PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR SALEM – 636011

DEGREE OF MASTER OF SCIENCE
CHOICE BASED CREDIT SYSTEM

M.Sc. MICRO BIOLOGY SYLLABUS
CHOICE BASED CREDIT SYSTEM 2021-2022

OBJECTIVE OF THE SYLLABUS 2021-2022

1. Internship training for 15 days is included
2. MOOC"S / SWAYAM online test is Compulsory are added
3. Pattern of theory examination were changed
4. CSIR Portions are framed as two papers included as Elective subjects is Compulsory
5. Contents of the syllabus were included and excluded in some papers.
6. Some Papers contents were fully changed and updated
7. EDC Papers not changed
8. New Subject Codes were given
9. Subject wise course objective and Course outcomes are given 10.Credits were given for Training and Online test

SYLLABUS FOR

M.SC -MICROBIOLOGY

(SEMESTER PATTERN)

(For Candidates admitted in the Colleges affiliated to Periyar University from 2021- 2022 on wards

REGULATIONS

1. CONDITIONS FOR ADMISSION

A. ELIGIBILITY CONDITIONS FOR ADMISSION

Candidate who has passed the B.Sc. degree in any Life Sciences[Microbiology / Applied Microbiology/Industrial Microbiology/ Botany/Plant Sciences and Plant biotechnology/Zoology/Animal Science/Applied Animal Science and Animal Biotechnology/Biochemistry/Bioinformatics/Biology/Food Science & Nutrition/ /B.Sc Medical Lab Technology/BSMS/BAMS/BUMS/BHMS/Chemistry with Botany/Zoology]as Allied Subjects of this University or an Examination of any other University accepted by the Syndicate as equivalent there to shall be eligible for admission to M.Sc. Degree Course in Applied Microbiology.

Candidate shall be admitted to the examination only if he/she has taken the qualifying degree in Science/Medical subjects as mentioned after having completed the prescribed courses consisting of twelve years of study and has passed the qualifying examination.

B. METHOD OF SELECTION

Candidates have to appear for an entrance examination in the respective subjects to be conducted by the respective departments and thereafter an interview. The date, venue and time of the entrance examination and interview will be notified to the applicants separately as soon as it is fixed.

2. ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be eligible for the award of the degree only if he / she has undergone the prescribed course of study in a college affiliated to the University for a period of not less than two academic years, passed the examination of all the four semesters prescribed earning 90 credits (plus 2 credits for Human Rights) and fulfilled such conditions as have been prescribed therefore.

3. DURATION OF THE COURSE

The duration of the course is for two academic years consisting of four semesters.

4. EXAMINATIONS

There shall be four semester examinations: first semester examinations at the middle of the first academic year and the second semester examination at the end of the first academic year. Similarly, the third and fourth semester examinations shall be held at the middle and the end of the second academic year, respectively.

1. COURSE OF STUDY AND SCHEME OF EXAMINATIONS NAME OF THE COURSES

- Semester –I
  - Core–I - General Microbiology
  - Core–II - Immunology and Immuno technology
  - Core–III - Cell and Molecular Biology
  - Elective –I - Inheritance Biology(Compulsory)
  - Practical – I &II
- Semester –II
  - Core–IV - Medical Bacteriology and Mycology
  - Core–V - Industrial and Pharmaceutical Microbiology
  - Core–VI - Genetic engineering and Advances in Biotechnology
  - EDC
  - Practical – III &IV
  - Internship Training for 15 days
- Semester –III
  - Core–VII - Medical Virology and Parasitology
  - Core–VIII - Food, Dairy and Environmental Microbiology
  - Core–IX - Soil, Agricultural Microbiology and Bio degradation
  - Elective –II - Methods in Biology(Compulsory)
  - Practical – V &VI
  - Internship Training project submission
- Semester –IV
  - Core–IX - Research Methodology, Biostatistics and Bio informatics
  - Elective –III
  - Project
  - Online Test Certificates should be submitted

Elective Courses – Major (Choose Any Three)

1. Inheritance Biology(Compulsory From CSIR - NET)
2. Methods in Biology(Compulsory From CSIR - NET)
3. Plant Phyiology and Plant Tissue Culture
4. Bio Instrumentation and Biological Techniques
5. Nanotechnology

6. Basics of Phytochemistry

EDC (Extra Disciplinary Courses) for other department

1. Entrepreneurial Microbiology
2. Microbial Nanotechnology
3. Basics of Microbiology
4. Human Infectious Diseases and Diagnostics

SCHEME OF EXAMINATIONS

The scheme of examinations for different semesters shall be as follows:

THEORY:

Time -3hrs. **Maximum marks – 75Marks:**

- **Part A – 15 Marks (15 Questions)and**
- **Part B – 2x5=10Marks (2Questions)**
- **Part C – 5x10=50 Marks (5 Questions)**

- Internal marks - 25
- External marks - 75
- Total marks - 100.

The following procedure will be followed for Internal Marks:

Internal Marks

Theory Papers:

- Best Two tests out of 3-10marks
- Attendance - 5marks
- Seminar - 5marks
- Assignment -

5 marks

25 Marks

Practical:

- Attendance - 5marks
- Practical Test Best 2 out of 3 - 30marks
- Record - 5 marks

I 40 Marks

Project:

- Internal Marks presentations - 40marks
- Viva - 10marks
- Project Report - 50marks

Break – up Details for Attendance

- Below60% - No marks
- 60%to75% - 3marks
- 76%to90% - 4marks
- 91%to100% - 5marks

IMPORTANT POINTS

1. The each practical examination should be conducted for 6hrs/day, 2

   consecutive days. The fee for the practicals is double the amount of the normal 6 hours practicals (ie. If the practical fee is Rs. 210 for 6 hrs practical's, for these Applied Microbiology students, the fee will be Rs. 420/- practical). Similarly, the practical examiners also should be paid with double the remuneration (i.e. Rs. 100/- practical)

2. Elective papers can be selected by the concerned College Departments based on the student's interest.
3. For EDC papers, students should choose the other department EDC papers.
4. For Internship Training Programme Fees should be decided.

According to TANSHE

S.No	Papers	Internal	External
1.	Theory	25	75
2.	Practical	40	60
3.	Project	40	60
4.	Internship Training	40	60
5.	MOOC'S (or)s SWAYAM (PDFs attached)	Anyone Must	Credits allowed

5. Human Rights – credits 2 (Compulsary) not included in Percentage
6. Elective Papers – 6 (any 3) (1 & 2 Compulsary)
7. EDC for other department students

COURSE OF STUDY AND SCHEME OF EXAMINATION

Course and Paper Code	Subject Title	Hrs/ Week	Cds	University Examination		Total Marks
				Int	External	
I SEMESTER						
Core – I – 21PMI01	General Microbiology	5	5	25	75	100
Core – II – 21PMI02	Immunology and Immuno technology	5	5	25	75	100
Core – III – 21PMI03	Cell and Molecular Biology	5	5	25	75	100
Elective – I – 21PMIE01	Inheritance Biology (from CSIR)	6	4	25	75	100
Practical I -21PMBP01	General Microbiology and Immunology	5	4	40	60	100
Practical II-21PMBP02	Cell and Molecular Biology	4	4	40	60	100
II SEMESTER						
Core – IV – 21PMI04	Medical Bacteriology and Mycology	5	5	25	75	100
Core – V – 21PMI05	Industrial and Pharmaceutical Microbiology	5	5	25	75	100
Core – VI – 21PMI06	Genetic Engineering and Advances in Biotechnology	5	5	25	75	100
EDC (enclosed)		3	2	25	75	100
Common Paper – 21PMIHR01	Human Rights	2	2	25	75	100
Practical III – 21PMBP03	Medical Bacteriology and Mycology	5	4	40	60	100
Practical IV – 21PMBP04	Genetic Engineering and Industrial Microbiology	5	4	40	60	100
Internship – 21PMBINI	15 days Training related to curriculam*		4	40	60	100

Internship* sample courses

Course Name	SME Name	Institute	Course Duration	Nptel URL
Animal Physiology	Prof. Mainak Das	IIT Kanpur	12 weeks	https://nptel.ac.in/courses/102104042
Animal Physiology	Prof. Mainak Das	IIT Kanpur	12 weeks	https://nptel.ac.in/courses/102104058
Applications Of Interactomics Using Genomics And Proteomics Technologies	Prof. Sanjeeva Srivastav	IIT Bombay	08 weeks	https://nptel.ac.in/courses/102101072
Aspects Of Biochemical Engineering	Prof. Debabrata Das	IIT Kharagpur	12 weeks	https://nptel.ac.in/courses/102105064
Bio Electricity	Prof. Mainak Das	IIT Kanpur	12 weeks	https://nptel.ac.in/courses/102104043
Biochemistry - IITM	Prof. Subramaniam K	IIT Madras	12 weeks	https://nptel.ac.in/courses/102106087
Bio electrochemistry	Prof. Mainak Das	IIT Kanpur	04 weeks	https://nptel.ac.in/courses/102104062
Bioenergetics Of Life Processes	Prof. Mainak Das	IIT Kanpur	04 weeks	https://nptel.ac.in/courses/102104063
Bio energy	Prof. Mainak Das	IIT Kanpur	08 weeks	https://nptel.ac.in/courses/102104057
Bioengineering: An Interface With Biology And Medicine	Prof. Sanjeeva Srivastava	IIT Bombay	08 weeks	https://nptel.ac.in/courses/102101068
Bio Informatics: Algorithms And Applications	Prof. Michael Gromiha	IIT Madras	12 weeks	https://nptel.ac.in/courses/102106065
Bio Interface Engineering	Prof. Lalit M. Pandey	IIT Guwahati	08 weeks	https://nptel.ac.in/courses/102103086
Biomedical Nanotechnology	Prof. P. Gopinath	IIT Roorkee	04 weeks	https://nptel.ac.in/courses/102107058
Bio Microfluidics	Prof. Tapas Kumar Maiti, Prof. Suman Chakraborty	IIT Kharagpur	04 weeks	https://nptel.ac.in/courses/102105068
Bioreactor Design And Analysis	Prof. Smita Srivastava	IIT Madras	08 weeks	https://nptel.ac.in/courses/102106086
Bioreactors	Prof. G. K. Suraishkumar	IIT Madras	04 weeks	https://nptel.ac.in/courses/102106053
Biostatistics And Design Of Experiments	Prof. Mukesh Doble	IIT Madras	08 weeks	https://nptel.ac.in/courses/102106051
Cell Culture Technologies	Prof. Mainak Das	IIT Kanpur	08 weeks	https://nptel.ac.in/courses/102104059
Computational Systems Biology	Prof. Karthik Raman	IIT Madras	12 weeks	https://nptel.ac.in/courses/102106068/
Computer Aided Drug Design	Prof. Mukesh Doble	IIT Madras	08 weeks	https://nptel.ac.in/courses/102106070/

Demystifying The Brain	Prof. Srinivas Chakravarthy	IIT Madras	04 weeks	https://nptel.ac.in/courses/102106066/
Drug Delivery: Principles And Engineering	Prof. Rachit Agarwal	IISc Bangalore	12 weeks	https://nptel.ac.in/courses/102108077/
Environmental Chemistry And Microbiology	Prof. Anjali Pal Prof. Sudha Goel	IIT Kharagpur	12 weeks	https://nptel.ac.in/courses/102105087/
Experimental Biotechnology	Prof. Vishal Trivedi	IIT Guwahati	12 weeks	https://nptel.ac.in/courses/102103083/
Forest Biometry	Prof. Ankur Awadhiya	IIT Kanpur	08 weeks	https://nptel.ac.in/courses/102104060/
Forests And Their Management	Prof. Ankur Awadhiya	IIT Kanpur	12 weeks	https://nptel.ac.in/courses/102104082/
Functional Genomics	Prof. S. Ganesh	IIT Kanpur	04 weeks	https://nptel.ac.in/courses/102104056/
Fundamentals Of Micro And Nanofabrication	Prof. Sushobhan Avasthi, Prof. Shankar Selvaraja	IISc Bangalore	12 weeks	https://nptel.ac.in/courses/102108078/
Genetic Engineering: Theory And Application	Prof. Vishal Trivedi	IIT Guwahati	12 weeks	https://nptel.ac.in/courses/102103074/
Human Molecular Genetics	Prof. S. Ganesh	IIT Kanpur	04 weeks	https://nptel.ac.in/courses/102104052/
Immunology	Prof. Sudip Kumar Ghosh, Prof. Agneyo Ganguly	IIT Kharagpur	12 weeks	https://nptel.ac.in/courses/102105083/
Industrial Biotechnology	Prof. Debabrata Das	IIT Kharagpur	12 weeks	https://nptel.ac.in/courses/102105058/
Interactomics : Basics & Applications	Prof. Sanjeeva Srivastava	IIT Bombay	12 weeks	https://nptel.ac.in/courses/102101082/
Interactomics: Protein Arrays & Label-free Biosensors	Prof. Sanjeeva Srivastava	IIT Bombay	08 weeks	https://nptel.ac.in/courses/102101054/
Introduction To Biostatistics	Prof. Shamik Sen	IIT Bombay	08 weeks	https://nptel.ac.in/courses/102101056/
Introduction To Developmental Biology	Prof. Subramaniam K	IIT Madras	12 weeks	https://nptel.ac.in/courses/102106084/
Introduction To Dynamical Models In Biology	Prof. Biplab Bose	IIT Guwahati	04 weeks	https://nptel.ac.in/courses/102103056/
Introduction To Geographic Information Systems	Prof. Arun K. Saraf	IIT Roorkee	04 weeks	https://nptel.ac.in/courses/105107155/
Introduction To Mechanobiology	Prof. Shamik Sen	IIT Bombay	08 weeks	https://nptel.ac.in/courses/102101058/
Introduction To Professional Scientific Communication	Prof. S. Ganesh	IIT Kanpur	04 weeks	https://nptel.ac.in/courses/102104061/
Introduction To Proteogenomics	Prof. Sanjeeva Srivastava	IIT Bombay	12 weeks	https://nptel.ac.in/courses/102101076/
Introduction To Proteomics	Prof. Sanjeeva Srivastava	IIT Bombay	08 weeks	https://nptel.ac.in/courses/102101055/

