

Solapur University, Solapur

**B. Sc. II (Biotechnology)
(Semester III & IV)
Syllabus**

June 2014

SOLAPUR UNIVERSITY, SOLAPUR

B. Sc. II Biotechnology Syllabus w.e.f. June- 2014

Semester III			
Paper code	Paper Title	Periods	Marks
BT 201	GENETICS		
BT 201 (I)	Inheritance Biology	45	50
BT 201 (II)	Cyto-Genetics and Population Genetics	45	50
BT 202	BIOTECHNIQUES		
BT 202 (I)	Biophysical Techniques	45	50
BT 202 (II)	Biochemical Techniques	45	50
BT 203	IMMUNOLOGY		
BT 203 (I)	Cell and Organs of Immunity	45	50
BT 203 (II)	Immune Effector Mechanisms	45	50

Semester IV			
Paper code	Paper Title	Periods	Marks
BT 204	MOLECULAR BIOLOGY		
BT 204 (I)	Molecular Biology of Gene	45	50
BT 204 (II)	Gene Regulation	45	50
BT 205	TISSUE TECHNIQUES		
BT 205 (I)	Plant Tissue Culture	45	50
BT 205 (II)	Animal Tissue Culture	45	50
BT 206	METABOLISM		
BT 206 (I)	Bioenergetics and Enzymology	45	50
BT 206 (II)	Metabolism	45	50

Practicals (Annually Once)			
Practical codes	Paper Title	Practicals	Marks
BT 207	Techniques in Molecular Genetics	25	100
BT 208	Methods in Advanced Biotechnology	25	100
BT 209	Techniques in Metabolism, Enzymology and Immunology	25	100

B. Sc. II Biotechnology Syllabus

Semester III

BT 201 GENETICS
BT 201 (I) Inheritance Biology

Unit	Syllabus	Lectures
I	Mendelism Introduction, Mendel's experiment, Monohybrid and Dihybrid crosses, Law of segregation and Law of independent Assortment, Modifications of Mendelian ratios: Co-dominance, Incomplete dominance, Interaction of genes-complementary (9:7), supplementary gene (9:3:4), inhibitory gene (13:3), epistasis (12:3:1)	9
II	Genetic Linkage and Chromosome Mapping Linkage and Recombination of Genes in a Chromosome, Crossing-over, The Molecular Basis of Crossing-over, Multiple Crossing-over, Gene Mapping from Three-Point Test crosses, Genetic Distance and Physical Distance, Mapping by Tetrad Analysis, The Analysis of Unordered Tetrads and the Analysis of Ordered Tetrads	11
III	Extra chromosomal inheritance Genetic system in mitochondria, chloroplast, and plasmid. Alleles, Multiple alleles- ABO blood groups in human, fur colour in rabbit, self incompatibility in plants, and eye colour in drosophila. Pseudo alleles, Complementation tests	7
IV	Sex linked Inheritance Sex Chromosomes, Complete and incompletely sex linked genes. Inheritance of XY linked genes, Y linked genes, X linked genes. Sex Determination in Drosophila	8
V	The Genetics of Bacteria The Genetic Organization of Bacteria, Bacterial Transformation, Conjugation, Transduction, Plasmids, Hfr Cells, Time-of-Entry Mapping, F' Plasmids	10
	References: <ol style="list-style-type: none"> 1. Genetics: Principles and Analysis; Fourth Edition; Daniel L. Hartl; Jones Bartlet Publishers. 2. Experiments in Plant Hybridization – G. Mendel; Prentice Hall, New Jersey. 3. Genetics – B. D. Singh; Kalyani Publication 4. Principles of Genetics – E. J. Gardner; John Willey & Sons, New York. 5. Molecular Biology – P. K. Gupta 6. Genetics – M. W. Strickberger; Macmillan Publication 7. Heterochromatin Science – S. W. Brown 8. The Theory of Gene – T. H. Morgan; Yale University press; New Haven, Conn. 9. Plant Breeding – Principles and Methods: B. D. Singh; Kalyani Publication. 10. Experimental studies in Physiology of Hereditary; Bateson & Punnet; Harrison's & Sons, London 	

