Andhra Pradesh State Council of Higher Education

MICROBIOLOGY: MINOR

w.e.f 2023-24 AY

COURSE STRUCTURE

Year	Semester	Course	Title	Hr/ week	credits
I	II	1	Introduction to Microbiology	3	3
			Introduction to Microbiology	2	1
II	III	2	Biomolecules & Enzymology	3	3
			Biomolecules & Enzymology	2	1
	IV	3	Molecular Biology and Microbial Genetics	3	3
			Molecular Biology and Microbial Genetics	2	1
		4	Microbial Physiology and Metabolism	3	3
			Microbial Physiology and Metabolism	2	1
III	V	5	Immunology & Medical Microbiology	3	3
			Immunology & Medical Microbiology	2	1
		6	Applied Microbiology	3	3
			Applied Microbiology	2	1

II SEMESTER

COURSE 1: - INTRODUCTION TO MICROBIOLOGY

credits -_3

I. Course Outcomes:

On successful completion of the course, the students will be able to

1. Understand the historical significance of microbiology and the contributions of key scientists.
2. Recognize the classification of microorganisms and their place in the living world.
3. Comprehend the scope and applications of microbiology, including the origin of microbial life and the distinction between eukaryotic and prokaryotic cells.
4. Describe the characteristics of bacteria, archaea, fungi, algae, and protozoa.
5. Describe viruses, including their nature, composition, and diversity in structure.
6. Develop practical skills in aseptic techniques, growth media preparation, isolation methods, and the identification of bacteria and fungi.

Unit - 1: **History of Microbiology** **No. of Hours: 10**

1. Discovery of Microscope and microbial world by Anton von Leeuwenhoek; Aseptic techniques with reference to Charak Samhita, Sushruta Samhita and Ignaz Philipp Semmelweis

2. Golden era of Microbiology- Refutation of abiogenesis; Germ theory of Disease; Discovery of vaccination; Discovery of penicillin

3. Major contributions of Scientists: Edward Jenner, Louis Pasteur, Robert Koch, Joseph Lister, Ivanowsky, Martinus Beijerinck and Sergei Winogradsky

Unit - 2: Place of Microorganisms in the living world **No. of Hours:10**

1. Haeckel's three Kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese

2. Definition and scope of Microbiology; Applications of Microbiology; Diverse groups of Microorganisms

3. Origin of microbial life on earth- Timeline, Miller's Experiment, endosymbiosis (cyanobacteria), distinguishing features of eukaryotic and prokaryotic cell

Unit - 3: Prokaryotic microorganisms and Viruses **No. of Hours:10**

1. General characteristics of Bacteria (Morphology, metabolic diversity and reproduction)
2. General characteristics of Archaea differentiating them from Bacteria
3. General characteristics of viruses (Nature, composition, size, host specificity, diversity in structure)

Unit - 4: Eukaryotic microorganisms **No. of Hours: 10**

1. Fungi - Habitat, nutrition, vegetative structure and modes of reproduction;

2. Algae- Habitat, thallus organization, photosynthetic pigments, storage forms of food, reproduction.
3. Protozoa–Habitat, cell structure, nutrition, locomotion, excretion, reproduction, encystment.

Unit - 5: Growing Microbes in Lab: Five I's **No. of Hours:05**

1. Inoculation-Aseptic methods of introducing inoculum to growth media; Composition of basic growth media, solid and liquid
2. Incubation and Isolation- Ambient temperature for growth of microorganisms; Concept of Pure culture, mixed culture and contaminated culture
3. Inspection and Identification - Observation of colour, size and shape of colonies; Wet mount and simple staining of bacteria and fungi

III. Skill Outcomes:

1. Implement safety protocols, handling hazardous materials, and practicing personal protective measures.

2. Identify microscope parts, adjusting focus and diaphragm, and accurately observing and documenting microscopic images.

