

**B.Sc (CBCS) Microbiology – I Year
Semester- I (Discipline Specific Course)
INTRODUCTORY MICROBIOLOGY**

Theory Syllabus

UNIT – I: INTRODUCTION

Microbiology: Definition and scope. History of microbiology: Contribution of Antony Van Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Iwanoswky, Beijernik, Winogradsky and Alexander Fleming.

Microbiological Techniques: Sterilization and Disinfection - Physical methods (dry and moist heat), filtration, radiation. Chemical methods (alcohols, phenols, aldehydes, fumigants)

UNIT – II: MICROSCOPY AND STAINING METHODS

Principles and applications of Microscopy-Bright field, Dark field, Phase-contrast, Fluorescent and Electron microscopy (SEM and TEM). Ocular and stage micrometry.

Principles and types of stains-Simple stain, Differential stain, Negative stain.

Structural stain: spore, capsule, flagella

UNIT – III: CLASSIFICATION, ISOLATION AND IDENTIFICATION OF MICROORGANISMS

Classification of living organisms; Haeckel, Whittaker and Carl Woese systems. Differentiation of prokaryotes and eukaryotes. Classification and identification of bacteria as per the second edition of Bergey's manual of systematic bacteriology. Classification of protozoa, microalgae and fungi.

Growth media – synthetic, semi- synthetic, selective, enrichment and differential media. Isolation of Pure culture techniques - Enrichment culturing, Dilution plating, streak plate, spread plate, Micromanipulator. Preservation of Microbial cultures – Sub culturing, overlaying cultures with minerals oils, sand cultures, lyophilization, storage at low temperature.

UNIT – IV: STRUCTURE AND GENERAL CHARACTERISTICS OF MICROORGANISMS

General characteristics of prokaryotes: Bacteria, Archaea bacteria. Rickettsia, Mycoplasma, Cyanobacteria and Actinomycetes. Ultra-structure of bacterial cell: cell wall, cell membrane, ribosomes, nucleoid, capsule, flagella, fimbriae, endospores & storage granules.

General characteristics of eukaryotes: protozoa, microalgae and fungi.

General characteristics and classification of virus. Morphology and structure of lambdabacteriophage (lytic and lysogeny), TMV and HIV.

References:

1. Michael J. Pelczar, Jr. E.C.S.Chan, Noel R. Krieg Microbiology Tata McGraw- Hill Publisher.
2. Prescott, M.J., Harley, J.P. and Klein Microbiology 5th Edition, WCB Mc GrawHill, New York.
3. Madigan, M.T., Martinkl, J.M and Parker,j. Broch Biology of Microorganism, 9th Edition, MacMillan Press, England.
4. Dube, R.C. and Maheshwari, D.K. General Microbiology S Chand, New Delhi.

Semester- I

INTRODUCTORY MICROBIOLOGY

Practicals

1. Compound microscope and its handling.
2. Sterilization techniques: Autoclave, Hot air oven and filtration
3. Calibration of microscope by ocular , stage micrometer and measurement of bacterial and fungal spores.
4. Simple and differential staining (Gram staining), Spore staining, capsule staining and flagellar staining.
5. Microscopic observation of bacteria (Gram positive bacilli and cocci, Gram negative bacilli), cyanobacteria (Nostoc, Spirulina), fungi (Saccharomyces, Rhizopus, Aspergillus, Penicillium)
6. Bacterial motility: hanging drop method
7. Preparation of culture media: Solid/Liquid.
8. Isolation of bacteria by serial dilution and pure cultures methods (streak, spread and pour plate techniques)
9. Preservation of microbial cultures- Slant, Stab, mineral oil overlay and glycerol stocks
10. Bacterial biochemical identification-IMViC test, carbohydrate fermentation test

References:

1. Experiments in Microbiology by K.R. Aneja.
2. Gopal Reddy.M., Reddy. M.N., Sai Gopal, DVR and Mallaiah K.V. Laboratory Experiments in Microbiology.
3. Dubey, R.C. and Maheshwari, D.K. Practical Microbiology, S. Chand and Co New Delhi.
4. Alcamo, I.E. Laboratory Fundamentals of Microbiology. Jones and Bartlett Publishers, USA.