BT 201 GENETICS
BT 201 (II) Cyto-Genetics and Population Genetics

Unit	Syllabus	Lectures
I	Chromosome Structure, Morphology, Organization, Heterochromatin & euchromatin, Lampbrush chromosome, polytene chromosome, Sex chromosome, Role of chromosome in heredity. Mitosis, Meiosis.	9
II	Mutation Spontaneous, Induced, Chemical and physical mutagenic agents. Causes and detection, Structural and Numerical alterations of Chromosome: Deletion, Duplication, Inversion, Translocation, Polyploidy, aneuploidy, euploidy.	10
III	Transposable elements Terminology, insertion sequences, types of bacterial transposons. Transposition-structure of transposons and target sites, replicative and non-replicative transposition. Eukaryotic transposable elements – DNA transposases, retroposes (LINES, SINES), Satellite DNA (mini & micro).	9
IV	Population Genetics Introduction, Hardy-weinberg law, gene frequency, factors affecting gene frequency- migration, selection, genetic drift, inbreeding and Mutations. Significance of population genetics. Genetic basis of evolution, evolution of some crop plants- Wheat, Cotton, Brassica	10
V	Quantitative Genetics Introduction, Multiple factor hypothesis, Transgressive segregation, Handling of quantitative data: mean, range, Variance, Standard deviation, Coefficient of Variation. Effects of the environment on quantitative traits,	7
	References: <ol style="list-style-type: none"> 1. Genetics: Principles and Analysis; Fourth Edition; Daniel L. Hartl; Jones Bartlet Publishers. 2. Genetics – B. D. Singh; Kalyani Publication 3. Principles of Genetics – E. J. Gardner; John Willey & Sons, New York. 4. Molecular Biology – P. K. Gupta 5. Genetics – M. W. Strickberger; Macmillan Publication 6. Heterochromatin Science – S. W. Brown 7. Plant Breeding – Principles and Methods: B. D. Singh: Kalyani Publication. 8. Experimental studies in Physiology of Hereditary; Bateson & Punnet; Harrison's & Sons, London 9. Gene VII; Benjamin Lewin; W. H. Freeman & Company. 10. Molecular Basis of Mutation: J. W. Drakey; Holdan Day, San Francisco. 	

BT 202 BIOTECHNIQUES
BT 202 (I) Biophysical Techniques

Unit	Syllabus	Lectures
I	Spectroscopy Electromagnetic wave, Electromagnetic spectrum, Applications of each region of electromagnetic spectrum for spectroscopy. Introduction to molecular energy levels: Excitation, Absorption, Emission. Types of transition: Electronic, Vibrational, Rotational UV-visible spectroscopy. Principle Beer – Lambert’s Law, deviation from Beer-Lambert’ Law, construction and working of colorimeter, turbidometer, nephelometer. IR spectroscopy, Atomic absorption spectroscopy (AAS).	10
II	Bioinstruments Principle, construction, working and application of the following instruments: pH meter: - Definition – acids and bases; pH. Dissociation of acids and bases, measurements of pH – pH indicators, pH paper, pH meter glass electrode, operation and calibration of pH electrode, errors in pH measurements. Centrifugation:- Introduction, Sedimentation and Relative Centrifugal Force, Rotor Types Swinging-Bucket Rotors, Fixed-Angle Rotors, Vertical Rotors, Density Gradients, Types of Centrifugation : Differential Centrifugation, Rate-Zonal Centrifugation, Isopycnic Centrifugation, Analytical Ultracentrifugation.	9
III	Microscopy:- Introduction, optical principles of microscopy Resolving power , Refractive index of glass lenses, Chromatic and achromatic aberrations, image formation in light and electron microscopy, Types of Light Microscopes: Darkfield, Phase contrast, Fluorescence, design and practice of Dissecting, Compound, Inverted ,Transmission Electron Microscope and Scanning Electron Microscope .	10
IV	Radioactivity : Introduction, properties of alpha, beta and gamma radiation, Neutron-proton ratio and nuclear Stability, Process of radioactive decay, radioactive decay energy, rate of radioactive decay, units of radioactivity, Dosimeter: Absorbed dose(D), Dose equivalent(H) and effective dose equivalent Radioactivity detection techniques: Ionization chamber, Geiger Muller counter, Scintillation counter, Hazards biological effect of radiation, Biological Applications of Radioisotope.	9
V	Molecular Characterization Techniques: Introduction, Principle, construction ,working and application of the following Instruments: Circular Dichroism and Optical Rotatory Dispersion, X-ray Diffraction, Flow Cytometry.	7
	References: 1. Instrumental Methods of Chemical Analysis – G. R. Chatwal, S.K.Anand 2. Handbook on Analytical Instruments –R. S. Khandpur. (Mc Graw Hill). 3. Biophysical Chemistry - Upadhyay, Nath, Upadhyay (Himalaya Publishing House). 4. Practical Biochemistry –Wilson & Walker. 5. Biophysics– Dr. Mohan P. Arora	

