DEGREE OF MASTER OF SCIENCE
CHOICE BASED CREDIT SYSTEM

SYLLABUS FOR
M.SC - MICROBIOLOGY
(SEMESTER PATTERN)
(For Candidates admitted in the Colleges affiliated to Periyar University from 2018-2019 onwards)
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 / 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.
5. 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
  ❖ 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

➢ 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
  ❖ Practical – V & VI

➢ Semester – IV
  ❖ Core – IX - Research Methodology, Bio statistics and Bio informatics
  ❖ Elective – III
  ❖ Project

Elective Courses – Major (Choose Any Three)
1. Plant Physiology and Plant Tissue Culture
2. Bio instrumentation and Biological Techniques
3. Human Anatomy and Physiology
4. Nanotechnology
5. Organic Farming
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 - 3 hrs. Maximum marks – 75 Marks:

- Part A – 25 Marks (5 Questions) and
- Part B – 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 - 10 marks
- Attendance - 5 marks
- Seminar - 5 marks
- Assignment - 5 marks

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

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

Break – up Details for Attendance
- Below 60 % - No marks
- 60% to 75% - 3 marks
- 76% to 90% - 4 marks
- 91% to 100% - 5 marks
IMPORTANT POINTS

1. The each practical examination should be conducted for 6 hrs / day, 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.
### COURSE OF STUDY AND SCHEME OF EXAMINATION

<table>
<thead>
<tr>
<th>Course</th>
<th>Subject Title</th>
<th>Hrs/Week</th>
<th>Credit</th>
<th>Internal (25%)</th>
<th>External (75%)</th>
<th>Total Marks</th>
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<tbody>
<tr>
<td>I SEMESTER</td>
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<tr>
<td>Core - I</td>
<td>General Microbiology</td>
<td>6</td>
<td>5</td>
<td>25</td>
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<tr>
<td>Core - II</td>
<td>Immunology and Immunotechnology</td>
<td>6</td>
<td>5</td>
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<td>Core - III</td>
<td>Cell and Molecular Biology</td>
<td>6</td>
<td>5</td>
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<tr>
<td>Elective - I</td>
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<td>6</td>
<td>5</td>
<td>25</td>
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<td>Practical I</td>
<td>General Microbiology and Immunology</td>
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<td>4</td>
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<td>Practical II</td>
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<td>6</td>
<td>4</td>
<td>25</td>
<td>75</td>
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<tr>
<td>II SEMESTER</td>
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<tr>
<td>Core - IV</td>
<td>Medical Bacteriology and Mycology</td>
<td>5</td>
<td>5</td>
<td>25</td>
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<td>100</td>
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<tr>
<td>Core - V</td>
<td>Industrial and Pharmaceutical Microbiology</td>
<td>5</td>
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<tr>
<td>Core - VI</td>
<td>Genetic Engineering and Advances in Biotechnology</td>
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<td>5</td>
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<td>Practical IV</td>
<td>Genetic Engineering and Industrial Microbiology</td>
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<td>Course</td>
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<td>University Examination</td>
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<tr>
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<tr>
<td>Core - VII</td>
<td>Medical Virology and Parasitology</td>
<td>5</td>
<td>5</td>
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<tr>
<td>Core - VIII</td>
<td>Food, Dairy and Environmental Microbiology</td>
<td>5</td>
<td>5</td>
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<tr>
<td>Core - IX</td>
<td>Soil, Agricultural Microbiology and Bio Degradation</td>
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<td>5</td>
<td>25 75 100</td>
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<td>Elective - II</td>
<td></td>
<td>4</td>
<td>3</td>
<td>25 75 100</td>
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<tr>
<td>Practical V</td>
<td>Medical Virology and Parasitology</td>
<td>6</td>
<td>4</td>
<td>40 40 100</td>
<td></td>
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</tr>
<tr>
<td>Practical VI</td>
<td>Food, Dairy, Environmental Microbiology</td>
<td>6</td>
<td>4</td>
<td>40 40 100</td>
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<tr>
<td>IV SEMESTER</td>
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<tr>
<td>Core - X</td>
<td>Research Methodology, Bio statistics and Bioinformatics</td>
<td>5</td>
<td>5</td>
<td>25 75 100</td>
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<td>25 75 100</td>
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<td>40 60 100</td>
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<td>Project</td>
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<td><strong>Total</strong></td>
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<td><strong>2200</strong></td>
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</tbody>
</table>