Semester-II (Discipline Specific Course)
MICROBIAL PHYSIOLOGY & BIOCHEMISTRY

Theory syllabus

UNIT – I: MICROBIAL NUTRITION AND GROWTH

Microbial Nutrition, Uptake of nutrients by cell. Nutritional groups of microorganisms – Autotrophs, Heterotrophs, Mixotrophs, Methylophiles. Photosynthetic apparatus in prokaryotes.

Bacterial growth – Different phases of growth, factors influencing bacterial growth. Synchronous, Continuous, Biphasic Growth. Methods for measuring microbial growth – Direct Microscopic, Viable count, Turbidometry.

UNIT – II: MICROBIAL METABOLISM

Bacterial photosynthesis: Outline of oxygenic and anoxygenic photosynthesis in bacteria.

Microbial respiration – Aerobic: Glycolysis, HMP Pathway, ED Pathway, TCA Cycle and Anaplerotic reactions, Electron transport, Oxidative and Substrate level phosphorylation.

Glyoxylate cycle, Anaerobic respiration (Nitrate and Sulphate).

UNIT – III: BIOMOLECULES

Classification and characteristics of carbohydrates (Monosaccharides, disaccharides and polysaccharides). General characteristics of amino acids and proteins, fatty acids (saturated and unsaturated) and lipids (sphingo lipids, sterols and phospholipids). Structure of nitrogenous bases, nucleotides and nucleic acids.

Properties and Classification of enzymes. Biocatalysis – Induced fit and Lock & Key Model, Coenzymes, Co-factors. Factors effecting enzyme activity.

UNIT – IV: BIOCHEMICAL TECHNIQUES

Hydrogen ion concentration in biological fluids. pH measurement. Types of buffers and their uses in biological reactions. Principles and application of colorimetry and chromatography (paper and thin layer). Principles and applications of Electrophoretic techniques- Agarose gel electrophoresis and SDS PAGE

References:

1. Michael J. Pelczar, Jr. E.C.S.Chan, Noel R. Krieg Microbiology Tata McGraw- Hill Publisher.
2. Prescott, M.J., Harley, J.P. and Klein Microbiology 5th Edition, WCB Mc GrawHill, New York.
3. Madigan, M.T., Martinkl, J.M and Parker, J. Broch Biology of Microorganism, 9th Edition, MacMillan Press, England.
4. Dube, R.C. and Maheshwari, D.K. General Microbiology S Chand, New Delhi.
5. Voet, D Biochemistry WCB. Mc GrawHill, Iowa.
6. N.J. Dimmock, A.J Easton, and K.N. Leppard. Introduction to Modern Virology. Blackwell Publishing.

Semester-II (Discipline Specific Course)
MICROBIAL PHYSIOLOGY & BIOCHEMISTRY

Practicals

1. Setting up of Winogradsky's column
2. Cultivation of photosynthetic bacteria
3. Determination of viable count of bacteria
4. Turbidometric measurement of bacterial growth curve
5. Factors affecting bacterial growth – pH, temperature, salts
6. Qualitative tests for carbohydrates and amino acids
7. Determination of pH
8. Preparation of Buffers
9. Colorimetry - Principles, laws, determination of absorption maxima
10. Paper chromatography-separation of sugars/amino acids

References:

1. Experiments in Microbiology by K.R. Aneja.
2. Gopal Reddy.M., Reddy. M.N., Sai Gopal, DVR and Mallaiah K.V. Laboratory Experiments in Microbiology.
3. Dubey, R.C. and Maheshwari, D.K. Practical Microbiology, S. Chand and Co New Delhi.
4. Alcamo, I.E. Laboratory Fundamentals of Microbiology. Jones and Bartlett Publishers, USA.
5. Mahy, B.W.J. and Kangro, H.O. Virology – Methods Manual Academic Press, USA.
6. Burleson et al Virology – A Laboratory Manual. Academic Press, USA.

Semester-III – (Discipline Specific Course)
MEDICAL MICROBIOLOGY & BASICS OF IMMUNOLOGY

Theory syllabus

UNIT – I: MEDICAL BACTERIOLOGY

1. History of Medical Microbiology. Normal flora of human body.
2. Host pathogen interactions. Bacterial toxins, virulence and attenuation. Antimicrobial resistance. Air-borne diseases – Tuberculosis. Food and water-borne diseases - Cholera, Typhoid.
3. Contact diseases - Syphilis, Gonorrhoea. General account of nosocomial infections.

