Dr. V. S. KRISHNA GOVT. DEGREE COLLEGE (AUTONOMOUS)

MADDILAPALEM, VISAKHAPATNAM

B.Sc MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2020 - 21)

FIRST YEAR – SEMESTER- I

COURSE-1 INTRODUCTORY MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 60 **CREDITS: 4**

Course outcomes: At the conclusion of this course the students –

CO 1 : Have developed a good knowledge of the development of the discipline of Microbiology and the contributions made by prominent scientists in this field.
CO 2 : Have developed a very good understanding of the characteristics of different types of microorganisms.
CO 3 : Are able to explain the useful and harmful activities of the microorganisms.
CO 4 : Describe characteristics of bacterial cells, cell organelles, cell wall composition and various appendages like capsules, flagella or pili.
CO 5: Understood what are viruses and the chemical nature of viruses, different types of viruses infecting animals, plants and bacteria (bacteriophages)
CO 6: Identify commonly available fungi and algae and their characteristics.
CO 7 : Are able to perform basic experiments to grow , study microorganisms and methods to preserve bacteria in the laboratory
CO 8 : Principles which underlies sterilization of culture media, glassware and plastic ware to be used for microbiological work.
CO 9 : Handling and use of microscopes for the study of microorganisms which are among the basic skills expected from a practicing microbiologist. They also get introduced a variety of modifications in the microscopes for specialized viewing.

UNIT-I HISTORY OF MICROBIOLOGY & SYSTEMATICS 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 BACTERIA & VIRUSES No. of hours: 12

General characteristics of Bacteria, Archaea, Mycoplasmas and Cyanobacteria.
Ultrastructure of a prokaryotic cell: Invariant components - Cell wall, cell membrane, ribosomes, nucleoid. Variant components - Capsule, fimbriae, pili, endospore and storage granules.
General characteristics of viruses.
Morphology, Structure and replication of TMV and HIV.

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

General characteristics and outline classification of Protozoa
General characteristics and outline classification of microalgae
General characteristics and outline classification of molds
General characteristics and outline classification of yeasts

UNIT-IV PRINCIPLES OF MICROBIOLOGY **No. of hours: 12**

Principles of microscopy - Bright field and Electron microscopy (SEM and TEM).
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 ISOLATION TECHNIQUES **No. of hours: 12**

Growth media- synthetic, complex, selective, enrichment and differential media.
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.

Additional inputs:
1. Differentiation of prokaryotes and eukaryotes
2. Definition & properties of a stain
3. Conditions required for culturing microbes & role of buffers

PRACTICAL-1 INTRODUCTORY MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 30 **CREDITS: 1**

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.

SUGGESTED READING

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FIRST YEAR – SEMESTER- II

COURSE-2 MICROBIAL BIOCHEMISTRY & METABOLISM

TOTAL HOURS: 60 **CREDITS: 4**

Course outcomes: By the end of this course the students

CO 1: Developed a very good understanding of various biomolecules which are required for development and functioning of a bacterial cell.
CO 2: Have developed how the carbohydrates make the structural and functional components such as energy generation and as storage food molecules for the bacterial cells
CO 3: Well conversant about multifarious function of proteins; also knowledge about lipids and nucleic acids.
CO 4: Principles of a number of analytical instruments which the students have to use during the study and also later as microbiologists for performing various laboratory manipulations.
CO 5: Several separation techniques which may be required to be handled later as microbiologists. CO 6 : Describing the growth characteristics of the microorganisms capable of growing under unusual environmental condition of temperature, oxygen, and solute and water activity.
CO 7 : Describing the growth characteristics of the microorganisms which require different nutrient for growth and the associated mechanisms of energy generation for their survival like autotrophs, heterotrophs, chemolithoautotrophs etc.
CO 8 : Differentiating concepts of aerobic and anaerobic respiration and how these are manifested in the form of different metabolic pathways in microorganisms.
CO 9 : Describe the nutritional requirements of bacteria for growth; developed knowledge and understanding that besides common bacteria there are several other microbes which grow under extreme environments.
CO 10 : Calculate generation time of growing bacteria.

UNIT-I MICROBIAL BIOCHEMISTRY **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 (sphingolipids, sterols and phospholipids)

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

Principle and applications of - Colorimetry

Chromatography (paper, thin-layer and column),

Spectrophotometry (UV & visible), Centrifugation and Gel Electrophoresis.