Introductory Mathematical Methods For Biologists	Prof. Ranjith Padinhateeri	IIT Bombay	08 weeks	https://nptel.ac.in/courses/102101067/
Learning About Learning : A Course On Neurobiology Of Learning And Memory	Prof. Balaji Jayaprakash	IISc Bangalore	04 weeks	https://nptel.ac.in/courses/102108071/
Mass Spectrometry Based Proteomics	Prof. Sanjeeva Srivastava	IIT Bombay	04 weeks	https://nptel.ac.in/courses/102101050/
Material And Energy Balances	Prof. Vignesh Muthuvijayan	IIT Madras	12 weeks	https://nptel.ac.in/courses/102106069/
Medical Biomaterials	Prof. Mukesh Doble	IIT Madras	08 weeks	https://nptel.ac.in/courses/102106057/
Metabolic Engineering	Prof. Pinaki Sar Prof. Amit Ghosh	IIT Kharagpur	08 weeks	https://nptel.ac.in/courses/102105086/
Nanotechnology In Agriculture	Prof. Mainak Das	IIT Kanpur	08 weeks	https://nptel.ac.in/courses/102104069/
Optical Spectroscopy And Microscopy : Fundamentals Of Optical Measurements And Instrumentation	Prof. Balaji Jayaprakash	IISc Bangalore	12 weeks	https://nptel.ac.in/courses/102108082/
Plant Cell Bioprocessing	Prof. Smita Srivastava	IIT Madras	08 weeks	https://nptel.ac.in/courses/102106080/
Plant Developmental Biology	Prof. Shri Ram Yadav	IIT Roorkee	04 weeks	https://nptel.ac.in/courses/102107075/
Principles And Applications Of NMR Spectroscopy	Prof. Hanudatta S. Atreya	IISc Bangalore	08 weeks	https://nptel.ac.in/courses/104108078/
Principles Of Downstream Techniques In Bioprocess	Prof. Mukesh Doble	IIT Madras	12 weeks	https://nptel.ac.in/courses/102106022/
Principles Of Downstream Techniques In Bioprocess	Prof. Mukesh Doble	IIT Madras	04 weeks	https://nptel.ac.in/courses/102106048/
Proteins And Gel-Based Proteomics	Prof. Sanjeeva Srivastava	IIT Bombay	04 weeks	https://nptel.ac.in/courses/102101049/
Structural Biology	Prof. Saugata Hazra	IIT Roorkee	12 weeks	https://nptel.ac.in/courses/102107086/
Thermodynamics For Biological Systems: Classical And Statistical Aspect	Prof. Suraishkumar G K Prof. Sanjib Senapati	IIT Madras	12 weeks	https://nptel.ac.in/courses/102106082/
Tissue Engineering	Prof. Vignesh Muthuvijayan	IIT Madras	08 weeks	https://nptel.ac.in/courses/102106081
Transport Phenomena In Biological Systems	Prof. G. K. Suraishkumar	IIT Madras	12 weeks	https://nptel.ac.in/courses/102106083
Wildlife Conservation	Prof. Ankur Awadhiya	IIT Kanpur	08 weeks	https://nptel.ac.in/courses/102104068
Wildlife Ecology	Prof. Ankur Awadhiya	IIT Kanpur	12 weeks	https://nptel.ac.in/courses/102104073

MOOC'S (or)s SWAYAM

https://swayam.gov.in/

Elective Courses – Major (Choose Any Three) - Paper Codes

1. Inheritance Biology(Compulsory From CSIR - NET) - 21PMIEL01
2. Methods in Biology(Compulsory From CSIR - NET) - 21PMIEL02
3. Plant Phyiology and Plant Tissue Culture - 21PMIEL03
4. Bio Instrumentation and Biological Techniques - 21PMIEL04
5. Nanotechnology - 21PMIEL05
6. Basics of Phytochemistry - 21PMIEL06

EDC (Extra Disciplinary Courses) for other department

1. Entrepreneurial Microbiology - 21PMIED01
2. Microbial Nanotechnology - 21PMIED02
3. Basics of Microbiology - 21PMIED03
4. Human Infectious Diseases and Diagnostics - 21PMIED04

Course	Subject Title	Hr/ Week	Credit	University Examination		Total Marks
				Int	Ext	
III SEMESTER						
Core – VII - 21PMI07	Medical Virology and Parasitology	5	5	25	75	100
Core – VIII – 21PMI08	Food, Dairy and Environmental Microbilogy	5	5	25	75	100
Core – IX – 21PMI09	Soil, Agricultural Microbiology Bio Degradation	5	5	25	75	100
Elective – II – 21PMIE02	Methods in Biology	5	4	25	75	100
Practical V – 21PMBP05	Medical Virology and Parasitology	5	4	40	40	100
Practical VI – 21PMBP06	Food, Dairy, Environmental and Agricultural Microbiology	5	4	40	40	100
	Online Course in MOOC"S (or) SWAYAM must be submitted at the end of the IVth Sem	-	2	-	-	-
IV SEMESTER						
Core – X – 21PMI10	Research Methodology, Bio statistics and Bioinformatics	5	5	25	75	100
Elective III – Code Enclosed		4	3	25	75	100
Core – XI – 21PMBPR1 Project		21	4	40	60	100
	Total		**96**			**2200**

No. of Core Papers	:	17
Elective–Major	:	03 (Choose any 3 out of 6)
Supportive course–EDC	:	01
Internship Training	:	01

***(Choose from other department EDC papers)**

6. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTERS:

(i) Candidates shall register their names for the First semester examination after the admission in the PG Courses.

(ii) Candidates shall be permitted to proceed from the First Semester up to the Final Semester irrespective of their failure in any of the Semester Examination subject to the condition that the candidates should register for all the arrear subjects of earlier semesters along with current (subject) Semester subjects.

(iii) Candidates shall be eligible to proceed to the subsequent semester, only if they earn sufficient attendance as prescribed therefore by the Syndicate from time to time.Provided in case of candidate earning less than 50% of attendance in any one of the semester due to any extraordinary circumstance such as medical grounds, such candidates who shall produce Medical Certificate issued by the Authorized Medical Attendant (AMA), duly certified by the Principal of the College, shall be permitted to proceed to the next semester and to complete the course of study. Such candidate shall have to repeat the missed semester by rejoining after completion of final semester of the course, after paying the fee for the break of study as prescribed by the University from time to time.

7. PASSING MINIMUM

a) There shall be no Passing Minimum for Internal.

b) For External Examination, Passing Minimum shall be of 50% (Fifty Percentage) of the maximum marks prescribed for the paper.

c) In the aggregate (External + Internal) the passing minimum shall be of 50% for each Paper/Practical/Project and Viva-voce.

d) Grading shall be based on overall marks obtained (internal + external).

8. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Candidates whose cured not less than 60% of aggregate mark (Internal + External) in the whole examination shall be declared to have passed the examination in the

First Class. All other successful candidates shall be declared to have passed in Second Class. Candidates who obtain75% of the marks in the aggregate (Internal + External) shall be deemed to have passed the examination in First Class with Distinction, provided they pass all the examinations (theory papers, practicals, project and viva- voce) prescribed for the course in the First appearance.

9. GRADING SYSTEM:

The term grading system indicates a Seven (7) Point Scale of evaluation of the performances of students in terms of marks obtained in the Internal and External Examination, grade points and letter grade.

SEVEN POINT SCALE (As per UGC notification 1998)

GRADE	GRADE POINT	PERCENTAGE OF EQUIVALENT
'O' = Outstanding	5.50 – 6.00	75– 100
'A' = Very Good	4.50 – 5.49	65 – 74
'B' = Good	3.50 – 4.49	55 – 64
'C' = Average	3.00 – 3.49	50 – 54
„D' = Below Average	1.50 – 2.99	35 – 49
'E' = Poor	0.50 – 1.49	25 – 34
„F' = Fail	0.00 – 0.49	0 – 24

10. RANKING

Candidates who pass all the examinations prescribed for the course in the first appearance itself alone are eligible for Ranking /Distinction.

Provided in the case of candidates who pass all the examinations prescribed for the course with a break in the First Appearance due to the reasons as furnished in the Regulations under "Requirements for Proceeding to subsequent Semester" are only eligible for Classification.

11. PATTERN OF QUESTION PAPER

PART – A (Objective type: Answer all Questions 15 X 1 = 15 Marks) PART - B Answer all Questions either or type 5x4=20 marks PART – C (400 words) Answer all 5 Questions either or type 5x8=40 marks

12. APPEARANCE FOR IMPROVEMENT

Candidates who have passed in a theory paper / papers are allowed to appear again for theory paper/ papers only once in order to improve his/her marks, by paying the fee prescribed from time to time. Such candidates are allowed to improve within a maximum period of 10 semesters counting from his / her first semester of his/her admission. If candidate improve his marks, then

his improved marks will be taken into consideration for the award of Classification only. Such improved marks will not be counted for the award of Prizes / Medals, Rank and Distinction. If the candidate does not show improvement in the marks, his previous marks will be taken into consideration. Candidate will be allowed to improve marks in the Practicals, Project, Viva-voce, Field work.

13. TRANSITORY PROVISION

Candidates who have undergone the course of study prior to the academic year 2021- 2022 will be permitted to appear for the examinations under those Regulations for a period of three years i.e., up to and inclusive of April / May 2017 Examinations. Thereafter, they will be permitted to appear for the examination only under the Regulations then inforce.

M.Sc. MICROBIOLOGY

SEMESTER - I

CORE I: GENERAL MICROBIOLOGY

SUBJECT CODE: 21PMI01

Course bjectives

To enable the students to understand the basic knowledge in Microbiology about the different forms of bacteria, fungi, algae, protozoan"s along with the basic principles of microbial taxonomy and microbial metabolism .

Course Outcome

At the end of the successful completion of this course, the learner will be able to

1. Gain a strong foundation on general microbiological practices

2. Learn the basics of various characteristics features of divisions used in the classification of bacteria, fungi, protozoa and algae.
3. Know the basics of Microbial taxonomy and Metabolism of microbes

UNIT – I

Introduction – Development, Scope and Future of Microbiology -Isolation of different types of bacteria – fungi – actinobacteria – cyanobacteria. Preservation methods of microbes for storage and microscopy studies, Microbial type culture collections. Sterilization and disinfection – physical and chemical methods for controlling microorganisms.

UNIT II

Microscopy - Working principle, instrumentation and applications of Bright field microscope, Phase contrast microscope, Dark field microscope, Fluorescent microscope and Electron microscopes (SEM and TEM). Staining Methods – Simple, Gram, Acid-fast, Spore, Granular, Capsular, Flagellar and Fat bodies.

UNIT – III

Morphological types - Gram negative and Gram positive, Cyanobacteria, Archeabacteria and Eubacteria. Ultrastructure of prokaryotic and eukaryotic cells. General Characteristics and Classification of Algae (Fritsch Method) . General Characteristics and Classification of Fungi (Alexopolus). General Characteristics and Classification of Protozoa.

UNIT – IV

Microbial Taxonomy-Definition, systematics, Nomenclature rules and identification, Hierarchical organization and the position of microbes in the living world, classification systems – Haeckel"s three kingdom concept- Whittaker"s five kingdom concept- three domain concept of Carl Woese. Characterization of microorganisms - Physiological, Metabolic, Serological and Molecular methods- Bergey"s Manual of Systematic Bacteriology with general characteristics of each division- Numerical Taxonomy- 16S rRNA based classification. Archeabacterium, Actinomycetes- Structure and Classification.

UNIT – V

Bacterial Metabolism -Microbial respiration and fermentative pathway - respiratory metabolism - Embden Mayer Hoff pathway - ED pathway - Glyoxalate pathway - Kreb"s cycle - ETC - oxidative and substrate level phosphorylation - TCA cycle – gluconeogenesis - Fermentation of carbohydrates - homo and hetero lactic fermentation. Bioenergetics, Cell division - endospore - structure and properties.

REFERENCES

1. Prescott LM, Harley JP and Klein DA. Microbiology. 7th edition, McGraw Hill, Newyork. 2008

2. Tortora, G.J., Funke, B.R. and Case, C.L. (2016) Microbiology: An Introduction, 11th Edition, Pearson Education, India

3. Holt JS, Kreig NR, Sneath PHA and Williams ST. Bergey"s Manual of Determinative Bacteriology (9th Edition), Williams and Wilkins,

Baltimore.1994.

4. Dubey, R.C. and Maheshwari, D.K. (2013) A Textbook of Microbiology. Revised Edition, Chand and company, NewDelhi

5.Baveja, C.P. and Baveja, V. (2017) APC Text Book of Microbiology.4thEdition, Arya Publications, New Delhi

6.Pelczar TR, Chan ECS and Kreig NR .Microbiology. 5th Edition, Tata McGraw – Hill, New Delhi.2006.

7. Alcamo E. Fundamentals of Microbiology. 6th Ed., Jones and Bartlett Publishers, New Delhi. 2001.

8. Salle AJ. Fundamental principles of Bacteriology.7th edition, Tata McGraw- Hill publishing company Ltd, New Delhi. 2001.

9.Geeta Sumbali and Mehrotra RS (2009). Principles of Microbiology. First edition, Tata McGraw Hill P. Ltd., New Delhi.

Web References

1. https://microbiologyinfo.com/top-and-best-microbiology-books/

2. www.microbiologyonline.org.uk

3. www.life.umd.edu/classroom/bsci424/BSCI223WebSiteFiles/LectureList.htm

4. https://open.umn.edu/opentextbooks/BookDetail.aspx?bookId=404

5. https://www.boundless.com/microbiology

6. www.ebooks.cambridge.org/ebook.jsf?bid=CBO9781139170635

7. www.grsmu.by/files/file/university/cafedry/.../files/essential_microbiology.pdf

M.Sc. MICROBIOLOGY

CORE II : IMMUNOLOGY AND IMMUNOTECHNOLOGY

SEMESTER - I

SUBJECT CODE: 21PMI02

Course Objectives

To enable the students to understand the basic knowledge in Microbiology about the different forms of bacteria about their immunological facts.

Course Outcome

At the end of the successful completion of this course, the learner will be able to

1. Gain a strong foundation on general immunological practices
2. Understanding the Immunological assays and test.
3. Understanding the various drugs and vacines in emerging diseases.

UNIT I - The Cells of Immune System

The Cells of Immune System-An over view of the immunology-Classification of the immune response. Cells and tissues of the immune system.Haematopoiesis: Origin and differentiation of Lymphocytes and phagocytic cells. Primary and secondary lymphoidorgans. Immunogens and antigens-haptens,adjuvants.

UNIT II - Humoral Immunity

Development,maturation,activation and differentiation of B-lymphocytes;Antibody: structure,classes and sub classes;antibody diversity-Antigen and antibody interaction. Complement – Classical, alternate and lectin pathways; Hybridoma

technologyforproductionofthemonoclonalantibodyandapplications.

UNIT III - Cellular Immunity

Classification and stages of development (T) Lymphocytes - T cell receptor - Major histocompatibility complex –structure, classification and genetic organization of MHC; mechanism of phagocytosis- ADCC- cell biology of antigen processing and presentation- cytokines; immunosuppression, tolerance.

