DEGREE OF BACHELOR OF SCIENCE

CHOICE BASED CREDIT SYSTEM

Syllabus for

B.SC. MICROBIOLOGY

(SEMESTER PATTERN)

( For Candidates admitted in the Colleges affiliated to Periyar University from 2017 - 2018 onwards )
CONDITION FOR ADMISSION

A candidate who has passed higher secondary examination in any one of the biological sciences (Botany, Zoology, Biology). (Academic/Vocational stream - Agri, Home Science, Poultry) under higher secondary board of examination, Tamil Nadu or as per norms set by the Government of Tamil Nadu or an examination accepted as Equivalent thereto by the Syndicate subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the BSc., Microbiology degree examination of this University after a course of study of three academic years.

Duration of the course

The course for the degree of Bachelor of Microbiology shall consist of three academic years divided into six semesters.

Course of study

The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time.

Examinations

The theory examination shall be three hours duration to each paper at the end of each semester. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examinations. The practical examinations for UG course should be conducted at the end of the every semester.

Maximum Duration for the completion of the UG Programme

The maximum duration for completion of the UG Programme shall not exceed twelve semesters.

Commencement of this Regulation

These regulations shall take effect from the academic year 2017-18, i.e., for students who are to be admitted to the first year of the course during the academic year 2017-18 and thereafter.
### COURSE OF STUDY AND SCHEME OF EXAMINATION

#### SEMESTER I

<table>
<thead>
<tr>
<th>Part</th>
<th>Paper Code</th>
<th>Title of the Paper</th>
<th>Credits</th>
<th>Internal Marks</th>
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<td>Biochemistry - I</td>
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### SEMESTER V

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**Grand Total**: 140 1160 2940

### SEMESTER VI

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B.Sc., Microbiology
(CBCS Pattern)

THEORY QUESTION PAPER PATTERN

Time: 3 hours          Max. Marks: 75

Part- A  (20 Marks) (Answer all the Question)

i) 10 x 1  = 10 (Choose the best answer) 2 questions from each unit

ii) 5 x 2  = 10 (2 Mark Question) 1 questions from each unit

Part- B  S x S  = 2S (Either or Choice)

(One question from each unit) Part- C  (3 x 10  = 30) Answer Any Three out of Five

(One question from each UNIT)

B.Sc., Microbiology
(CBCS Pattern)

CORE PRACTICAL QUESTION PAPER PATTERN

Time : 6 hours

Maximum Marks (University Exam) - 60
Major Practical - 1 - 20 Marks
Minor Practical - 1 & 2 - 2 X 10 = 20 (A & B)
Spotters - S X 2 = 10
Record - OS
Viva voce - OS
Internal Marks - 40
Total - 100
LIST OF COURSES
1. Fundamentals of Microbiology
2. Microbial Physiology and Metabolism
3. Microbial Genetics
4. Immunology
5. Medical Bacteriology
6. Food and Dairy Microbiology
7. Soil and Agricultural Microbiology
8. Environmental and Pharmaceutical Microbiology
9. Medical Virology
10. Core Practical 1
11. Core Practical 2
12. Core Practical 3
13. Core Practical 4
14. Core Practical 5
15. Core Practical 6
16. In House Mini project

ELECTIVE COURSES
1. Elective 1 Medical Parasitology & Entomology
2. Elective 2 Medical Mycology
3. Elective 3 Industrial Microbiology

SKILL BASED ELECTIVE COURSES (SBEC)
1. SBEC - 1 - Microbial Diversity
2. SBEC - 2 - Principles of Bioinstrumentation
PART - III

In-House Mini Project

ALLIED COURSES

1. Biochemistry I
2. Biochemistry II
3. Biostatistics
4. Computer Applications in Biology
5. Allied practical I Biochemistry
6. Allied practical II Computer Applications in Biology

NON MAJOR ELECTIVE COURSES (NMEC)

1. NMEC 1 - Principles of Bioinstrumentation
2. NMEC 2 - Mushroom Technology
3. NMEC 3 - Entrepreneurial Microbiology
4. NMEC 4 - Elemental Concepts of Microbiology

PART-IV

1. Environmental Studies
2. Value Education - Yoga

PART-V

1. Extension Activities (Awareness Programme, Participating in Grama Shaba, Campus Cleaning and YRS&RRC).

* In-House Mini Project should be worked out after the fourth semester. Project reports should be submitted at the time of V'h semester practical examination. It can be done by an Individual or by a Group (Maximum limit 5 members).
History and scope of Microbiology, Spontaneous generation - Biogenesis theory - Contribution of
Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Paul Ehrlich and Flemming.