UNIT – II: MEDICAL VIROLOGY AND PARASITOLOGY

1. Air borne diseases – Influenza. Food and water-borne diseases – Poliomyelitis, Amoebiasis.
2. Insect-borne diseases - Malaria, Dengue fever. Zoonotic diseases – Rabies
3. Viral diseases - Hepatitis B, HIV, SARS, MERS;

UNIT-III: INTRODUCTION OF IMMUNOLOGY

1. History of Immunology, Cells and Organs of the immune system – Primary and Secondary lymphoid organs. Function of B and T lymphocytes. Natural Killer cells, Polymorphonuclear cells.
2. Structure and Classification of Antigens, Factors affecting antigenicity. Antibodies: Basic structure, Types of properties and functions of immunoglobulins
3. Types of Immunity: Innate and Acquired Immunity, Humoral and cell-mediated immune response.

UNIT-IV: IMMUNOLOGICAL DISORDERS AND AG-AB REACTIONS

1. Types of hyper sensitivity reactions – Immediate and delayed. Systemic and Localized autoimmune disorders. Complement pathways - Classical and Alternative pathways.
2. Types of antigen-antibody reactions – Agglutinations, Precipitation, Neutralization, Blood groups.
3. Complement fixation Test. Labeled antibody based techniques – ELISA, RIA and immunofluorescence; Polyclonal and Monoclonal antibodies production and application.

Semester-III (Discipline Specific Course)
MEDICAL MICROBIOLOGY & BASICS OF IMMUNOLOGY

Practical syllabus

1. Enumeration of RBC and WBC
2. Estimation of blood haemoglobin.
3. Determination of blood groups and Rh typing.
4. Isolation and identification of medically important bacteria by cultural, microscopic and biochemical tests.
5. Antibiotic sensitivity testing – disc diffusion method.
6. Parasites – Malarial parasite, *Entamoeba* (study of permanent slides).
7. Tests for disinfectant (Phenol coefficient).
8. Typing of human blood groups-slide agglutination
9. Estimation of hemoglobin content of human blood
10. Preparation of blood smear and different blood cell count
11. RBC count
12. WBC count
13. Differential staining of WBC by Leishman's stain
14. Widal-slide agglutination test
15. RPR card test for syphilis
16. Tridot test
17. Tube flocculation test

References:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education
5. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition.
6. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
7. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
8. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
9. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
10. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinburgh.

MICROBIAL DIAGNOSIS IN HEALTH CLINICS

Theory syllabus

UNIT - I

1. Importance of diagnosis of diseases: Bacterial, Viral, Fungal and Protozoan diseases of various human body systems. Clinical samples for diagnosis of infectious disease.
2. Collection of Clinical Samples: How to collect clinical samples (oral cavity, throat, skin, Blood, CSF, urine and faeces) and precautions required.
3. Method of transport of clinical samples to laboratory and storage.

UNIT – II

1. Microscopic examination and culture methods: Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa-stained thin blood film for malaria.
2. Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar.
3. Serological diagnostic methods: Serological Methods - Agglutination, Precipitation.

References:

1. Ananthanarayan R and Paniker CKJ (2009) Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
3. Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd.
4. Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby.

FUNDAMENTALS OF BIOINFORMATICS

Theory syllabus

UNIT – I

1. Introduction to Bioinformatics: Bioinformatics – Definition and Applications
2. Information Flow in Biology, DNA Structure, RNA Structure, Protein Structure,
3. Genomes (Prokaryotic and Eukaryotic), Genome sequencing.

UNIT – II

1. Introduction of Bioinformatics and Molecular Databases,
2. Primary Databanks – NCBI, EMBL, DDBJ, Secondary Database – UNIPROT.
3. Structural Database – PDB, Database similarity search (FASTA, BLAST)
4. Alignment: Pairwise and Multiple sequence alignment; Whole genome sequence; Genome Annotation and Gene prediction; Primer Designing; Phylogenetic analysis and Tree construction.