BT 202 BIOTECHNIQUES
BT 202 (II) Biochemical Techniques

Unit	Syllabus	Lectures
I	Electrophoresis: Basic principles of electrophoresis, support media, theory and application of paper, starch gel, agarose, native and denaturing PAGE, isoelectric focusing, Southern, Northern and Western blotting. Tube Gel Electrophoresis.	9
II	Chromatography : Introduction, two dimensional chromatography ,Paper Chromatography ,Column chromatography, Molecular exclusion chromatography, Ion exchange chromatography, Affinity chromatography, HPLC, GLC.	9
III	Protein Purification Techniques : Cell disruption techniques , Ultrasonication, Ammonium Sulphate Precipitation, Solvent extraction, Dialysis, Ultrafiltration ,Immobilization,	8
IV	Protein Determination: BCA Assay, Bradford Assay, Lowry Assay ,SDS PAGE Electrophoresis, Without Stacker, Native Gels, Staining Gels: Fixing, Staining, Drying, Precipitation and Concentration: Denaturing Precipitation, Native Precipitation, Concentration, Blotting: Protein Staining on Blots, Blocking, Immunostaining, ELISA, Autoradiography of Gels and Blots.	9
V	Proteomics: Introduction, Sample Taking, 2D Gel Electrophoresis, Mass Spectroscopy of Peptides and Proteins, Mass Spectrometers, Sample Preparation for MALDI, The Possibilities of MALDI and TOF. Micro sequencing: Preparing the Protein, the Edman Degradation, Carboxyterminal Sequencing.	10
	References: 1. Protein purification –Robert Scoopes 2. Instrumental Methods of Chemical Analysis – Gurudeep R. Chatwal, Sham K. Anand (Himalaya Publishing House). 3. Handbook on Analytical Instruments –R. S. Khandpur. (Mc Graw Hill). 4. Biophysical Chemistry - Upadhyay, Nath, Upadhyay (Himalaya Publishing House). 5. Practical Biochemistry –Wilson & Walker. 6. Biophysics– Dr. Mohan P. Arora	

