

Punyashlok Ahilyadevi Holkar Solapur University, Solapur



NAAC Accredited-2022
'B++'Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

(As per New Education Policy 2020)

Syllabus: Biotechnology

Name of the Course: B.Sc. I (Sem. I & II)

(Syllabus to be implemented from June 2024)

Structure as per NEP-2020

B. Sc. I (Biotechnology)

| Level | Sem. | Major | | Minor | VSC/ SEC | GE/ OE | IKS, AEC, VEC | CC | Total Credits | Cumulative Credits |
|-------|------|-------|---|-------|-----------|--------|---|----------|---------------|--------------------|
| | | T | P | T | | | | | | |
| 4.5 | I | 2 | 2 | -- | SEC-1 (2) | -- | IKS-1 (2) AEC: L1-1 (2) VEC-1 (2) | CC-1 (2) | 22 | 44 |
| | | 2 | 2 | -- | | | | | | |
| | | 2 | 2 | -- | | | | | | |
| | II | 2 | 2 | -- | SEC-2 (2) | 2 | AEC: L1-2 (2) VEC-2 (2) | CC-2 (2) | 22 | |
| | | 2 | 2 | -- | | | | | | |
| | | 2 | 2 | -- | | | | | | |

Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

Abbreviations:

| | | |
|---|---|---|
| VSC: Vocational Skill Course SEC: Skill Enhancement course VSEC: Vocational Skill and Skill Enhancement Course | GE/OE: Generic/ Open Elective | IKS: Indian Knowledge System AEC: Ability Enhancement Course VEC: Value Education Course |
| CC: Co-curricular Course | FP: Field project RP: Research Project | OJT: On Job Training |

| SEMESTER - I | | | | |
|----------------------|--------------------|-----------------------|--|---------------|
| Sr.No. | Course Type | Course Code | Paper Title | Credit |
| 1. | Major | DSC 1-1 | Biotechnology – Paper I (Biotechnology in Human Welfare) | 2 |
| 2. | Major | DSC 2-1 | Biotechnology – Paper II (Basic Biophysics and Chemical Science) | 2 |
| 3. | Major | DSC 3-1 | Biotechnology – Paper III (Biochemistry) | 2 |
| 4. | Practical | Practical Course -I | Practical Course - I (Based on DSC1-1, DSC 2-1 & DSC 3-1) | 6 |
| 8. | (SEC/VSC) | SEC-1 | Basic laboratory Skills in Biotechnology | 2 |
| 9. | AEC | L1-1 | English Paper - I | 2 |
| 10. | IKS | IKS-1 | Indian Knowledge System | 2 |
| 11. | VEC | VEC-1 | Constitution of India | 2 |
| 12. | CC1 | CC-1 | Community Engagement & Services | 2 |
| | | | Total | 22 |
| SEMESTER - II | | | | |
| Sr.No. | Course Type | Course Code | Paper Title | Credit |
| 1. | Major | DSC 1-2 | Biotechnology – Paper IV (Fundamental Microbiology) | 2 |
| 2. | Major | DSC 2-2 | Biotechnology – Paper V (Cell Biology) | 2 |
| 3. | Major | DSC 3-2 | Biotechnology – Paper VI (Cell Physiology) | 2 |
| 4. | Practical | Practical Course - II | Practical Course- II (Based on DSC 1-2, DSC 2-2 and DSC 3-2) | 6 |
| 8. | OE/ GE | OE-I/ GE-I | To be selected from the Basket of OE-I/GE-I | 2 |
| 9. | SEC | SEC-2 | Plant Tissue Culture | 2 |
| 10. | AEC | L1-2 | English Paper - II | 2 |
| 11. | VEC | VEC-2 | Environmental studies | 2 |
| 12. | CC2 | CC-2 | Community Engagement & Services | 2 |
| | | | Total | 22 |