No. of Core Papers : 16  
Elective – Major : 03 (Choose any 3 out of 6)  
Supportive course – EDC : 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 who secured not less than 60% of aggregate marks (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 obtain 75% 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)

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

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 (200 words)     Answer all 5 Questions either or type     5x5=25 marks
PART – B (500 words)     Answer all 5 Questions either or type     5x10=50 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 2008-2009 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 2012 Examinations. Thereafter, they will be permitted to appear for the examination only under the Regulations then in force.
M.Sc. MICROBIOLOGY

SEMESTER - I

CORE I : GENERAL MICROBIOLOGY

UNIT I History and Classification

Development, Scope and Future of Microbiology. Classification of microorganisms - Haeckel’s three Kingdom concepts, Whittaker’s five kingdom concepts. Microbial taxonomy, Numerical taxonomy, Taxonomic ranks. Classification and salient features of bacteria according to Bergey’s manual of bacteriology. Microbial type culture collections.

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 Bacterial anatomy and Growth


UNIT IV Bacterial Metabolism


UNIT V Control of Microorganisms

Sterilization – Types – Mode of action – Applications. Disinfectants. Sterility control of autoclave, hot air oven and laminar air flow. Antimicrobial chemotherapy – Antibiotics (Anti bacterial and antifungal) – Classification (Based on chemistry and mode of action) – Sensitivity tests and drug resistance mechanism.
REFERENCE BOOKS


M.Sc. MICROBIOLOGY
SEMESTER - I

CORE II : IMMUNOLOGY AND IMMUNOTECHNOLOGY

UNIT I The Cells of Immune System


UNIT II Humoral Immunity

Development, maturation, activation and differentiation of B-lymphocytes; Antibody: structure, classes and subclasses; antibody diversity- Antigen and antibody interaction. Complement – Classical, alternate and lectin pathways; Hybridoma technology for production of the monoclonal antibody and applications.

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 Autoimmunity Immunopathology and Techniques in Immunotechnology

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

REFERENCE BOOKS
M.Sc. MICROBIOLOGY
SEMESTER - I
CORE III : CELL AND MOLECULAR BIOLOGY

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, mechanics of cell division-mitosis and meiosis; Cell signaling – signaling molecules, 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 and Transcription

Basic rules of replication- genes and enzymology of replication, processivity and fidelity 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 and termination.

UNIT V Gene expression and regulation

TEXT BOOKS

REFERENCE BOOKS
M.Sc. MICROBIOLOGY
SEMESTER - I
PRACTICAL – I
GENERAL MICROBIOLOGY AND IMMUNOLOGY
Practical Exam : 6 Hrs / Day; 2 Consecutive days

