Dr. V. S. KRISHNA GOVT. DEGREE COLLEGE (AUTONOMOUS)
MADDILAPALEM, VISAKHAPATNAM

B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2018 - 19)

FIRST YEAR – SEMESTER- I

PAPER – 1A INTRODUCTORY MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 60 **CREDITS: 3**

Course outcomes: Upon completion of the course, the student will be able to achieve the following outcomes.

CO1: Gain knowledge about the origins of microbiology discipline, relationship between microorganisms and disease, major contributions of important microbiologists to the field of microbiology and different classification system of bacteria.

CO2: Understand the morphological, physiological and biochemical properties of different groups of microorganisms like bacteria, archaea, cyanobacteria and viruses.

CO3: Able to identify a microorganism as bacteria, fungi, algae and protozoa and operate the microscope independently.

CO4: Apply the principles of staining techniques to distinguish different groups of microorganisms and plan a suitable physical and chemical methods of sterilization in creating the aseptic environment.

CO5: Design suitable methods for isolation of microbes from different environments by applying the principles of pure culture and enrichment methods.

UNIT-I **No. of hours: 12**

History and mile stones in microbiology.
Contributions of Anton von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Ivanowsky.
Importance and applications of microbiology.

Classification of microorganisms – Haeckel's three Kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese.
Outline classification of bacteria as per the second edition of Bergey's Manual of Systematic Bacteriology.

UNIT – II **No. of hours: 12**

General characteristics of Bacteria, Archaea, Mycoplasmas and Cyanobacteria.
Ultrastructure of Prokaryotic cell- Variant components and invariant components.
General characteristics of viruses.
Morphology, Structure and replication of TMV and HIV.

UNIT-III **No. of hours: 12**

General characteristics and outline classification of Fungi, Algae and Protozoa.
Principles of microscopy - Bright field and Electron microscopy (SEM and TEM).

UNIT IV **No. of hours: 12**

Staining Techniques –Simple and Differential (Gram Staining and Spore Staining).
Sterilization and disinfection techniques - Physical methods – autoclave, hot- air oven, pressure cooker, laminar air flow, filter sterilization, Radiation methods – UV rays, Gamma rays.
Chemical methods – alcohols, aldehydes, fumigants, phenols, halogens and hypochlorites.

UNIT –V **No. of hours: 12**

Isolation of Microorganisms from natural habitats.
Pure culture techniques – dilution-plating, Streak-plate, Spread-plate, Pour-Plate and micromanipulator. Enrichment culturing.
Preservation of microbial cultures – subculturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature.

PRACTICAL-1A INTRODUCTORY MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 45 **CREDITS: 2**

Course outcomes: Upon completion of the practical course, the student will be able to achieve the following outcomes.

CO1: Explain good laboratory practices in microbiology and classify different biosafety levels.
CO2: Learn the principles and procedures of media preparation for cultivation of bacteria and fungi.
CO3: Select suitable method for achieving sterilization of culture media, glassware, antibiotics etc.
CO4: Apply the staining principles for visualizing the gram-positive, gram-negative bacteria, fungi and protozoa.
CO5: Employ suitable pure culture and enrichment techniques for isolation of microorganisms from clinical or environmental samples.

List of experiments:

1. Microbiology Good Laboratory Practices and Biosafety.
2. Preparation of culture media for cultivation of bacteria
3. Preparation of culture media for cultivation of fungi
4. Sterilization of medium using Autoclave
5. Sterilization of glassware using Hot Air Oven
6. Light compound microscope and its handling

7. Simple staining
8. Gram's staining
9. Hanging-drop method.
10. Isolation of pure cultures of bacteria by streaking method.

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B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2018 - 19)
FIRST YEAR –SEMESTER- II

PAPER-1B MICROBIAL BIOCHEMISTRY & METABOLISM

TOTAL HOURS: 60 **CREDITS: 3**

Course outcomes: Upon completion of the course, the student will be able to achieve the following outcomes.

CO1: Describe different classes of macromolecules such as carbohydrates, lipids, proteins and nucleic acids, classify them and understand their functions.

CO2: Understand the principles and instrumentation for colorimetry, spectrophotometry, chromatography, centrifugation and electrophoresis.

CO3: Explain enzyme properties and factors affecting the enzyme activity and role of cofactors in defining the enzymatic activity.

CO4: Illustrate different nutritional groups of microorganisms, growth requirements of microbes, different stages of microbial growth and factors affecting the microbial growth.

CO5: Explain different life processes such as aerobic and anaerobic respiration, fermentation, oxygenic and anoxygenic photosynthesis.

UNIT-I **No. of hours: 12**

Outline classification and general characteristics of carbohydrates (monosaccharides, disaccharides and polysaccharides).
General characteristics of amino acids and proteins.
Structure of nitrogenous bases, nucleotides, nucleic acids.
Fatty acids (saturated and unsaturated), lipids (spingolipids,)

UNIT-II **No. of hours: 12**

Principle and applications of - Colorimetry
Chromatography (paper, thin-layer and column),
Spectrophotometry (UV & visible), Centrifugation and Gel Electrophoresis.