UNIT IV- Hypersensitivity, Transplantation, Immunology of Tumors

Injury and inflammation; allergy and hypersensitivity-types; Transplantation: types, immunological mechanisms of graft rejection- immunological strategies to prevent graft rejection- Tumors: Immune response to tumors- type of tumor antigens.

UNIT V- Auto immunity Immuno pathology and Techniques in Immuno technology

Autoimmunity: Diseases & mechanisms - Preparation and storage of tissues - identification of various cell types and antigens in tissues. Immuno cytochemistry- immuno fluorescence, immuno enzymatic and immuno ferrtin techniques and immune electron microscopy; Isolation of pure antibody, assays of circulating immune complexes; Isolation of lymphocyte populations. Vaccine Types- Preparation ofvaccines.

TEXT BOOKS

1. Owen,J.,Punt,JandStrandford,S.“KubyImmunology”, 7th Ed., W.H.Freeman Publication, NewYork,USA,2012.
2. Abbas,

K.A.,Litchman,A.H.andPober,J.S."CellularandMolecularImmunology", 4th Ed., W.B.Saunders Co., Pennsylvania, USA, 2005.

3. Talwar, G. P. and Gupta S. K. A "Hand book of practical and clinical immunology"Vol. I & II. CSB Publications, New Delhi, 1992.

REFERENCE BOOKS

1. Roitt, I., Brostoff, J. and David, M. "Immunology", 6th Ed., Mosby publishers Ltd., New York, USA, 2001.
2. Tizard, R.I. "Immunology", 4 th Ed., Saunders college publishing, Chennai Micro print Pvt. Ltd., Chennai, 2004.

M.Sc. MICROBIOLOGY

CORE III: CELL AND MOLECULAR BIOLOGY

SEMESTER - III SUBJECT

CODE: 21PMI03

Course Objectives

To enable the students to understand the basic knowledge of Cell Structure Division and Molecular Structures of different forms of bacteria.

Course Outcome

At the end of the successful completion of this course, the learner will be

able to 1.Gain a strong foundation on general Cell Structures and Molecular

practices.

2.Understanding the Molecular Structure of Genes.

3.Basic process and encoding Genetic level important mechanisms.

UNIT I Cell Structure Permeability and Transport

Prokaryotes, Development of multicellular organisms, Cell wall structure of bacteria and eukaryotes, Plasma membrane structure and models, cell organelles; cell permeability-concentration gradient and partition coefficient, transport of small molecules- active, passive, ion channels, facilitated diffusions.

UNIT – II Cell division, Cell signaling and protein localization

Cell cycle and its regulation, Bacterial cell division, Eukaryotic

cell division, mechanicsofcelldivision-mitosisandmeiosis;Cellsignaling–signalingmolecules,G protein coupled receptors, Ion-channel receptors, enzyme linked receptors, protein sorting, nuclear localization, mitochondria and chloroplast import and export mechanism.

UNIT – III Molecular structures of genes and chromosomes

Structure of DNA - DNA melting and reannealing, base composition and sequence,
size, shape, super twisting; molecular events of prokaryotic and eukaryotic chromosome organization, exon; intron- DNA mutation and repair mechanism.

UNIT IV Replication andTranscription

Basic rules of replication- genes and enzymology of replication, processivity and fedility of replication,rolling circle replication,termination of replication,importance of teleomerase in eukaryotic replication- gene transfer mechanism in bacteria; Molecular events of Prokaryotic and Eukaryotic Transcription; initiation,elongation andtermination.

UNIT V Gene expression and regulation

Geneticcode,Ribosome of prokaryote and eukaryote and its evolutionary importance; mechanism of translation- initiation, elongation and termination. Inhibitors of Translation. Post translational modification. Regulation of gene expression – lac operon,trpoperon,araoperon.

TEXT BOOKS

1. Lodish, H., Berk, A., Zipurursky, S. L., Matsudaria, P., Baltimore D, and Darnell, J, "MolecularCellBiology",W.H.Free ManandCompany,England,2000.
2. BenjaminLewin,"GeneIX",OxfordUniversityPress,NewDelhi,India,2000.

REFERENCE BOOKS

3. Roitt, I., Brostoff, J. and David, M. "Immunology", 6th Ed., Mosby publishers Ltd., New York, USA, 2001.
4. Tizard, R.I. "Immunology", 4 th Ed., Saunders college publishing, Chennai

Microprint Pvt.Ltd., Chennai, 2004

M.Sc. –MICROBIOLOGY
SEMSESTER - I
PRACTICAL - I
GENERAL MICROBIOLOGY AND IMMUNOLOGY
Practical Exam: 6 Hrs / Day; 2 Consecutive days
GENERAL MICROBIOLOGY
Code: 21PMBP01

Course Objectives

The learners will be able to gain adequate knowledge and acquire skill to perform different staining techniques, growth rate of bacteria and biochemical test. To impart knowledge and understanding of practical skills in applying these principles in diagnostic , therapeutic techniques and research.

Course Outcome

At the end of the course, learners will be able to

1. Perform the various staining techniques of bacteria and study

the growth rate of bacteria.

2. Understand the various methods to isolate and identify the Microorganisms.

GENERAL MICROBIOLOGY

1.Measurement of microorganisms – Micrometry

2.Staining methods - Gram Staining , Acid fast, Metachromatic granular Staining , Spore Staining , Capsule Staining , Flagella staining .

3.Motility Determination – Hanging drop method and Soft agar

4.Media preparation - Cultural Characters of bacteria on different types of Media - Selective , Differential, Enriched, Enrichment and Transport media

5.Pure culture techniques - Streak plate, Pour plate and Spread plate

6. Bacterial Growth - Growth curve and Effect of various intrinsic factors such as pH, Temperature on the growth of bacterium-Spectroscopic method.

7. Anaerobic cultivation - Anaerobic gas pack method (Demo), Wright's tube method

8. Algae - Isolation and cultivation of Algae

9. Fungi - Fungal Slide Culture, Lactophenol Cotton Blue Staining

10.Study on bacterial extra cellular enzymes - Starch, Casein, Gelatin and Lipid hydrolysis

11.Biochemical Tests for identification of bacteria

- Oxidase test
- Catalase test
- Coagulase test
- Nitrate reduction test
- Carbohydrate fermentation test
- IMViC test
- TSI test
- Urease test
- Amino acid decarboxylation test

12.Antibiotic sensitivity methods – Kirby-Bauer method and Stokes method

13. Fumigation technique.

References

1.James G. Cappuccino and Natalie Sherman (2014) Microbiology: A Laboratory Manual (10th Edition), Pearson.

2. Sundaraj T, Aswathy Sundarraj (2002), Microbiology Laboratory Manual (First edition), Chennai.

3.Aneja, K.R (2003) Experiments in Microbiology, Plant Pathology and Biotechnology (4th edition), New age international, New Delhi.

4. Dubey, R.C and Maheshwari, O.K (2005) Practical Microbiology, S Chand and Co. Ltd., (First edition), New Delhi.

5. Alfred E. Brown (2010) Benson's Microbiological Applications:

Laboratory Manual in General Microbiology, 11th Edition,

McGraw-Hill Companies.

6.Kocher, G.S. (2013) Practical Manual Series Vol III: Practical

Teaching in Microbiology HB, NPH Publishers and Distributors.

Web References

1. http://www.pdfsdocuments.com/cp-baveja-microbiology.pdf

2. http:/www.faculty.washington.edukorshin/Class486/MicrobiolTechniques.pdf

3. http://www.microbiologyonline.org.uk/media/.../sgm_basic practical micro biology_2.pdf

4. http://www.cmu.edu.cn/jc_sys1/upl_files/200858184159474.pdf

5. http:// www vlab.amrita.edu/?sub=3&brch=69&sim=192&cnt=1

6. http:// www homepage.usask.ca/~jrg426/manualtoc.html

7. http:// www.asmscience.org/content/book/10.1128/9781555815905

M.Sc. MICROBIOLOGY
SEMSESTER - I
PRACTICAL - I
PRACTICAL – IMMUNOLOGY

1. **ABO Blood grouping – Rh typing and cross matching**
2. **Agglutination tests**
   - WIDAL
   - RA
   - ASO
   - CRP
   - Beta-HCG
3. **Precipitation**
   - Ouchterlony's Double Immuno - diffusiontest
   - Counter Immunoelectrophoresis
   - Rocket Immunoelectrophoresis
   - Radial Immunoelectrophoresis
4. **Rapid plasma reagin test (RPR)**
5. **ELISA (HIV & Hbs)**

REFERENCES:

1. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. Fourth edition, New Age International Publishers, Chennai.
2. Dubey RC and Maheswari DK (2004). Practical Microbiology First edition,S Chand and Company Ltd., New Delhi.
3. Kannan N (2003). Handbook of laboratory culture media, Reagents, Stains and buffers. Panima Publishing Corporation, New Delhi.
4. Kannan N (1996). Laboratory Manual in General Microbiology. First edition, Palani Paramount Publications, Palani. Tamil Nadu.
5. Horold J Benson (1998).Microbiological Applications-Laboratory Manual in General Microbiology. Seventh International edition, Mc Grew-Hill, Boston.
6. Myer's and Koshy's manual of diagnostic procedures in medical

microbiology and immunology/serology. Published by department of clinical microbiology, CMC and Hospital, Vellore, Tamil Nadu.

7. The Hi Media Manual (2003). For microbiology and Cell Culture Laboratory Practice. Published by Hi Media Laboratories (P) Ltd., Mumbai.
8. Mukherjee, L. (1997). Medical Laboratory Technology. Volume I & II. Tata McGrew – Hill Publishing Company Limited, New Delhi.

M.Sc. MICROBIOLOGY
SEMSESTER - I
PRACTICAL – II CELL AND MOLECULAR BIOLOGY
Practical Exam: 6 Hrs / Day; 2 Consecutive days
Code: 21PMBP02

Course Objectives

The learners will be able to gain adequate knowledge and acquire skill to perform different staining techniques, various techniques isolation of Nuclic Acids. To impart knowledge and understanding of practical skills in applying these principles in diagnostic , therapeutic techniques and research.

Course Outcome

At the end of the course, learners will be able to

1. Perform the various staining techniques of bacteria and study the Isolation of DNA and RNA process of Bacteria.

2.Understand the various methods to isolate and identify the Microorganisms and Bacterial Genetical analytical process.

PRACTICALS

1. Identification of different stages of mitosis in Allium cepa (Onion) by staining
2. Isolation of genomic DNA from bacterial cells.
3. Extraction of genomic DNA from yeast cells.
4. Isolation of genomic DNA from blood by high salt method.
5. Isolation of genomic DNA from plants by CTAB method.

6. Extraction of plasmid DNA from bacterial cells.
7. Isolation of total RNA from prokaryotes.
8. Quantification of DNA by UV spectrometer.
9. Isolation of drug resistant mutants by gradient plate technique.
10. Size determination of DNA agarose gel electrophoresis.
11. Ames test.
12. Bacterial conjugation.
13. Bacterial transformation.
14. Isolation of Bacterio phage from sewage.

REFERENCES

1. Sam brook, J., Russsel, D.W., 'Molecular cloning – A laboratory manual', Third edition, Cold spring Harbor Laboratory Press, Cold spring Harbor, New York, USA, 2001.
2. Ansubel, F.M., Brent, R., Kingston, R.e., and Moore, D.D., 'Current protocols in Molecular Biology', Geone publication associates, New York, USA, 2001.
3. Rajan S and Selvi Christy (2011). Experimental procedures in life sciences. Anjana Book House, publishers and distributors, Chennai.
4. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. Fourth edition, New Age International Publishers, Chennai.
5. Dubey RC and Maheswari DK (2004). Practical microbiology First edition, S Chand andCompanyLtd.,NewDelhi.
6. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual.Sixthedition,PublishedbyPearsonEducation.
7. Kannan N (2003). Handbook of laboratory culture media, Reagents,

Stains and buffers.PanimaPublishingCorporation,NewDelhi.

8. Kannan N (1996). Laboratory Manual in General Microbiology. First edition, Palani Paramount Publications, Palani. TamilNadu.

9. Horold J Benson (1998). Microbiological Applications-Laboratory Manual in General Microbiology. Seventh International edition, Mc Grew-Hill, Boston.

10. The Hi Media Manual (2003). For microbiology and Cell Culture Laboratory Practice. Published by Hi Media Laboratories (P) Ltd., Mumbai.

M.Sc. MICROBIOLOGY

SEMESTER - II

CORE IV - MEDICAL BACTERIOLOGY AND MYCOLOGY

SUBJECT CODE : 21PMI04

Course Objectives:

- To understand the basic information on bacterial and fungal disease
- Important knowledge on host and parasitic infections
- Create a knowledge on the infection caused by the organism
- To understand the pathogenesis of bacterial and fungal diseases

Course outcome:

on successful completion of the course the students will be able to

1. Gain wide information regarding various types of bacterial and fungal infections enable proper diagnosis and treatment of various infections caused by bacteria and fungi
2. **A**pply their acquired knowledge on laboratory techniques on diagnosis of bacterial and fungal disease

UNIT I Bacteriology

Indigenous normal microbial flora of human body. General attributes and virulencefactors of bacteria causing infections. Host Parasite relationships – Nonspecific host immune mechanisms. Ground rules for collection and dispatch of clinical specimens for microbiological diagnosis and discarding of clinical Specimens.

UNIT II

Morphology, classification, cultural characteristics, pathogenicity, pathology, laboratory diagnosis and prevention – Control and treatment of diseases caused by the Following organisms: *Staphylococci, Streptococci, Pneumococci, Neisseriae* (*Gonococci* & *Meningococci*), *Corynebacterium diptheriae, Mycobacterium tuberculosis, M. leprae, Clostridium tetani, Cl. botulinum* and *Bacillus anthracis.*

UNIT III

Morphology, classification, cultural characteristics, pathogenicity, pathology, Laboratory diagnosis and prevention – *Salmonella, Shigella dysenteriae, Vibrio cholerae, E. coli,* ***Pseudomonas aeruginosa,Haemophilus influenza, Helicobacter pylori,*** *Brucella abortus,****Bordetella.*** *Spirochetes, Rickettsiae rickettsi, Chlamydiae trachomatis, Mycoplasmas* – **Emerging Bacterial infections,** Zoonotic diseases and their control – Hospital acquired infections – Hospital Infection control committee – functions – Hospital waste disposal – Ethical committee – functions.