Unit- II

Microscope- Principles, working mechanism and application - Simple and compound microscope -
Dark field - Phase contrast, Fluorescence , SEM and TEM.

Unit- III

Structure and organization of bacterial cell, Gram positive and Gram negative bacterial cell wall. Types of
Staining - Simple, Differential (Gram's, AFB), Special - Capsular staining (negative), Spore. LPCB, KOH
mount.

Unit- IV

Sterilization and Disinfection - principles -methods of sterilization- physical methods - Dry heat- Moist
heat- Radiation. Filtration (Membrane and HEPA). Chemical sterilization- Chemical agents- mode of
action- phenol coefficient test- sterility testing.

Unit- V

Culture and media preparation -solid and liquid . Types of media- Semi synthetic
, Synthetic, Enriched, Enrichment, Selective and Differential media. Pure culture techniques - Tube
dilution, Pour, Spread, Streak plate. Anaerobic culture technique Wright's Tube, Roll tube method,
Anaerobic Jar.

REFERENCES

McGraw Hill.
New York.
Ltd., New Delhi.
B.SC. MICROBIOLOGY
SEMESTER II

CORE II - MICROBIAL PHYSIOLOGY AND METABOLISM

Nutritional requirements of Microorganisms- Autotrophs, Heterotrophs ,Chemotrophs, Copiotrophs and Oligotrophs. Transport Mechanisms - Diffusion- Facilitated Diffusion, Active transport- Group translocation.

Unit- II


Unit- III

Metabolism - EMP, HMP, ED Pathway - TCA cycle - Electron transport chain, Phosphorylation, Oxidative Phosphorylation, Substrate level Phosphorylation

Unit- IV

Anaerobic respiration-sulphur, nitrogenous compounds and C02 as a final electron acceptor- Fermentation: Alcoholic fermentation, mixed acid fermentation, lactic acid fermentation

Unit- V

Photosynthesis - Characteristics and types of Photosynthetic Prokaryotes. C02 fixation Oxygenic and Anoxygencnic- Bio luminescence.

REFERENCES

B Sc MICROBIOLOGY

B.SC. MICROBIOLOGY

SEMESTER II

SKILL BASED ELECTIVE COURSE

SBEC - I - MICROBIAL DIVERSITY

Prokaryotic and Eukaryotic microorganisms. Classification of microorganisms. General principles and nomenclature - Hackel three kingdom and Whittaker's five kingdom concept.

Unit-II
Classification and characterization of bacteria (Bergery's manual), structure of bacterial cell. Economic importance of bacteria. General characters of Actinomycetes and their importance.

Unit-III

Unit-IV
Algae - morphology and general characters - Algal cell structure. Cyanobacteria - salient features and its importance, Heterocyst.

Unit-V
Virus - morphology, general characters, structure of animal virus (Adena virus), plant virus (TMV), bacteriophage (T4), insect virus (PV). Protozoa - general characters, structure of Euglena, Paramecium

REFERENCES
B.SC. MICROBIOLOGY

SEMESTER III

CORE III - MICROBIAL GENETICS

Cell Cycle - Mitosis - Meiosis - Bacterial chromosome organization, structure and function of DNA, RNA & its types. Extrachromosomal DNA (Plasmid).

Unit- II
DNA replication m prokaryotes - Meselson-Stahl experiment, Mechanism and enzymology of replication, DNA polymerase III structure, Rolling circle replication.