UNIT-III **No. of hours: 12**

Properties and classification of Enzymes.
Biocatalysis- induced fit and lock and key models.
Coenzymes and Cofactors.
Factors affecting catalytic activity.
Inhibition of enzyme activity- competitive, noncompetitive, uncompetitive and allosteric.

UNIT-IV **No. of hours: 12**

Microbial Nutrition –Nutritional requirements and uptake of nutrients by cells.
Nutritional groups of microorganisms- autotrophs, heterotrophs, mixotrophs.
Growth media- synthetic, complex, selective, enrichment and differential media.
Microbial Growth- different phases of growth in batch cultures, Synchronous, continuous, biphasic growth. Factors influencing microbial growth. Methods for measuring microbial growth – Direct microscopy, viable count estimates, turbiodometry and biomass.

UNIT-V **No. of hours: 12**

Aerobic respiration -Glycolysis, HMP path way, ED path way, TCA cycle, Electron transport, oxidative and substrate level phosphorylation. Anaerobic respiration (Nitrate).
Fermentation - Alcohol and lactic acid fermentations.
Outlines of oxygenic and anoxygenic photosynthesis in bacteria.

PRACTICAL-1B MICROBIAL BIOCHEMISTRY & METABOLISM

TOTAL HOURS: 45 **CREDITS: 2**

Course outcomes: Upon completion of the practical course, the student will be able to achieve the following outcomes.

CO1: Perform different colorimetry experiments for quantification of macromolecules by methods such as Lowry's, Biuret or diphenylamine method.

CO2: Learn paper chromatography for separation of amino acids, pigments and other biological molecules.

CO3: Undertake experiments to prepare natural and synthetic media and measure microbial growth such as plate count, turbidometry.

CO4: Design an experiment for preparation of microbial growth curve.

CO5: Plan experiments to check the influence the effects of physical parameters on microbial growth.

List of experiments:

1. Colorimetric estimation DNA by diphenylamine method
2. Colorimetric estimation of proteins by Biuret/Lowry method
3. Paper chromatographic separation of amino acids.
4. Preparation of different media- Synthetic and Complex Media
5. Setting and observation of Winogradsky column.
6. Estimation of CFU count by spread plate method/pour plate method.
7. Bacterial growth curve.
8. Factors affecting bacterial growth – pH.
9. Factors affecting bacterial growth – Temperature.
10. Factors affecting bacterial growth –Salts

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B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2018 - 19)
SECOND YEAR – SEMESTER- III

PAPER-2A MICROBIAL GENETICS AND MOLECULAR BIOLOGY

TOTAL HOURS: 60 **CREDITS: 3**

Course outcomes: Upon completion of the course, the student will be able to achieve the following outcomes.

CO1: Understand the importance of DNA and RNA in inheritance, DNA organization, replication and extrachromosomal elements.

CO2: Explain mutations, mutation types, different types of mutagens and list out different DNA repair mechanisms.

CO3: Compare and contrast concepts such as gene, cistron, muton, recon, enzyme, polypeptide etc. one gene – enzyme vs one gene – one polypeptide hypothesis.

CO4: Illustrate different classes of genes, outline the steps involved in transcription and translation mechanisms and gene regulatory mechanisms.

CO5: Examine the applications of vectors, DNA modifying enzymes, polymerase chain reaction and creating of genomic and cDNA libraries in gene cloning.

UNIT-I **No. of hours: 12**

DNA and RNA as genetic material.
Structure and organization of prokaryotic DNA.
Extrachromosomal genetic elements – Plasmids and transposons.
Replication of DNA – Semi conservative mechanism, Enzymes involved in replication.

UNIT-II **No. of hours: 12**

Mutations – spontaneous and induced, base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions.
Mutagens - Physical and Chemical mutagens.
Outlines of DNA damage and repair mechanisms.
Genetic recombination in bacteria – Conjugation, Transformation and Transduction.

UNIT-III **No. of hours: 12**

Concept of gene – Muton, Recon and Cistron. One gene one enzyme and one gene one polypeptide hypotheses.
Types of RNA and their functions. Genetic code. Structure of ribosomes.

UNIT-IV **No. of hours: 12**

Types of genes – structural, constitutive, regulatory
Protein synthesis – Transcription and translation.
Regulation of gene expression in bacteria – *lac* operon.

UNIT-V **No. of hours: 12**

Basic principles of genetic engineering.
Restriction endonucleases, DNA polymerases and ligases.
Vectors.
Outlines of gene cloning methods.
Polymerase chain reaction. Genomic and cDNA libraries.
General account on application of genetic engineering in industry, agriculture and medicine.

PRACTICAL-2A MICROBIAL GENETICS AND MOLECULAR BIOLOGY

TOTAL HOURS: 45 **CREDITS: 2**

Course outcomes: Upon completion of the practical course, the student will be able to achieve the following outcomes.