BT 203: IMMUNOLOGY
BT 203 (I) Cells and Organs of Immunity

Unit	Syllabus	Lectures
I	<p>Cells and Organs: Hematopoiesis: Introduction, factors involved in hematopoiesis, programmed cell death and Homeostasis. Cell of immune system: B lymphocytes, T lymphocytes, Natural Killer Cells, Mononuclear phagocytes, Dendritic cells, Follicular dendritic cells. Organs of immune system: Structure and functions of primary lymphoid organs (Thymus, Bone marrow, and Lymphatic system), secondary lymphoid organs (Lymph nodes, Spleen), and Mucosa Associated Lymphoid Tissue, Cutaneous Associated Lymphoid Tissue.</p>	10
II	<p>Mediators: Major Histocompatibility Complex: Introduction, two classes, (structure and function) Cytokines: Introduction, properties, function, cytokines receptors. Complement system: Introduction, functions, components, general account on complement activation (classical, alternative and lectin pathways).</p>	10
III	<p>Cellular Interactions: Cell Surface proteins, Cell Surface Dynamics (Endocytic and Exocytic pathways), Cell cycle, Cell surface receptors and Signal Transduction (Protein Phosphorylation and Transcription Factors), Cell Adhesion Molecules: Introduction, Families and its functions.</p>	9
IV	<p>Responders: Antigen: Introduction, immunogenicity, antigenicity, types of antigens, Haptens, properties of immunogen, role of biological system in immunogenicity (genotype of animal, immunogen dosage, route of Administration), adjuvant, epitope. Antibody: Introduction, basic structure and biological function of antibody classes, antigenic determinants.</p>	8
V	<p>Immuno-techniques: Antigen – antibody interactions: Principles and applications of interaction, strength of interactions, cross – reactivity, features of interactions, measurement of antigen – antibody, Precipitation, Immunodiffusion, Immunoelectrophoresis, Electroimmunodiffusion, Agglutination, Complement Fixation Test, Immunofluorescence Test, Radioimmunoassay, ELISA.</p>	8
	<p>References: 1. Immunology - Kuby 2. Essential Immunology- Roitt 3. Cellular and Molecular Immunology- Abbas 4. Immunology and Serology- Philip Carpenter 5. Textbook of Immunology- Barrette J.T. 6. Basic and Clinical Immunology- Fundenberg H. 7. Biology of Immune response- Abramoff and Lavice 8. Fundamental Immunology 5th edition (August 2003): by William E., Md. Paul 9. Immunology an Introduction- Tizard</p>	

BT 203: IMMUNOLOGY
BT 203 (II): Immune Effector Mechanisms

Unit	Syllabus	Lectures
I	Native Immunity: Innate immunity: introduction, First line of Defense (Physical and Chemical barriers at the portal of entry), Second line of Defense (Antimicrobial substances, Cellular factors and Process).	6
II	Acquired Immunity: Humoral immunity: Primary and secondary immune response, antibody production against (T cell independent antigen, T cell dependent antigen and antigen presented by antigen presenting cells), role of B cells, T cells, antigen presenting cells, B cell receptors, B cell (maturation, activation, differentiation.) Cell mediated immunity: T cell receptors, types of cells, their role in immunity, T cell (maturation, activation, differentiation),	10
III	Abnormal Immunity: Hypersensitivity: Introduction, Gell and Coombs classification, types general mechanism and component staking part in hypersensitivity) Autoimmunity: Introduction, general mechanism, classification of autoimmune diseases (Hemolytic, organ specific, and non-organ specific).	9
IV	Immunity to Infections: Immunity to Bacteria, Protozoa, Helminthes and Viruses: Regarding nonspecific Immunity, specific immunity and evasion of the immune response.	8
V	Essential Immunology: Immunohematology: ABO blood group system, Rh blood group system, applications of blood group, Hemolytic diseases of new born, detection of Rh antibodies, ABO hemolytic diseases. Vaccines: Introduction active and passive immunization, Live – attenuated vaccines, killed vaccines, subunit vaccines, conjugate vaccines, DNA vaccines, recombinant vector vaccines. Transplantation immunity: Allograft rejection, Graft-Versus-Host Disease, Grafts that are not rejected suppression of the allograft response. Monoclonal antibodies: Hybridoma Technology and its applications.	12
	References: 1. Immunology - Kuby 2. Essential Immunology- Roitt 3. Cellular and Molecular Immunology- Abbas 4. Immunology and Serology- Philip Carpenter 5. Textbook of Immunology- Barrette J.T. 6. Basic and Clinical Immunology- Fundenberg H. 7. Biology of Immune response- Abramoff and Lavice 8. Fundamental Immunology 5th edition (August 2003): by William E., Md. Paul 9. Immunology an Introduction- Tizard	