SEMESTER - I

| SEMESTER - I | | | | |
|--------------|------------------|---------------------|--|-----------|
| Sr.No. | Course Type | Course Code | Paper Title | Credit |
| 1. | Major | DSC 1-1 | Biotechnology – Paper I (Biotechnology in Human Welfare) | 2 |
| 2. | Major | DSC 2-1 | Biotechnology – Paper II (Basic Biophysics and Chemical Science) | 2 |
| 3. | Major | DSC 3-1 | Biotechnology – Paper III (Biochemistry) | 2 |
| 4. | Practical | Practical Course -I | Practical Course - I (Based on DSC1-1, DSC 2-1 & DSC 3-1) | 6 |
| 8. | (SEC/VSC) | SEC-1 | Basic laboratory Skills in Biotechnology | 2 |
| 9. | AEC | L1-1 | English Paper - I | 2 |
| 10. | IKS | IKS-1 | Indian Knowledge System | 2 |
| 11. | VEC | VEC-1 | Constitution of India | 2 |
| 12. | CC1 | CC-1 | Community Engagement & Services | 2 |
| | | | Total | 22 |

DSC 1-1: BIOTECHNOLOGY IN HUMAN WELFARE (Theory)

| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
|---|--|-----------------------------|-------------------|
| 2 Credits | 2 Hours | 30 ours | 50 (30:20) |
| Objectives: | <ul style="list-style-type: none"> To get information about scope of biotechnology in various fields. To get knowledge about applications of biotechnology in various fields. To understand the interdisciplinary scope of biotechnology. | | |
| Outcomes: | <ul style="list-style-type: none"> Students get information about scope of biotechnology in various fields. Students get knowledge about applications of biotechnology in various fields. Students can understand the interdisciplinary scope of biotechnology. | | |
| Unit I | INTRODUCTION AND SCOPE OF BIOTECHNOLOGY | | 15 |
| <p>A. Introduction to Biotechnology: History, Contribution of Biotechnology [Waldeyer, Rosalind Franklin, J.D. Watson, Karry Mullis, Norman Borlaug], National Institutes of Biotechnology in India.</p> <p>B. Biotechnological Milestones: Green Revolution, White Revolution, Blue Revolution, Yellow Revolution, Grey Revolution, Red Biotechnology.</p> <p>C. Biotechnology and Interdisciplinary scope: Chemical science, Physics, Mathematics, Statistics, Computer application, Pharmacy, Remote sensing, Robotics, Artificial Intelligence, Nanotechnology.</p> | | | |
| Unit II | BIOTECHNOLOGY-APPLICATIONS | | 15 |
| <p>A. Agribiotechnology and Pharmaceuticals : Golden Rice, Bt cotton, Bt-Brinjal, Edible vaccines, Importance of Medicinal plants in therapeutics, Genetically engineered insulin, vermi-technology.</p> <p>B. Transgenic organisms and reproductive technology : Transgenic pioneers – Nancy, Ethal and Herman, Knock out mice, transgenic fish, Transgenic cattle, birds, pigs. Test of Infertility [Male and Female], Donated sperm – Artificial insemination, Donated uterus – Surogate motherhood, <i>In vitro</i> fertilization.</p> <p>C. Biotechnology in Human Welfare : Effects, Prevention and Control of human diseases [Pneumonia, Common cold, Malaria, Amoebiosis, Ascariasis, Elephantiasis], Active and Passive immunity, Vaccination and Immunization.</p> | | | |

References:

1. Introduction to Biotechnology, 2014, 3rd ed. William J. Thieman, Michael A. Palladino, Pearson Education India.
2. Biotechnology: Principles and Applications, S.C. Rastogi, Alpha Science International, 2007.
3. A textbook of Biotechnology by R.C. Dubey, 1993
4. Biotechnology U. Satyanarayana, 2020
5. Biotechnology for beginners, Renneberg, R. & Berkling, V. Academic Press, 2017
6. Biotechnology and Human Welfare for Competitive Examinations McGraw-Hill; First Edition (30 January 2020)(ISBN-10 : 9387432467).