3. Prepare smears, identifying different microorganisms, and interpreting microscopic characteristics.

4. Analyze electron micrographs, identifying virus types, and describing their morphology and size.

5. Operate Autoclave, Hot Air Oven, and Laminar Air Flow Chamber for sterilization and decontamination purposes.

II SEMESTER

COURSE 1: - INTRODUCTION TO MICROBIOLOGY

credits -_1

1. Good Laboratory Practices and Biosafety
2. Compound Light microscope -Parts and its handling
3. Microscopic observation of bacteria, Algae and Fungi and protozoa
4. Observation of electron micrographs of viruses (Lambda, T4, TMV, HIV, SARS CoV-2, Polio)
5. Laboratory equipment -Working principles of Autoclave, Hot air oven, Laminar airflow chamber

IV. References:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5th Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi.
2. ·Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand, New Delhi. Edition), Himalaya Publishing House, Mumbai.
3. Prescott, M.J., Harley, J.P. and Klein, D.A. (2012). Microbiology. 5th Edition, WCB McGraw Hill, New York.
4. Reddy, S.M. and Reddy, S.R. (1998). Microbiology Practical Manual, 3 rd Edition, Sri Padmavathi Publications, Hyderabad.
5. Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi.
6. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed.,Prentice Hall of India Pvt. Ltd., New Delhi.
7. Jaya Babu (2006). Practical Manual on Microbial Metabolisms and General Microbiology. Kalyani Publishers, New Delhi.
8. Gopal Reddy et al., Laboratory Experiments in Microbiology

V. Co-Curricular Activities:

1. Establish a Microbiology Club where students can come together to discuss and explore various topics related to microbiology.

4. Organizing microbiology-themed events like microbiology day 3 Poster presentations, oral presentations, and Q&A sessions.Field Trips to Microbiology-related Sites

5. Establish a Microbiology Journal Club where students can review and discuss scientific articles related to microbiology.

III SEMESTER

COURSE 2: - BIOMOLECULES AND ENZYMOLOGY

credits -_3

I. Course Outcomes:

On successful completion of the course, the students will be able to

1. Understand the classification and properties of carbohydrates, including monosaccharides, disaccharides, polysaccharides, and sugar derivatives.
2. Gain knowledge of lipids and fatty acids, including their classification, structures, functions, and their role in cell signaling and metabolism.
3. Comprehend the structure and functions of amino acids and proteins, including their primary, secondary, tertiary, and quaternary structures.
4. Learn about the structure and functions of nucleic acids, including DNA and RNA, as well as the concept of base composition and nucleic acid- protein interactions. They will also be introduced to the role of vitamins in metabolism.
5. Understand the structure of enzymes, enzyme classification, and mechanisms of action. They will also learn about the factors influencing enzyme activity and various types of enzyme inhibition.

UNIT-I: Carbohydrates **No. of hours: 9**

1. General characters and outline classification of Carbohydrates
2. Monosaccharides- Glucose, fructose, ribose; Stereo isomerism of monosaccharides, epimers, mutarotation and anomers of glucose
3. Disaccharides- concept of reducing and non-reducing sugars; Sucrose, Lactose
4. Polysaccharides- Storage -Starch, glycogen, Structural- Cellulose peptidoglycan and chitin
5. Sugar derivatives- glucosamine.

UNIT-II: Lipids and fatty acids **No. of hours: 9** 1.Definition and classification of lipids. Structure and properties of lipids. Importance of lipids in biological systems.

2. Introduction to fatty acids: definition, structure, and nomenclature. Saturated and unsaturated fatty acids.
3. Triglycerides: structure, function, and metabolism. Phospholipids: structure, function, and role in cell membranes. Steroids: structure, biosynthesis, and physiological roles.Waxes: structure, functions, and applications.

UNIT-III: Amino acids and Proteins. **No. of hours:9**

1. Biochemical structure and notation of standard protein amino acids
2. General characteristics of amino acids and proteins.

3. Primary, secondary, tertiary and quaternary structures of Protein
4. Non protein amino acids: Gramicidin, beta-alanine, D-alanine and D- glutamic acid.

UNIT-IV: **Nucleic acids and Vitamins** **No. of hours:9**

1. Structure and functions of DNA and RNA.
2. Base composition. A+T and G+C rich genomes. Basic concept of nucleic acids protein interactions.
3. Concept and types of vitamins and their role in metabolism.