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

Properties and classification of Enzymes.
Biocatalysts - 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 MICROBIAL NUTRITION & GROWTH **No. of hours: 12**

Microbial Nutrition –Nutritional requirements and uptake of nutrients by cells.
Nutritional groups of microorganisms- autotrophs, heterotrophs, mixotrophs.
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, turbidometry and biomass.

UNIT-V MICROBIAL METABOLISM **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.

Additional inputs:
Structure of proteins
Pasteur's effect
Photosynthetic apparatus in green, purple & cyanobacteria

PRACTICAL - 2 MICROBIAL BIOCHEMISTRY & METABOLISM

TOTAL HOURS: 30 **CREDITS: 1**

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

SUGGESTED READING

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Caldwell, D.R. (1995). **Microbial Physiology and Metabolism**, W.C. Brown Publications, Iowa, USA.

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SECOND YEAR – SEMESTER- III

COURSE - 3 MICROBIAL GENETICS AND MOLECULAR BIOLOGY

TOTAL HOURS: 60 **CREDITS: 4**

Course outcomes: By the conclusion of this course, the students have –

CO 1: Understood genome organization of model organisms namely E.coli and Saccharomyces.
CO 2: Developed a fairly good knowledge about the three well known mechanisms by which genetic material is transferred among the microorganisms namely transformation, transduction and conjugation.
CO 3: Are able to describe different types of the extrachromosomal elements or the plasmids; the nature of the transposable elements in the prokaryotic and the eukaryotic cells.
CO 4 : Understood the central dogma – replication, transcription and translation.
CO 5 : Developed knowledge on types of mutations , the molecular mechanisms that underlie mutations and their repair.
CO 6 : Understood Genetic code and studied the salient features.
CO 7: Able to explain the Protein synthesis and expression of genes.
CO 8 : Explain the principles and applications of genetic engineering.
CO 9 : Hands on skills of isolation of genomic DNA from bacterial cells and its visualization by performing agarose gel electrophoresis.
CO 10 : Are able to explain the working principles of Ultra centrifuge, Transilluminator and PCR

UNIT-I GENETIC MATERIAL **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 MUTATIONS & RECOMBINATION **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 GENE CONCEPT **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 GENE EXPRESSION **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 GENETIC ENGINEERING **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.

Additional inputs:
Forms of DNA
Experiments to prove replication and recombination in bacteria
Inhibitors of transcription & translation

PRACTICAL-3 MICROBIAL GENETICS AND MOLECULAR BIOLOGY

TOTAL HOURS: 30 **CREDITS: 1**

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

SUGGESTED READING

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SECOND YEAR – SEMESTER- IV

COURSE-4 IMMUNOLOGY AND MEDICAL MICROBIOLOGY

TOTAL HOURS: 60 **CREDITS: 4**

Course outcomes: By the conclusion of this course, the students clearly –

CO 1 : Conceptualized the protective role of the immune system of the host and developed an understanding of the basic components.
CO 2 : Explain the cells and organs involved in the development of immune response.
CO 3 : Knowledge on antigens, antibodies and their interactions.
CO 4 : Understood the principles and applications of various antigen-antibody reactions.
CO 5 : The mechanisms underlying the immune system and its response to pathogenic microorganisms.
CO 6 : Understood the basic and general concepts of causation of disease by the pathogenic microorganisms and the various parameters of assessment of their severity including the broad categorization of the methods of diagnosis.
CO 7: Has acquired a fairly good understanding of normal microflora of human body, common diseases caused by bacteria, viruses and other microbes.
CO 8: Are able to conduct experiments for growing common bacteria in different microbiological media, antibiotic sensitivity determination and antigen antibody reaction.
CO 9: Identify blood groups , estimate hemoglobin levels and count the WBC.
CO 10: Identify bacteria from clinical samples and analyze antibiotic sensitivity of bacteria.

UNIT-I IMMUNITY — 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 ANTIGEN ANTIBODY REACTIONS — 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 HOST MICROBIAL INTERACTIONS & DIAGNOSIS — 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 THERAPEUTICS **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 MICROBIAL DISEASES **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

Additional inputs:

Primary & secondary immune response
Challenges in development of vaccines
SARS-CoV-2

PRACTICAL-4 IMMUNOLOGY AND MEDICAL MICROBIOLOGY

TOTAL HOURS: 30 **CREDITS: 1**

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

SUGGESTED READING

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FINAL YEAR – SEMESTER- IV

COURSE-5 ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY

TOTAL HOURS: 60 **CREDITS: 4**

Course learning outcomes: By the completion of this course, the students –

CO 1: Have developed a fairly good knowledge and understanding of different types of environments and habitats where microorganisms grow including soil, air, water and extreme environments.