UNIT IV Mycology

Classification of medically important Fungi (Morphology, Infection & Reproduction), Immunity to Fungal Infections. Culture Media and Stains in Mycology, Normal fungal flora of human beings, Specimen collection, preservation, Transportation & Identification of Mycological Agent. Biochemical tests for fungal identification, Anti fungal agents- sensitivity test

UNIT V

Pityriasis vesicolor, White piedra, Black piedra, Tinea nigra, Cutaneous mycosis-Dermatophytes. Subcutaneous Mycosis–Mycetoma,Sporotrichosis, Chromoblastomycosis, Systemic Mycosis-*Histoplasmosis*, Blastomycosis, *Coccidio idomycosis*,*Paracoccidioidesbrasiliensis*.pportunisticMycosis–***Crypto coccus neoformans.*** Candidiasis, Aspergillosis, Miscellaneous Mycosis- Otomycosis. Fungal infections in eyes. Mycotoxins. Allergic Fungal diseases
- Mycetismus.

REFERENCE BOOKS

1. Alexopoulus CJ and C. W. Mims (1993) Introductory Mycology (3rd edition) Wiley Eastern Ltd. New Delhi.

2. Elizabeth Moore Landecker (1996) Fundamentals of the Fungi (4th edition) Prentice Hall International Inc, London.

3. Mehrotra, R.S. and Aneja, K.R., 2006. An introduction to Mycology. Reprinted and Published by New Age International (P) Ltd, Publishers, New Delhi.

4. Jegadish Chander, 1996. A Text Book of Medical Mycology. Interprint, New Delhi.

5. D. R. Arora (2014) Medical Mycology, CBS Publishers & Distributors; 1st edition.

6. Greenwood, D., Slack, R.B. and Peutherer, J.F. (2002) Medical Microbiology, 16th Edn. Churchill Livingstone, London.

7. Topley and Wilson (1995) Principles of Bacteriology Virology and Immunity. 9th Edn. Vol I, Edward Arnold, London.

8. Chakraborty, P., 2003. A Text Book of Microbiology. 2nd edition, Published by New Central Agency (P) Ltd., Kolkatta.

9. Dey, N.C., Dey, T.K. and Sinha, D., 1999. Medical Bacteriology including Medical Mycology and AIDS. 17th edition, New Central Book agency. Kolkatta.

10. Ananthanarayan and Paniker's Text book of Microbiology (1978) Universities Press (9th edition), Hyderabad.

11. Jawetz, Melnick, & Adelberg's. (2013). Medical Microbiology. 26th Edition. McGraw-Hill.

WEB REFERENCES.

1. https://microscopemaster.com
2. https://cartercenter.com
3. https://microbesnotes.com
4. https://microbiology info.com
5. https://www.ncbi.nih.gov.in
6. https://www.austincc.edu
7. https://www.mans.edu.eg
8. https://medicalfocustz.weebly.com
9. https://mccmscontent.mayo.edu
10. https://www.easybiologyclass.com.

M.Sc. MICROBIOLOGY

SEMESTER - II

CORE V - INDUSTRIAL AND PHARMACEUTICAL MICROBIOLOGY

CODE : 21PMI05

Course Objectives:

- To understand the basic information on bacterial and fungal and importance of their industrial use.

Course outcome:

on successful completion of the course the students will be able to

1. Gain wide information regarding various types of bacterial and fungal Biochemical process and Fermentations.

2. Microbial production of various industrial important products

by bacteria and fungai. 3. Understanding Pharmaceutical

microbiological process by checking sterlity of the samples.

UNITI

Introduction to fermentation – the range of fermentation process. The chronological development of the fermentation industry. The component parts of a fermentation process. Industrially important organisms – Isolation, preservation and strain improvement.

UNIT II

Development of inoculum-Scaleup (Pilotstudy)–Upstream processing–media for industrial fermentation–formulation–

sterilization–Microbial growth kinetics. Fermentation – types. Downstream processing. Fermentor – parts, design – types – Instrumentation and control.

UNIT III

Microbial production of organic acids (Citricacid, Aceticacid, Lactic acid and Itaconic acid), Amino acids (L - Glutamic acid and L - Lysine), Antibiotics (Penicillin, Semi synthetic penicillins,Streptomycin,Tetracyclines and Griseofulvin),enzymes (Amylases, Proteases and Pectinases), vitamins (B12, B2 and C), alcoholic beverages.
Microbial transformations–steroids, sterols, antibiotics and

pesticides. Water analysis.

UNIT IV

Production of vaccines, toxoid, antisera and their standardization. Antiseptics, disinfectants and their standardization. Types of water (DM/Purified water/water for injection) used in pharmaceutical industry. Environmental monitoring. Growth promotion test. Sterlity sample analysis. Biological Indicators.

UNIT V

Sub culturing and culture suspension preparation. Microbial assay of antibiotics and vitamins. Sterility testing. Bacterial Endotoxin Test (BET). Microbial limit test. Validation of instruments (Laminar air flow, autoclave and Hot air oven). Good Documentation Practice (GDP) – SOP – GLP. Failure investigation. Different types Ingupators.

REFERENCE BOOKS

1. Stanbury, P.F., Whittaker, A and Hall, S.J., (1995) Principles of fermentation technology,Elsevier;3rd edition.
2. Crueger and Crueger, A., Biotechnology: A text book of Industrial Microbiology, Sinavosassociation,Ino Sundeland;2nd edition.
3. Cassida,J.E.,(1968).Industrial Microbiology,New Age International (2007).
4. PresscottandDunn,S.,(1982)IndustrialMicrobiology.TheAVI Publishing Company Inc.,USA;4th edition.
5. Peppler,H.J.and Pearlman, D.(1979). Microbial Technology, Vol1and2, Academic press.
6. Demain, A. L. and Soloman INA, (1986). Manual of Industrial Microbiology and Biotechnology,American society for Microbiology,Washington DC.
7. Chisti,Y.,Fermentation,Biocatalysis and bioseparation, Encyclopedia of Bioprocess Technology,Vol.5,John Wiley and Sons,N.Y.
8. Belter, P.A., Cussler, E.L. and Hu, W.S., Bio separation: Downstream processing for Biotechnology, John Wiley and Sons,N.Y.
9. Agarwal AK & Pradeep Parihar (2006). Industrial Microbiology. Published by Student Edition, Behind Nasrani Cinema, Chopasani Road, Jodhpur.
10. Patel A H (2005). Industrial Microbiology. Laxmi Publications, New Delhi; Second edition
11. https://www.scribd.com/document/322795616/Free-Download-Indian- Pharmacopoeia-2010-PDF

M.Sc. APPLIED MICROBIOLOGY
SEMESTER - II
CORE VI - GENETIC ENGINEERING AND ADVANCES IN BIOTECHNOLOGY
SUBJECT CODE : 21PMI06

Course Objectives:

- To learn the basics of recombinant DNA technology.
- To acquire an idea about cloning mechanisms.

CONTENTS

UNIT I: **Introduction to Genetic Engineering:** Definition, Historical perspectives. Enzymes in rDNA technology - Restriction enzymes – types – nomenclature. DNA ligase. DNA modifying enzymes – alkaline phosphatase and polynucleotide kinase- Polymerases and types- Conversion of blunt ended molecules to sticky ended- linkers – adopters – homopolymer tailing.

UNIT II: **Cloning Vectors:** Cloning vectors: Bacterial Plasmids- pBR322 & pUC vectors, Bacteriophage vectors λ, M13, Hybrid vectors- cosmid, phagemid. Yeast vectors- YEP, YRP, YIP & YAC. Shuttle vectors. Expression vectors for expressing eukaryotic gene.

UNIT III: **Cloning Strategies:** Construction of cDNA and genomic libraries.Genetransfer methods–transformation, electroporation, particle bombardment and micro injection.
Screening and selection of clones.

UNIT IV: **Transgenic Animals and Plants:** Animal vectors – SV 40, Retroviral vector. Production and applications of transgenic mice. Gene transfer to plants- Callus culture, *Agrobacterium* mediated transformation: Crown gall disease, Ti plasmids, T-DNA transfer, Ti plasmid derivatives- co-integrate vectors and binary vectors.

UNIT V: **rDNA technology**: Blotting techniques – Southern, Northern and Western blotting. PCR amplification and its application.DNA sequencing methods – dideoxy, chemical and Next Generation Sequencing (NGS), RFLP, RAPD, Microarray. Applications of Genetic Engineering in Medicine and Agriculture.

Text Book

1. *Brown, T.A.* 1995.**Gene Cloning–An Introduction**. [Third Edition]. Chapmanand Hall, UK.

2. *Old, R.M. and Primrose, S.B.* 1995. **Principles of Gene Manipulation**. [Sixth Edition]. Blackwell Scientific Publication, London.

Reference Books

1. *Glick, B.K.* and *Pasternik, J.J.* 1998. **Molecular Biotechnology**. **Principles and applications of recombinant DNA**. [Second Edition]. ASM Press, Washington DC, USA.

2. *Winnacker, E.L.* 1987. **From Genes to Clones**. **Introduction to Gene technology**. [First Edition]. Panima Publishing Corporation, New Delhi.

M.Sc. APPLIED MICROBIOLOGY

SEMESTER - II COMMEN PAPER

SUBJECT CODE: 21PHR01

VALUE EDUCATION: HUMAN RIGHTS

Course Objectives

To make the students to understand the concepts of human rights.

COURSE OUTCOME

After completion of the course, the students will be able to

1. Understand the core principles of human rights philosophy.
2. Know the importance and functions of human rights commission
3. Know the rights from the Governance, economic and social development through various Acts
4. Understand the right to information Act, rights for women, children, Nomads, refugees and various sectors of people in our country.

UNIT-I

Human Rights: Definition - Historical Evolution - Classification of Rights - Universal Declaration of Human Rights - International Covenants on Economic and Social Rights - Constitutional Provision for Human Rights - Fundamental Rights - Directive Principles of the State Policy - Indian Constitution.

UNIT-II

Civil and Political Rights: Right to Work - Right to Personal Freedom - Right to Freedom of Expression - Right to Property - Right to Education - Right to Equality- Right to Religion - Right to Form Associations and Unions - Right to Movement- Right to Family - Right to Contract - Right to Constitutional Remedies-Right to

Vote and Contest in Elections - Right to Hold Public Offices- Right to Petition- Right to Information - Right to Criticise the Government-Right to Democratic Governance.

UNIT-III

Economic Rights: Right to Work - Right to Adequate Wages - Right to Reasonable Hours of Work
- Right to Fair Working Conditions - Right to Self Government in Industry - Customer Rights - Social and Cultural Rights - Right to Life - Right to Clean Environment.

UNIT-IV

Women's Rights: Right to Inheritance - Right to Marriage - Divorce and Remarry -Right to Adoption - Right to Education - Right to Employment and Career. Advancement - Rights Relating to Dowry - Right for Equality - Right for Safe Working Conditions - Children's Rights - Right to Protection and Care – Right to Education - Issues Related with Infanticide - Street Children – Child Labour- Bonded Labour - Refugees Rights - Minority Rights - Dalit Rights-Tribal Rights- Nomads Rights.

UNIT_V

Human Rights Violation: International, National, Regional Level Organizations to Protect Human Rights - UNO - National Commission for Human Rights - State Commissions - Non Governmental Organizations and Human Rights - Amnesty Terrorism and Human Rights - Emergency and Human Rights - Judiciary and Human Rights - Media and Human Rights - Police and Human Rights.

Reference Books

Paul Singh. **HumanRights and Legal System.** Himalaya Publishing House, New Delhi.

M.Sc. APPLIED MICROBIOLOGY
SEMESTER - II COMMEN PAPER
SUBJECT CODE: 21PMI06
GENETIC ENGINEERING AND ADVANCES IN BIOTECHNOLOGY

Course Objectives:

- To learn the basics of recombinant DNA technology. To acquire an idea about cloning mechanisms.

COURSE OUTCOMES

After completion of the course, the students' will be able to

1. Recall the basics and importance of enzymes in molecular research.
2. Apply cloning for developing novel recombinant products.
3. Develop transformants for production of various pharmacologically important products.
4. Apply gene transfer technology for controlling plant diseases.
5. Demonstrate sequencing method for bacterial identification.

UNIT-I

Introduction to Genetic Engineering: Definition, Historical perspectives. Enzymes in rDNA technology **-** Restriction enzymes – types – nomenclature. DNA ligase. DNA modifying enzymes – alkaline phosphatase and polynucleotide kinase- Polymerases and types- Conversion of blunt ended molecules to sticky ended- linkers – adopters – homopolymer tailing.

UNIT-II

Cloning Vectors: Cloning vectors: Bacterial Plasmids- pBR322 & pUC vectors, Bacteriophage vectors λ, M13, Hybrid vectors- cosmid, phagemid. Yeast vectors- YEP, YRP, YIP & YAC. Shuttle vectors. Expression vectors for expressing eukaryotic gene.

UNIT-III

Cloning Strategies: Construction of cDNA and genomic libraries. Gene transfer methods– transformation, electroporation, particle bombardment and microinjection. Screening and selection of clones.

UNIT-IV

Transgenic Animals and Plants: Animal vectors – SV 40, Retro viral vector. Production and applications of transgenic mice. Gene transfer to plants- Callus culture, *Agrobacterium* mediated transformation: Crown gall disease, Ti plasmids, T-DNA transfer, Ti plasmid derivatives- co- integrate vectors and binary vectors.

UNIT-V

DNA technology: Blotting techniques – Southern, Northern and Western blotting. PCR amplification and its application.DNA sequencing methods – dideoxy, chemical and Next Generation Sequencing (NGS), RFLP, RAPD, Microarray. Applications of Genetic Engineering in Medicine and Agriculture.

Text Book

Brown, T.A. 1995.**Gene Cloning–An Introduction**. [Third Edition]. Chapmanand Hall, UK.

Old, R.M. and Primrose, S.B. 1995. **Principles of Gene Manipulation**. [Sixth Edition]. Blackwell Scientific Publication, London.

Reference Books

Glick, B.K. and *Pasternik, J.J.* 1998. **Molecular Biotechnology**. **Principles and applications of recombinant DNA**. [Second Edition]. ASM Press, Washington DC, USA.

Winnacker, E.L. 1987. **From Genes to Clones**. **Introduction to Gene technology**. [First Edition]. Panima Publishing Corporation, New Delhi.

M.Sc. MICROBIOLOGY

PRACTICAL - III

SEMESTER - II

MEDICAL BACTERIOLOGY AND MYCOLOGY

Practical Exam: 6 Hrs / Day; 2 Consecutive days

Code: 21PMBP03

Course Objectives

The learners will be able to gain adequate knowledge and acquire skill to perform different staining techniques, various techniques isolation and identification of Baceteria and fungai. To impart knowledge and understanding of practical skills in applying these principles in diagnostic , therapeutic techniques and research.

