

PROPOSED SYLLABUS (2019-20) for B.Sc Microbiology
Code: BS 104, DSC

B.Sc I year: I Semester Paper-I Theory

Paper Title: Introductory Microbiology

4HPW-credits: 4

1st Credit: 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)

2nd Credit: 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

3rd Credit: 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.

4th Credit: 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 lambda bacteriophage (lytic and lysogeny), TMV and HIV.

Title: Microbial Physiology and Biochemistry

4HPW-credits-4

1st Credit: Microbial nutrition and growth

Microbial Nutrition, Uptake of nutrients by cell. Nutritional groups of microorganisms – Autotrophs, Heterotrophs, Mixotrophs, Methylophils. 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.

2nd Credit: 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).

3rd Credit: 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.

4th Credit: 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.

MEDICAL MICROBIOLOGY & BASICS OF IMMUNOLOGY

(PAPER - III: Discipline Specific Course)

Theory: 4 Hours/Week; Credits: 4 Marks: 100 (Internal: 20; External: 80)
Practical: 3 Hours/Week Credits: 1 Marks: 25

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.

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.

KAKATIYA UNIVERSITY - WARANGAL - TELANGANA
Under Graduate Courses (Under CBCS 2020 – 2021 onwards)
B.Sc. MICROBIOLOGY II Year
SEMESTER – IV

MOLECULAR BIOLOGY AND MICROBIAL GENETICS
(PAPER – IV: Discipline Specific Course)

Theory:	4 Hours/Week;	Credits: 4	Marks: 100 (Internal: 20; External: 80)
Practical:	3 Hours/Week	Credits: 1	Marks: 25

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.

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.



KAKATIYA UNIVERSITY
B. Sc (CBCS) Microbiology – III Year
Semester-V – B (Discipline Specific Elective)
INDUSTRIAL AND FOOD MICROBIOLOGY

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.

KAKATIYA UNIVERSITY
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.