Unit- III
Mutation - types of mutation - spontaneous and induced - mutagen and mutagenesis. Detection of mutants - Ames test. DNA repair mechanism.

Unit- IV

Unit- V
Genetic exchange - Transformation, Conjugation and Transduction (Specialized and Generalized). Transposons.

REFERENCES
B.SC. MICROBIOLOGY
SEMESTER III
SKILL BASED ELECTIVE COURSE
SBEC- II- PRINCIPLES OF BIOINSTRUMENTATION

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
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.

Unit-V
Colorimetry, Spectrometry - UV & visible spectrophotometer, Flame photometry, FACS.Biosensors.

REFERENCES
B.SC. MICROBIOLOGY
SEMESTER IV

CORE - IV - IMMUNOLOGY

History of immunology, Innate immunity and acquired immunity, Haematopoiesis, Cells and organs of immune system. B-cell and T-cell activation. Phagocytosis.

Unit - II

Unit - III

Unit - IV
Auto immune diseases - Types and mechanisms. Hypersensitivity reactions - types, Antibody mediated (Type-I, Type II, Type III) and Cell mediated (Type-IV).

Unit - V
Immuno hematology, Blood group, Rh - incompatibilities. Transplantation Immunology - HLA Tissue Typing - mechanism of acceptance and rejection. Vaccines - Types, Immunization schedule.

REFERENCES
UNIT I

UNIT II
Morphology, Pathogenicity, Biochemical laboratory diagnosis and prevention of bacterial diseases - *Staphylococcus aureus, Streptococcus pyogens, S. pneumoniae, Neisseria sps.*

UNIT III
Morphology, pathogenicity, biochemical laboratory diagnosis and prevention of bacterial diseases - *Bacillus anthracis, C. diphtheriae, Clostridium tetani, Mycobacterium tuberculosis, M. leprae.*

UNIT IV
Morphology, pathogenicity, biochemical laboratory diagnosis and prevention of bacterial diseases - *Salmonella typhi, Shigella dysenteriae, Vibrio cholerae, E. coli, Proteus vulgaris, Klebsiella pneumoniae, Pseudomonas aeruginosa, Yersinia pestis.*

UNIT V
Morphology, pathogenicity, biochemical laboratory diagnosis and prevention of bacterial diseases - *Treponema pallidum, Leptospira interrogans, Mycoplasma pneumoniae, Haemophilus influenzae.*

REFERENCES
B.SC. MICROBIOLOGY

SEMESTER V

CORE - VI - FOOD AND DAIRY MICROBIOLOGY

Food and microorganisms - important microorganisms in food (Bacteria, Mold and Yeasts). Factors affecting the growth of microorganisms in food - pH, moisture, oxidation - Reduction potential, nutrient content and inhibitory substances and biological structure.

Unit- II


Unit- III


Unit- IV

Food quality control measures. Quality assurance of food products. Food standards, quality control of milk - MBRT, Litmus milk, Phosphatase tests. HACCP, FDA, WHO, FSSAI, ISI, EPA.

Unit- V

Food borne diseases: Food poisoning and food borne infections - Bacterial and Mycotoxins - Investigation of food poisoning outbreaks.

REFERENCES

B Sc MICROBIOLOGY

B.SC. MICROBIOLOGY

SEMESTER V

ELECTIVE - I - MEDICAL PARASITOLOGY & ENTOMOLOGY

Unit- I

Introduction- Classification- Laboratory diagnosis of parasitic infections- Direct and concentration methods, blood smear examination.

Unit- II

*Entamoeba histolytica*, *Giardia intestinalis*, *Trichomonas vaginalis*. *Haemoflagellate - eishmania donovani*.

Unit- III

Malarial parasite - *Plasmodium. Taeniasolium, Paragonimus westermani, Fasciola hepatica*.

Unit-IV

*Ancylostoma duodenale, Ascaris lumbricoides, Wuchereri abancrofti, Enterobius vermicularis*.

Unit- V

Medical Entomology - Brief account on morphology, Classification, Metamorphosis of insects - House fly, Mosquito, Tick, Fleas & Mite. Classification of Vector borne diseases and its control measures.