CO 2: Are able to identify the important role microorganisms play in maintaining healthy environment by degradation of solid/liquid wastes; how these activities of microorganisms are used in sewage treatment plants, production of activated sludge and functioning of septic tanks.

CO 3: Have understood the significance of BOD/COD and various tests involving use of enumerating fecal *E.coli* for assessing quality of water.

CO 4: Have developed the practical skills for conducting experiments to assess the BOD/COD of wastewaters and their interpretation; practically assess the portability of drinking water by the use of standard microbiological tests.

CO 5: Developed a clear understanding of the multifarious roles of microorganisms in soil, in association with plants and thus in the field of agriculture.

CO 6: Developed basic concepts of causation of diseases in plants by the different types of microorganisms namely bacterial, fungal and viral.

CO 7: Knowledge of important plant diseases, their etiology, salient characteristics and control measures.

CO 8: Perform solid waste management and prepare compost with decomposable waste.

CO 9: Understood how the waste water could be converted into reusable water.

CO 10: Concept of biofertilizers and their applications in various fields.

UNIT - I MICROBIAL HABITATS No. of hours:12

Terrestrial Environment: Soil profile and soil microflora
Aquatic Environment: Microflora of fresh water and marine habitats
Atmosphere: Aeromicroflora and dispersal of microbes
Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels.

UNIT – II MICROBIAL INTERACTIONS & WATER MICROBIOLOGY No. of hours: 12

Role of microorganisms in nutrient cycling (Carbon, nitrogen, phosphorus).
Microbial interactions – mutualism, commensalism, antagonism, competition, parasitism, predation.\
Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane filter technique.

UNIT – III WASTE MANAGEMENT **No. of hours: 12**

Outlines of Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill).
Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary sewage treatment.

UNIT – IV MICROBES AS FERTILIZERS **No. of hours: 12**

Plant Growth Promoting Microorganisms - Mycorrhizae, Rhizobia, *Azospirillum, Azotobacter, Frankia,* phosphate-solubilizers and Cyanobacteria.
Outlines of biological nitrogen fixation (symbiotic, non-symbiotic).
Biofertilizers - *Rhizobium*.

UNIT – V PLANT DISEASES **No. of hours: 12**

Concept of disease in plants. Symptoms of plant diseases caused by fungi, bacteria, and viruses. Plant diseases - groundnut rust, Citrus canker and tomato leaf curl.
Principles of plant disease control.

Additional inputs:
Air sampling
Field applications of biofertilizers

Practical - 5 ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY

TOTAL HOURS: 30 **CREDITS: 1**

1. Analysis of soil – pH, Moisture content and water holding capacity.
2. Isolation of microbes (bacteria and fungi) from soil.
3. Study of air flora by petriplate exposure method.
4. Analysis of potable water: SPC, Presumptive, confirmed and completed test, determination of coliform count in water by MPN.
5. Determination of Biological Oxygen Demand (BOD) of waste water samples.
6. Isolation of *Rhizobium* from root nodules.
7. Staining and observation of Vesicular Arbuscular Mycorrhizal (VAM) fungi.
8. Observation of plant diseases of local importance - Citrus canker, Tikka disease of Groundnut, Bhendi yellow vein mosaic, Rusts, Smuts, Powdery mildews, Tomato leaf curl.

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Martin A. (1977). **An Introduction to Soil Microbiology**. 2nd edition. John Wiley & Sons Inc. New York & London.

Okafor, N (2011). **Environmental Microbiology of Aquatic & Waste systems**. 1st edition, Springer, New York.