B. Sc. II Biotechnology Syllabus

Semester IV

BT 204: MOLECULAR BIOLOGY
BT 204 (I) : Molecular Biology of Gene

Unit	Syllabus	Lectures
I	Central Dogma DNA as the carrier of genetic information; The Central Dogma; Molecular nature of Gene; Genetic code - evidences and properties.	8
II	Structure of Genetic Elements DNA Structure: Mischer to Watson and Crick historic perspective; DNA structure; Salient features of double helix; Types of DNA; Denaturation and renaturation of DNA; cot curves; DNA topology-linking number, topoisomerases; Organization of DNA in Prokaryotes, Viruses, Eukaryotes; RNA Structure; Organelle DNA – mitochondria and chloroplast DNA.	11
III	Replication of DNA in Prokaryotes General principles - bidirectional replication, Semiconservative, Semi discontinuous; RNA priming; Various models of DNA replication including rolling circle, Θ (theta) mode of replication, replication of linear ds-DNA; Enzyme involved in DNA replication of prokaryotes – DNA polymerases, DNA ligase, Primase, Telomerase and other accessory proteins; Initiation, elongation and termination of replication.	10
IV	Replication of DNA in Eukaryotes D-loop (mitochondrial) replication model; DNA polymerases of eukaryotes; Initiation, elongation and termination of replication.	7
V	Mutability and Repair of DNA DNA damage; DNA Repair- Photoreactivation, Mismatch, Excision, Recombination, SOS repair mechanisms and disorders.	9
	Reference Books: <ol style="list-style-type: none"> 1. Molecular Biology; R. Weaver; 2nd Edition, McGraw Hill. 2. Molecular Cell Biology; Lodish; 6th Edition; W. H. Freeman & Company. 3. Gene VII; Benjamin Lewin; Pearson Education. 4. Genetics; B.D. Singh; Kalyani Publication 	

BT 204: MOLECULAR BIOLOGY**BT 204 (II) Gene Expression**

Unit	Syllabus	Lectures
I	Transcription RNA polymerase and the transcription unit; Initiation, elongation and termination of transcription in Prokaryotes and Eukaryotes.	9
II	RNA Modification Split genes, concept of introns and exons, removal of Introns, spliceosome machinery, splicing pathways, alternative splicing, exon shuffling, RNA editing, and mRNA transport	8
III	Translation (Prokaryotes and Eukaryotes) Ribosome structure and assembly; various steps in protein synthesis; Charging of tRNA, aminoacyl tRNA synthetases; Proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation; Inhibitors of protein synthesis; Regulation of translation- Translation-dependent regulation of mRNA and Protein Stability.	12
IV	Transcription Regulation in Prokaryotes Principles of transcriptional regulation; Operon concept; Repression and induction of genes; Regulation of operon : Lac operon and Trp operon.	8
V	UNIT V: Transcription Regulation in Eukaryotes Conserved mechanism of regulation; Eukaryotic activators; Signal integration; combinatorial control; transcriptional repressors; Signal transduction in regulation (Auxin).	8
	Reference Books: 1. Molecular Biology; R. Weaver; 2 nd Edition, McGraw Hill. 2. Molecular Cell Biology; Lodish; 6 th Edition; W. H. Freeman & Company. 3. Gene VII; Benjamin Lewin; Pearson Education. 4. Genetics; B.D. Singh; Kalyani Publication 5. Life-The Science of Biology; David Sadava; 9 th Edition; W. H. Freeman & Company	