Course Outcome

At the end of the course, learners will be able to

1. Perform the various staining techniques of bacteria and study the Isolation from various samples.

2. Understand the various methods to isolate and identify the Microorganisms from Bacterial Infection samples.

PRACTICAL

1. Preparation of cotton swab and sterile container for clinical sample collection.

2. Collection of clinical specimens (Throat swab, pus sample, sputum, urine and stool sample).

3. Microscopic examination of wet film (*V.cholerae*).

4. Preparation of Stains for bacterial and fungal observation. 5.Staining methods

a) Gram staining

b) AFB staining

c) Capsule staining

d) Spore staining

e) Granular staining

f) Flagella (Silver staining) g) Nuclear staining

6. Biochemical reactions for identification of pathogenic bacteria

a) *S. aureus* ,

b) *E. coli*,

c) K. pneumoniae,

d) P. aeroginosa

e) *S. typhi*,

f) *Shigella dysentriae*,

g) *Proteus vulgaris*,

h) V. cholerae

7. Kirby Bauer (AST) antibiotic sensitivity test.

8. KOH, **KOH-DMSO Mount, Indian Ink**/LPCB preparation of Skin/hair/nail for fungal observation.

9. Microscopic identification of (*Penicillium*, *Aspergillus*, *Mucor*, *Rhizopus*,*Fusarium*, *Trichophyton*, *Microsporum* and *Epidermophyton* fungi).

10. Slide culture method.

11. Cultivation of Yeast (*Candida*&*Cryptococcus*).

12. Biochemical identification *Candida* spp.

13. Germ tube technique.

14. Capsule staining.

15. Antibiotic sensitivity test for fungi.

REFERENCE BOOKS:

1. Dubey, R.C. and Maheshwari, D.K. (2002) Practical Microbiology, 1st Edn. S. Chand & Co. Ltd., New Delhi.

2. Cappuccino, J. and Sherman, N. (2002) Microbiology: A Laboratory Manual, 6th Edn.

Pearson Education Publication, New Delhi.

3. Collee, J.C., Duguid, J.P., Fraser, A.C. and Marimon, B.P. (1996) Mackie and

McCartney Practical Medical Microbiology, 14th Edn. Churchill Livingstone,

London.

4. Cowan and Steel (1995) Manual for Identification of Medical Bacteria, 4th

Edn. Cambridge University Press, London.

5. Murray, P.R., Baron, E.J., Jorgensen, J.H., Pfaller, M.A. and Yoke, R.H.

(2003) Manual of Clinical Microbiology , 8th Edn. Vol 1&2, ASM Press,

Washington, D.C.

6. Balows, A., Hausler. W.J., Ohashi.M. and Turano.A. (Eds) (1988) Laboratory

Diagnosis of Infectious Diseases: Principles and Practice, Vol 1 Springer Verlag,

New York.

7. Holt, J.S., Krieg, N.R., Sneath, P.H.A. and Williams, S.S.T. (1994) Bergey's Manual of

Determinative Bacteriology, 9th Edn. Williams & Wilkins, Baltimore.

8. Gerhardt, P., Murray, R.G., Wood, W.A. and Kreig, N.R. (Eds) (1994) Methods for General and Molecular Bacteriology. ASM Press, Washington, DC.

9. Finegold, S.M. (2000) Diagnostic Microbiology, 10th Edn. C.V. Mosby Company, St. Louis.

10. Sundararaj, T (2005). Microbiology Laboratory Manual, Perungudi, Chennai - 96.

M.Sc. MICROBIOLOGY SEMESTER - II PRACTICAL- IV

SUBJECT CODE: 21PMBP04

(GENETIC ENGINEERING AND INDUSTRIAL MICROBIOLOGY)

GENETIC ENGINEERING

Course Objectives:

- To understand the basic information on bacterial and fungal industrial products
- Important knowledge on microbial products.
- Create knowledge on industrially important process.
- To understand the isolation of nueclic acids from bacteria.

Course outcome:

On successful completion of the course the students will be able to

1. Gain wide information regarding various types of bacterial and fungal industrial products and various important processes in industries.

2. **A**pply their acquired knowledge on laboratory techniques and screening of various microbial products important in commercial products.

3. Production of various metabolites and enzymes and acids as end products.

4. To understanding the genetic analytical process.

PRACTICAL

1. Isolation of chromosomal DNA from bacteria.
2. Isolation of plasmi dDNA.
3. Restriction digestion of ʎ DNA (EcoR1 and BamH1) and ligation.
4. Bacterial transformation, competence cell preparation.

5.SDS -PAGE.

6.Protein estimation by Lowry et al method

7.Westernblotting.

8.Southern blotting.

9.Separation of biomolecules by paper,thin layer and column chromatography.

10.Polymerase chain reaction.

11.Plant tissue culture–Explant preparation,Call us formation in MS media.

REFERENCES BOOKS:

1. Rajan S and Selvi Christy (2011). Experimental procedures in life sciences. Anjana Book House, publishers and distributors,Chennai.
2. AnejaKR(2005).ExperimentsinMicrobiology,Plantpatholog yandBiotechnology. Fourth edition, New Age International Publishers,Chennai.
3. DubeyRCandMaheswariDK(2004).PracticalmicrobiologyFirs tedition,SChand and Company Ltd., NewDelhi.
4. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual. Sixth edition, Published by PearsonEducation.
5. Kannan N (2003). Handbook of laboratory culture media, Reagents, Stains and buffers. Panima Publishing Corporation, NewDelhi.
6. Kannan N (1996). Laboratory Manual in General Microbiology. First edition,Palani Paramount Publications,

Palani. TamilNadu.

7. Horold J Benson (1998).MicrobiologicalApplications-LaboratoryManualin General Microbiology. Seventh International edition, Mc Grew-Hill,Boston.
8. The Hi Media Manual (2003). For microbiology and Cell Culture Laboratory Practice.Published by Hi Media Laboratories (P) Ltd., Mumbai.

M.Sc. MICROBIOLOGY

SEMESTER - II

PRACTICAL- IV

SUBJECT CODE: 21PMBP04

INDUSTRIAL MICROBIOLOGY

1. Screening of antibiotics producing microbes from soil.

2. Productionofmicrobialenzymes
   a).Solidstatefermentation(Anyoneenzyme)
   b).Submergedfermentation(Anyoneenzyme)
3. Assay of enzymes
   a).Amylase b). Protease c). Lipase
4. Immobilization of cells and enzymes
5. Microbialproductionofwine
6. Citric acid production using Aspergillusniger.
7. Minimal inhibitory concentration (MIC) determination of antibiotics – Broth Dilution
8. Minimal inhibitory concentration (MIC) determination of antibiotics–Filter paper discassay
9. Evaluation of disinfectants–Filter paper discassay
10. Phenolco–efficient test
11. Vitamin assay (B12/Nicotinic acid)
12. Sterility testing of pharmaceutical products (Membrane filter assay – Fluid thigly collate medium)(Demo)
13. Bacterial Endotoxin Test–Limulus Amoebocyte Lysate (LAL) assay (Demo).

REFERENCE BOOKS:

1. Stanbury, P.F., Whittaker, A and Hall, S.J., (1995) Principles of fermentation technology, Elsevier; 3rd edition.
2. Crueger and Crueger, A., Biotechnology : A text book of Industrial Microbiology, Sinavosassociation,InoSundeland;2nd edition.
3. Cassida,J.E.,(1968).IndustrialMicrobiology,NewAgeInternational(2007).
4. Presscottand Dunn, S., (1982) Industrial Microbiology. The AVI Publishing Company Inc., USA; 4th edition.
5. Demain, A. L. and Soloman INA, (1986). Manual of Industrial Microbiology and Biotechnology, American society for Microbiology, Washington DC.
6. Chisti, Y., Fermentation, Biocatalysis and bioseparation,Encyclopaedia of Bioprocess Technology, Vol.5, John Wileyand Sons,N,Y.
7. Patel A H (2005). Industrial Microbiology. Laxmi Publications, New Delhi; Second edition.

M.Sc. MICROBIOLOGY

SEMESTER – III

CORE VII - MEDICAL VIROLOGY AND PARASITOLOGY

SUBJECT CODE: 21PMIP07

Course objectives.

The course is designed to develop the student with enough knowledge about disease caused by viruses and parasites

- The epidemiological diagnostic techniques
- Preventive measures and techniques

Course Outcome

Knowledge gained as collection from infected clinical samples

Isolation and identification of diseases producing bacteria from clinical

samples. Anti biotic sensitivity test.

UNIT I

Brief outline on discovery of Viruses, nomenclature, ICTV classification of Viruses, Distinctive properties of Viruses, Morphology & ultra structure. General methods of diagnosis and serology, viriods, prions, satellite RNAs and virusoids. Anti viral agents
– Viral vaccines, Interferon.

UNIT II

Epidemiology, life cycle, pathogenicity, diagnosis, prevention and treatment of DNA Viruses. Pox virus – Variola, Vaccinia, Herpes Simplex Virus – Varicella Zoaster virus, Adeno virus, Hepatitis virus – A, B & C, Cytomegalo virus, Epstein Barr virus, Oncogenic virus – Papilloma virus , Polyoma viasrus.

UNIT III

Epidemiology, life cycle, pathogenicity, diagnosis, prevention and treatment of RNA Viruses. Picorna viruses – Polio virus, Orthomyxo virus – Influenza virus (H1NI1), Paramyxo viruses – Mumps virus, Measles virus, Rhabdo viruses - Rabies virus, Retro virus – HIV, Arbo viruses – Yellow fever virus, Dengue virus, Japanese B Encephalitis virus. **NEWLY EMERGING VIRAL DISEASES –. - CORANA- SARS- MERS- AVIAN FLU- EBOLA & ZIKA VIRUS, MARBUG-NIPAH**

UNIT IV

Introduction and classification of parasites - Laboratory diagnostic techniques in parasitology - Examination of faeces, cultivation, Direct and concentration methods - Intestinal amoebae - Entamoeba histolytica, Entamoeba coli. Free living amoebae - Naegleria fowleri, Acanthamoeba spp. Intestinal and genital flagellates - Giardia, Trichomonas. Blood and tissue flagellates - Leishmania donovani, Trypanosoma cruzi. Haemosporina - Malarial parasites. Coccidian – **Pneumocystis carnii-** Toxoplasma, Cryptosporium.

UNIT V

Helminthic Infections - Taenia solium, T. Saginata, Echinococcus granulosus, Fasciola hepatica, **Fasciolopsis buski**, Paragonimus westermani and Schistosomes, **Nectator americanus**, Ascaris lumbricoids, Ancylostoma duodenale, **Strongyloides stercoralis,** Trichuris triuchura, Enterobius vermicularis and **Filarial nematodes** Wuchereria bancrofti, **Brugia malayai**, **Brugia timori**, **Onchocercavolvulus, Loa loa, Spirurid nematode-Dracunculus medinesis.** Blood smear examination - Serology and Molecular diagnosis - PCR. Emerging parasitic infection.

REFERENCE BOOKS

1. Topley and Wilson (1995) Principles of Bacteriology Virology and Immunity. 9th Edn. Vol I, Edward Arnold, London.

2. Morag, C. and Timbury, M.C. (1994) Medical Virology, 10th Edn. Churchill Livingston, London.

3. Dimmock, N.J. and Pimrose, S.B. (1994) Introduction to Modern Virology, 4th Edn. Blackwell Scientific Publications, Oxford.

4. Conrat, H.F., Kimball, P.C. and Levy, J.A. (1994) Virology, 3rd Edn, Prentice Hall, New Jersey.

5. Chakraborty, P., 2003. A Text Book of Microbiology. 2nd edition, Published by New Central Agency (P) Ltd., Kolkatta.

6. Monica Chees brough, 2003. District Laboratory Practice in Tropical Countries. Part 1 and 2. Cambridge University Press.

7. Dey, N.C., Dey, T.K. and Sinha, D., 1999. Medical Bacteriology including Medical Mycology and AIDS. 17th edition, New Central Book agency. Kolkatta.

8. Subhash Chandra Parija, 2004. Text book of Medical Parasitology – Protozoology and Helminthology. 2nd edition, published by All India Publishers and Distributors, Medical book publisher, New Delhi.

9. Chatterjee, 1986. Medical Parasitology. Tata McGraw Hill, New Delhi.

10. Karyakarte, R.P. and Damle, A.S., 2005. Medical Parasitolog. Revised edition. Published by Books and Allied (P) Ltd., Kolkatta.

11. Jeyaram Paniker, 2004. Text book of Medical Parasitology. 5th edition,

JAYPEE brothers, Medical Publishers (P) Ltd, New Delhi.

12. Ichpujani, R.L. and Rajesh Bhatia, 2003. Medical Parasitology. 3rd edition, JAYPEE brothers, Medical publishers (P) Ltd, New Delhi.

13. Patrick R. Murray PhD (Author), Ken S. Rosenthal PhD (Author), Michael A. Pfaller MD (Author). Medical Microbiology, 8e 8th Edition.

14. Ananthanarayan R and Jayaram Paniker CK (2005) Text Book of Microbiology. Seventh edition, Orient Longman Limited, Hyderabad.

15. Jawetz, Melnick, & Adelberg's. (2013). Medical Microbiology. 26th Edition. McGraw-Hill.

WEB REFERENCES:

1. http://dmoz.org/Science/Biology/Microbiology/

2. http://microbiology.mtsinai.on.ca/manual/default.asp

3. http://cal.vet.upenn.edu/parasite/links.html

4. http.www.suite101.com/links.cfm/microbiology

5. http://www.biosci.ohio-state.edu/-zoology/parasite/home.html

OTHER WEB

1. https://gmch.gov.in
2. https://www.researchgate.net
3. https://www.cartercenter.org
4. https://www.studocu.com
5. https://www.microbenotes.com
6. https://www.labquality.be

7. https://www.kumc.edu

8. https://www.meddean.luc.edu

9. https://www.virology.ws

10.https:www.jcp.bmj/com

M.Sc. MICROBIOLOGY

SEMESTER - III

CORE VIII - FOOD, DAIRY AND ENVIRONMENTAL MICROBIOLOGY

SUBJECT CODE: 21PMI08

Course objectives.

The course is designed to develop the student with enough knowledge about disease caused by Food borne micro organism.

- The Micro organisms present in air and seawage.

Course Outcome

1. Knowledge gained as collection from infected food samples

2. Solation and identification of diseases producing bacteria from food samples.

3. Micro organism present in the air sample and seawage samples.

4. Various treatment processes in seawage for microbial load.

UNIT I

Food as a substrate for microbes. Microorganisms important in food microbiology. Factors influencing microbial growth in food.Extrinsic and Intrinsic factors.Sources of food contamination.

UNIT II

Principles of food preservation, Contamination, preservation and spoilage of fruits,vegetables, meat ,poultry, eggs, fish and other seafoods. Canning-Methods-Types-Spoilage of canned foods. Food borne diseases,food intoxication and their control measures.

