JIWAJI UNIVERSITY, GWALIOR-474011
M.SC. BIOTECHNOLOGY

CURRICULUM - *2015-2017*

Semester	Course Code	Title of the Paper	Type	Credits
First	BT-101	Cell Biology	Core	03
	BT-102	Microbiology	Core	03
	BT-103	Bioinstrumentation	Core	03
	BT-104	Biomolecules and Metabolism	Core	03
	BT-105	Practical-I	Core	03
	BT-106	Practical-II	Core	03
	BT-107	Seminar	Core	01
	BT-108	Assignment	Core	01
	BT-109	Comprehensive Viva Voce	Virtual	04
			Total Credits	**24**
Second	BT-201	Molecular Biology	Core	03
	BT-202	Immuno-technology	Core	03
	BT-203	Enzyme-technology	Core	03
	BT-204	Environmental & Animal Biotechnology	Core	03
	BT-205	Practical-I	Core	03
	BT-206	Practical-II	Core	03
	BT-207	Seminar	Core	01
	BT-208	Assignment	Core	01
	BT-209	Comprehensive Viva Voce	Virtual	04
			Total Credits	**24**
Third	BT-301	Bioprocess Engineering & Microbial Technology	Core	03
	BT-302	Genetic Engineering & its Applications	Core	03
	BT-303A BT-303B	Fermentation Technology & Downstream Processing Biostatistics, Bioinformatics& Technical writing	Centric Elective	03
	BT-304A BT-304B	Emerging Trends in Biotechnology Plant Biotechnology	Generic Elective	03
	BT-305	Practical-I	Core	03
	BT-306	Practical-II	Generic	03
	BT-307	Seminar	Core	01
	BT-308	Assignment	Core	01
	BT-309	Comprehensive Viva Voce	Virtual	04
			Total Credits	**24**
Fourth	BT-401	Project Work	Core	15
	BT-402	Seminar	Core	05
	BT-403	Assignment	Core	02
	BT-404	Comprehensive Viva Voce	Virtual	02
			Total Credits	**24**

-Minimum Number of credits be earned for award of degree- 96 credits

[Valid credits 80 + Virtual credits 16]

*****Evaluated both by the Internal & External examiner at the time of presentation. There shall not be compulsory project works during first three semesters. There are weekly seminars and continuous internal assessment throughout the course.

101: CELL BIOLOGY

UNIT I

1. Cell Membrane: physicochemical properties and asymmetrical organization of lipids, proteins and carbohydrates
2. Transport of small molecules across cell membranes: types and mechanism
3. Active Transport by ATP-powered pumps types:p-type, V-type, F-type ABC transporters
4. Properties and mechanisms of transporters; patch pump technique

UNIT II

1. Protein targeting-cell map: signal hypothesis and default protein secretory pathway
2. Protein targeting- endoplasmic reticulum, golgi body,lysosomeand mitochondria
3. Protein glycosylation-N and O linkages
4. Transport by vesicle formation: endocytosis and exocytosis

UNIT III

1. Ultra structure and function of lysosomes
2. Ultra structure and function of peroxisomes
3. Cell motility: structure and functions of microfilaments and microtubules and intermediate filaments
4. Cell junctions: occluding junctions, anchoring junctions and communicating junctions

UNIT IV

1. Molecular mechanism of Ca^{++} dependent cell adhesion
2. Molecular mechanism of Ca^{++} independent cell adhesion
3. Organization and functionsofextra-cellular matrix in animals
4. Extra-cellular matrix receptors on animal cells: integrins

UNIT V

1. Cell Signaling: G-Protein signaling, initiation and regulation of MAP kinase and tyrosine kinase pathway
2. Molecular events accompanyingeukaryotic cell cycle
3. The cell cycle control proteins: cyclins
4. Apoptosis: Morphological, biochemical changes and significance

Practical Exercises

1. Sub cellular fractionation
2. Chromosome preparation: Mitosis – Onion root tip, rat/mouse cornea, rat/mouse bone marrow, human lymphocytes
3. Chromosome preparation: Meiosis – Rat/mouse testis, Grasshopper testis
4. Polytene chromosome preparation from Drosophila salivary gland
5. Identification of tissue typing: Histological preparation of tissue
6. Identification of different biomolecules in different tissues by histochemical techniques
7. Electron microscopy: Demonstration and good photographs for interpretation.