| DSC 2-1 : BIOPHYSICS AND CHEMICAL SCIENCE | | | |
|--|--|------------------------------------|--------------------|
| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
| 2 Credits | 2 Hours | 30 Hours | 50 (30:20) |
| Objectives: | <ul style="list-style-type: none"> • To understand basic concepts in physics applicable for biological science. • To understand basic concepts of chemistry applicable for biological science. | | |
| Outcomes: | <ul style="list-style-type: none"> • Understanding of the correlation between physics concepts and biology. • Understanding of the correlation between chemistry concepts and biology. | | |
| Unit I | BASICS BIOPHYSICS | | 15 |
| <p>A. Biophysics of Water: Molecular structure, Association of water through H-bonding, Nature of hydrophobic interactions, physicochemical properties of water.</p> <p>B. Physical properties in biology: Molecular weight, molecular charge, affinity, pH, pOH, Buffer, Henderson Haselbalch equation, Sedimentation, Centrifugal force, Density, Surface tension, Laws of thermodynamics, concept of: Free Energy, Enthalpy and Entropy</p> <p>C. Electromagnetic spectrum, Properties of light, Absorption, Transmittance, Refractive index, Molar absorption coefficient, Beer Lamberts Law</p> | | | |
| Unit II | BASICS CHEMICAL SCIENCE | | 15 |
| <p>A. Mendeleev's and Modern periodic law, Types of bonds in biomolecules Concept of Hybridization: sp, sp², sp³ hybridization with respect to C₂H₂, C₂H₄, CH₄ (bond length, bond angle, bond energy and shape of the molecule). Dipole moment: Definition and significance.</p> <p>B. Solutions: Solutions, types of solutions, solubility & factors affecting solubility; Mole concept: Definition & introduction to molarity, normality, molality, percentage by mass and volume</p> <p>C. Classification of solvents, Dilution factor. Colligative properties: Osmosis, reverse osmosis, osmotic pressure, boiling point, freezing point, vapor pressure</p> | | | |

References:

1. Ackerman E.A. Ellis, L.E.E. & Williams L.E. (1979), Biophysical Science, Prentice-Hall Inc.
2. Barrow.C. (1974), Physical Chemistry For Life Sciences, McGraw-Hill.
3. Essentials of Physical Chemistry by B.S. Bahel and G.D. Tuli
4. College Chemistry by Linus Pauling
5. Basic Inorganic Chemistry by Cotton and Wilkinson
6. Organic Chemistry, 5th Edition by Morrison Prentice Hall of India Pvt. Ltd. Boyd, New Delhi

DSC 3-1: BIOCHEMISTRY

| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
|--|--|-----------------------------|-------------------|
| 2 Credits | 2 Hours | 30 Hours | 50 (30:20) |
| Objectives | <ul style="list-style-type: none"> • To get introduced with structure, function and role of biomolecules. • To understand structure, function and role of important bioactive components. | | |
| Outcomes | <ul style="list-style-type: none"> • Understanding of basic structure, function and role of biomolecules. • Understanding of structure, function and role of important bioactive components. | | |
| Unit I | INTRODUCTION TO BIOMOLECULES | | 15 |
| <p>A. Carbohydrates: Structure, properties and function of Monosaccharide (glucose, fructose, mannose, galactose, ribose), Disaccharide (sucrose, lactose), Polysaccharide (starch, glycogen, cellulose, peptidoglycan).</p> <p>B. Proteins: Classification of amino acids, Proteins: Peptide bond, forces stabilizing protein structure, classification of proteins based on composition.</p> <p>C. Lipids: Structure and properties of fatty acids, storage lipid (triacylglycerol, wax), membrane lipid (phospholipids, spingolipids, sterol)</p> <p>Nucleic acids: Composition, structure and nomenclature of nucleotides, Structure of B-form of DNA, RNA and its types.</p> | | | |
| Unit II | BIOACTIVE COMPONENTS | | 15 |
| <p>A. Vitamins: Source, daily requirements, physiological role, deficiency/ hyper vitaminosis of water soluble and fat soluble vitamins.</p> <p>B. Enzymes: Structure of enzyme: Apoenzyme, Coenzyme, Cofactor, Prosthetic group, Lock and key model, Induced fit hypothesis, concept of activation energy, Classification of enzymes</p> <p>C. Hormones: Classification of human hormones, biological role of pituitary, thyroid, adrenal and gonadotropic hormones</p> | | | |

References:

