATION ETHICS (7 hours)

1. Publication ethics: definition, introduction and importance.
2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest.
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types.
5. Violation of publication ethics, authorship and contributorship.
6. Identification of publication misconduct, complaints and appeals.
7. Predatory publishers and journals.

PRACTICE

Unit IV: OPEN ACCESS PUBLISHING (4 hours.)

1. Open access publications and initiatives.
2. SHERPA/RoMEO online resourse to check publisher copyright & self-archiving policies.
3. Software tool to ideitify predatory publications developed by SPPU.
4. Journal finder / journal suggestion tools viz, JANE, Elsevier Journal Folder, Springer Journal Suggester, etc.

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UNIT V : PUBLICATION MISCONDUCT (4 hours)

A. Group Discussions (2 hours)

1. Subject specific ethical issues, FFP, authorship
2. Conflicts of interest.
3. Complaints and appeals: examples and fraud from India and abroad.

B. Software tools (2 hours)

Use of plagiarism software like Turnitin, Urkund and other open source software tools.

UNIT VI: DATABASES AND RESEARCH METRICS (7 hours)

A. Databases (4 hours)

1. Indexing databases.
2. Citation database: Web of Science, Scopus etc.

B. Research Metrices (3 hours)

1. Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP,Cite Score.
2. Metrices: h-index, g index, i10 index, altmetrics.

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UNIT V : PUBLICATION MISCONDUCT (4 hours)

A. Group Discussions (2 hours)

1. Subject specific ethical issues, FFP, authorship
2. Conflicts of interest.
3. Complaints and appeals: examples and fraud from India and abroad.

B. Software tools (2 hours)

Use of plagiarism software like Turnitin, Urkund and other open source software tools.

UNIT VI: DATABASES AND RESEARCH METRICS (7 hours)

A. Databases (4 hours)

1. Indexing databases.
2. Citation database: Web of Science, Scopus etc.

B. Research Metrices (3 hours)

1. Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP,Cite Score.
2. Metrices: h-index, g index, i10 index, altmetrics.

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Annexure-V

LIST OF EXAMINERS -2020-2021

1. Dr. Bakrudeen Ali AhamedProfessor (Chairman , BOS)
2. Dr. L.Chinnappa / Dean (EX-Offico)
3. Dr. C. Sundar Associate Professor, (Member, BOS)
4. Dr. T. Ushadevi, Associate Professor (Member, BOS)
5. Dr. R.Sathya Assistant Professor, (Member, BOS)
6. Dr. P. Mathan Periyasamy Assistant Professor, (Member, BOS)
7. Dr. P. Anantharaman Professor, CAS in Marine Biology, Annamalai University (External Member, BOS)
8. Dr. Rajkumar, Managing Director, Cell Zyme Biotech Coimbatore (External Member, BOS)