BT 205: TISSUE TECHNOLOGY**BT 205 (I) Plant Tissue Culture**

Unit	Syllabus	Lectures
I	Introduction : History, milestones in plant tissue culture. Concepts of Cell theory & Cellular totipotency, Aseptic techniques – Washing & preparation of glassware, packing & sterilization, media sterilization, surface sterilization, aseptic work station, precautions to maintain aseptic conditions. Culture Medium – Nutritional requirements of the explants, plant growth regulators & their <i>in vitro</i> role, media preparation.	8
II	Infrastructure & Organization : Plant tissue culture laboratory – General & aseptic laboratory, different work areas, equipments & instruments required, other requirements.	6
III	‘Explants’: f or plant tissue culture – histological and/or cellular characteristics Response of explants <i>in vitro</i> – Dedifferentiation and redifferentiation a) callus formation b) organogenesis (direct and indirect) c) embryogenesis (direct and indirect)	10
IV	Culture techniques: Introduction, principle, protocol, factors affecting, Morphology & internal structure of Callus culture, Suspension culture, Organ culture, Anther & pollen culture cell synchronization. <i>In vitro</i> multiplication. – a) auxiliary bud proliferation, b) somatic embryogenesis, c)organogenesis Production of artificial seeds – techniques & factors affecting them.	11
V	Protoplast culture: Protoplast isolation, protoplast culture. Somatic hybridization – Protoplast fusion techniques, selection of hybrids, production of symmetric & asymmetric hybrids & cybrid production. Somaclonal variation – Introduction, terminology, origin, selection at plant level, selection at cell level, mechanism, assessment, gametoclonal variation.	10
	References: 1. Introduction to plant tissue culture- M.K. Razdan 2. Plant tissue culture-Theory & practice-S.S.Bhojwani & M.K. Razdan 3. Plant tissue culture-Kalyankumar Dey 4. Biotechnology- B.D. Singh 5. A text book of Biotechnology- R.C. Dubey 6. Biotechnology- H.S. Chawla	

BT 205: TISSUE TECHNOLOGY
BT 205 (II): Animal Tissue Culture

Unit	Syllabus	Lectures
I	Introduction: History, milestones in animal tissue culture, – Principles & practice, Cleanliness, precautions, care to be taken. Nutrition & Physiological media components, Serum, washing, packing, sterilization practices, instruments.	8
II	Requirements of Animal cell culture- Characteristics of animal cell in culture, substrate for cell growth, Equipments required for animal cell culture (Laminar air flow, CO ₂ incubator, Centrifuge, Inverted microscope) Culture media- Natural media, synthetic media (serum containing media, serum free media, balanced salt solution, media Constituents, complete culture media, physicochemical properties of media.	10
III	Culture techniques: Primary cell culture, establishing & maintenance of lymphocyte culture. Cell lines – Insects & Animals cells, subculture. Organs & tissue culture. Characteristics of cultured cells, cell adhesion, cell proliferation, cell differentiation, metabolism of cultured cells, Initiation of cell culture, Evolution and development of cell lines. Morphology of cells, species of origin of cells, Identification of tissue of origin, transformed cells. Identification of specific cell lines. Biochemical & genetic characterization of cell lines.	10
IV	Measurement of growth parameters of cultured cells- Growth cycle of cultured cells, plating efficiency of cultured cells, measurement of growth. Cell synchronization- Cell separation by physical means, cell Separation by chemical blockade. Senescence and apoptosis- Cellular senescence, Measurement of senescence. Apoptosis, Measurement of apoptosis	9
V	Applications of cell culture- In transplantation, and tissue engineering, monoclonal antibodies production, culture based vaccine, valuable recombinant product, cloning, Karyotyping, Cell Repositories, their function. Stem cell culture.	8
	References: 1. Animal Tissue culture : J. Paul 2. Culture of animal cell 3rd edition-R Ian Freshney 3. Animal cell culture- R.W.Masters 4. Animal biotechnology-M.M.Ranga 5. Animal biotechnology-R.Sasidhara 6. Animal cell culture technique-Ed. Martin Clynes Springer 7. Cell growth & division a practical approach-Ed. R. B. Sega& R.L.Press	

