SRI VENKATESWARA UNIVERSITY - TIRUPATI
B.SC. (HONOURS) IN BIOTECHNOLOGY (MAJOR)
W.E.F 2024-2025
SEMESTER III
COURSE-5 – MICROBIOLOGY

Theory Credits:3 3hrs

I. Learning outcomes:

Students after successful completion of the course will be able to

1. Gain knowledge on Scope and techniques of microbiology
2. Know the structure and life cycle of bacteria and viruses
3. Understand on microbial nutrition
4. Learn about microbial Taxonomy
5. Impart knowledge on host-pathogen interaction

II. Syllabus:

UNIT -1: History, Scope and techniques of microbiology

History and contribution of Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Alexander Fleming. Growth curve. Pure culture techniques. Sterilization techniques, Principles and application of physical methods (autoclave, hot air oven, incineration), chemical methods and radiation methods. Simple, gram and acid-fast staining.

UNIT-2: Bacteria and Viruses

Bacteria: Bacterial morphology and subcellular structures, Cell wall of gram +ve and Gram -ve cells. General account of flagella and fimbriae. Chromatin material, plasmids; definition and types of plasmids- F, R, and Col plasmids. Endospores: Detailed study of endospore structure and its formation, germination, basis of resistance. **Viruses**: General characteristics of viruses, difference between virus and typical microbial cell, structure, different shapes and symmetries with one example of each type, classification of viruses on the basis of nucleic acids, phage and animal cell viruses, example of each and their importance. Brief idea of lytic cycle and lysogeny.

UNIT -3:Microbial Nutrition

Basic nutritional requirements: Basic idea of such nutrients as water, carbon, nitrogen, sulfur and vitamins etc., natural and synthetic media, nutritional classification of bacteria. Selective and Differential media, Enriched media, Enrichment media.

UNIT- 4:Microbial Taxonomy

Concepts of microbial species and strains. Classification of bacteria based on morphology, nutrition and environment. General characteristics, transmission and cultivation of viruses. Structure and properties of plant

(tobacco mosaic virus, TMV), animal (Newcastle disease virus, NDV), human (Human immunodeficiency virus, HIV) and bacterial viruses (T4 phage).Emerging and re-emerging viruses (dengue virus, SARS-CoV-2), zoonotic viruses (rabies,).Introduction to fungi, algae and mycoplasma.

UNIT – 5: Host-microbial interaction

Host-pathogen interaction, ecological impact of microbes; symbiosis (Nitrogen fixation and ruminant symbiosis); microbes and nutrient cycles; prebiotics and probiotics.

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SEMESTER III
Practical syllabus: Course 5-Microbiology

Practical Credits:1 2hrs/week

III. Skill outcomes

The student will be able

1. To learn the skill of staining of bacteria
2. To know the technique of pure culture techniques
3. To gain knowledge about preparation of nutrient medium and sterilization
4. To gain knowledge about growth curve of bacteria

IV. Practical syllabus:

1. Isolation of microorganisms from soil
2. staining of bacteria (simple staining and Gram's staining)
3. Pure culture techniques (serial dilution, Spread plate and streak plate methods)
4. Preparation of nutrient medium and sterilization
5. Growth curve of bacteria

V. References:

1.Pelczar, M. J., Reid, R. D., & Chan, E. C. (2001). Microbiology (5th ed.). New York: McGraw-Hill.
2. Willey, J. M., Sherwood, L., Woolverton, C. J., Prescott, L. M., & Willey, J. M. (2011).
Prescott's Microbiology. New York: McGraw-Hill.
3. Matthai, W., Berg, C. Y., & Black, J. G. (2005). Microbiology, Principles and
Explorations. Boston, MA: John Wiley & Sons.
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SEMESTER III

COURSE: 6–IMMUNOLOGY

Theory Credits:3 3hrs/week

I. Learning outcomes:

Students after successful completion of the course will be able to

1. Gain knowledge of fundamental concepts of immunity
2. Learn about nature of antigens and antibodies
3. Understand the antigen – antibody interactions
4. Understand the mechanism of various immunological disorders
5. Impart knowledge on transplantation Immunology

II. Syllabus:

UNIT -1: **Fundamental concepts of Immunity**

Types of immunity – innate, acquired, passive and active. Organisation and structure of lymphoid organs – bone marrow, thymus, spleen and lymphnodes. Cells of the immune system – B-Lymphocytes, T-Lymphocytes, Macrophages. Immunological memory. Adjuvants .

UNIT-2: **Antigens and antibodies**

Nature of antigens and antibodies.Factors affecting antigenicity. Structure, functions and types of antibodies.Isotypes, Allotypes andIdiotypes.Antibody diversity.Cell mediated and humoral immunity. Complement system.