References:

1. Saxena Sanjay (2003) A First Course in Computers, Vikas Publishing House
2. Pradeep and Sinha Preeti (2007) Foundations of Computing, 4th ed., BPB Publications
3. Lesk M.A. (2008) Introduction to Bioinformatics. Oxford Publication, 3rd International Student Edition
4. Rastogi S.C., Mendiratta N. and Rastogi P. (2007) Bioinformatics: methods and applications, genomics, proteomics and drug discovery, 2nd ed. Prentice Hall India Publication
5. Primrose and Twyman (2003) Principles of Genome Analysis & Genomics. Blackwell
6. Ghosh, Z. and Mallick, V. (2008) Bioinformatics- Principles and Applications. Oxford University Press.

B. Sc (CBCS) Microbiology – II Year
Semester-IV – (Discipline Specific Course)
MOLECULAR BIOLOGY AND MICROBIAL GENETICS

Theory syllabus

UNIT – I

1. Overview of prokaryotic and eukaryotic cells, cell size and shape, Eukaryotic and prokaryotic Cell organelles, Cell division (mitosis and Meiosis)
2. Fundamentals of genetics - Mendelian laws, alleles, crossing over, and linkage. DNA and RNA as genetic materials.
3. Structure of DNA – Watson and Crick model. Extrachromosomal genetic elements – Plasmids and transposons. Replication of DNA – Semiconservative mechanism.

UNIT – II

1. Brief account on horizontal gene transfer among bacteria – transformation, transduction and conjugation.
2. Mutations – spontaneous and induced, base pair changes, frameshifts, deletions, inversions, tandem duplications, insertions. Physical and chemical mutagens.
3. Outlines of DNA damage and repair mechanisms.

UNIT – III

1. Concept of gene – Muton, recon and cistron. One gene-one enzyme, one gene-one polypeptide, one gene-one product hypotheses.
2. Types of RNA and their functions. Outlines of RNA biosynthesis in prokaryotes.
3. Genetic code. Structure of ribosomes and a brief account of protein synthesis.

UNIT – IV

1. Types of genes – structural, constitutive, regulatory. Operon concept. Regulation of gene expression in bacteria – *lac* operon.
2. Basic principles of genetic engineering - restriction endonucleases, DNA polymerases and ligases, vectors. Outlines of gene cloning methods. Genomic and cDNA libraries.
3. General account on application of genetic engineering in industry, agriculture and medicine.

B. Sc (CBCS) Microbiology – II Year
Semester-IV (Discipline Specific Course)
MOLECULAR BIOLGY AND MICROBIAL GENETICS

Practical syllabus

1. Estimation DNA by diphenylamine (DPA) method.
2. Estimation of RNA by orcinol method
3. Study of cell division in onion root tip (mitotic divisions)
4. Isolation of DNA from bacteria.
5. Isolation of mutants of bacteria by UV exposure.
6. Problems related to Mendelian laws mono and dihybrid cross (problems)
7. Problems related to gene interactions
8. Problems related to DNA and RNA characteristics, Transcription and Translation.

References:

1. Genes XI, Author- B. Lewin.
2. Principles of Genetics, Authors- Gardner, Simmons and Snustad.
3. Concepts of Genetics, Authors- Klug and Cummings.
4. Microbial Genetics, Authors- Freifelder.
5. Genetics, Authors- Arora and Sandhu.
6. Text of Microbiology, Authors- Ananthanarayanan and Paniker.
7. S R Maloy, D Freifelder and J E Cronan. Microbial Genetics. Jones and Barlett Publishers.

**B. Sc (CBCS) Microbiology – II Year
SEMESTER – IV - SEC-3
MICROBIAL QUALITY CONTROL IN FOOD AND
PHARMACEUTICAL INDUSTRIES**

Theory syllabus

UNIT – I

1. Microbiological Laboratory and Safe Practices: Good laboratory practices, Good microbiological practices.
2. Biosafety cabinets – Working of biosafety cabinets, using protective clothing, specification for BSL-1, BSL-2, BSL-3.
3. Discarding biohazardous waste – Methodology of Disinfection, Autoclaving & Incineration.

UNIT – II

1. Determining Microbes in Food / Pharmaceutical Samples: Culture and microscopic methods - Standard plate count, Most probable numbers, Direct microscopic counts,
2. Biochemical and immunological methods: Limulus lysate test for endotoxin, gel diffusion, sterility testing for pharmaceutical products.
3. Molecular methods - Nucleic acid probes, PCR based detection, biosensors.