UNIT III

Dairy Microbiology: Micro flora of milk. Sources of milk contamination. Preservation and spoil age of milk and milk products. Fermented foods-Fermented vegetables and dairy products. Food sanitation. Food control agencies and their regulations.

UNIT IV

Environmental Microbiology: Microbiology of air - composition of air, number and types of organisms in air. Distribution and sources of air borne organisms.Enumeration of bacteria in air - Air sampling devices. Air sanitation.Air borne diseases and their control.Microbiology of water- ndicatororganisms.Assessment of water quality.Water sanitation.Water borne diseases. ISI and BIS Regulations for packaged drinking water.

UNIT V

Waste treatment-Types of wastes- Characterization of solid and liquidwastes.Effluent treatment-Primary, secondary (aerobic and anaerobic) and tertiary Methods- Disinfection - SCP and Biogas production.Definition of DO,BOD,COD and their limits in treated industrial effluents.Solid waste management - Composting,vermicomposting,silage,pyrolysis saccharifications and Mushroom cultivation.

REREFENCES

1. Adams MR & MO Moss (2005). Food Microbiology, New Age International (P) Limited. Publishers; 1st Edition, NewDelhi.
2. James M Jay (2004).Modern Food Microbiology,CBS Publishers & Distributors;4th Edition, NewDelhi.
3. Patel A H (2005). Industrial Microbiology. Published Laxmi Publications; Second edition.
4. Rita Narayanan B. Dhanalakshmi (2013) Food Microbiology: Basic and Applied with Laboratory-New India Publishing Agency.
5. A.Bohra P.Bohra (2011)Food Microbiology,Agrobios.
6. William Frazier and Dennis Westhoff (2008) - Food Microbiology McGraw Hill Education; 4th edition.
7. Purohit SS,AK Saluja, HN Kakrani (2004).Pharmaceutical Biotechnology,Agrobios (India); Ist Edition.
8. IanL.PepperProfessor,CharlesP.GerbaandTerryJ.Gentry(2014),Environmental Microbiology, Academic Press; 3rd edition.
9. Buckley R G (2016) Environmental Microbiology – CBS; 1st edition.
10. Ralph Mitchell and Ji-Dong Gu (2009) Environmental Microbiology, Wiley- Blackwell.
11. Singh DP & SK Dwivedi (2005). Environmental Microbiology and Biotechnology, New Age International Publishers (P)Ltd;1st Edition, New Delhi.
12. Vijaya Ramesh K (2004). Environmental Microbiology, MJP Publishers; 1stEdition, Chennai.
13. Joseph C Daniel (1999) Environment Aspects of Microbiology,Brightsun Publications;1stEdition,Chennai.

14.1M.S. Bhatt and Asheref Illiyan (2012), Solid Waste Management: An Indian Perspective, Synergy Books India, New Delhi.

M.Sc. MICROBIOLOGY
SEMESTER - III
CORE IX - SOIL, AGRICULTURAL MICROBIOLOGY AND BIODEGRADATION
SUBJECT CODE: 21PMI09

Course objectives.

The course is designed to develop the student with enough knowledge about soil micro organism.

- The Micro organisms present in soil.
- Bio fertilizers.

Course Outcome

Knowledge gained as

1. Isolation and identification of diseases producing bacteria from soil samples.

2. Micro organism present as Bio fertilizers.

3. Soil pathogens.

4. Degradation process in soil.

UNIT I

Discoveries in soil Microbiology; distribution of micro organisms in soil, Autochthonous, Allochthonous and Zymogenous microbes, quantitative estimation of micro organisms in soil, role of micro organisms in soil fertility; influence of soil and environmental factors on micro flora,moisture,pH,temperature,organic matter,agronomic practices.

UNIT II

Biogeochemical cycles, Carbon cycle, organic matter decomposition, humus formation, Nitrogen cycle - nitrogen fixation, ammonification, nitrification, denitrification, reactions – organisms involved. Nitrogen fixation – symbiotic - root nodulation, non symbiotic, associative organisms, nitrogenase, hydrogenase, nif gene, nod gene. Microbial transformation of phosphorus, solubilization by phosphobacteria and P-mobilization by mycorrhizal fungi, Microbial transformation of sulphur - sulphur toxicity and sulphur bacteria.

UNIT III

Interaction between soil microbes–Neutralism, Commensalism, Symbiosis, Synergism, Amensalism, Parasitism, Predation and Competetion. Interrelationships between soil microbes and plants, Rhizosphere concept, R:S ratio, rhizoplane; spermosphere; phyllosphere, Mycorrhizae-types, Rumen flora, Insects microbial interactions.

UNIT IV

Phytopathology – Classification of plant diseases, signs, and related terminology. Bacterial disease – Citrus canker, Blight of paddy, Fungal Disease- Red rot of sugarcane, Black stem rust of wheat, Tikka leaf spot, Wilt of cotton, Viral Disease – TMV, Vein clearing disease. Principles and methods of plant disease management, integrated plant disease management.

UNIT V

Biofertilizers – Rhizobium, Azotobacter, Cyanobacteria, Azolla, and VAM. Biopesticides – Bacillus thuringiensis, Psuedomonas fluroscence - 84, Trichoderma viridae, Bavaria bassiana, Nuclear Polyheadrosis Virus. Biodegradation – Cellulose, Lignin. Biodetoriation – Wool, Leather. Bioleaching- Copper, Uranium. Biomagnification, Bioremidiation – Degradation of DDT, Atrazine (Xenobiotic Compounds) and Cleanup oil spills – P. putida.

REFERENCE BOOKS:

1. Subba Rao NS (2004). Soil Microbiology. Fourth edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Mishra RR (2004). Soil Microbiology. First edition, CBS Publishers and distributors, New Delhi.
3. Rangaswami G and Mahadevan A (2002). Disease of Crop Plants in India. Fourth edition, PHI Learning (P) Ltd., New Delhi.
4. Rangaswami G and Bagyaraj DJ (2002). Agricultural Microbiology. Second edition, PHI Learning (P)Ltd., New Delhi.
5. Robert, L Tate (1995). Soil Microbiology. First edition, John Wiley and Sons, Inc. New York.
6. R, M, Atlus and Richard Bartha (2000). Microbial Ecology, Fourth edition, an imprint of Addison Wesley Longman, Inc, New York.

M.Sc. MICROBIOLOGY
SEMESTER - III
SUBJECT CODE: 21PMB05
PRACTICAL V - MEDICAL VIROLOGY AND PARASITOLOGY

Course objectives.

The course is designed to develop the student with enough knowledge about virus and parasites.

- Staining techniques to observe parasites.

Course Outcome

Knowledge gained as

1.Isolation and identification of viruses and parasites in the clinical sample.

PRACTICAL

1. Examination of parasites in clinical specimens - ova/cysts in faeces- **Saline/ Iodine/ /LPCB Wetmount**
2. Direct and concentration: methods - Formal Ether and Zinc sulphate methods - Saturated salt solution method.
3. Blood smear examination for malarial parasites.
4. Thin smear by Leishman's stain.
5. Isolation and characterization of bacteriophage from natural sources – phage titration-T4.
6. Study of virus infected plants - chick embryo isolation- fibroblast culture preparation (demonstration).
7. Spotters of viral inclusions and CPE - stained smears. Viral serology- HAI – ELISA kits, Western Blotting.

REFERENCE BOOKS:

1. Dubey, R.C. and Maheshwari, D.K. (2002) Practical Microbiology, 1st Edn. S. Chand & Co. Ltd., New Delhi.

2. Cappuccino, J. and Sherman, N. (2002) Microbiology: A Laboratory Manual, 6th Edn. Pearson Education Publication, New Delhi.

3. Collee, J.C., Duguid, J.P., Fraser, A.C. and Marimon, B.P. (1996) Mackie and McCartney Practical Medical Microbiology, 14th Edn. Churchill Livingstone, London.

4. Cowan and Steel (1995) Manual for Identification of Medical Bacteria, 4th Edn.

Cambridge University Press, London.

5. Murray, P.R., Baron, E.J., Jorgensen, J.H., Pfaller, M.A. and Yoke, R.H. (2003) Manual of Clinical Microbiology, 8th Edn. Vol 1&2, ASM Press, Washington, D.C.

6. Balows, A., Hausler. W.J., Ohashi.M. and Turano.A. (Eds) (1988) Laboratory Diagnosis of Infectious Diseases: Principles and Practice, Vol 1 Springer-Verlag, New York.

7. Holt, J.S., Krieg, N.R., Sneath, P.H.A. and Williams, S.S.T. (1994) Bergey's Manual of Determinative Bacteriology, 9th Edn. Williams & Wilkins, Baltimore.

8. Gerhardt, P., Murray, R.G., Wood, W.A. and Kreig, N.R. (Eds) (1994) Methods for General and Molecular Bacteriology. ASM Press, washington, DC.

9. Finegold, S.M. (2000) Diagnostic Microbiology, 10th Edn. C.V. Mosby Company, St. Louis.

M.Sc. MICROBIOLOGY
SEMESTER - III
SUBJECT CODE : 21PMIP06
PRACTICAL VI-(FOOD, DIARY, ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY)

Course objectives.

The course is designed to develop the student with enough knowledge about soil micro organism.

- The Micro organisms present in soil.
- Bio fertilizers.

Course Outcome

Knowledge gained as

1. Isolation and identification of diseases producing bacteria from soil samples.

2. Micro organism present as Bio fertilizers.

3. Soil pathogens.

4. Degradation process in soil.

PRACTICAL

1. Microbiological (Bacteria and Fungi) examination of spoiled foods
   - Vegetables
   - Fruits
   - Dairy products
2. Examination of microbial loadin

- ❖ Fruit pulp
- ❖ Carbonated beverages
- ❖ Ice creams

3. Assessment of milk quality by
   - ❖ Breeds count
   - ❖ Standard Plate Count (SPC)method
   - ❖ Methylene Blue Reduction Test(MBRT)
   - ❖ ResazurinTest
4. Litmus milk test
5. Quantification of microbes in air by
   - ❖ Settle plate method
   - ❖ Air sampler
6. Examination of pot ability of drinking water by
   - ❖ Membrane filter technique
   - ❖ Standard Plate Count (SPC)method
   - ❖ Most Probable Number Test(MPN)
7. Physico- chemical assessment of treated water by
   - ❖ DO
   - ❖ COD
   - ❖ BOD

REFERENCE BOOKS:

1. Dubey, R.C and Maheshwari, O.K (2005) Practical Microbiology, S Chand and Co. Ltd., (First edition), New Delhi.
2. James G. Cappuccino and Natalie Sherman (2014) Microbiology: A Laboratory Manual (10th Edition), Pearson.
3. Aneja, K.R (2003) Experiments in Microbiology, Plant Pathology and Biotechnology (4thedition), New age

international, New Delhi.

4. Rajan S., R. Selvi Christy (2010), Experimental procedures in Life Sciences, (3rd reprint) Anjanaa Book House,Chennai.2000) Diagnostic Microbiology,10th Edn. C.V.Mos by Company,St.Louis

M.Sc. MICROBIOLOGY
SEMESTER - III
PRACTICAL VI - AGRICULTURAL MICROBIOLOGY AND BIODEGRADATION
SUBJECT CODE: 21PMB06

1. Enumeration of Heterotrophic microbes from soil
2. Isolation of Rhizobium from rootnodules
3. Isolation of Azotobacter from soil
4. Isolation of Azospirillum from root
5. Isolation of Phosphate Solubilizers
6. Estimation of R:S ratio of rhizosphere
7. Isolation of Antagonistic microorganism from soil
8. Isolation and identification of plant pathogens
   - ❖ Citrus canker-Xanthomonas citric
   - ❖ Blight of paddy-Xanthomonas oryzae
   - ❖ Tikka leaf spot-Cercosporasp.
   - ❖ Wilt of cotton -Fusarium oxysporum
   - ❖ Redroot of sugarcane–Colletotricum falcatum
9. Study of Cyano bacteria
   - ❖ Anabaena
   - ❖ Nastoc
   - ❖ Oscillatoria
   - ❖ Lyngbya
10. Isolation and identification of Trichodermasp.
11. Isolation of Cellulose degrading bacteria.
12. Isolation of Xenobiotic (pesticide) degrading bacteria.
13. Isolation and Microscopic observation of Mycorrhizae/spore.
14. Microscopic observation of Bavariasp.

REFERENCES:

1. Subba Rao NS (2004). Soil Microbiology. Fourth edition, Oxford and IBH Publishing Co.Pvt.Ltd., New Delhi.
2. Mishra RR (2004). Soil Microbiology. First edition, CBS Publishers and distributors, New Delhi.
3. Rangaswami G and Mahadevan A (2002). Disease of Crop Plants in India. Fourth edition, PHI Learning(P) Ltd., New Delhi.
4. Rangaswami G and Bagyaraj DJ (2002). Agricultural Microbiology. Second edition, PHI Learning (P) Ltd., New Delhi.
5. Robert, L Tate (1995). Soil Microbiology. First edition, John Wiley and Sons, Inc. New York.
6. R,M, Atlus and Richard Bartha (2000). Microbial Ecology, Fourth edition, An imprint of Addison Wesley Longman, Inc, New York.

M.Sc. MICROBIOLOGY
SEMESTER - IV
CORE X - RESEARCH METHODOLOGY, BIOSTATISTICS AND BIOINFORMATICS

Course objectives.

The course is designed to develop the student with enough knowledge about data collections for research work.

- Bio informatics.

Course Outcome

Knowledge gained as

1. .Data collection and computations in biology.
2. Presentation of research.
3. Bio informatics related with research.

UNIT I

ResearchMethodology-Meaning and importance. Statement, Constraints, Review of literature -Review and synopsis presentation.Types of research,Research tools,Qualities of a good researcher.Researchprocess,Research designs - Experimental and non-experimental. Preparation of research report. Guidelines for preparing an article.Computers in biological research.

UNIT II

Data collection, source of data, types of classification of data, Tabulation of data – Diagrammatic representation of data (line, bar diagram, pie diagram, pictogram and cartogram) - Graphical representation of data. Measures of central tendency – mean, median, mode - Standard deviation. Correlation – coefficient of correlation (Karl Pearson method, group bi –variable data). Coefficient of variation. Probability.

UNIT III

ANOVA (one way and two way), Chi square test –Student's T test – testing of hypothesis-null hypothesis- level of significance-standard error. F Test Web Resources for Microbiology–Use of Digital Library.

UNIT IV

Bioinformatics - Introduction and skills for a bio informatician. Biological databases- Database searching, Sequence analysis, Pair alignment, Visualizing protein structures, Predicting structure and function of protein are using sequences, Tools for genomics and proteomics.

UNIT V

Problem selection and project designing. Review of literature, source of collection, processing of data, presentation of data, error, editing the final draft, presentation of research project.