BT 206: METABOLISM
BT 206 (I) Bioenergetics and Enzymology

Unit	Syllabus	Lectures
I	<p>Principles of Thermodynamics Thermodynamic systems; First and second law of thermodynamics; Free energy concept; Biological standard state; Standard free energy change; Mass action ratio of reaction; Determination of free energy change of reaction; Relationship between equilibrium constant and standard free energy change (Problems based on it); Properties of standard and actual free energy change.</p>	8
II	<p>Common Biochemical Reactions Only introduction to aldol condensation, claisen condensation, internal rearrangement, isomerization, elimination, free radical reactions; Group transfer reactions (phosphate group transfer) free energy of hydrolysis of ATP, other high energy compounds, group transfer reactions by ATP, ATP as universal currency of free energy in biological system; Biological Oxidation reduction reactions, Biological half reactions, Electron transfer from biomolecules, Redox potential and measurement, Relation between standard redox potential and free energy change (derivation and numericals included); Comparison of biochemical and chemical equations.</p>	10
III	<p>Basics of Enzymes Introduction – definition, apoenzyme, coenzymes, holoenzyme, prosthetic group, cofactors; Classification of enzymes with two examples of each class; IUB nomenclature and numbering of enzymes; Enzyme catalyzed and uncatalyzed reactions; concept of activation energy in enzyme catalysed reaction; Unit of enzyme activity, specific activity and turnover number; Active site of enzyme and its features; Lock and key mechanism; Induced fit hypothesis; Types of enzyme specificity.</p>	10
IV	<p>Kinetics of Enzyme Factors affecting enzyme activity – pH, temperature, substrate concentration, product concentration, inhibitors and activator; Derivation of Michaelis-Menten equation for single substrate; Significance of Km and Vmax; Lineweaver Burk plot and limitations; Enzyme inhibition with kinetics – irreversible, competitive, uncompetitive and non competitive inhibition.</p>	8
V	<p>Advanced Enzymology Isoenzymes of LDH and their clinical importance; Allosteric enzymes – allosteric modulator; Regulation of enzyme in living system (allosteric regulation, activation of latent enzymes, compartmentation of metabolic pathways, control of enzyme synthesis, enzyme degradation, isoenzymes); Abzymes; Non protein enzymes – ribozymes; Biological role of enzymes.</p>	9
	<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Lehninger's Principles of Biochemistry –Nelson & Cox, 5th Edition. 2. Fundamentals of Biochemistry – J. L. Jain, S. Chand & Company Ltd, New Delhi. 3. Fundamentals of Biochemistry – Voet & Voet, 3rd Edition, 4. Harper's Illustrated Biochemistry – R. K. Murray, 26th Edition, 5. Biochemistry – Lubert Stryer, 5th Edition, W.H. Freeman and Company, New York. 6. Biochemistry – U. Satyanarayan, 3rd Edition, Books and allied (P) Ltd. 	

BT 206: METABOLISM**BT 206 (II): Metabolism**

Unit	Syllabus	Lectures
I	Carbohydrate metabolism Glycolysis and its energetics, gluconeogenesis, reciprocal regulation both cycles, lactic acid and ethanol fermentation; TCA cycle, its regulation and energetic; Glycogenesis and glycogenolysis; Reactions and physiological significance of pentose phosphate pathway	10
II	Oxidative phosphorylation Ultra structure of mitochondria; Components of respiratory chain, membrane arrangement of respiratory chain and electron transfer; Q cycle; mechanism of oxidative phosphorylation (Chemiosmotic coupling hypothesis); ATP synthase complex and ATP generation; Stoichiometry of O ₂ consumption and ATP synthesis; Inhibitors of electron transport chain and ATP synthase complex; Uncoupler; Transport of reducing potential from cytosole to mitochondria.	10
III	Brief overview of Photosynthesis Location; light harvesting in green plants; Photosystem I & II; Z scheme of noncyclic photophosphorylation; Cyclic photophosphorylation; Dark reactions – C ₃ and C ₄ pathway; Rubisco enzyme; Synthesis of sucrose and starch.	7
IV	Amino Acid and Nucleotide Metabolism General reactions of amino acid metabolism – Transamination, oxidative deamination and decarboxylation; Urea cycle; Degradation and biosynthesis of amino acids, glycogenic and ketogenic amino acids; Nucleotide Metabolism – Sources of the atoms in the purine and pyrimidine molecules; Outline of biosynthesis and degradation of purine and pyrimidines (Structures not required). Regulation of purine and pyrimidine metabolism.	10
V	Lipid Metabolism Hydrolysis of triacylglycerols; Transport of fatty acid into mitochondria; β oxidation of saturated fatty acids, ATP yield from palmitic acid oxidation; Oxidation of unsaturated and odd chain fatty acids; Biosynthesis of saturated and unsaturated fatty acids; Biosynthesis of triglyceridse, phospholipids and cholesterol; Regulation of cholesterol metabolism.	8
	Reference Books: <ol style="list-style-type: none">1. Lehninger's Principles of Biochemistry –Nelson & Cox, 5th Edition, W.H. Freeman and Company, New York.2. Fundamentals of Biochemistry – J. L. Jain, S. Chand & Company Ltd, New Delhi.3. Fundamentals of Biochemistry – Voet & Voet, 3rd Edition, W.H. Freeman and Company, New York.4. Harper's Illustrated Biochemistry – R. K. Murray, 26th Edition, Lange Medical Books/McGraw-Hill, Medical Publishing Division, New Delhi.5. Biochemistry – Lubert Stryer, 5th Edition, W.H. Freeman and Company, New York.6. Biochemistry – U. Satyanarayan, 3rd Edition, Books and allied (P) Ltd.	