CO1: Create the DNA, RNA models using ball and stick or paper cuttings

CO2: Design a suitable experiment to isolate genomic DNA from microorganisms

CO3: Understand the principles of electrophoresis and DNA staining by dyes for visualization.

CO4: Plan an experiment to induce mutations in microorganisms using physical mutagens such as UV radiation

CO5: Explain the principle and working of instruments such as centrifuge and thermal cycler.

List of experiments:

1. Study of different types of DNA and RNA using micrographs and model / schematic representations
2. Study of semi-conservative replication of DNA through micrographs / schematic representations
3. Isolation of genomic DNA from *E. coli*
4. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
5. Problems related to DNA and RNA characteristics, Transcription and Translation.
6. Induction of mutations in bacteria by UV light.
7. Instrumentation in molecular biology – Ultra centrifuge, Transilluminator, PCR

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SECOND YEAR – SEMESTER- IV

PAPER-2B IMMUNOLOGY AND MEDICAL MICROBIOLOGY

TOTAL HOURS: 60 **CREDITS: 3**

Course outcomes: Upon completion of the course, the student will be able to achieve the following outcomes.

CO1: Acquire knowledge about immune system, types of immunity, cells of immune system and role of lymphoid organs in immunity.

CO2: Understand the concepts of antigen, antibody, haptens, and different types of antigen – antibody reactions.

CO3: Explain the concepts in clinical microbiology and use procedures such as sample collection, storage, processing and apply culture based, biochemical, molecular tools for disease diagnosis.

CO4: Apply the principles of antimicrobial resistance and use suitable methods to detect the antimicrobial resistance in microorganisms.

CO5: Describe the epidemiological principles and pathogenesis, symptoms, diagnosis and treatment of various infectious diseases.

UNIT-I **No. of hours: 12**

Types of immunity – innate and acquired; active and passive; humoral and cell-mediated immunity.
Primary and secondary organs of immune system – thymus, bursa fabricus, bone marrow, spleen and lymph nodes. Cells of immune system. Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils.

UNIT-II **No. of hours: 12**

Antigens – types, chemical nature, antigenic determinants, haptens. Factors affecting antigenicity.
Antibodies – basic structure, types, properties and functions of immunoglobulins.
Types of antigen-antibody reactions - Agglutinations, Precipitation, Neutralization, complement fixation, blood groups. Labeled antibody-based techniques – ELISA, RIA and Immunofluorescence. Polyclonal and monoclonal antibodies – production and applications.
Concept of hypersensitivity and Autoimmunity.

UNIT-III **No. of hours: 12**

Normal flora of human body. General account on nosocomial infection.
Host pathogen interactions: infection, invasion, pathogen, pathogenicity, virulence and opportunistic infection.
General principles of diagnostic microbiology- collection, transport and processing of clinical samples.
General methods of laboratory diagnosis - cultural, biochemical, serological and molecular methods.

UNIT-IV **No. of hours: 12**

Antibacterial Agents- Penicillin, Streptomycin and Tetracycline.
Antifungal agents – Amphotericin B, Griseofulvin
Antiviral substances - Amantadine and Acyclovir
Tests for antimicrobial susceptibility.
Brief account on antibiotic resistance in bacteria - Methicillin-resistant Staphylococcus aureus (MRSA).
Vaccines – Natural and recombinant.

UNIT-V **No. of hours: 12**

General account on microbial diseases – causal organism, pathogenesis, epidemiology, diagnosis, prevention and control
Bacterial diseases – Tuberculosis and Typhoid
Fungal diseases – Candidiasis.
Protozoal diseases – Malaria.
Viral Diseases - Hepatitis- A and AIDS

PRACTICAL-2B IMMUNOLOGY AND MEDICAL MICROBIOLOGY

Course outcomes: At the end of the course, the student would have achieved the following outcomes.

CO 1: Determine the blood group of any individual by using a commercial blood typing kit using agglutination principle

CO 2: Learn procedures for serum separation from blood and quantification of hemoglobin.

CO 3: Perform procedures for determining total leucocytes and differential leucocytes count by staining procedures.

CO 4: Undertake the biochemical tests for determination of bacterial identity for clinical or environmental isolates.

CO 5: Test the susceptibility or resistance of a microorganism to an antibiotic by Kirby-Bauer disc diffusion test.

TOTAL HOURS: 45 **CREDITS: 2**

1. Identification of human blood groups.
2. Separate serum from the blood sample (demonstration).
3. Estimation of blood haemoglobin.
4. Total Leukocyte Count of the given blood sample.
5. Differential Leukocyte Count of the given blood sample.
6. Identify bacteria (*E. coli, Pseudomonas, Staphylococcus, Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, urease production and catalase tests
7. Isolation of bacterial flora of skin by swab method.
8. Antibacterial sensitivity by Kirby-Bauer method