REFERENCES


B.SC. MICROBIOLOGY
SEMESTER V
ELECTIVE- II -MEDICAL MYCOLOGY

Unit- I
Introduction to medical Mycology - Morphological features of fungi - classification of medically important fungi, isolation, identification and diagnosis of fungi from clinical specimens.

Unit- II
Superficial mycosis - Pityriasis versicolor, Tinea nigra, Otomyces - Cutaneous mycosis -Dermatophytosis.

Unit- III
Subcutaneous mycosis - Sporotrichosis, Mycetoma, Chromoblastomycosis. Systemic mycosis- Histoplasmosis, Coccidioidomycosis.

Unit- IV
Opportunistic mycosis- Candidiasis, Cryptococcosis- Aspergillosis - Penicillosis.

Unit- V
Allergic fungal diseases - Bronchial Asthma, Maple Bark Stripper's disease - Antifungal agents- sensitivity tests- Mycotoxins and Mycetismus.

REFERENCES
B.SC. MICROBIOLOGY

SEMESTER V

SKILL BASED ELECTIVE COURSE

SBEC III - RECOMBINANT DNA TECHNOLOGY

Unit -I
History and achievements of rDNA technology. Cloning vectors - Plasmid based vectors
-Natural (pSClOl, pMBI), Artificial- pBR322 and pUC. Phage based vectors - 'A (Lambda) phage
vectors and its derivatives. Hybrid vectors - Phagemid, Phasmid and Cosmid, BAC and YAC. Expression
vectors.

Unit- II
Nomenclature, classification of Restriction Endonucleases - ligases, types - gene cloning in prokaryotes
-cloning strategies. Construction of genomic library and eDNA library.

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

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

Unit- V
Transgenic Plants - Ti plasmid, insect resistant plant. Transgenic animal - m1ce - retroviral method-
DNA microinjection method. PCR methods and its applications.

REFERENCES
Company Ltd., New Delhi.
Third edition, ASM Press, Washington, D.C.
company Ltd., New Delhi.
B.SC. MICROBIOLOGY
SEMESTER - VI

CORE VII - SOIL AND AGRICULTURAL MICROBIOLOGY

Unit-I

Unit-II

Unit-III

Unit-IV

Unit-V
Biofertilizers - classification, Mass cultivation and field application - *Rhizobium*, *Azotobacter*, *Azospirillum*, *Glucanoacetobacter diazotrophicus phosphate* solubilizers, potash mobilizers (*Frateuria aurentia*), VAM, Azolla. Liquid biofertilizer. Biopesticides: classification, mode of action - Bacterial insecticides (*Bacillus thuringiensis*) and Viral insecticides (NPV) and *T.viride*. PGPR.

REFERENCES


B.SC. MICROBIOLOGY
SEMESTER VI
CORE VIII - ENVIRONMENTAL AND PHARMACEUTICAL MICROBIOLOGY

Unit- I
Microbiology of air - Enumeration of bacteria from air - Air sampling devices - Air sanitation - Air borne diseases.

Unit- II
Microbiology of water - Potability of water - MPN technique - Indicator organisms water purification - Water borne diseases and their control measures.

Unit- III
Microbiology of sewage - chemical and biochemical characteristics of sewage - BOD and COD - Sewage treatment - physical, chemical & biological - aerobic and anaerobic (trickling filter, activated sludge and oxidation pond) treatment - disposable of wastes.

Unit- IV

Unit- V

REFERENCES
B Sc MICROBIOLOGY

B.SC. MICROBIOLOGY
SEMESTER VI
CORE IX - MEDICAL VIROLOGY

Unit- I

Unit- II
Pox viruses - Variola, Herpes viruses - Herpes Simplex Virus, Cytomegalo Virus, Epstein Barr Virus.

Unit- III
Adena viruses, Hepatitis viruses, Papova viruses, Papilloma, Polyoma, Parvo virus, Retro virus - HIV.