UNIT-V: Enzymes **No. of hours: 9**

1. Structure of enzyme, Apoenzyme and cofactors, prosthetic group- TPP, coenzyme -NAD, metal cofactors; Definitions of terms – enzyme unit, specific activity and turnover number
2. Classification of enzymes, Mechanism of action of enzymes: active site, transition state complex and activation energy. Lock and key hypothesis, and Induced Fit hypothesis.
3. Effect of pH and temperature on enzyme activity.
4. Inhibition of enzyme activity- competitive, noncompetitive, uncompetitive and allosteric.

III. Skill Outcomes:

On successful completion of the course, the students will be able to

1. Qualitatively Identify mono and disaccharides
2. Qualitatively Identify specific aminoacids
3. Quantitatively estimate DNA
4. Quantitatively estimate protein

III SEMESTER

COURSE 2: - BIOMOLECULES AND ENZYMOLOGY

credits -1

1. Qualitative tests for sugars
2. Qualitative Analysis of Aminoacids.
3. Colorimetric estimation DNA by diphenylamine method.
4. Colorimetric estimation of proteins by Biuret/Lowry method

IV. References:

1. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company Caldwell, D.R. (1995). Microbial Physiology and Metabolism, W.C. Brown Publications,Iowa, USA.
2. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2 nd Edition, CBS Publishers and Distributors, New Delhi.
3. Sashidhara Rao, B. and Deshpande, V. (2007). Experimental Biochemistry: A student Companion. I.K. International Pvt. Ltd.
4. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
5. Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley and Sons
6. White, D. (1995). The Physiology and Biochemistry of Prokaryotes, Oxford University Press, New York.

V. Co-Curricular Activities:

1. Organize Biomolecule Modeling Workshops where students can learn to build physical models or use computer simulations to visualize biomolecules such as proteins, nucleic acids, carbohydrates, and lipids. These workshops can help students understand the three-dimensional structures and interactions of biomolecules, enhancing their comprehension of molecular biology concepts.
2. Assign Biomolecule and Enzyme Case Studies case studies that require students to analyze real-world scenarios related to biomolecules and enzymes in medicine, biotechnology, or environmental science.

IV SEMESTER
COURSE 3: - MOLECULAR BIOLOGY AND MICROBIAL GENETICS
credits -_3

I. Course Outcomes:

By the Completion of the course the learner should able to–

1. Understand the nature of genetic material, its organization in prokaryotes and eukaryotes, and the role of DNA and RNA.
2. Explain the process of DNA replication in prokaryotes and the involvement of enzymes and factors.
3. Recognize the characteristics, types, and applications of extra chromosomal genetic elements such as plasmids and transposons.
4. Differentiate between classical and modern concepts of genes, understand gene structure, and the process of transcription.
5. Comprehend the genetic code, translation process, and regulation of gene expression in bacteria.
6. Define and classify mutations, understand their molecular basis, and gain knowledge of DNA repair mechanisms.
7. Familiarize with genetic recombination in bacteria, including conjugation, transformation, and transduction processes.

Unit - 1: DNA/RNA as genetic material, Replication of DNA No. of Hours:9

1.1 Experimental evidences that established DNA and RNA as genetic material. Genome organization in prokaryotes and eukaryotes.

1.2 Replication of DNA in prokaryotes.: Bidirectional and unidirectional replication, Semiconservative replication, Proof of Semiconservative replication (Messelson – Stahl Experiment). Mechanism of DNA Replication in Prokaryotes: step by step process, Enzymes and factors involved in replication- Primase, Helicase, Gyrase, DNA polymerases, DNA ligase, SSB proteins.

1.3 Extra chromosomal genetic elements: General characters, types and applications of Plasmids and transposons.

Unit - 2: Concept of gene, Transcription No. of Hours:9

2.1 Classical Concept of gene: Muton, Recon and Cistron; One gene-one enzyme and one gene - one polypeptide and One gene – One Product hypotheses.

2.2Modern concept of gene: Definition of gene; Open reading frame; structural, constitutive and regulatory genes; uninterrupted genes, Split genes- concept of introns and exons.