References:

1. Harrigan WF (1998) Laboratory Methods in Food Microbiology, 3rd ed. Academic Press.
2. Garg N, Garg KL and Mukerji KG (2010) Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.
3. Jay JM, Loessner MJ, Golden DA (2005) Modern Food Microbiology, 7th edition. Springer.
4. Baird RM, Hodges NA and Denyer SP (2005) Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis Inc.

UNIT-I

- 1 Introduction to mushroom cultivation, Importance and History of mushroom cultivation in India
- 2 Global status of mushroom production
- 3 Edible mushrooms (White button oyster, Paddy straw).Nutritional value and health benefits of mushrooms.

UNIT – II

- Steps in mushroom cultivation
 1. Selection of site and types of mushroom. Mushroom farm structure, design layout. Principle and techniques of compost and composting.
 2. Principle of spawn production. Casing and crop production.
 3. Harvesting and marketing. Entrepreneurship development in Mushroom cultivation
- Pest and pathogens of mushrooms
- Post harvest handling and preservation of mushrooms.

References:

1. Changs. T. W.A. Hayanes 1978. "Biology and cultivation of Mushrooms" AcadPress.N.Y.
2. Zadrazil. F & K. Grabbe 1983 "Edible Mushroom, Biotechnology" Vol. 3, Weinheim: Verlag Chemie, Berlin.
3. Kannaiyan. 2001. Handbook of Edible Mushrooms" TNAU Publication.

Theory syllabus

UNIT – I

1. Microscopy: Brightfield and darkfield microscopy, Fluorescence Microscopy, Phase contrast Microscopy.
2. Electron Microscopy (Scanning and Transmission Electron Microscopy).
3. Biophysical Principles: Osmosis, osmotic pressure, Donan equilibrium, diffusion potential, diffusion coefficient, endocytosis & exocytosis, gradient of chemical potential as driving force in transport, membrane potential & ionophores.

UNIT - II

1. Chromatography: Principles and applications of paper chromatography (including Descending and 2-D), Thin layer chromatography. Column packing and fraction collection.
2. Gel filtration chromatography, ion-exchange chromatography and affinity chromatography, GLC, HPLC.
3. Sedimentation and filtration.

UNIT - III

1. Electrophoresis: Principle and applications of native polyacrylamide gel electrophoresis.
2. SDS- polyacrylamide gel electrophoresis, 2D gel electrophoresis. Isoelectric focusing, Zymogram preparation and Agarose gel electrophoresis.
3. Spectrophotometry: Principle and use of study of absorption spectra of biomolecules. Analysis of biomolecules using UV and visible range. Colorimetry and turbidometry.

UNIT - IV

1. Centrifugation: Principle, working and applications of centrifuge. Preparative and analytical centrifugation, fixed angle and swinging bucket rotors.
2. RCF and sedimentation coefficient, differential centrifugation, density gradient centrifugation and ultracentrifugation.
3. Fundamental of Radioactivity: Radioactive & non radioactive isotopes, Laws of Radioactivity, Half life & Average life, types of radiation (α , β , γ radiations) application of radioactive isotopes in biology.

Theory syllabus

UNIT – I

1. Introduction to Industrial microbiology: Brief history and developments in industrial microbiology.
2. Types of fermentation processes - solid state, liquid state, batch, fed-batch and continuous.
3. Types of fermenters – laboratory, pilot-scale and production fermenters. Components of a typical continuously stirred tank bioreactor.

UNIT - II

1. Isolation of industrial strains and fermentation medium: Primary and secondary screening. Preservation and maintenance of industrial strains.
2. Ingredients used in fermentation medium - molasses, corn steep liquor, whey & yeast extract.
3. Microbial fermentation processes: Downstream processing - filtration, centrifugation, cell disruption, solvent extraction.

UNIT - III

1. Microbial production of industrial products - citric acid, ethanol and penicillin.
2. Food as a substrate for microbial growth: Intrinsic and extrinsic parameters that affect microbial growth in food.
3. Microbial spoilage of food - milk, egg, bread and canned foods.