Reference Books

1. Molecular Biology of the Cell (2002), Alberts et al
2. Molecular Cell Biology (2004), Lodish et al
3. Working with Molecular Cell Biology: A study Companion (2000), Storrie et al
4. Cell and Molecular Biology: Concepts and Experiments (3rd Ed., 2002), Gerald Karp
5. The Cell: A Molecular Approach (2004), G.M. Cooper
6. The Word of the Cell (1996), Becker et al
7. Cell Proliferation and Apoptosis (2003), Hughes and Mehnet
8. Essential Cell Biology (1998), Alberts et al
9. Biochemistry and Molecular Biology of Plants (2000), Buchanan et al
10. Harpers Biochemistry Murray et al

102. MICROBIOLOGY

UNIT I

1. Classification of Microorganisms
2. Morphology and structure of cell wall; eubacteria, archaebacteriaand fungi
3. Preparation of culture media, pure culture techniques and microbial staining
4. General account and economic importancecyanobacteria

UNIT II

1. Sterilization: physical and chemical methods
2. Microbial growth: growth curve, measurement of growth and factors affecting growth
3. Nutrition based classification of Microorganisms, Different carbon and nitrogen sources, transport of nutrition across membrane
4. Oxygen toxicity: Study of catalase, peroxidase, superoxidase dismutase, mechanism of oxygen toxicity

UNIT III

1. Infection and disease, types of infection, mechanism of pathogenesis of bacterial and viral diseases
2. *Staphylococcal* and *Clostridia* food Poisoning, Bacterial Diseases: *Salmonellosis* and *Shigellosis*
3. Fungal Diseases: *Aspergillosis* and *Candidasis*
4. Viral diseases: Hepatitis B and HIV

UNIT IV

1. Viruses: types, isolation, cultivation and identification
2. Lytic and lysogenic cycle of bacteriophages
3. Life cycle of DNA viruses: SV 40, RNA viruses: Retroviruses
4. Plant viruses: TMV and Gemini

UNIT V

1. Bacterial Recombination: transformation, conjugation, transduction, F-duction
2. Chemotherapeutic agents: classification of antibiotics, broad and narrow spectrum antibiotics; antibiotics from prokaryotes
3. Anti-fungal and antiviral antibiotics, mode of action of antibiotics
4. Mechanism of drug resistance and plasmids

Practical Exercises

1. Preparation of Liquid and Solid media for growth of microorganisms.
2. Isolation and maintenance of organisms by plating, streaking and serial dilution method, slant and stab cultures, storage of microorganisms.
3. Isolation of pure cultures from soil and water
4. Growth; Growth curve; Measurement of bacteria population by turbidometry and serial dilution methods. Effect of temperature, pH and carbon and nitrogen sources on growth.
5. Microscopic examination of bacteria, Yeast and mold and study of organism by Gram's stain, acid fast stain and staining for spores
6. Study of mutation by Ame's Test.
7. Assay of antibiotics and demonstration of antibiotic resistance
8. Analysis of water for potability and determination of MPN.
9. Bacterial transformation.
10. Biochemical Characterization of selected microbes.
11. One Step growth curve of coliphage.

Reference Books

1. General microbiology, R.Y. Ingraham, J.L. Wheelis, M.L. and Painter, P.R. The Macmillan Press Ltd.
2. Brock Biology of microorganism, M.T. Martinko, J.M. and Parker, J. Prentice-Hall.
3. Microbiology, Pelczar, M.J., Chan E.C.S. and Kreig, N.R., Tata McGraw Hill.
4. Microbial Genetics, Malloy, S.R., Cronan, J.E. Jr and Freifelder, D.Jones, Bartlett Publishers
5. Microbiology-A Laboratory Manual, cappuccino, J.G. Sherman, N. Addison Wesley.
6. Microbiological Applications (A Laboratory Manual in General microbiology) Benson, H.J. WCB: Wm C Brown Publishers

103. BIOINSTRUMENTATION

UNIT I

1. Centrifugation:basic principles, types and applications
2. Photometry: basic principles, instrumentation and application of UV-visible spectrophotometry
3. Infrared (IR) spectroscopy and its applications
4. Fluorescence spectroscopy: principle, instrumentation and applications