2,3 Protein synthesis in Prokaryotes: Transcription- Definition, difference from replication, promoter, RNA Polymerase, mechanism of transcription. RNA splicing in eukaryotes;

Unit - 3: Translation and regulation of gene expression **No. of Hours:9**

Protein synthesis in Prokaryotes

3.1 Genetic code: Salient features, Wobble hypothesis.

3.2 Translation- Charging of tRNA, aminoacyl tRNA synthetases, Mechanisms of initiation, elongation and termination of polypeptides. Inhibitors of protein synthesis.

3.3 Regulation of gene expression in bacteria – lac operon.

Unit - 4: Mutations and DNA repair **No. of Hours:9**

4.1 Mutations: Definition and types of Mutations (Spontaneous and induced, Somatic and germline); Physical and chemical mutagens;

4.2 Molecular basis of mutations (base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions); Functional mutants (loss and gain of function mutants); Uses of mutations.

4.3 Outlines of DNA repair mechanisms: Direct repair, Excision repair, Mismatch Repair, Recombination Repair, SOS Repair.

Unit - 5: Genetic recombination in bacteria **No. of Hours:9**

5.1 Conjugation - discovery, F-factor, F+ & Hfr, mechanism of conjugation, applications of conjugation;

5.2Transformation- Discovery, mechanism of transformation, Competence Factors affecting transformation and application of transformation.

5.3 Transduction- discovery, mechanism and types of transduction.

III. Skill Outcomes:

1. performing cell lysis and purification, quantifying DNA, and recognizing the importance of genomic DNA isolation.
2. Estimate DNA using UV Spectrophotometer include preparing DNA samples, measuring absorbance at 260 nm, calculating DNA concentration, and assessing DNA purity.
3. Solve Problems related to DNA and RNA characteristics, Transcription and Translation. 4. Analyze and solve problems related to DNA and RNA structure, understanding transcription and translation processes, and interpreting the impact of mutations on protein synthesis.
4. Prepare gels, loading DNA samples, visualizing DNA bands, analyzing fragment size, and understanding the principles of electrophoresis.
5. Understand Mutagenesis principles, perform UV exposure, assessing mutation frequency, and comprehend the effects of mutations on bacterial phenotypes.

IV SEMESTER
COURSE 3: - MOLECULAR BIOLOGY AND MICROBIAL GENETICS
credits -1

1. Isolation of genomic DNA from E. coli
2. Estimation of DNA using UV spectrophotometer (A260measurement).
3. Problems related to DNA and RNA characteristics, Transcription and Translation.
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. Study of different conformations of plasmid DNA through agarose gel electrophoresis.
8. Demonstration of bacterial transformation
9. Instrumentation in molecular biology – Ultra centrifuge, Transilluminator, PCR
10. Study of different types of DNA and RNA using micrographs and model / schematic
11. representations
12. Study of semi-conservative replication of DNA through micrographs / schematic
13. Representations

IV. References

Text books:

1. James D. Watson Tania A. Baker, Stephen P. Bell Alexander Gann, Michael Levine, Richard Losick, 2013, Molecular Biology of the Gene, 5th Edition, Pearson Edu Publishers.
2. Roger Y. Stanier, Edward A. Adelberg, John L. Ingraham, 1977, General Microbiology 5th edition, London Macmillan.
3. David Freifelder1986 Molecular Biology 3rd edition, Jones & Bartlett Publishers
4. T.A. Brown, Gene cloning and DNA analysis- An Introduction, 4thedition
5. Bernard R. Glick and Jack. J. Pasternak, Molecular Biotechnology. 3rd edition
6. David Freifelder.Essentials of molecular biology.Jones and Bartlett Publishers, 1998

V. Co-Curricular Activities:

1. Conduct poster presentations, oral presentations, and interactive sessions.
2. Visit laboratories employing molecular biology techniques

IV SEMESTER
COURSE 4: - MICROBIAL PHYSIOLOGY AND METABOLISM
credits -_3

I. Course Outcomes:

On successful completion of the course, the students will be able to

1. Understand the nutritional requirements of microorganisms and the different methods of nutrient uptake. They will also gain knowledge of different nutritional groups and types of growth media used for microbial cultivation.
2. Comprehend microbial growth, including the definition of growth, generation time, and the different phases of growth. They will also learn about factors influencing microbial growth and methods for measuring it.
3. Gain knowledge of thermodynamics in biological systems, including concepts of free energy, enthalpy, and entropy. They will also learn about ATP structure and properties, oxidation-reduction reactions, and carbohydrate breakdown pathways.
4. Understand microbial respiration, including aerobic and anaerobic respiration, chemoautotrophy, and fermentative modes.
5. Differentiate the processes of oxygenic and anoxygenic photosynthesis.