UNIT - IV

1. Principles and methods of food preservation and food sanitation: Physical methods - high temperature, low temperature, irradiation, aseptic packaging. Chemical methods - salt, sugar, benzoates, citric acid, ethylene oxide, nitrate and nitrite.
2. Dairy products, probiotics and Food-borne Diseases: Fermented dairy products yogurt, acidophilus milk, kefir, dahi and cheese.
3. Probiotics definition, examples and benefits.

Practical syllabus

1. Microbial fermentation for the production and estimation of amylase.
2. Microbial fermentation for the production and estimation of citric acid.
3. Microbial fermentation for the production and estimation of ethanol.
4. Determination of the microbiological quality of milk sample by MBRT.
5. Isolation of fungi from spoilt bread/fruits/vegetables.
6. Preparation of yogurt.

References:

7. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd Edition. Panima Publishing Company, New Delhi.
8. Patel AH. (1996). Industrial Microbiology .1st Edition. MacMillan India Limited Publishing Company Ltd. New Delhi, India.
9. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An introduction.9th Edition. Pearson Education.
10. Willey JM, Sherwood LM AND Woolverton CJ (2013), Prescott, Harley and Klein's Microbiology.9th Edition. McGraw Hill Higher education.
11. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
12. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
13. Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
14. Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.
15. Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
16. Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India.

B. Sc (CBCS) Microbiology – III Year
Semester-V – (Generic Elective)
MICROBIOLOGY AND HUMAN HEALTH

Theory syllabus

UNIT-I: INTRODUCTION

1. History development of Microbiology: Contributions of Van Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch.
2. Types of Microorganisms, Morphological characteristics of bacteria,
3. Staining, cultivation methods of bacteria, Culture Media used for the growth of microorganisms.

UNIT-II: MIROORGANISMS: GOOD AND BAD

1. Microorganisms related to human health. Normal microflora, Human micro biome concept.
2. Bacterial diseases: Typhoid, Tuberculosis, Syphilis.
3. Viral diseases: Flu, SARS, MERS, SARS-CoV-2, HIV. Insect borne: Malaria and Dengue.

UNIT – III: IMMUNITY AND HELATH

1. Introduction to immune system: Understanding the terms: Disease, Infection, Pathogenicity, Prophylaxis, Host resistance.
2. Innate immunity and acquired immunity, Epidemics, Endemics and Pandemics.
3. Importance of probiotics and vaccines for human health.

UNIT - IV

1. Health hazards associated with damage of industrial and biomedical waste.
2. National and international guidelines for the disposal of waste. Guidelines of Central Pollution Control Board (CPCB).
3. Safe disposal and pretreatment of wastes. Mechanical and chemical treatment of the waste. Autoclaving, incineration.

References:

1. Michael J. Pelczar. Jr. E.C.S.Chan, Noel R. Krieg Microbiology Tata Mc Grew-Hill Publisher.
2. Prescott, M.J., Harley, J.P. and Klein Microbiology 5th Edition, WCB Mc GrawHill, New York.
3. Madigan, M.T., Matinkl, J.M and Parker J. Broch Biology of Microorganism. 9th Editio, Macmillan Press, England.
4. Dube, R.C and Maheshwari, D.K General Microbiolgy S Chand, New Delhi.
5. Ananthanarayan and Panikar. Text book of Microbiology, Universities Press.

B. Sc (CBCS) Microbiology – III Year Semester-VI – (Discipline Specific Elective) CELL BIOLOGY

Theory syllabus

UNIT – I

1. Structure of Cell: Plasma membrane: Structure and transport of small molecules.
2. Cell Wall: Eukaryotic cell wall, extracellular matrix and cell matrix interactions, cell-cell Interactions - adhesion junctions, tight junctions, gap junctions, and plasmodesmata (only structural aspects).
3. Mitochondria, chloroplasts and peroxisomes.

UNIT - II

1. Cytoskeleton: Structure and organization of actin filaments, association of actin filaments with plasma membrane, cell surface protrusions, intermediate filaments, microtubules.
2. Nucleus: Nuclear envelope, nuclear pore complex and nuclear lamina. Chromatin – Molecular organization. Nucleolus.
3. Protein targeting and Transport

UNIT - III

1. Golgi Apparatus – Organization, protein glycosylation, protein sorting and export from Golgi Apparatus. Lysosomes.
2. Cell Signaling: Signaling molecules and their receptors. Function of cell surface receptors.
3. Pathways of intracellular receptors – Cyclic AMP pathway, cyclic GMP and MAP kinase pathway.