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Dr. V. S. KRISHNA GOVT. DEGREE COLLEGE (AUTONOMOUS)

MADDILAPALEM, VISAKHAPATNAM

B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2020 - 21)

THIRD YEAR – SEMESTER –V/ VI

COURSE-6A FOOD AND INDUSTRIAL MICROBIOLOGY

TOTAL HOURS: 60 **CREDITS: 4**

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

Cos	Course Outcomes
1.	Understand food as a suitable habitat for growth of microorganisms
2.	Become aware of microbial characteristic desirable to the food industry and their roles in food production, food spoilage, and food-borne illnesses.
3.	Explain the principles involved in microbial control, conventional and new methods of preserving foods, probiotics and useful microorganism in food.
4.	Well versed with nutritional benefits of varied microbe foods such as single cell proteins, mushrooms and probiotics.
5.	Understand the economic importance of different categories of microbes to food, pharma and allied industries.
6.	Appreciate the importance of screening microorganisms producing primary and secondary metabolites with industrial and economic importance.
7.	Describe the principles and applications of batch and continuous fermentation processes
8.	Explain the procedures applied in purification of any industrial product from fermentation media.
9.	Describe the applications of microbial enzymes in manufacturing of detergents, textiles, leather, and mining applications.
10.	List some of the important metabolites from microbial metabolism along with their applications.

UNIT – 1 **No. of Hours: 12**

FOOD SPOILAGE: Intrinsic and extrinsic parameters that affect microbial growth in food. Microbial spoilage of foods - fruits, vegetables, milk, meat, egg, bread and canned foods. Food intoxication (botulism), Food-borne diseases (salmonellosis) and their detection.

UNIT – II **No. of Hours: 12**

FOOD PRESERVATION AND MICROBES AS FOOD: Principles of food preservation - Physical and chemical methods. Fermented Dairy foods – cheese and yogurt.
Microorganisms as food – SCP, edible mushrooms (white button, oyster and paddy straw). Probiotics and their benefits.

UNIT – III **No.of hours: 12**

INDUSTRIAL MICROBES AND MICROBIAL METABOLITES: Microorganisms of industrial importance – yeasts (*Saccharomyces cerevisiae*),molds (*Aspergillus niger*), bacteria (*E.coli*), actinomycetes(*Streptomyces griseus*).Primary and secondary microbial metabolites. Screening techniques - Techniques involved in selection of industrially important metabolites from microbes.

UNIT – IV **No. of hours: 12**

FERMENTATION AND DOWNSTREAM PROCESSING: Basic concepts of Design of fermenter. Types of fermenters – batch, continuous and fed batch. Types of fermentation processes – solid state, liquid state. Principles of production media, components of media, chemical composition of fermentation media. Downstream processing - filtration, centrifugation, cell disruption, solvent extraction.

UNIT – V **No. of hours: 12**

INDUSTRIAL MICROBIOLOGY: Microorganisms involved in Pharma and therapeutic enzymes. Microbial enzymes used in detergents, textiles and leather industries. Industrial production of Amylases and Proteases. Microbial therapeutic enzymes. Microbial production of Industrial products: Citric acid, Ethanol, Penicillin, Glutamic acid, and vitamin B12.

Practical – 6A:FOOD AND INDUSTRIAL MICROBIOLOGY

Total hours: 36 **Credits: 1**

1. Production of ethanol
2. Estimation of ethanol
3. Isolation of amylase producing microorganisms from soil
4. Production of amylase from bacteria and fungi
5. Assay of amylase
6. Demonstration of fermenter
7. Production of wine from grapes
8. Growth curve and kinetics of any two industrially important microorganisms.
9. Microbial fermentation for the production and estimation of ethanol from grapes
10. Microbial fermentation for the production and estimation of citric acid

Suggested Readings

1. Frazier,W.C. and Westhoff, D. C. 2004. **Food Microbiology**. 3rd McGraw Hill, New Delhi.
2. Jay, J. M. 1992. **Modern Food Microbiology**. 4th Van Nostrand Reinhold, New York, USA.
3. Okafor, N. 2007. **Modern Industrial Microbiology and Biotechnology**. Enfield: Science Publ., USA.
4. Ray, B. 2004. **Fundamental Food Microbiology** 3rd, CRC Press, Washington D.C. USA.
5. Waites, M. J. 2001. **Industrial Microbiology: An Introduction**. Blackwell Science, London.