Unit- IV
Picorna viruses - Polio, Rhino virus, Orthomyxovirus - Influenza, Paramyxo virus - Parainfluenza, Mumps, Measles, Rhabdo virus, Rota virus.

Unit- V

REFERENCES
B.S.C. MICROBIOLOGY
SEMMESTER VI
ELECTIVE - III - INDUSTRIAL MICROBIOLOGY

Unit- I
Industrially important microorganisms - Screening Techniques- Primary and Secondary - Preservation of cultures - Strain improvement- Development of inoculum for various fermentation processes.

Unit- II
Fermentor - Components, Types of fermentors, Control systems in fermentation - pH, Temperature, Oxygen and foam. Computer applications in fermentation technology.

Unit- III
Media for industrial fermentation - submerged and solid state fermentation - Downstream processing - Recovery and purification of intra cellular and extracellular products.

Unit- IV
Microbial production Alcoholic beverages - Wine, beer, ethanol. Organic acids - Citric acid and Acetic acid.

Unit- V

REFERENCES
B Sc MICROBIOLOGY

B.SC. MICROBIOLOGY
SEMESTER VI
SKILL BASED ELECTIVE COURSE
SBEC IV - CLINICAL LAB TECHNOLOGY

Managing Clinical Microbiology Laboratory. Methods of Collection, transport and processing of clinical specimens - Blood, Urine, Sputum, CSF, Pus & Faeces for microbiological examination. Separation of blood and serum.

Unit- II
Examination of urine: sample collection, physical and chemical tests, principles and methods, microscopic examination - crystals, casts, sediments, pregnancy test.

Unit- III

Unit- IV
Laboratory methods in Basic Mycology - Collection and transport of clinical specimens - Microscopy, examination of culture media and incubation, Serological test for fungi. Laboratory methods in basic Virology - Viral culture - Media and cells used - specimen processing - Isolation and identification of Viruses. Viral Serology.

Unit- V

REFERENCES
B.SC. MICROBIOLOGY  
SEMESTER III  
NON MAJOR ELECTIVE COURSE  
NMEC I - PRINCIPLES OF BIOINSTRUMENTATION  

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

Unit- II  
Centrifugation: Principle - types of centrifuges - low speed, high speed, ultra centrifuge, Differential centrifugation - density gradient centrifugation. 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.  

Unit- V  
Colorimetry, Spectrometry - UV & visible spectrophotometer, Flame photometry, FACS. Biosensors.  

REFERENCES  
B.SC. MICROBIOLOGY

SEMESTER III

NON MAJOR ELECTIVE COURSE

NMEC II- MUSHROOM TECHNOLOGY

Introduction-History-Scope and importance of mushroom cultivation. Present status of mushroom industry in India - Mushroom research and development - National and international agencies.

Unit- II

Pure Culture- Media- Preparation and maintenance of mother culture in test tube slants - Petriplates- saline bottle - poly propylene bags. Spawn production - types- methods storage and transportation.

Unit- III


Unit- IV


Unit - V


REFERENCES

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 - Bakers 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

Microorganisms Brewing - Media components, preparation of medium, 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

3. Arora. Entrepreneurial Development in India.
B Sc MICROBIOLOGY

B.SC. MICROBIOLOGY
SEMESTER III
NON MAJOR ELECTIVE COURSE
NMEC IV - ELEMENTAL CONCEPTS OF MICROBIOLOGY


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

B.SC. MICROBIOLOGY

SEMESTER-I

CORE PRACTICAL-I

FUNDAMENTALS OF MICROBIOLOGY

1. Handling of Instruments and Laboratory safety measures.
2. Handling and Maintenance of compound microscope.
4. Staining techniques
   a. Simple
   b. Differential staining (Gram's and Ziehl-Neelsen),
   c. Special staining (Spore and Capsular staining methods),
5. Handling of laboratory instruments
   a. Autoclave
   b. Hot air oven
   c. Laminar air flow
   d. pH meter.
6. Media preparation
   a. Liquid media- Peptone water, Nutrient broth.
   b. Solid media- Nutrient agar (Agar slant, Agar plate)
   c. Enriched Medium- Blood agar
   d. Differential medium - Mac Conkey agar.
   e. Enrichment Medium - Selenite F broth
   f. Selective medium- EMB, MSA.