UNIT I: Microbial Nutrition **No. of hours: 9**

1. Nutritional requirements of Microorganisms
2. Methods of uptake of nutrients by cells- Primary and secondary active transport, concept of uniport, symport and antiport Group translocation; Iron uptake
3. Nutritional groups of microorganisms-based on C, energy and electron. sources
4. Growth media - synthetic, nonsynthetic, selective, enrichment and differential media.

UNIT II: Microbial Growth **No. of hours:9**

1. Microbial Growth- Definitions of growth, generation time and specific growth rate; different phases of growth in batch cultures;
2. Synchronous, continuous, biphasic growth.
3. Factors influencing microbial growth
4. Methods for measuring microbial growth - Direct microscopy, viable count estimates, turbidometry and biomass.

UNIT IV: Thermodynamics; Breakdown of Carbohydrates **No.of hours: 9**

1. Thermodynamics in biological systems - Concept of free energy, Enthalpy, Standard Free Energy change of reaction, Entropy. First and Second law of Thermodynamics. Open and Closed system.
2. Structure and properties of ATP, Standard Free energy change of hydrolysis of ATP and other high energy compounds. Biological oxidation-reduction reactions. Structure and Function of NAD and FAD.

3. Breakdown of carbohydrates· Glycolytic pathways- EMP, HMP shunt/pentose phosphate pathway and ED; TCA cycle.

UNIT V: Microbial Respiration and Fermentation No. of hours: 9

1. Aerobic respiration - ETS and oxidative phosphorylation
2. Anaerobic respiration, chemoautotrophy - oxidation of inorganic compounds - N, S, Fe and H.
3. Fermentative modes in microorganisms with special reference to alcoholic, Lactic acid fermentations

UNIT V: Bacterial Photosynthesis No. of hours:9

1. Photosynthetic pigments, Photosynthetic apparatus in prokaryotes
2. Outline of oxygenic photosynthesis in bacteria
3. Outline of anoxygenic photosynthesis in bacteria

II. Skill Outcomes:

On successful completion of the course, the students will be able to

1. Understand the impact of temperature and pH on bacterial growth and metabolism.
2. Gain proficiency in colony counting techniques for microbial enumeration.
3. Analyze and interpret growth curve data to understand bacterial growth dynamics.
4. Develop skills in observing and identifying cyanobacteria under the microscope.
5. Apply knowledge of microbial growth factors and techniques to interpret and analyze experimental results.

IV SEMESTER
COURSE 4: - MICROBIAL PHYSIOLOGY AND METABOLISM
credits -1

1. Effect of Temperature on bacterial growth 2.Effect of pH on bacterial growth
2. Colony count in Plates
3. Study and plot the growth curve of E. coli by turbidometric and standard plate count methods
4. Observation and identification of permanent slides of cyanobacteria

IV References:

1. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company Caldwell, D.R. (1995). Microbial Physiology and Metabolism, W.C. Brown Publications,Iowa, USA.
2. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2 nd Edition, CBS Publishers and Distributors, New Delhi.
3. Sashidhara Rao, B. and Deshpande, V. (2007). Experimental Biochemistry: A student Companion. I.K. International Pvt. Ltd.
4. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
5. Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley and Sons
6. White, D. (1995). The Physiology and Biochemistry of Prokaryotes, Oxford University Press, New York.