REFERENCES:

1. Balagurusamy. E, 1992, Programming in ANSIC, Tata McgrawHill.
2. Bernard Rosner, 1999, Fundamentals of Biostatistics, DuxburyPress.
3. Attwood T.K. and D.J. Parry-Smith, 2001. Introduction to Bioinformatics, Pearson Education Asia.
4. Jeffrey A. Witmer Myra L. Samuels, 2002. Prentice Hall Statistics for the Life Sciences (3rdEdition).
5. Gurumani. N., 2006. Research methodology for biological sciences. 1st edition, MJP Publishers. A unit of Tamil nadu Book House,Chennai.
6. Wayne W. Daniel, 2006. Biostatistics- A foundation for analysis in the Health Sciences. 7TH edition. Wiley India publication.
7. Rastogi. S. C, N. Mendiratta and P. Rastogi, 2008. Bioinformatics- Methods and Applications Genomics, Proteomics and Drug Discovery 3rd edition.
8. Harvey Motulsky, 1995, Intuitive Biostatistics, Oxford University Press.
9. Marcello Pagano Kimberlee Gauvreau, 2000. Principles of Biostatistics , 2nd Edition, Brooks Cole.
10. Higginns. D and W. Taylor (Eds.) 2000. Bioinformatics. Sequence, Structure and databanks- A Practical Approach by Oxford University Press.
11. Baxevanis A.D and B.F. Francis Ouellette (Eds.) Wiley-Interscience, 2001. Bioinformatics - A Practical Guide to the Analysis of Genes and Proteins.
12. Stanton A. Glantz, 2001. Primer of Biostatistics McGraw-Hill.

13. David W. Mount, Cold Bioinformatics, 2001. Sequence and Genome Analysis, Spring Harbor Laboratory Press.

14. ClaverieJ-MandC.Notredame,2003. Bio informatics for Dummies,Wiley Publishing, Inc.

15. Beth Dawson Robert G. Trapp Beth Dawson Robert Trapp, 2004. Basic and Clinical Biostatistics (LANGE Basic Science),McGraw-Hill.

16. S.P.Guptha - Statistical Methods

17. Palanisamy and Manoharan - Statistical methods of Biology

18. Khan and Khan - Fundamentals of Biostatistics

19. Kothari - Research Methodology.

M.Sc. MICROBIOLOGY

ELECTIVE COURSES

INHERITENCE BIOLOGY (COMPULSORY)

SUBJECT CODE: 21PMIEL01

Course objectives.

The course is designed to develop the student with enough knowledge about genetic field.

Course Outcome

Knowledge gained as

4. Mendelian Principle.
5. Gene Mapping.
6. Mutation.

1. INHERITANCE BIOLOGY

UNIT-I

Mendelian principles: Dominance, segregation, independentassortment.

Concept of gene: Allele, multiple alleles, pseudoallele, complementationtests

Extensions of Mendelian principles: Codominance, incomplete dominance, gene interactionspleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influencedcharacters.

UNIT-II

Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population inplants.

Extra chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance.

UNIT-III

Microbial genetics: Methods of genetic transfers – transformation, conjugation, transduction and sex- duction, mapping genes by interrupted mating, fine structure analysis ofgenes.

Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

UNIT – IV

Quantitative genetics: Polygenic inheritance, heritability and its measurements, QTL mapping.

Mutation: Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis.

UNIT- V

Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their geneticimplications.

Recombination: Homologous and non-homologous recombination includingtransposition.

M.Sc. MICROBIOLOGY

ELECTIVE COURSES

METHODS IN BIOLOGY (COMPULSORY)

SUBJECT CODE: 21PMIEL02

Course objectives.

The course is designed to develop the student with enough knowledge about Molecular Techniques.

Course Outcome

Knowledge gained as

1. Recombinent DNA methods.

2. Immuno Techniques.

3.Biophysical Method.

2. METHODS IN BIOLOGY

UNIT-I

Molecular Biology and Recombinant DNAmethods:

Isolation and purification of RNA , DNA (genomic and plasmid) and proteins, different separation methods.Analysis of RNA, DNA and proteins by one and two dimensional gelelectrophoresis, Isoelectric focusing gels.Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems. Expression of recombinant proteins using bacterial, animal and plant vectors.Isolation of specific nucleic acid sequences Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors. In vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms.Protein sequencing methods, detection of post translation modification of proteins. DNA sequencing methods, strategies for genome sequencing.

Methods for analysis of gene expression at RNA and protein level, large scale

expression, such as micro array basedtechniques Isolation, separation and analysis of carbohydrate and lipid molecules RFLP, RAPD and AFLP techniques

UNIT-II

Histo chemical and Immuno techniques

Antibody generation, Detection of molecules using ISA, IA, western blot, immune precipitation, fluocytometry and immune fluorescence microscopy,detection of molecules in living cells, in situ localization by techniques such as FISH and GISH.

Biophysical Method:

Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy Molecular structure determination using X-ray diffraction and NMR, Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance method

UNIT-II

Statisitcal Methods:

Measures of central tendency and dispersal; probability distributions (Binomial, Poisson and normal); Sampling distribution; Difference between parametric and non-parametric statistics; Confidence Interval; Errors; Levels of significance; Regression and Correlation; t-test; Analysis of variance; X^2 test;; Basic introduction to Muetrovariate statistics, etc.

UNIT-IV

Radio labeling techniques:

Detection and measurement of different types of radioisotopes normally used in biology, incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines.

Microscopic techniques:

Visulization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze- fracture methods for EM, image processing methods inmicroscopy.

UNIT-V

Electrophysiological methods:

Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI, fMRI, CAT.

Methods in field biology:

Methods of estimating population density of animals and plants, ranging patterns through direct, indirect and remote observations, sampling methods in the study of behavior, habitat characterization: ground and remote sensing methods.

M. Sc. MICROBIOLOGY

ELECTIVE COURSES

PLANT PHYSIOLOGY AND PLANT TISSUE CULTURE

SUBJECT CODE: 21PMIEL03

Course objectives.

The course is designed to develop the student with enough knowledge about Photosynthatic micro organisms and Energy generating process.

Course Outcome

Knowledge gained as

1.Photosynthetic mechanism Energy

2.Energy generting path ways

3.Micro probagation process

UNIT I

Photosynthesis - light harvesting complexes, structure and function of chlorophylls and other pigments. Mechanism of light absorption – Photo system-I and II. Photophosphorylation. Co2 fixation – C3-C4 and CAM Pathways. Structure, function and mechanism of phytochromes, Cryptochromes and phototropins.

UNIT II

Respiration and photorespiration - Glycolysis, Citric acid cycle, plant mitochondrial electron transport and ATP synthesis. Secondary metabolites – Bio synthesis of Terpenes, Phenols and Nitrogenous compounds and their roles.

UNIT III

Nitrogen metabolism-Sources of Nitrogen, Biochemistry and Physiology of Symbiotic Nitrogen fixation in root nodule - Leghaemoglobin. Nitrate and ammonium assimilation, Amino acid biosynthesis. Plant hormones (Auxin,Gibberell in and Cytokinin) physiological effects and mechanism of action.

UNIT IV

General Techniques of Micro propagation, Initiation of culture, Multiplication, Rooting – Hardening, callus culture, Embryogenesis. Somaclonal and gametoclonal variation, uses in crop improvement. Synthetic seeds-practical application. PTC medium.

UNIT V

Shoot Tip-Meristem culture for virus free plants. Anther culture-production of Haploids.Protoplast culture-protoplast isolation-Purification–culture-regeneration.Somatic hybridization–protoplast fusion techniques. Cryo preservation and Germplasm storage.

REFERENCES:

1. S.N. Pandey, B.K. Sinha (2009). Plant physiology. Vikas Publishing House Pvt Limited.
2. Francis H. Witham, Robert M. Devlin (1986). Plant physiology. CBS Publishers& Distributor.3. V.K. Jain. Fundamentals of plant physiology (2005). S. Chand & CompanyLtd.
4. M.K.Razdan.Introductiontoplanttissueculture.(2003).Sciencepublishersinc.
5. NIIR Board of Consultants & Engineers (2005). Handbook on plant and cell tissue culture. Asia Pacific Business Press Inc.,

M.Sc. MICROBIOLOGY

ELECTIVE COURSES

BIOINSTRUMENTATION AND BIOLOGICAL TECHNIQUES

SUBJECT CODE: 21PMIEL04

Course objectives.

The course is designed to develop the student with enough knowledge about bio instruments

Course Outcome

Knowledge gained as

1. Bio instruments mechanism Energy
2. Principles and methodology of biological technique
3. Molecular techniques process

UNIT I

Buffers, molars and normal solutions, pH meter, pH electrodes – calomel and glass electrodes. Incubator, water bath shaker, laminar airflow.

UNIT II

Centrifugation: Principle – types of centrifuges – low speed, high speed, ultra centrifuge, and Differential centrifugation – density gradient centrifugation. Conversion of 'G' intorpm .Applications of centrifuge.

UNIT III

Electrophoresis – SDS – PAGE and Agarose gel electrophoresis. Southern blotting – Northern blotting – Western blotting – DOT blotting.

UNIT IV

Chromatography – paper, thin layer, column, ion exchange, gas chromatography and HPLC, Colorimelry, spectrometry - FACS - Biosensors.

UNIT V

Biological Techniques-ELISA-Principles and types. Immuno diffusion techniques- ODD, RIA. Agglutination and its applications-IFT, CFT.

REFERENCES:

1. Bajpai PK (2010). Biological Instrumentation and Methodology. Revised edition, S.Chand & Co.Ltd., New Delhi.
2. Palanivelu P (2004). Analytical Biochemistry and Separation techniques. Third edition, MKU Co-op,Press Ltd., PalkalaiNagar, Madurai.
3. Gurumani N (2006).Research Methodology for Biological Sciences. First edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.
4. Subramanian MA (2005). Biophysics – Principles and Techniques. First edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.
5. John G Webster (2004). Bioinstrumentation .Student edition. John Wileyand Sons, Ltd.
6. Ravishankar S (2001). A Text Book of Pharmaceutical Analysis. Third edition. Rx Publications, Tirunelveli.

Upadhyay&Upadhyay.BiophysicalChemistry,(2010).HimalayaPublishinghouse.

M.Sc. MICROBIOLOGY

ELECTIVE COURSES

NANOTECHNOLOGY

SUBJECT CODE: 21PMIEL05

Course objectives.

The course is designed to develop the student with enough knowledge about Nano Technology.

Course Outcome

Knowledge gained as

1. Nano technology and nano particals.
2. Application of Nano particals.

UNIT I - Introduction to nanotechnology

What is nanotechnology? - What is Nanobiotechnology? - What is nanomaterial? - Classification of nanostructures - Nanospheres, Nanotubes, Nanorods, Nanowires, Nanosheets, Quantum dots - Effects of the nanometre length scale - Changes to the system structure - How nanoscale dimensions affect properties - Nanocomposites - Graphene - Carbon Nanotubes - Fullerenes - Natural Nanomaterials - Bio-inspired nano materials.

UNIT II- Synthesis Methods of Nano materials

Physical synthesis - Ball Milling - Electrodeposition - Spray Pyrolysis - Thermal evaporationChemicalsynthesis-Sol-GelProcess-MetalNanocrystalsbyReduction
- Solvothermal Synthesis - Biological Synthesis - Protein-Based Nanostructure Formation - DNA-Templated Nanostructure Formation - Protein Assembly

UNIT III- Properties of Nano materials

Physical properties - Electrical, Optical, Mechanical, Magnetic, Quantum confinement, Surface Plasmon resonance - Electrochemical Properties of Nano scale Materials, Intra-molecular bonding, Inter-molecular bonding, Nano catalysis, Surface energy, Self-assembly - Interaction Between Biomolecules and Nano particle Surfaces

UNIT IV - Characterization methods

X-ray diffraction (XRD) - Dynamic Light Scattering (DLS). Electron microscopes: Scanning Electron Microscope (SEM) - Transmission Electron Microscope (TEM); Atomic Force Microscope (AFM) -UV - Visible Spectrophotometer - Photoluminescence (PL) Spectrophotometer - Fourier Transform Infra Red Spectrometer (FTIR) - Nuclear Magnetic Resonance (NMR) - Differential scanning calorimeter (DSC) – Thermo gravimetric/Diffferential Thermal Analyzer (TG/DTA)

UNIT V -Applications of Nano particles

Polymeric,Lipidnanoparticlesfordrugdelivery,MicellesinDrugDelivery.Quantum Dots, Gold, silica, silver and magnetic nano particles for biomedical applications - Biosensors - Proteins in Nanotechnology Enabled Sensors - Nano-sensors based on Nucleotides and DNA Micro arrays-Cell Biochips-in-vitro Characterization-in-vivo Investigations - Use of Nano particles in Animals – Nano particles for Imaging and Therapy in Humans - Military applications of Nano technology – Nano materials for food Applications-Toxicity of Nano particles-Future Perspectives.

M.Sc. MICROBIOLOGY

ELECTIVE COURSES

BASICS OF PHYTOCHEMISTRY

SUBJECT CODE: 21PMIEL06

Course objectives:

1. **To gain knowledge on diversity and distribution of the Indian medicinal plants**
2. **To know about the Indian Systems of medicine.**
3. **To understand the various phyto chemicals that are of therapeutic use**
4. **To observe the applications of ethno medicine in synthesis and discovery of novel medicines**
5. **To get awareness on the constitutional laws related to medicinal**

plants Course Outcome

Knowledge gained as

1. Plant secondary metabolize.
2. Phyto chemical screening.

UNIT I

Distribution of Indian medicinal plants; Introduction, Important medicinal plants, eco distribution, mapping distribution in different bio geographic zones. Diversity hot spots - Endemism - Rare, endangered and threatened species. Plant genetic resources and their conservation: Knowledge on tribal and folkloric medicine in India. Hot spots in India: Western Ghats and The Himalayas. Medicinal and Aromatic plants – Scope and importance of medicinal plants. Drug discovery from plants – the role of plants in human history- the role of plant derived compounds in drug development. NMPB, AYUSH and their role in promoting research on medicinal plants in India.

UNIT II

Plant secondary metabolites as drug precursors-Recent developments in drug discovery from plants – Introduction to Phytochemicals -Alkaloids - Anthocyanins - carotenoids - flavonoids – terpenoids - Hydroxycinnamic acids - Xanthophylls – Antioxidants. Plants with phytochemicals - Production of Phyto chemicals from medicinal plants - Extraction of phytochemicals - Developing new drugs from Ethnomedicines.