- 1) Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, Vth Edition, W.H. Freeman and Co., New York.
- 2) Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
- 3) Voet and Voet's Biochemistry, D. Voet and J. Voet 5th edition, 2016, John Wiley and Sons Inc., 2005
- 4) Biochemistry–U. Satyanarayan

Practical Course - I

(Based on DSC1-1, DSC 2-1 & DSC 3-1)

| DSC 1-1: BIOTECHNOLOGY IN HUMAN WELFARE (2 Credits) | |
|--|--|
| 1 | Study and preparation of Watson and Crick Model of DNA. |
| 2 | Qualitative analysis of milk by Methylene Blue Reduction Test. |
| 3 | Synthesis of silver nanoparticles by biological method. |
| 4 | Study of vermicompost/vermiwash |
| 5 | Applications of remote sensing in precision agriculture. |

| DSC 2-1: BIOPHYSICS AND CHEMICAL SCIENCE (2 Credits) | |
|---|--|
| 1 | Study of Lambert's & Beer's law using colorimeter. |
| 2 | Study of UV spectra of protein/DNA using spectrophotometer. |
| 3 | Preparation of Molarity, normality and percentage solutions. |
| 4 | Measurement of pH and preparation of buffers (Phosphate buffer, acetate buffer). |
| 5 | To determine viscosity and/or conductivity of given liquids. |
| 6 | Study of osmosis using dialysis bag. |

| DSC 3-1: BIOCHEMISTRY (2 Credits) | |
|--|---|
| 1 | Qualitative analysis of carbohydrates |
| 2 | Study of titration curve of amino acids |
| 3 | Paper chromatography amino acids |
| 4 | Qualitative analysis of lipids |
| 5 | Study of enzyme activity (amylase/invertase) |
| 6 | Study the effect of temperature on enzyme activity. |

References:

1. Verma, S., Das, S. and Singh, A. (2014). Laboratory Manual for Biotechnology Students. S. Chand.
2. Jayaram, J Laboratory manual in Biochemistry. Wiley Eastern 1981.
3. Mu P, Plummer DT. Introduction to practical Biochemistry. Tata Mcgraw-Hill Education: 2011
4. Alexander J. Ninfa, David Ballou, and Marilee Benore (1998). Fundamental Laboratory Approaches for Biochemistry and Biotechnology. Wiley
5. S. Harisha(2007) Biotechnology Procedures and Experiments Handbook. Infinity Science Press LLC, Hingham, Massachusetts New Delhi, India.

| SKILL ENHANCEMENT COURSE | | | |
|--|--|------------------------------------|--------------------|
| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
| 2 Credits | 2 Hours | 30 Hours | 50 (30:20) |
| SEC - 1: BASIC LABORATORY SKILLS IN BIOTECHNOLOGY | | | |
| 1 | Handling of chemicals and reagents | | |
| 2 | Handling of microorganisms | | |
| 3 | Handling and care of microscope | | |
| 4 | Washing and sterilization of glassware | | |
| 5 | Handling and care of weighing balance | | |
| 6 | Laboratory Waste disposal | | |
| 7 | Laboratory safety | | |

References:

1. Basic Practical Microbiology : A Manual (2006). Society for General Microbiology (SGM), ISBN 0 95368 383 4.
2. Alexander J. Ninfa, David Ballou, and Marilee Benore (1998). Fundamental Laboratory Approaches for Biochemistry and Biotechnology. Wiley
3. S. Harisha (2007) Biotechnology Procedures and Experiments Handbook. Infinity Science Press LLC, Hingham, Massachusetts New Delhi, India.

Ability Enhancement Course (AEC)
L1-1 (2) ENGLISH PAPER - I

| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
|-----------------------|------------------------------|------------------------------------|--------------------|
| 2 Credits | 2 Hours | 30 Hours | 50 (30:20) |