UNIT -3:**Antigen – antibody interactions**

Precipitation, agglutination, Immuno diffusion, ELISA, RIA, Western Blotting, Immuno fluorescent techniques - FACS.Hybridoma technology - production and applications of monoclonal antibodies. Vaccines – types.

UNIT- 4:Immunological disorders

Hypersensitivity – definition, types of hypersensitivity, examples. Autoimmunity – definition, factors affecting autoimmunity, local and systemic autoimmune disorders. Introduction to Tumour immunology.

UNIT – 5: Transplantation Immunology

Major Histocompatibility Complex (MHC) – role in autoimmune and infectious diseases, Human leukocyte antigens (HLA) - typing.Role of HLA in transplantation immunology.

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SEMESTER III

Practical syllabus: Course III-2: Immunology

Practical Credits:1 2hrs/week

III. Skill outcomes

The student will be able

1. To learn to identify the immune organs in rat
2. To Perform the technique of blood grouping
3. To do Immuno diffusion to know antigen antibody interaction
4. To gain knowledge about growth curve of bacteria
5. To Perform ELISA and Western blotting

IV. Practical syllabus:

1. Demonstration of immune organs in rat
2. Agglutination reaction using blood group typing
3. Immuno diffusion (single and double)
4. ELISA and Western blotting

V. References:

1.Kindt, T. J., Goldsby, R. A., Osborne, B. A., &Kuby, J. (2006). Kuby Immunology.
New York: W.H. Freeman.
2. Brostoff, J., Seaddin, J. K., Male, D., &Roitt, I. M. (2002). Clinical Immunology.
London: Gower Medical Pub.
3. Murphy, K., Travers, P., Walport, M., &Janeway, C. (2012). Janeway's Immunobiology. New York: Garland Science.
4. Paul, W. E. (2012). Fundamental Immunology. New York: Raven Press.
5. Parham, P. (2005). The Immune System. New York: Garland Science.

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SEMESTER III

Course Code:

COURSE:7–CELL AND MOLECULAR BIOLOGY

Theory Credits:3 3hrs/week

I. Learning outcomes:

Students after successful completion of the course will be able to understand

1. the basic structure of eukaryotic cell, Cell cycle and its regulation
2. replication of DNA and various models
3. the damage of DNA and the repair mechanisms
4. transcription and translation
5. Gene expression and various controls of gene expression

II. Syllabus:

UNIT -1: Eukaryotic cell

Structure of eukaryotic cell (plant and animal cells) and structure, functions of organelles. Cell division – mitosis and meiosis. Cell cycle and its regulation. Exo and endocytosis. Phago- and pinocytosis. Transport processes - active transport, ionophores and
ion channels.

UNIT-2: DNA replication

Nucleic acids as genetic material, Central dogma of Molecular biology, DNA replication: conservative, semi-conservative and dispersive modes; Meselson& Stahl experiments, Enzymes involved in replication, Initiation, elongation and termination of DNA replication in prokaryotes. Rolling circle replication.

UNIT -3:DNA damage and repair

Structure of telomere, telomerase and its significance, factors contributing to DNA damage, types; repair mechanisms (Photoreactivation, mis-match, Excision, recombination & SOS repairs).

UNIT- 4:Transcription and Translation

Structure of RNA polymerase, significance of σ (sigma) factor, Structure of Promoter, mechanism of initiation, elongation and termination of transcription in prokaryotes; Post transcriptional modifications (cap, Poly A formation & splicing) in eukaryotes. Genetic code, Wobble hypothesis.Mechanism of initiation, elongation and termination of translation in prokaryotes.

UNIT – 5: Regulation of gene expression

Regulation of gene expression in prokaryotes - The operon concept, lac &tryp operons.
Transcriptional control. Post translational control. DNA methylation & gene expression.Chromatin structure & gene expression.

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SEMESTER III

PRACTICAL SYLLABUS: COURSE 7–CELL AND MOLECULAR BIOLOGY

Practical Credits:1 2hrs/week

III. Skill outcomes

The student will be able

1. To observe various mitotic stages in onion root tips
2. To Perform problem solving related to genetic code

IV. Practical syllabus:

1. Observation of various mitotic stages in onion root tips
2. Theoretical problem solving related to start codon, mRNA length and protein molecular weight of a given DNA segment
3. Problem solving related to genetic code

V. References:

1.Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2008).
Molecular Biology of the Cell (5th Ed.). New York: Garland Science.
2. Lodish, H. F. (2016). Molecular Cell Biology (8th Ed.). New York: W.H. Freeman.
3. Krebs, J. E., Lewin, B., Kilpatrick, S. T., & Goldstein, E. S. (2014). Lewin's Genes XI.
Burlington, MA: Jones & Bartlett Learning.
4. Cooper, G. M., &Hausman, R. E. (2013). The Cell: a Molecular Approach (6th Ed.).
Washington: ASM ; Sunderland.
5. Hardin, J., Bertoni, G., Kleinsmith, L. J.,