GENERAL MICROBIOLOGY

1. Measurement of microorganisms – Micrometry
2. Staining methods – Simple, Gram's, Acid fast, Spore, Granular, Capsule (Positive and Negative) and Fat stain (Sudan Black Method)
3. Motility Determination – Hanging drop method and Soft agar
4. Media preparation and Cultural Characters of bacteria on
   Agar Plate
   - Size and Pigmentation
   - Form – Circular, Irregular and Rhizoid,
   - Margin – Entire, Lobate, Undulate, Serrate and Filamentous,
   - Elevation – Flat, Raised, Convex and Umbonate
   Agar Slant
   - Abundance of growth, Pigmentation, Optical Characteristics
   - Form – Filiform, Echinulate, Beaded, Effuse, Arborescent and Rhizoid
   Broth
   - Uniform turbidity, Flocculent, Pellicle and Sediment
   Types of Media
   - Enriched, Selective, Differential, Enrichment and Transport media
4. Pure culture techniques
   - Streak plate, Pour plate and Spread plate
5. Bacterial Growth
   - Total Count – Neubauer chamber
   - Growth curve – Turbidity method – Spectrophotometer / Colorimetry
6. Effect of various factors on growth of bacteria
   - Temperature, pH and Osmotic pressure
7. Anaerobic cultivation
   - Anaerobic gas pack method (Demo)
8. Study on bacterial extra cellular enzymes
   - Starch, Casein, Gelatin and Lipid hydrolysis
10. **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

11. **Antibiotic sensitivity methods — Kirby-Bauer method and Stokes method**

**REFERENCE BOOKS**


M.Sc. MICROBIOLOGY

SEMESTER - I

PRACTICAL – I

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 - diffusion test
   - Counter Immuno electrophoresis
   - Rocket Immuno electrophoresis
   - Radial Immuno electrophoresis

4. Rapid plasma reagin test (RPR)

5. ELISA (HIV & Hbs)

REFERENCES:

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.
M.Sc. MICROBIOLOGY

SEMESTER - I

PRACTICAL – II

CELL AND MOLECULAR BIOLOGY

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.
13. Bacterial transformation.

REFERENCES


M.Sc., MICROBIOLOGY
SEMESTER - II
CORE IV - MEDICAL BACTERIOLOGY AND MYCOLOGY

Bacteriology

UNIT I


UNIT II – Gram Positive Bacteria

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 – Gram Negative Bacteria

Morphology, classification, cultural characteristics, pathogenicity, pathology, Laboratory diagnosis and prevention – *Salmonella, Shigella dysenteriae, Vibrio cholerae, E. coli, Brucella abortus, Spirochetes, Rickettsiae rickettsii, Chlamydiae trachomatis, Mycoplasmas*, Zoonotic diseases and their control. Hospital acquired infections.

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

**REFERENCE BOOKS**


M.Sc. MICROBIOLOGY

SEMESTER - II

CORE V - INDUSTRIAL AND PHARMACEUTICAL MICROBIOLOGY

UNIT I

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, screening, strain improvement and preservation.

UNIT II


UNIT III

Microbial production of organic acids (Citric acid, Acetic acid, 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 (Beer and Wine) Microbial transformations – steroids, sterols, antibiotics and pesticides

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 (QC and QA)

UNIT V

REFERENCE BOOKS


M.Sc. MICROBIOLOGY
SEMESTER - II
CORE VI - GENETIC ENGINEERING AND ADVANCES IN BIOTECHNOLOGY

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
Techniques in Biotechnology – Blotting techniques – Southern, Northern and Western blotting. PCR amplification and its application. RFLP and RAPD analysis and its applications. DNA sequencing methods – dideoxy, chemical and Next Generation Sequencing (NGS). Site directed mutagenesis, Protein engineering.
TEXT BOOKS


REFERENCE BOOKS


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 (\textit{V.cholerae}).
4. Biochemical reactions for identification of pathogenic bacteria
   a) \textit{Staphylococcus aureus}
   b) \textit{Escherichia coli}
   c) \textit{Klebsiella pneumoniae}
   d) \textit{Pseudomonas aeruginosa}
   e) Salmonella Typhi
   f) \textit{Shigella dysentriae}
   g) \textit{Proteus vulgaris}
   h) \textit{Vibrio cholerae}
5. Kirby Bauer (AST) antibiotic sensitivity test.
6. KOH/LPCB preparation of Skin/hair/nail for fungal observation.
7. Microscopic identification of (Penicillium, Aspergillus, Mucor, Rhizopus, Trichophyton, Microsporum and Epidermophyton) fungi.
8. Slide culture method.
10. Germ tube technique.
11. Capsule staining.
REFERENCE BOOKS:


M.Sc. MICROBIOLOGY
SEMESTER - II
PRACTICAL - IV

GENETIC ENGINEERING AND INDUSTRIAL MICROBIOLOGY

GENETIC ENGINEERING

1. Isolation of chromosomal DNA from bacteria.
2. Isolation of plasmid DNA.
4. SDS - PAGE.
5. Protein estimation by Lowry et al method
6. Separation of biomolecules by paper, thin layer and column chromatography.
7. Polymerase chain reaction (Demonstration)
8. Plant tissue culture – Explant preparation, Callus formation in MS media (Demonstration)

REFERENCES BOOKS:

M.Sc. MICROBIOLOGY

SEMESTER - II

PRACTICAL IV - INDUSTRIAL MICROBIOLOGY

1. Screening of antibiotics producing microbes from soil.
2. Production of microbial enzymes
   a). Solid state fermentation (Any one enzyme) b). Submerged fermentation (Any one enzyme)
4. Immobilization of cells and enzymes
5. Microbial production of wine
7. Minimal inhibitory concentration (MIC) determination of antibiotics – Broth Dilution
8. Minimal inhibitory concentration (MIC) determination of antibiotics – Filter paper disc assay
9. Evaluation of disinfectants – Filter paper disc assay
10. Phenol co – efficient test
11. Vitamin assay (B12/Nicotinic acid)
12. Sterility testing of pharmaceutical products (Membrane filter assay – Fluid thiglycollate medium) (Demo)
13. Bacterial Endotoxin Test – Limulus Amoebocyte Lysate (LAL) assay (Demo).

REFERENCE BOOKS:
UNIT I

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

UNIT IV
General Techniques of Micropropagation, 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

REFERENCES:
4. NIIR Board of Consultants & Engineers (2005). Handbook on plant and cell tissue culture. Asia Pacific Business Press Inc.,
UNIT I

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

UNIT II


UNIT III


UNIT IV

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

UNIT V

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

REFERENCES:

UNIT I

An Introduction to Human body - Overview of level of organization and characteristics
- Digestive system - Components of digestive system (GI tract and accessory organs) and their functions.

UNIT II

Muscular system - Muscle tissue - types (Skeletal, smooth and cardiac) - functions and properties. Neuro muscular junction.

UNIT III

Respiratory system - Anatomy - External and internal respiration. Cardiovascular system - Anatomy of heart, Cardiac cycle and ECG.

UNIT IV


UNIT V


REFERENCES:

UNIT I Introduction to nanotechnology


UNIT II Synthesis Methods of Nanomaterials

Physical synthesis - Ball Milling - Electrodeposition - Spray Pyrolysis - Thermal evaporation Chemical synthesis - Sol-Gel Process - Metal Nanocrystals by Reduction
- Solvothermal Synthesis - Biological Synthesis - Protein-Based Nanostructure Formation - DNA-Templated Nanostructure Formation - Protein Assembly

UNIT III Properties of Nanomaterials

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

UNIT IV Characterization methods


UNIT V Applications of Nanoparticles

REFERENCES:


M.Sc. MICROBIOLOGY
ELECTIVE COURSES - ORGANIC FARMING

UNIT I

UNIT II

UNIT III

UNIT IV
Biogas technology for organic farming - Composition of biogas slurry- Agronomic importance. Waste water treatment method (sewage) and its uses for organic farming
- Macrophyte Treatment. Agricultural waste management – Crop waste - cattle, Poultry and pig waste - Farm waste recycling.