UNIT II

1. Atomic absorption spectroscopy: principle, instrumentation and application
2. Chromatography: principle, types and applications; paper, thin layer and HPLC
3. Column chromatography: gel filtration,ion exchange and affinity chromatography
4. Electrophoresis: principle, types and applications; 2-D gel electrophoresis

UNIT III

1. Electron spin resonance (ESR) spectroscopy
2. Nuclear Magnetic resonance (NMR)
3. Circular dichrorism spectroscopy (CD)
4. X-ray crystallography

UNIT IV

1. Mass spectrometry: principle and components of mass spectrometer
2. Mass analyzers: magnetic sector, time of flight (TOF), Quadruple
3. Surface plasma resonance and its applications
4. Flow cytometry: principle and applications

UNIT V

1. Microtomy and sample preparation for microscopy
2. Microscopy: basic principle and components of microscope, phase contrast and fluorescent microscopes
3. Electron microscopy: Principle and applications
4. Autoradiography: principle and applications, radioisotopes used in biology and their applications

Practical Exercises

1. Verification of Beer's law
2. Determination of absorption maxima
3. Electrophoresis of Proteins- native and under denaturing conditions.
4. Aminoacid and carbohydrate separations by paper & thin layer chromatography
5. Gas chromatography
6. Ion exchange and gel filtration chromatography
7. Separation of subcellular organelles by differential centrifugation
8. Separation of blood cells by density gradient centrifugation

Reference Books

1. Physical Biochemistry: Applications to Biochemistry and Molecular Biology by Freifelder
2. Biochemical Techniques : Theory and Practice by Robyt and White
3. Principles of Instrumental Analysis by Skoog and West
4. Analytical Biochemistry by Holme and Peck
5. Biological Spectroscopy by Campbell and Dwek
6. Organic Spectroscopy by Kemp
7. A Biologist's Guide to Pronciples and Techniques of Practical Biochemistry by Wilson and Goulding
8. Principles of Instrumental Analysis by Skoog, Hollar and Nicman

104. BIOMOLECULES & METABOLISM

UNIT I

1. Carbohydrates: structure, classification, properties and functions
2. Homo and hetero polysaccharides: carbohydrate derivatives
3. Lipids classification, structure, properties and functions
4. Lipids with specific biological functions:micelles and liposomes

UNIT II

1. Amino acids: structure, classification, properties and functions, peptides and polypeptides
2. Proteins: properties, primary, secondary, tertiary and quaternary structure
3. Water soluble vitamins; Structure, distribution, interaction and functions
4. Fat soluble vitamins: structure, distribution and functions

UNIT III

1. Nucleotides: structure of purines and pyrimidine bases, nucleosides and nucleotides
2. DNA: structure and confirmation
3. DNA: denaturation, degradation, modification and repair
4. RNA: structure, types and functions of mRNA, tRNA and rRNA

UNIT IV

1. First and second laws of thermodynamics & concept of free energy
2. ATP synthesis and its importance in biological reactions
3. Carbohydrate metabolism: Basic concepts of glycolysis, Krebs cycle, glycogenesis, pentose phosphate pathway, glyconeogenesis
4. Electron transport and oxidative phosphorylation : electron carriers, complexes I to IV, chemiosmotic theory

UNIT V

1 Overview of aminoacid metabolism
2 Regulation of amino acid metabolism
3 Overview of nucleotide metabolism
4 Inborn errors of metabolism

Practical Exercises

1. Titration of amino acids.
2. Colorometric determination of pK.
3. Model building using space filling/ ball and stick models.
4. Reactions of amino acids, sugars and lipids.
5. Quantitation of proteins and sugars.
6. Analysis of oils- iodine number, saponification value, acid number.

Reference Books

1. Principles of Biochemistry by Nelson, Cox and Lehninger.
2. Biochemistry by G. Zubay
3. Biochemistry by Stryer
4. Biochemistry by Garrett and Grisham
5. Biochemical Calculations, Irwin H. Segel, john Wiley and sons Inc
6. Biochemistry,DVoet and jGVoet , J Wiley and Sons
7. Biochemistry, D Freifilder, W.H. Freeman & Company
8. Laboratory Techniques in Biochemistry and molecular Biology, Work and Work
9. A Biologists guide to Principles and Techniques of practical Biochemistry, K.Wilson& K.H. Goulding, ELBS Edition