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SEMESTER III

Course Code:

COURSE: 8–ENZYMOLOGY & INTERMEDIARY METABOLISM

Theory Credits:3 3hrs/week

I. Learning outcomes:

Students after successful completion of the course will be able to

1. Gain knowledge on different enzymes and their significance
2. Learn about bioenergetics and biological oxidation
3. Understand carbohydrate metabolism
4. Understand lipid metabolism
5. Impart knowledge about amino acid and nucleic acid metabolism

II. Syllabus:

UNIT -1: Enzymology

Introduction to Biocatalysis, differences between chemical and biological catalysis. Nomenclature and classification of enzymes. Definition of holo-enzyme, apo-enzyme, coenzyme, cofactor. Active site, Enzyme specificity. Principles of energy of activation, transition state. Interaction between enzyme and substrate-lock and key, induced fit models. Fundamentals of enzyme assay, enzyme units. Outlines of mechanism of enzyme action, factors affecting enzyme activity.Commercial application of enzymes.

UNIT-2: Bioenergetics and Biological oxidation

Concept of free energy, enthalpy (H), entropy (S). Free energy change in biological transformations in living systems; High energy compounds. Oxidation-reduction reactions.Organization of electron carriers and enzymes in mitochondria. Inhibitors and uncouplers of electron transport chain, oxidative phosphorylation. Mechanism of oxidative phosphorylation.

UNIT -3:Carbohydrate metabolism

Concept of anabolism and catabolism.Glycolytic pathway, energy yield.Fate of pyruvate - formation of lactate and ethanol, Citric acid cycle, regulation, energy yield, amphipathic role.Anaplerotic reactions.Glycogenolysis and glycogenesis.Pentose phosphate pathway.Gluconeogenesis.Photosytnthesis-Light and Dark reactions, Calvin cycle, C4 Pathway.

UNIT- 4:Lipid metabolism

Catabolism of fatty acids (β- oxidation) with even and odd number of carbon atoms, Ketogenesis, DE NOVO synthesis of fatty acids, elongation of fatty acids in mitochondria and microsomes, Biosynthesis and degradation of triacylglycerol and lecithin. Biosynthesis of cholesterol.

UNIT- 5: Amino acid and nucleic acid metabolism

General reactions of amino acid metabolism- transamination, decarboxylation and deamination, Urea cycle and regulation, Catabolism of carbon skeleton of amino acids- glycogenic and ketogenic amino acids.Purine and pyrimidine metabolism.

Practical syllabus: Course 8–Enzymology & Intermediary metabolism

Practical Credits:1 2hrs/week

III. Skill outcomes

The student will be able

1. To learn to assay of amylase, urease,catalase
2. To know the effect of pH, temperature and substrate concentration on enzyme activity.
3. To do estimation of glucose
4. To do estimation of total carbohydrates
5. To Perform estimation of amino acid This course enables the students to:

IV. Practical syllabus:

1. Assay of amylase.
2. Assay of urease.
3. Assay of catalase
4. Effect of pH, temperature and substrate concentration on enzyme activity.
5. Estimation of glucose by DNS method.
6. Estimation of glucose by Benedict's titrimetric method.
7. Estimation of total carbohydrates by Anthrone method.
8. Tests for lipids-Salkowski test, Lieberman-Burchardtest.
9. Estimation of amino acid by Ninhydrin method

V. References:

01. Principles of Biochemistry by A.L.Lehninger, 2 Ed. (worth).
02. Lehninger Principles of Biochemistry by Nelson, D and Cox, D. Macmillon Pub.
03. Biochemistry by L.Stryer 5 Ed. (Freeman-Toppan).
04. Text Book of Biochemistry by West et. al., (Mac Millan).
05. Principles of Biochemistry by Smith et. al., (McGraw Hill).
06. Harper's Biochemistry (Langeman).
07. Biochemistry by D.Voet and J.G.Voet (John weily).
08. Enzymes by Palmer (East).

MODEL QUESTION PAPER

Max. Marks: 75 Time: 3 hrs

SECTION A (Total: 5x5=25 Marks)

(Answer any five questions. Each answer carries 5 marks
(At least 1 question should be given from each Unit)

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SECTION B (Total: 5x10 = 50 Marks)

(Answer any five questions. Each answer carries 10 marks
(At least 1 question should be given from each Unit)

9.	A or B
10.	A or B
11.	A or B
12.	A or B
13.	A or B