UNIT V

REFERENCES:

Web Sites:
1. http://www.agritech.tnau.ac.in/org_farm/orgfarm_index.html
M.Sc. MICROBIOLOGY
ELECTIVE COURSES - BASICS OF PHYTOCHEMISTRY

UNIT I
Distribution of Indian medicinal plants; Introduction, Important medicinal plants, eco distribution, mapping distribution in different biogeographic zones. Diversity hot spots - Endemism - Rare, endangered and threatened species. Plant genetic resources and their conservation: 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.

UNIT II

UNIT III

UNIT IV

UNIT V
REFERENCES:


3. Bajpai, s. Biological instrumentation and methodology.


M.Sc. MICROBIOLOGY
EXTRA DISCIPLINARY COURSES
ENTREPRENEURIAL MICROBIOLOGY

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

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. Rhizobium sp., Azospirillum sp., Azotobacter sp., as Biofertilizers

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

UNIT V
Patents and secret process, History of patenting, composition, subject matter and characteristics of a patent, inventor, infringement, cost of patent. Patents in India and other countries. Fermentation economics.

REFERENCES:
5. Arora. Entrepreneurial Development in India.
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


UNIT III


UNIT IV


UNIT V


REFERENCES:
M.Sc. MICROBIOLOGY
EXTRA DISCIPLINARY COURSES

BASICS OF MICROBIOLOGY

UNIT I


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


UNIT V


REFERENCES:

UNIT I
Scope and relevance of Microbiology-Definition and concepts, Type of microorganism, 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 microorganism- 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, immunofluorescence, ELISA, Skin test; Vaccines: Principles underlying the preparation of live and attenuated vaccines. Immunization; Automation in Disease diagnosis.
REFERENCES:


WEB SITES

M.Sc. MICROBIOLOGY

SEMESTER - III

CORE VII - MEDICAL VIROLOGY AND PARASITOLOGY

UNIT I

Brief outline on discovery of Viruses, nomenclature, ICTV classification of Viruses, Distinctive properties of Viruses, Morphology & ultra structure, Cultivation of virus viriods, prions, satellite RNAs and virusoids. Anti viral agents – Interferons and Vaccines.

UNIT II


UNIT III


UNIT IV


UNIT V

Helminthic Infections - Taenia solium, Echinococcus granulosus, Fasciola hepatica, Paragonimus westermani and Schistosomes, Ascaris lumbricoids, Ancylostoma duodenale, Trichuris triuchura, Enterobius vermicularis and Wuchereria bancrofti.
REFERENCES BOOKS


WEB REFERENCES:
1. http://dmoz.org/Science/Biology/Microbiology/
5. http://www.biosci.ohio-state.edu/-zoology/parasite/home.html
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 sea foods. Canning - Methods - Types - Spoilage of canned foods. Food borne diseases, food intoxication and their control measures.

UNIT III


UNIT IV


UNIT V

Waste treatment - Types of wastes - Characterization of solid and liquid wastes. 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.
REFERENCES


M.Sc. MICROBIOLOGY
SEMESTER - III
CORE IX - SOIL, AGRICULTURAL MICROBIOLOGY AND
BIODEGRADATION

UNIT I
Introduction to soil Microbiology; distribution of microorganisms in soil, Autochthonous, Allochthonous and Zymogenous microbes, quantitative estimation of microorganisms in soil, role of microorganisms in soil fertility; Factors influencing soil microbes.

UNIT II

UNIT III
Interaction between soil microbes–Neutralism, Commensalism, Symbiosis, Synergism, Amensalism, Parasitism, Predation and Competition. Interrelationships between soil microbes and plants, Rhizosphere, phyllosphere, Mycorrhizae-types, Rumen flora, Insects microbial interactions.

UNIT IV

UNIT V
REFERENCE BOOKS:


M.Sc. MICROBIOLOGY

SEMESTER - III

PRACTICAL V - MEDICAL VIROLOGY AND PARASITOLOGY

1. Examination of parasites in clinical specimens - ova/cysts in faeces.
2. Direct and concentration: methods - Formal Ether and Zinc sulphate methods - Saturated salt solution method.
4. Thin smear by Leishman’s stain.
7. Spotters of viral inclusions and CPE - stained smears. Viral serology- HIV and HBs -ELISA.