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MADDILAPALEM, VISAKHAPATNAM

B.Sc. MICROBIOLOGY (CBCS) SYLLABUS (W.E.F 2022 - 23)

FINAL YEAR – SEMESTER- 5/6

COURSE-7A: CLINICAL MICROBIOLOGY

TOTAL HOURS: 60 **CREDITS: 4**

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

COs	Course Outcomes
1.	Deep understanding of the disease cycles and their outbreaks
2.	Gaining theoretical knowledge of most common disease-causing organisms
3.	Enumerating the methods and vehicles of disease transmission
4.	Understanding the basics of Clinical laboratory protocols
5.	Systematic knowledge on the pathogenesis and laboratory diagnosis of diseases
6.	Developing insights into clinical practices and serological techniques.
7.	Gain knowledge on advanced techniques and diagnosis
8.	Identify the blood groups and estimate the concentration of Hemoglobin
9.	Develop knowledge on antimicrobial sensitivity and resistance mechanism
10.	Perform antibiotic sensitivity tests of some antibiotics on few organisms

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

TYPES OF DISEASES: Disease - incidence, prevalence; communicable, non-communicable; frequency of occurrence (sporadic, endemic, epidemic, pandemic), severity /duration of disease(acute, chronic, latent); development of disease; the spread of infection(human reservoirs, animal reservoirs, non-living reservoirs); transmission of disease (contact (direct, indirect, droplet); vehicle (water, food, air, vectors(mechanical, biological); portals of entry(mucus membrane, skin, parenteral route) & portals of exit. Herd immunity. Control of disease transmission.

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

TYPES OF INFECTIONS: Description of pathogenesis, etiology and laboratory diagnosis of the following:

Respiratory infections – Pneumonia, Influenza

Food and water borne infections – cholera, polio

Urinary tract and Gastro intestinal infections (*E. coli*)

Central Nervous System infections (meningitis, encephalitis)

Sexually transmitted diseases: Treponema, Neisseria.

Blood stream infections – Bacteraemia

UNIT – III **No. of Hours:12**

IDENTIFICATION OF ORGANISMS: Microscopic examination of specimen for Bacterial pathogens – simple staining, Gram staining and motility by Hanging drop method.

Biochemical reaction – Sugar fermentation test,

Cultural tests- IMVIC tests (Indole test, methyl red test, Voges- Proskauer test and Simon Citrate agar test)

Determination of antibiotic sensitivity – Qualitative methods (Kirby Bauer's Method; Stokes method) and quantitative methods (Tube dilution and agar dilution methods). E-test.

UNIT – IV **No. of Hours:12**

CLINICAL LAB TECHNOLOGY: Collection of clinical samples (oral cavity, throat, skin, blood, CSF, urine, and feces) and precautions required. Method of transport of clinical samples to laboratory and storage.

Observation of blood cells – preparation of blood smear, Leishman staining, Giemsa & Wright staining, bleeding time(BT), clotting time(CT).

Microscopic observation of Bacteria and yeast, Casts, Epithelial cells,Crystals, Red blood cells and White blood cells in urine sample.

UNIT – VNo. of Hours:12

SEROLOGY: Antigen - antibody reactions – Agglutinations (blood grouping, WIDAL test) Hemagglutination, Flocculation (VDRL test), Complementation fixation test, Ouchterlony double diffusion test, Rocket immunoelectrophoresis. ELISA and RIA. RT-PCR; Western blot analysis for HIV. HCG pregnancy test.

Practical – 7A: CLINICAL MICROBIOLOGY

TOTAL HOURS: 40 **CREDITS: 1**

1. Collection transport and processing of clinical specimens (Blood, Urine, Stool and Sputum). Receipts, Labeling, recording, and dispatching clinical specimens.
2. Examination of urine for pathogenic microorganisms –collection of urine, microscopic examination of urine.
3. Isolation and identification of Escherichia coli, Klebsiella pneumonia from urine samples.
4. Mycology – Direct microscopy – cultures using Sabouraud's Dextrose agar medium, Wet mount preparations using Lactophenol cotton blue/KOH mount.
5. Estimation of hemoglobin (Acid hematin and cyanmethemoglobin method).
6. Immunohematology: Blood group typing by slide test & tube for ABO & Rh systems.
7. Determination of Antibiotic sensitivity Test by Kirby Bauer's method.
8. Study of various concentration of an antibiotic on any 2 bacteria by E-test.
9. RBC and WBC count
10. Bleeding time and Clotting time

SUGGESTED READING

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. Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and Mccartney **Practical Medical Microbiology**, 14th edition, Elsevier.
4. Randhawa, VS, Mehta G and Sharma KB (2009) **Practicals and Viva in Medical Microbiology** 2nd edition, Elsevier India Pvt Ltd.
5. Tille P (2013) Bailey's and Scott's **Diagnostic Microbiology**, 13th edition, Mosby.
6. Tortora, G.J., Funke, B.R. and Case, C.L. (2010) **Microbiology: An Introduction**. 10th Edition, Pearson Benjamin Cummings, San Francisco.