INDIAN KNOWLEDGE SYSTEM (IKS)
IKS – 1

| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
|-----------------------|------------------------------|------------------------------------|--------------------|
| 2 Credits | 2 Hours | 30 Hours | 50 (30:20) |

| VALUE EDUCATION COURSE | | | |
|-------------------------------|------------------------------|------------------------------------|--------------------|
| VEC-1 | | | |
| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
| 2 Credits | 2 Hours | 30 Hours | 50 (30:20) |
| Constitution of India | | | |

| CO CURRICULAR | | | |
|--|------------------------------|------------------------------------|--------------------|
| CC-1 | | | |
| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
| 2 Credits | 2 Hours | 30 Hours | 50 (30:20) |
| Health and Wellness, Yoga education sports, and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/ Performing Arts | | | |

SEMESTER - II

| SEMESTER - II | | | | |
|---------------|-------------|-----------------------|---|-----------|
| Sr.No. | Course Type | Course Code | Paper Title | Credit |
| 1. | Major | DSC 1-2 | Biotechnology – Paper IV (Fundamental Microbiology) | 2 |
| 2. | Major | DSC 2-2 | Biotechnology – Paper V (Cell Biology) | 2 |
| 3. | Major | DSC 3-2 | Biotechnology – Paper VI (Cell Physiology) | 2 |
| 4. | Practical | Practical Course - II | Practical Course- II (Based on DSC 1-2, DSC 2-2 and DSC 3-2) | 6 |
| 8. | OE/ GE | OE-I/ GE-I | To be selected from the Basket of OE-I/GE-I | 2 |
| 9. | SEC | SEC - 2 | Plant Tissue Culture | 2 |
| 10. | AEC | L1-2 | English Paper - II | 2 |
| 11. | VEC | VEC - 2 | Environmental Studies | 2 |
| 12. | CC2 | CC- 2 | Community Engagement & Services | 2 |
| | | | Total | 22 |

| DSC1-2: FUNDAMENTAL MICROBIOLOGY (Theory) | | | |
|--|--|------------------------------------|--------------------|
| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
| 2 Credits | 2 Hours | 30 Hours | 50 (30:20) |
| Objectives: | <ul style="list-style-type: none"> To get information about history and development of microbiology. To understand the diversity of microbial world and organization of microorganisms. | | |
| Outcomes: | <ul style="list-style-type: none"> Students get information about history and development of microbiology. Students understand the aspects of microbial structure and organization. | | |
| Unit I | HISTORY AND DEVELOPMENT OF MICROBIOLOGY | | 15 |
| | <p>A. Development of microbiology as a discipline, Spontaneous generation vs. biogenesis.</p> <p>B. Contributions of Antonie van Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Paul Ehrlich, Elie Metchnikoff, Edward Jenner, Martinus W. Beijerinck, Sergei N. Winogradsky, Selman A. Waksman. Germ theory of disease, Hargovind Khorana.</p> <p>C. An overview of Scope of Microbiology a) Air b) Waste Water c) Soil d) food& dairy.</p> | | |
| Unit II | MICROBIAL WORLD | | 15 |
| | <p>A. Aim and principles of Bacterial classification, systematics and taxonomy, concept of species, taxa, strain; Differences between: prokaryotic-eukaryotic microorganisms, eubacteria-Archaeobacteria.</p> <p>B. Acellular microorganisms (Viruses, Viroids, Prions) and Cellular microorganisms (Algae, Fungi and Protozoa)</p> <p>C. Study of bacteria- Size, Shape, Morphological arrangement, Structure and functions of: Cell wall, Cell membrane, Flagella, Nuclear equivalent, Ribosome, Capsule, Slime layer. Mesosomes, Pili.</p> | | |

References:

1. Tortora GJ, Funke BR and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education
2. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition
3. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company
4. Stanier R Y General microbiology Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International