REFERENCE BOOKS:

1. Microbiological (Bacteria and Fungi) examination of spoiled foods
   - Vegetables
   - Fruits
   - Dairy products
2. Examination of microbial load in
   - Fruit pulp
   - Carbonated beverages
   - Ice creams
3. Assessment of milk quality by
   - Standard Plate Count (SPC) method
   - Methylene Blue Reduction Test (MBRT)
   - Resazurin Test
   - Breeds count
4. Quantification of microbes in air by
   - Settle plate method
   - Air sampler
5. Examination of potability of drinking water by
   - Most Probable Number Test (MPN)
   - Standard Plate Count (SPC) method
   - Membrane filter technique
6. Physico-chemical assessment of treated water by
   - DO
   - COD
   - BOD
REFERENCE BOOKS:


M.Sc. MICROBIOLOGY
SEMESTER - III
PRACTICAL VI - AGRICULTURAL MICROBIOLOGY AND BIODEGRADATION

1. Enumeration of Heterotrophic microbes from soil
2. Isolation of Rhizobium from root nodules
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 citri
   - Blight of paddy - Xanthomonas oryzae
   - Tikka leaf spot - Cercospora sp.
   - Wilt of cotton - Fusarium oxysporum
   - Red rot of sugarcane – Colletotrichum falcatum
9. Study of Cyanobacteria
   - Anabaena
   - Nastoc
   - Oscillatoria
   - Lyngbya
10. Isolation and identification of Trichoderma sp.
11. Isolation of Cellulose degrading bacteria.
12. Isolation of Xenobiotic (pesticide) degrading bacteria.
13. Isolation and Microscopic observation of Mycorrhizae/spore/VAM.

REFERENCES:
M.Sc. MICROBIOLOGY

SEMESTER - IV

CORE X - RESEARCH METHODOLOGY, BIOSTATISTICS
AND BIOINFORMATICS

UNIT I


UNIT II


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 bioinformatician. Biological databases-Database searching, Sequence analysis, Pair alignment, Visualizing protein structures, Predicting structure and function of protein using sequences, Tools for genomics and proteomics.

UNIT V

Bioinstrumentation- Principles and applications of pH meter, Centrifuge . Electrophoresis- AGE/PAGE, Chromatography -Thin layer, Column, Gas and high pressure liquid chromatography, spectrophotometry, NMR, Atomic absorption spectrophotometer, Autoanalyser.
REFERENCES:

M.Sc. MICROBIOLOGY

ELECTIVE COURSES

PLANT PHYSIOLOGY AND PLANT TISSUE CULTURE

UNIT I

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

UNIT III

UNIT IV
General Techniques of Micropropagation, 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

REFERENCES:
4. 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

UNIT I
Buffers, molars and normal solutions, pH meter, pH electrodes – calomel and glass electrodes. Incubator, water bath shaker, laminar air flow.

UNIT II

UNIT III

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. Immunodiffusion techniques - ODD, RIA. Agglutination and its applications - IFT, CFT.

REFERENCES:
M.Sc. MICROBIOLOGY

ELECTIVE COURSES

HUMAN ANATOMY AND PHYSIOLOGY

UNIT I

An Introduction to Human body - Overview of level of organization and characteristics
- Digestive system - Components of digestive system (GI tract and accessory organs) and their functions.

UNIT II

Muscular system - Muscle tissue - types (Skeletal, smooth and cardiac) - functions and properties. Neuro muscular junction.

UNIT III

Respiratory system - Anatomy - External and internal respiration. Cardiovascular system - Anatomy of heart, Cardiac cycle and ECG.