UNIT - IV

1. Cell Cycle, Cell Death and Cell Renewal: Eukaryotic cell cycle and its regulation, Mitosis and Meiosis.
2. Development of cancer, causes, types, Diagnosis and therapy. Programmed cell death.
3. Stem cells. Types: Embryonic stem cell, induced pluripotent stem cells.

**B. Sc (CBCS) Microbiology – III Year
Semester-VI – A (Discipline Specific Elective)
CELL BIOLOGY**

Practical syllabus

1. Study a representative plant and animal cell by microscopy.
2. Cytochemical staining of DNA – Feulgen.
3. Study of polyploidy in Onion root tip by colchicine treatment.
4. Identification and study of cancer cells by photomicrographs.
5. Study of cell division in onion root tip (mitotic divisions)
6. Study of different stages of Mitosis.
7. Study of different stages of Meiosis by permanent slides.

References:

1. Hardin J, Bertoni G and Kleinsmith LJ. (2010). Becker's World of the Cell. 8th edition. Pearson.
2. Karp G. (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
3. De Robertis, EDP and De Robertis EMF. (2006). Cell and Molecular Biology. 8th edition. Lipincott Williams and Wilkins, Philadelphia.
4. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. 5th Edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

**B. Sc (CBCS) Microbiology – III Year
SEMESTER – VI - C
ENVIRONMENTAL MICROBIOLOGY**

Theory syllabus

UNIT - I

1. Aero microbiology: Bioaerosols, Air borne microorganisms (bacteria, Viruses, fungi).
2. Impact of air borne microorganisms on human health and environment.
3. Significance of air borne microorganisms in food and pharma industries and operation theatres, allergens.

UNIT - II

1. Air sample collection and analysis: Bioaerosol sampling, air samplers, methods of analysis, CFU.
2. Culture media for bacteria and fungi, Identification characteristics.
3. Control measures: Fate of bioaerosols, inactivation mechanisms – UV light, HEPA filters, desiccation, Incineration.

UNIT - III

1. Water Microbiology: Water borne pathogens.
2. Water borne diseases.
3. Microbiological analysis of water: Sample Collection, Treatment and safety of drinking (potable) water.

UNIT - IV

1. Methods to detect potability of water samples: Standard qualitative procedure: presumptive test(MPN test), confirmed and completed tests for faecal coliforms
2. Membrane filter technique and Presence/absence tests.
3. Control measures: Precipitation, chemical disinfection, filtration, high temperature, UV light.

References:

1. Da Silva N, Taniwaki MH, Junqueira VC, Silveira N, Nascimento MS, Gomes RAR (2012) Microbiological Examination Methods of Food and Water-A Laboratory Manual, CRC Press
2. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA.
3. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press.
4. Hurst CJ, Crawford RL, Garland JL, Lipson DA (2007) Manual of Environmental Microbiology, 3rd edition, ASM press.

**B. Sc (CBCS) Microbiology – III Year
SEMESTER – VI - C
ENVIRONMENTAL MICROBIOLOGY**

Practicals

1. Determination of Biochemical Oxygen Demand (BOD) of sewage water
2. Determination of Chemical Oxygen Demand (COD) of industrial waste water
3. Bacteriological examination of water using multiple tube fermentation test: presumptive test, confirmed test and completed coli form test
4. Analysis of Air Microflora

**B. Sc (CBCS) Microbiology – III Year
SEMESTER – VI
PROJECT**

Guidelines:

1. Number of students who will be offered project work will vary batch to batch depending upon the infrastructural facilities and may vary each year (Not exceeding 5 students per group)
2. Project work will involve experimental work and the student will have to complete this in stipulated time.
3. The final evaluation of the project work will be through a Panel involving internal and external examiners.
4. Students will be asked their choice for Project work at the beginning of VI semester and all formalities of topic and mentor selection will be completed.

Project work will be offered in lieu of expertise and infrastructural facilities of the department and will be evaluated for credits.

5. The distribution of marks for project work will be:

Project work: 100 Marks (80 marks for Project evaluation, 20 marks for Viva Voce)