| DSC 2-2: CELL BIOLOGY (Theory) | | | |
|---|--|------------------------------------|--------------------|
| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
| 2 Credits | 2 Hours | 30 Hours | 50 (30:20) |
| Objectives: | <ul style="list-style-type: none"> To give detailed explanation of cell and the structure and functions of various organelles of cells. To elaborately explain the step-by-step process of cell cycle, cell division. To get detailed understanding of cytoskeleton and cancer. | | |
| Outcomes: | <ul style="list-style-type: none"> Students will understand concepts of cell in all. Students will understand steps of cell cycle and division. Students will understand importance of cytoskeleton and cancer. | | |
| Unit I | CELL ORGANIZATION | | 15 |
| <p>A. Introduction of Cell, Historical account of cell biology; cell theory and protoplasm theory, B. Organization of cells - Prokaryotic, Eukaryotic, animal, plant, bacterial, Virus, yeast. C. Structure and functions of Cell Organelles: Mitochondria, Chloroplasts, Vacuoles, microbodies, Golgi Bodies, Lysosomes, Endoplasmic Reticulam, Ribosomes and Peroxisomes. Nucleus, types of chromosomes based on centromere and their structure.</p> | | | |
| Unit II | CELL GROWTH, CYTOSKELETON AND CANCER | | 15 |
| <p>A. Cell growth: Concept of cell growth and differentiation, Cell cycle, Mitosis, and Meiosis. B. Cytoskeleton: Structure and function of microfilament, intermediate filament and microtubules. C. Cancer: Characteristics and molecular basis of cancer, Carcinogenesis, agents promoting carcinogenesis.</p> | | | |

References:

- Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
- De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
- Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7 th edition. Pearson Benjamin Cummings Publishing, San Francisco.

DSC 3-2: CELL PHYSIOLOGY (Theory)

| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
|------------------|--|-----------------------------|-------------------|
| 2 Credits | 2 Hours | 30 Hours | 50 (30:20) |
| Objectives: | <ul style="list-style-type: none"> To learn principles of cell communication and recognition in biological systems. To learn the concept of cell signaling and ultrastructure of the cellular structures involved. To get introduced with membrane and microbial physiology and important physiological processes associated with them. | | |
| Outcomes: | <ul style="list-style-type: none"> Students understand the principles of cell communication and recognition process. Students get knowledge about the cellular structures and the concept of cell signaling. Students get knowledge about the membrane and microbial physiology and important physiological processes associated with them. | | |
| Unit I | CELL COMMUNICATION AND CELL RECOGNITION | | 15 |
| | <p>A. General principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, cell-ECM interactions, integrins, neurotransmission and its regulation.</p> <p>B. Cell signaling – Chemical nature of signaling molecules and their receptors, secondary messengers, signal transduction pathway (e.g. epinephrine signaling in glycogen metabolism), bacterial chemotaxis and quorum sensing.</p> <p>C. Structure and functions of cells involved in cell physiology – Epithelial, Nerve, Muscle and Connective tissue</p> | | |
| Unit II | MEMBRANE AND MICROBIAL PHYSIOLOGY | | 15 |
| | <p>A. Membrane transport - lipid bilayer and membrane protein diffusion, osmosis, ion channels, active/passive transport, membrane pumps</p> <p>B. Role of golgi and ER in protein synthesis, Vesicle trafficking, endocytosis and exocytosis</p> <p>C. Microbial Physiology - Growth yield and characteristics, strategies of cell division, stress Response.</p> | | |

References:

1. Principles of Biochemistry - L. Stryer (W.H. Freeman & Co.)
2. Principles of Biochemistry - A.L. Lehninger, D.W. Nelson & M.M. Cox (Macmillan)
3. Biochemistry - D. Voet & J.G. Voet (John Willey)
4. Biophysics, Vasant Pattabhi, Gautam (2002), Narosa .
5. Biomembrane structure and Function, Chapman D.
6. Introduction to Biological Membrane, Jain R K
7. Biophysics, Hopp, Lohman, Mark and Ziegler
8. Molecular and Cellular Biophysics, Meyer B Jackson (2006), Cambridge)

Practical Course - II
(Based on DSC1-2, DSC 2-2 & DSC 3-2)

| DSC 1-2: FUNDAMENTAL MICROBIOLOGY (2 Credits) | |
|--|--|
| 1 | Introduction to Microbiology laboratory Glassware: petri-plates, slants, incubation flasks, glass spreader, suspension tube and Equipment: Microscope, Autoclave, Incubator, Hot Air Oven, Laminar Air flow, Rotary Shaker |
| 2 | Introduction to Microbiology Culture media – Nutrient broth, selective medium, differential medium, minimal medium, concept of sterilization. |
| 3 | Microbiology Culture techniques: Preparation of suspension, smear, inoculation, and streaking, spreading, concept of aseptic technique. |
| 4 | Microbiology Culture techniques: Preparation of suspension, smear, inoculation, and streaking, spreading, concept of aseptic technique. |
| 5 | Gram staining and motility test by Hanging drop technique. |
| 6 | Mounting & Identification of Fungi |