UNIT IV


UNIT V


REFERENCES:

M.Sc. MICROBIOLOGY
ELECTIVE COURSES NANOTECHNOLOGY

UNIT I Introduction to nanotechnology

UNIT II Synthesis Methods of Nanomaterials
Physical synthesis - Ball Milling - Thermal evaporation Chemical synthesis - Sol-Gel Process - Solvothermal Synthesis - Biological Synthesis – Bacteria, fungi and plant MEDIATED synthesis. DNA-Templated Nanostructure Formation - Protein Assembly

UNIT III Properties of Nanomaterials
Physical properties - Optical, Thermal Surface Plasmon resonance - Intra-molecular bonding, Inter-molecular bonding, Self-assembly - Interaction Between Biomolecules and Nanoparticle Surfaces

UNIT IV Characterization methods
UV Spectrophotometer, X-ray diffraction (XRD), Fourier Transform InfraRed Spectrometer (FTIR), Scanning Electron Microscope (SEM), EDAX, Transmission Electron Microscope (TEM)

UNIT V Applications of Nanoparticles
REFERENCES:


M.Sc. MICROBIOLOGY
ELECTIVE COURSES ORGANIC FARMING

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

REFERENCES:

Web Sites:
1. http://www.agritech.tnau.ac.in/org_farm/orgfarm_index.html
M.Sc. MICROBIOLOGY
ELECTIVE COURSES BASICS OF PHYTOCHEMISTRY

UNIT I
Distribution of Indian medicinal plants; Introduction, Important medicinal plants, eco distribution, mapping distribution in different biogeographic zones. Diversity hot spots - Endemism - Rare, endangered and threatened species. Plant genetic resources and their conservation: 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.

UNIT II

UNIT III

UNIT IV

UNIT V
REFERENCES:


3. Bajpai, s. Biological instrumentation and methodology.


M.Sc. MICROBIOLOGY
EDC COURSES - EXTRA DISCIPLINARY COURSES
ENTREPRENEURIAL MICROBIOLOGY

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

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. Rhizobium sp., Azospirillum sp., Azotobacter sp., as Biofertilizers

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 characteristics of a patent, inventor, infringement, cost of patent. Patents in India and other countries. Fermentation economics.

REFERENCES:
5. Arora. Entrepreneurial Development in India.
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

UNIT III

UNIT IV

UNIT V

REFERENCES:
M.Sc. MICROBIOLOGY
EDC COURSES - EXTRA DISCIPLINARY COURSES

BASICS OF MICROBIOLOGY

UNIT I

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

UNIT V

REFERENCES:
M.Sc. MICROBIOLOGY
EDC COURSES - EXTRA DISCIPLINARY COURSES
HUMAN INFECTIOUS DISEASES AND DIAGNOSTICS

UNIT I

Scope and relevance of Microbiology- Definition and concepts, Type of microorganism, 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 Rickettsiae; 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 microorganism- 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, immunofluorescence, ELISA, Skin test; Vaccines: Principles underlying the preparation of live and attenuated vaccines. Immunization; Automation in Disease diagnosis.
REFERENCES:


WEB SITES

QUESTION PAPER PATTERN
Theory
I/II/III/IV Semester
M. Sc. Examination,
....MONTH & ...YEAR
M.Sc. Microbiology

Paper title

Duration: 3 Hrs Max Marks:75

Instruction: Answer all the two Parts.

PART – A (Either or Choice)
(One question from each unit)

Answer all the questions: 5 X 5 = 25

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

PART – B (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

Microbiology Practical Examination
Duration: 6 Hrs/ day, 2 days
Max. Marks: 60

Q.1. Major Practical 20 Marks
Q.2. Minor Practical 15 marks
Q.3 Spotters
Identify and Critical comment on. (Specimens / Spotters) 5 X 3 = 15 Marks
A.
B.
C.
D.
E.
Viva-Voce 05 Marks
Record note 05 Marks

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

Dissertation Thesis 50 Marks
Viva-Voce 10 Marks