REFERENCES


B.SC. MICROBIOLOGY

SEMESTER- II

CORE PRACTICAL-II

MICROBIAL PHYSIOLOGY AND DIVERSITY

1. Microscopic examinations of
   a. Algae - Diatoms, Chlamydomonas, Volvox. -Wet mount
   b. Cyanobacteria: Oscillatoria, Nostoc, Anabaena.-Wet mount
   c. Fungi- Mucor spp., Aspergillus spp., Penicillium spp, Alternaria spp & Yeast. LPCB


3. Culture characteristics of Microorganisms- colony morphology, shape, margin.

4. Demonstration of pigment production on Nutrient agar medium (Staphylococcus aureus, Pseudomonas aeruginosa & Serratia)

5. Pure culture techniques- pour plate, streak plate & spread plate.

6. Measurement of microbial growth- turbidity method


8. Neubaur counting chamber.

9. Micrometry (Demonstration).

10. Observation of budding cells of yeast.

REFERENCES


B Sc MICROBIOLOGY

House, publishers and distributors, Chennai


B.Sc. Microbiology
Semester- III
Core Practical-III
Microbial Genetics

1. Observation of mitosis from onion root tip.
2. Isolation of Genomic DNA from Bacteria.
3. Isolation of Genomic DNA from Cyanobacteria.
5. Separation of DNA by Agarose gel Electrophoresis.
6. Isolation of Auxotrophic mutant by replica plate method.
7. Isolation of drug resistant mutants by gradient plate method.
8. Isolation of phage from Sewage (Demonstration)

References

2. Blood grouping - Rh typing - cross matching.
3. Examinations of Blood Cells
   a. Total Count
   b. Differential Count
4. Agglutination reaction
   a. Widal test-slide and tube test b. ASO test
   c. RA test
   d. CRP test
   e. Pregnancy test (Slide and Card test).
5. Precipitation reaction
   a. Ouchterlony double immunodiffusion test.
   b. Counter immunoelectrophoresis.
6. Flocculation-RPR TEST
8. ELISA-HIV/HBSAg (Demonstration).

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.


B.SC. MICROBIOLOGY

SEMESTER - V

CORE PRACTICAL - V

MEDICAL MICROBIOLOGY

1. Staining techniques- Gram's, Ziehl-Neelsen, Capsular, Spore staining.
   Following tests to be performed:- TSI, Indole, MR, VP, Citrate, Urease, Catalase & Oxidase test for
   a. *Staphylococcus aureus*
   b. *Escherichia coli*
   c. *Klebsiella pneumoniae*
   iv) *Salmonella typhi*
   v) *Proteus vulgaris*
   vi) *Psedomonas aeruginosa*
5. Blood smear examination for malarial parasite (*Plasmodium vivax* and *P. malariae*).
6. Examination of Dermatophytes and other fungi by KOH and Lactophenol cotton blue stain.
7. Examination of *Candida albicans* by Gram's stain, Germ tube.
8. Examination of *Cryptococcus neoformans* by Negative staining.
10. Egg inoculation technique- All routes (Demontration).
11. ELISA- HIV/HBSAg

REFERENCES


9. 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.


2. Enumeration of bacteria and fungi from soil.
3. Isolation of Nitrogen fixing bacteria from root nodules of legumes.
4. Isolation of Azospirillum and Azotobacter from Rhizosphere soil.
5. Study of morphology of Cyanobacteria- Oscillatoria, Anabaena.
6. Examination of Mycorrhizae in Maize roots.
7. Standard plate count technique (SPC) Milk and yogurt.
8. Demonstration of cellulose degradation.
10. MPN test.
11. Enumeration of Microbes from air by settle plate method and air sampling device.
13. Isolation of Lactobacilli and Streptococcus lactis from curd.
15. Demonstration of batch fermentation using Erlenmeyer flask.
16. REFERENCES


8. 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.