V Co-Curricular Activities:

1. Assignments in nutrient utilization, energy production, metabolic pathways,

2. Students can study microbial growth curves, metabolic pathways, or physiological responses to environmental factors.

3. Organize seminars where students can deliver presentations on specific topics in microbial physiology and metabolism.

4. Create visual representations of microbial metabolic pathways.

V SEMESTER
COURSE 5: IMMUNOLOGY AND MEDICAL MICROBIOLOGY

credits -3

I Course outcomes:

By the Completion of the course the learner should able to–

1. Describe the key concepts in Immunology and how the immune system is able to discriminate self vs. non-self
2. Explain how the innate and adaptive immune systems work together to generate an effective immune response against a specific pathogen.
3. Explain how the immune system is able to respond to so many diverse antigens.
4. To understand the importance of pathogenic microorganisms in human disease with respect to infections of the respiratory tract, gastrointestinal tract, urinary tract etc
5. To understand and able to correlate disease symptoms with causative agent, isolate and identify pathogens.

Unit - 1: **Immune System** **No. of Hours:9**

1. Concept of Innate and Adaptive immunity
2. Primary and secondary organs of immune system - thymus, bursa fabricius, bone marrow, spleen, lymph nodes and lymphoid tissues
3. Cells of immune system- Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils Components of innate immunity;Complement system (in brief)

Unit - 2: **Immune response** No. of Hours 9

1. Characteristics of antigen (Foreignness, Molecular size, Heterogeneity and solubility) haptens.
2. Antibodies - basic structure and types.
3. Generation of Immune Response - Primary and Secondary Generation of Humoral Immune Response (Plasma and Memory cells), MHC Generation of Cell Mediated Immune Response
4. Immune complex formation and elimination -Agglutination, Precipitation, Neutralisation, Complement fixation, Phagocytosis
5. Hypersensitivity- definition and types (in brief)

Unit - 3: Microbes in Health and Disease **No. of Hours:9**

1. Normal flora of human body.
2. Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Opportunistic infections, Nosocomial infections.

3. General account on microbial diseases - causal organism, pathogenesis, epidemiology, diagnosis, prevention and control of the following
Bacterial diseases - Tuberculosis, Typhoid, Botulism Fungal diseases - Candidiasis.
Viral Diseases - Hepatitis- A and AIDS

Unit - 4: Principles of Diagnosis **No. of Hours:9**

1. General principles of diagnostic microbiology- Collection, transport of clinical samples
2. Identification by culturing
3. Identification by biochemical/physiological properties
4. Identification by molecular assays (PCR, DNA probes)
5. Identification by serological tests (ELISA, Immunofluorescence, Agglutination based tests, Complement fixation)

Unit - 5: Prevention and Treatment **No. of Hours:9**

1. Vaccines - Active (Natural and recombinant) and passive
2. Antimicrobial agents- General modes of action of antibacterial (Penicillin, Streptomycin), antifungal (Amphotericin and Griseofulvin), antiviral (Amantadine, Acyclovir)agents
3. Interferons
4. Antibiotic resistance -Tests for antimicrobial susceptibility (Disc diffusion)

II Skill Outcomes:

By the completion of the course the learner should able to– 1**.**Perform some of the ag-ab reactions
2. Carry out the biochemical tests useful for identification of of bacteria
3. Perform antibiotic sensitivity test
4. Identify some common symptoms and relate them to etiology
5. Prepare some differential media routinely used for identification of bacteria

V SEMESTER
COURSE 5: IMMUNOLOGY AND MEDICAL MICROBIOLOGY
credits -1

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1. Identification of human blood groups.
2. Separate serum from the blood sample (demonstration).
3. Immunodiffusion by Ouchterlony method.
4. Identification of any of the bacteria (E. coli, Pseudomonas, Staphylococcus, Bacillus) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, urease production and catalase tests
5. Study of composition and use of important differential media for identification of

6. bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS Isolation of bacterial flora of skin by swab method.
7. Antibacterial sensitivity by Kirby-Bauer method
8. Determination of minimal inhibitory concentration of an antibiotic
9. Study symptoms of the diseases with the help of photographs: Anthrax,Polio, Herpes, chicken pox, HPV warts, Dermatomycoses (ring worms)
10. Isolation of Normal flora of human body (Hands, Feet, Nostrils, Teeth Surface) by swab method.