| DSC 2-2: CELL BIOLOGY (2 Credits) | |
|--|--|
| 1 | Study of membrane permeability. |
| 2 | Study of histology of stomach/ileum/liver/pancreas/kidney. |
| 3 | Study on Quorum Sensing. |
| 4 | Study of chemotaxis in bacteria. |
| 5 | Study of bacterial growth curve. |

| DSC 3-2: CELL PHYSIOLOGY (2 Credits) | |
|---|---|
| 1 | Study of animal cell and plant cell structure under microscope. |
| 2 | Isolation of chloroplast from plant material. |
| 3 | Study of mitochondria using Janus Green B stain. |
| 4 | Study of cell division under microscope (mitosis / meiosis) |
| 5 | Measurement of cell size by micrometry. |

References:

1. Handbook of Microbiological Media (2010). Ed. Atlas, Ronald, CRC Press, USA.
2. Bergey's Manual of Systematic Bacteriology. 2005. Ed. Brenner, Don, J. Vol. 2, Springer Publisher, USA.
3. Basic Practical Microbiology : A Manual (2006). Society for General Microbiology (SGM), ISBN 0 95368 383 4.
4. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited
5. Current protocols in Cell biology- March 2019- Wiley
6. Alexander J. Ninfa, David Ballou, and Marilee Benore (1998). Fundamental Laboratory Approaches for Biochemistry and Biotechnology. Wiley
7. S. Harisha (2007) Biotechnology Procedures and Experiments Handbook. Infinity Science Press LLC, Hingham, Massachusetts New Delhi, India.

| SKILL ENHANCEMENT COURSE | | | |
|--------------------------------------|---|------------------------------------|--------------------|
| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
| 2 Credits | 2 Hours | 30 Hours | 50 (30:20) |
| SEC - 2: PLANT TISSUE CULTURE | | | |
| 1 | Sterilization and preparation of media. | | |
| 2 | Isolation and surface sterilization of explants. | | |
| 3 | Initiation and maintenance of callus. | | |
| 4 | Micropropagation by proliferation of axillary bud. | | |
| 5 | Micropropagation by adventitious shoot proliferation. | | |
| 6 | Initiation and establishment of cell suspension cultures. | | |
| 7 | Microspore/ anther culture for haploid production. | | |
| 8 | Protoplast isolation and culture. | | |
| 9 | Embryogenesis and embryo culture, synthetic seeds. | | |
| 10 | In vitro pollination and culture of ovary/ ovule. | | |
| 11 | Study of Phytohormones. | | |
| 12 | Protoplast fusion and somatic hybridization. | | |
| 13 | Visit to commercial plant tissue culture unit. | | |

References –

1. Plant tissue culture by K.K.Dey.
2. Methods in plant tissue culture by Razdan.
3. Plant tissue culture by Jha & Ghosh.
4. Trends in plant tissue culture by Pareek.
5. Plant cell, Organ & tissue culture by Norasa.
6. Plant cell & tissue culture by S.Narayaswami.

Ability Enhancement Course (AEC)
L2- (2) ENGLISH PAPER - II

| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
|-----------------------|------------------------------|------------------------------------|--------------------|
| 2 Credits | 2 Hours | 30 Hours | 50 (30:20) |

VALUE EDUCATION COURSE
VEC - 2

| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
|-----------------------|------------------------------|------------------------------------|--------------------|
| 2 Credits | 2 Hours | 30 Hours | 50 (30:20) |
| Environmental Studies | | | |

CO CURRICULAR
CC - 2

| Course Credits | No. of Hours per Week | Total No. of Teaching Hours | Total marks |
|--|------------------------------|------------------------------------|--------------------|
| 2 Credits | 2 Hours | 30 Hours | 50 (30:20) |
| Health and Wellness, Yoga education sports, and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/ Performing Arts | | | |