UNIT III

Pharmacognosy - Introduction - history - Indian System of medicine - Difference between allopathic and alternative systems of medicine. Natural sources of Drugs – Crude drugs – Classification of crude drugs – Collection and Processing of crude drugs– Drug adulteration and evaluation.

UNIT IV

Phytoconstituents of therapeutic value – Histochemical tests for phytochemicals – Analytical pharmacognosy – Anatomical features of selected medicinal plants (Senna leaf, Datura leaf, Cinchona bark, Nux Vomica seed). Separation of bioactive compounds – Extraction methods: distillation- steam and solvent. Phytochemical screening – Phytochemistry – Extraction, isolation, characterization and identification of terpenes, alkaloids and flavonoids.

UNIT V

An overview of bioinformatics. Molecular docking, drug design and commercial bioinformatics. Computing tools: phylogenetics and computational biology. Intellectual property rights, patents, trade secrets, copyrights, trade mark. Patenting transgenic organisms. Plant breeders' right. Minor forest produces and Forest Rights Act, 2007.

REFERENCES:

1. Goodman Gillmans. The pharmacological basis of therapeutics

(2001). Ed. Hardman JG.

2. Limbird LE (Tenth Edition) McGraw Hill press New York.

3. Bajpai, s. Biological instrumentation and methodology.

4. Avinash Upadhyay. Biophysical chemistry, Principle and Techniques.

5. Attwood T.K. and D.J. Parry- smith. Introduction to bioinformatics pearson education.

6. Subbaram , N. Patents. Pharma Book syndicate.

7. Harborne JB (1984) Phytochemical methods: A guide to Modern techniques of plant.

8. Analysis, 2nd edn., Chapman and Hall , New York.

9. Jones WP, Chin YW, Kinghorn AD (2006) Curr Drug Targets 7:247.

10. Drug Discovery from plants. A.A. Salim, Y., M. Chin and A.D. Kinghorn 2008.

11. Webster J.G., Bioinstrumentation.

12. Wilson, K. and J.Walker Practical biochemistry principles and Techniques.

15. D.J. Holme and H. Peck, Analytical Biochemistry, Longman Group, 1983.

16. Higgins, D. and W. Taylor. Bioinformatics. Sequence, Structure and Databanks.

"An Introduction to Ethical, Safety and Intellectual Property Rights Issues in Biotechnology" by Padma Nambisan

www.nmpb.nic.in

ayush.gov.in

www.indiaenvironmentportal.org.in/.../**minor-forest-produce**

M.SC.MICROBIOLOGY

EDC COURSES - EXTRA DISCIPLINARY COURSES

ENTREPRENEURIAL MICROBIOLOGY

SUBJECT CODE : 21PMIED01

UNIT I

Entrepreneur development, activity, Institutes involved, Government contributions to entrepreneur, risk assessment, Industrial Microbiology, Definition, scope and historicaldevelopment.

UNIT II

Microbial cells as fermentation products – Baker's yeast, food and feed yeasts, bacterial insecticides, legume inoculants, Mushrooms , Algae, Enzymes as fermentation products-bacterial and fungal amylases, proteolytic enzymes.

UNIT III

Mushroom cultivation and composting-cultivation of Agaricus campestris, Agaricus bisporous and Volvoriell volvaciae: Preparation of compost, filling tray beds, spawning, maintaining optimal temperature, casing , water harvesting, storage, Biofertilizer-Historical background, chemical fertilizers versus biofertilizers,organic farming.Rhizobiumsp.,Azospirillumsp.,Azotobactersp.,asBiofertilizers

UNIT IV

Brewing - Media components, preparation of medium, microorganisms involved, maturation, carbonation, packaging, keeping quality, contamination, by products. Production of industrial alcohol.

UNIT V

Patients and secret process, History of patenting, composition, subject matter and characteristicsofapatent,inventor,infringement,costofpatent.PatentsinIndiaand othercountries.Fermentationeconomics.

REFERENCES:

1. Prescott LM, Harley JP and Klein DA (2003) Microbiology (10th edition) McGraw Hill, NewYork.
2. PelczarJr,M.J.Chan,E.C.Sand Krei N.R (1993) Microbiology McGraw Hill, NewYork.
3. Subba Rao NS (1997). Biofertilizer in Agriculture and Forestry, 3rd edition, Oxford & IBU Publications.
4. LE Cassida JR (2005). Industrial Microbiology. New Age International (P) Ltd., New Delhi.
5. Arora.Entrepreneurial Development in India.
6. Aneja, K.R. Experiments in Microbiology, Plant Pathology, Tissue Culture and MushroomProductionTechnology,6th Edition,New age International Publication.

COURSES - EXTRA DISCIPLINARY COURSES

MICROBIAL NANOTECHNOLOGY

SUBJECT CODE : 21PMIED02

UNIT-I

Definition – Evolution of Nanoscience – Need of Nanotechnology – Hurdles for Nanotechnology development – Factors affecting the manufacturing process of nano materials – Role of physicists, chemists, medical doctors, engineers, biologists and computer scientists in nanotechnology.

UNIT II

Spectroscopy and Microscopy–the two most important tools used in nanotechnology research–Infra red spectroscopy,Raman spectroscopy,Ultra violet- visible spectroscopy. Atomic force microscope – Scanning electron microscope – Transmission electron microscope – Scanning tunneling microscope-Magnetic resonance force microscopy.

UNIT III

Nanospectrabiosciences.Nanocrystals–Quantum dotas Biological fluorescent tag– Bucky balls for medical imaging – Ganolidium for Magnetic resonance imaging – Dendrimers in molecular imaging. Nanoprobes for nucleic and hybridization detection.Nucleophillic carbenes.Working on the DNA chain gangs.DNAandprotein based nano circuitry.

UNIT IV

Nanotechnology for drug development and medical applications.Nanotechnology for drug solubilization and drug delivery. Diagnosis using nanomaterials. Nanotherapy for cancer treatment–Interior artery expansions–Replacing joints with better stuff.- Radio active tuberenec ages in Nuclear medicine.

UNIT V

Cleaner environment with Nanotechnology. Cleaning the air with Nanotechnology – Nanotechnology for water treatment. Microbial nano particles. Nano carbon ball as deodorizer inferment process.Biomotorsforengineereddevices.Possible harm from Nano materials. Nanoscience in India – Nanoscience education abroad – Looking atethics andsociety.

REFERENCES:

1. Richard Brooker and Earl Boysen (2006). Nanotechnology. Wiley Publishing Inc., India. Pp361.
2. Paul Dieppe and PaulCalvert.(1983).Crystals and Joint disease,Chapmanand Hall Ltd,London.
3. Duckruix, A. and R. Giege, (1992). Crystallization of Nucleic acids and Proteins. A practical approach,Oxford University Press,England.

M.Sc. APPLIED MICROBIOLOGY

EDC COURSES - EXTRA DISCIPLINARY COURSES

BASICS OF MICROBIOLOGY

SUBJECT CODE: 21PMIED03

Course Objectives:

- Providing information on the basics of Microbiology.

COURSE OUTCOME

Knowledge gained as

- Understanding history of microbiology and microbial techniques

UNIT I

History and scope of microbiology–Louis Pasteur–Robert Koch.Microscope and its applications.Importance of staining.Classification of micro organisms.

UNIT II

Structure and organization of bacterial cell.Sterilization and Disinfection,Methods of sterilization–Physical and chemical methods.

UNIT III

Culture and media preparation, Nutrition – Different phases of growth – Growth curve. Structure and function of DNA and RNA.

UNIT IV

Antigen, Antibody – Humoral and Cell - Mediated immunity. Blood grouping– Infections – Source and methods. Definitions – Epidemic, Pandemic, Endemic. Normal flora. Bacteria – S. aureus, E. coli. Fungi - Candida. Virus – Rabies, HIV, Parasite –Malaria.

UNIT V

Fermentation and its uses. Production of Penicillin and Streptomycin, Beer, Wine, Yoghurt. Plant - microbial interaction – N2 fixation in root nodules.

REFERENCES:

1. Prescott L M, J P Harley and D A Klein (2005). Microbiology. Sixth edition, International edition, McGraw Hill.
2. Pelczar TRMJ Chan ECS and Kreig NR (2006).Microbiology. Fifth edition, Tata Mc Graw-Hill INC.New York.
3. Kuby Immunology - Richard A Goldsby, Thomas J Kindt. Barbara A Osborne, (2000). Fourth edition,WH Freeman and company.New York.
4. Jawetz, Melnick, & Adelberg's. (2013). Medical Microbiology. 26th Edition. Mc Graw- Hill.
5. Patel AH (2005). Industrial microbiology. Published by Mac Millan India Ltd., Chennai.
6. Subba Rao NS (2004). Soil Microbiology. Fourth edition, Oxford and IBH Publishing Co.Pvt.Ltd.,New Delhi.

M.Sc. MICROBIOLOGY

EDC COURSES - EXTRA DISCIPLINARY

COURSES HUMANINFECTIOUS DISEASES AND

DIAGNOSTICS

SUBJECT CODE: 21PMIED04

Course Objectives:

- Providing information on the types of infection and their diagnosis
- Imports knowledge on host defence mechanism

COURSE OUTCOME

Knowledge gained as

- Important technique of diagnosis procedure
- Understanding the preventive measure towards infection

UNIT I

Scope and relevance of Microbiology-Definition and concepts, Type of micro organism, Distribution of Microorganism in nature; Development of Microbiology as a Scientific discipline; General characteristics of microorganisms- General principles, Taxonomy, classification and structural organization of Bacteria, Fungi, Viruses, Algae, Actinomycetes, Mycoplasma, and Ricketssiae; Microscopy-Principles and applications.

UNIT II

Fixatives and Fixation of smears, Stains- Definition, Acidic, Basic stains, simple and differential staining, use and significance of stains in microbiology; cultivation of micro organism- Pure culture techniques; cultivation of anaerobes; control of

microorganism- sterilization by physical and chemical methods , Antiseptics .

UNIT III

Binomial nomenclature; Outline classification of living organisms- Haeckel, Whittaker, and woese system, normal micro flora in human body and their beneficial effects; Lymphoid organs and types of immunity; General principles of diagnostic microbiology- collection, transport, and processing of clinical specimens, General methods of laboratory diagnosis-cultural, biochemical, serological, and molecular methods.

UNIT IV

Host pathogen interaction- virulence factors, General account of the following diseases- Causal organisms, pathogenesis, diagnosis, prevention and therapy of Typhoid, cholera, dysentery, whooping cough, tuberculosis, Malaria, small pox, and AIDS. General account of Nosocomial Infections and prevention.

UNIT V

Antimicrobial therapy in the diagnosis of diseases; In vitro diagnostic methods agglutination, precipitation, immunofluoresence, ELISA, Skin test; Vaccines: Principles underlying the preparation of live and attenuated vaccines. Immunization; Automation in Disease diagnosis.

REFERENCES:

1. Morag, C. and Timbury, M.C. (1994) Medical Virology, 10th Edn. Churchill Livingston, London.

2. Dimmock, N.J. and Pimrose, S.B. (1994) Introduction to Modern Virology, 4th Edn. Blackwell Scientific Publications, Oxford.

3. Conrat, H.F., Kimball, P.C. and Levy, J.A. (1994) Virology, 3rd Edn, Prentice

Hall, New Jersey.

4. Maloy SR,Cronan Jr.JE, Freifelder D. (1998). Microbial Genetics. Jones and Bartlett publishers.

5. Robert G. Welstar and Allan Garnoll. Encyclopaedia of Virology (1994). Vol. I, II &III Academic Press inc. San Diego, CA 92101. Ed.

6. Greenwood, D., Slack, R.B. and Peutherer, J.F.(2002) Medical Microbiology, 16th Edn. Churchill Livingstone, London.

7. Finegold, S.M. (2000) Diagnostic Microbiology, 10th Edn. C.V. Mosby Company, St. Louis.

8. Ananthanarayanan, R. and Jayaram Panicker C.K. (2004) Text book of Microbiology. Orient Longman, Hyderabad.

9. Gerhardt, P., Murray, R.G., Wood, W.A. and Kreig, N.R. (Eds) (1994) Methods for General and Molecular Bacteriology. ASM Press, Washington, DC.

10. Topley and Wilson (1995) Principles of Bacteriology Virology and Immunity. 9th Edn. Vol I, Edward Arnold, London.

WEB SITES

1. http:// www.microbiologyonline.org.uk/sgmprac.htm

2. http:// www.cvm.uiuc.edu/vdl/AppenA_man.html

3. http:// www.microbes.info/resources/education_and learning

4. http://infohost.nmt.edu/-nmtlib/subj/boil.html

5. http:// www.hoflink.com/%7Ehouse/microbio.html

6. http://www. Splammo.net/bact102/home102.html

7. http:// www.pathmicro.med.sc.edu/book/bact-sta.htm

8. http:// www.textbookofbacteriology.net/

OTHER WEB SITES

1. https://www.mayoclinic.org
2. https://www.euro.who.int
3. https://animals.org/aim
4. https://www.yourgenome.org
5. https://www.britannica.com/sciencce/infectious -diseases
6. https://www.austincc.edu

QUESTION PAPER PATTERN

Theory I/II/III/IV Semester

M. Sc. Examination,

...MONTH & …YEAR

M.Sc. Microbiology

Paper title

Duration: 3Hrs MaxMarks: 75

Instruction: Answer all the two Parts.

PART – A (15 X 1 = 15)

(Three question from each unit)

Answer all the questions:

Objective Questions (Multiple Choice)

PART – B (Either or Choice)

(One question from each unit)

Answer all the questions: 5 X 2 = 10

1. a). (or) b)
.
2. a). (or) b)
.
3. a). (or) b)
.
4. a). (or) b)
.
5. a). (or) b)

.

PART – C (Either or Choice)

(One question from each unit)

Answer All the questions: 5 X 10 = 50

1. a). (or) b).
2. a). (or) b).
3. a). (or) b).
4. a). (or) b).
5. a). (or) b).

QUESTION PAPER PATTERN PRACTICAL

M.Sc. Microbiology Scheme of Examination

I/II/III/ Semester M. Sc. Examination,

..MONTH &…YEAR

Applied Microbiology Practical Examination

Duration: 6 Hrs/ day, 2 days

Max. Marks: 60

Q.1.	Major Practical	20Marks
Q.2.	Minor Practical Spotters	15marks
Q.3	Identify and Critical comment on. (Specimens/Spotters)	5 X 3 = 15 Marks

A.
B.
C.
D.
E.

Viva-Voce	05Marks
Record note	05Marks

III - Semester M.Sc. Examination Project work (Training)

Internship Training Dissertation Thesis	50 Marks
Viva-Voce Training in Bioscience filed	10 Marks

IV Semester M.Sc. Examination Project work (Dissertation)

Dissertation Thesis	50Marks
Viva-Voce	10Marks