III 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. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford.
4. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
5. Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
6. Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Microbiology. 4th edition. Elsevier Publication.
7. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education Practical microbiology-M.N.Reddy Practical microbiology-M.N.Reddy
8. Microbiology: a laboratory manual / James G. Cappuccino, Natalie.
9. Plant pathology and Microbiology-K.R.Aneja
10. Mackie & Mccartney Practical Medical Microbiology,

VI. Co-Curricular Activities:

1. Screening of Blood groups
2. Visit to Diagnostic /Laboratory
3. Competition on composition and sterile media preparation
4. Competition on Isolation and Identification of bacteria from a sample

V SEMESTER
COURSE 6: APPLIED MICROBIOLOGY
credits -3

I. Course Outcomes:

By the completion of the course the learner should able to–

1. Identify the areas of entrepreneurship, and assess the scope for establishment.
2. Explain production of fermentation products and economics
3. Explain the production method of biofertilisers and mushrooms
4. Explain the process of baking and brewing
5. Prepare DPR and understand patenting

Unit–I: Entrepreneurial skill **No of Hours: 9**

Entrepreneurial skills–Institutes involved, Government support to entrepreneurs, Incubation centers, risk assessment. Scope for small, medium and Large scale industries in Microbiology

Unit–II: Fermentation Products No of Hours: 9

1. Microbial cells as fermentation products-
2. Bakers yeast, food and feed yeasts, SCP, Bacterial Insecticides, Legume Inoculants, Algae.
3. Enzymes as fermentation products–
4. Bacterial and Fungal Amylases, Proteolytic Enzymes, Pectinases, Invertases, and other enzymes
5. Fermentation Economics

Unit–III: Bio-fertilisers and Mushrooms No of Hours: 9

1. Mushroom cultivation–Cultivation of Agaricus campestris,Calocyba indica, Agaricus bisporus, and Volvariella volvaciae; Preparation of compost, filling tray beds, spawning, maintaing optimal temperature, casing, watering, harvesting, storage.
2. Biofertilizers –Chemical fertilizers versus biofertilizers, organic farming. Production of biofertilisers-Rhizobium sp, Azospirillumsp, Azotobactersp.
3. Microbial consortia for composting and as biofertilisers

Unit–IV: Baking and Brewing processes No of Hours: 9

Brewing–Media components, preparation of medium, Microorganisms involved, maturation,

carbonation, packaging, keeping quality, contamination, by products. Bread making- Yeast activation,

Unit–V:DPR and Patents **No of Hours: 9**

1. Preparation of DPR (Detailed Project Report)
2. Patents and secret processes –History of patenting, composition, subject matter and characteristics of a patent, Inventor, Infringement, cost of patent

Skill Outcomes:

By the completion of the course the learner should able to–

1. Prepare Microbial consortia for composting
2. Prepare a report on the working of production unit of mushrooms/biofertiliser
3. Prepare sample DPR

V SEMESTER

COURSE 6 : APPLIED MICROBIOLOGY

credits -1

1. Preparation of Microbial consortia for composting
2. Field visit and report preparation of Mushroom cultivation unit/ Biofertiliser production centre/or any other
3. Preparation of sample DPR

References:

1. Entrepreneurial Development in India -ByArora.
2. Sathyanarayana.U, Biotechnology.(2005)1stEd.BooksandAllied(P)Ltd.
3. Casida,LEJR,(2019). Industrial Microbiology.NewAge International Publishers
4. K.R.Aneja,ExperimentsinMicrobiology,Plantpathology,Tissueculture and Mushroom productiontechnology,6thEd.SChandPublication
5. NdukaOkafor.ModernIndustrialMicrobiologyandBiotechnology.2007.CRCPre s s
6. MichaelJ.Waites,NeilL.Morgan,JohnS.Rockey,GaryHigton.IndustrialMicrobio l ogy: AnIntroduction.2013.WileyBlackwellPublishers.
7. A.H.Patel.IndustrialMicrobiology.2016.2ndEd.LaxmiPublications,NewDelhi.
8. DubeyRC.ATextbookofBiotechnology.(2014).SChand Publishers.
9. RobertD.Hisrich,MichaelP.Peters,"EntrepreneurshipDevelopment",TataMcGr a w Hill

II. Co-Curricular Activities:

1. Prepare fermented foods
2. Workshop on project report preparation of mushroom cultivation unit
3. Visit to industry producing microbial produc