Practicals (Annually Once)

BT 207: Techniques in Molecular Genetics

Sr. No.	Name of the Practical
1	Meiosis in Flower Buds of <i>Allium cepa</i> -Acetocarmine Stain
2	Mitosis in Onion Root Tip (<i>Allium cepa</i>)
3	Study of Mendelian Traits
4	Problem sets in Mendelian inheritance, single point, two point crosses and gene interaction & gene mapping.
5	Induction of Polyploidy
6	Identification of mutant phenotypes- Body shape /nature of wings /eye colour in <i>Drosophila</i> .
7	Sex-Linked Inheritance in <i>Drosophila melanogaster</i>
8	Preparation of Salivary Gland Chromosomes
9	Observation of Mutants in <i>Drosophila melanogaster</i>
10	Spontaneous mutation: Fluctuation test – StrR
11	Examples based on Hardy Weinberg Equilibrium
12	Isolation of bacterial DNA
13	Isolation of Plasmid DNA
14	Isolation of DNA from Animal Cell/ plant cell
15	Isolation of RNA from yeast
16	Isolation of RNA from plant cells / tissue
17	Study of nucleotide composition of RNA
18	Isolation of coliphages
19	Transfer of genetic material - Transformation
20	Transfer of genetic material – Conjugation
21	Transfer of genetic material - Transduction
22	Visit to the field to study Mendelian genetics.

References:

1. Practical Biochemistry – David Plummer
2. Biotechnology procedure and Experiments handbook – S. Harisha
3. Numerical Problems in Plant Breeding & Genetics – Phundan Singh
4. Biochemical methods- Sadasivan & Manikam.
5. Genetics – B. D. Singh

BT 208: Methods in Advanced Biotechnology

Sr. No.	Name of the Practical
1	Cell disruption by SDS/ / Lysozyme/ Toluene
2	Purification of Amylase by dialysis
3	Ammonium sulphate / Acetone precipitation of enzyme
4	Immobilization of enzymes(Amylase/Invertase)
5	Maltose calibration curve by using colorimeter
6	Growth curve by turbidimetry /Nephelometry
7	UV spectra of protein and nucleic acid
8	Electrophoresis of RNA/DNA
9	SDS-PAGE for protein mol. Wt. Determination
10	Ion-exchange chromatography for protein purification
11	Gel permeation chromatography
12	TLC for separation of Amino acids
13	Washing of glassware, , Sterilization techniques
14	Plant Tissue Culture Media preparation
15	Isolation of explants, establishment of Callus
16	Aseptic seed germination
17	Initiation and establishment of cell suspension culture
18	Establishment of Ovule culture
19	Establishment of Anther culture
20	Establishment of Embryo culture
21	Separation of serum and plasma from blood by using centrifugation technique.
22	Protein estimation by Lowery Method
23	Protoplast isolation
24	Animal Cell culture media preparation
25	Setting up of Primary cell culture
26	Cell counting
27	Visit to a commercial Plant Tissue Culture Laboratory

References:

1. Biotechnology procedure and Experiments handbook – S. Harisha.
2. Biochemical methods – Sadasivan & Manikam

BT 209: Techniques in Metabolism, Enzymology and Immunology

Sr. No.	Name of the Practical
1	To determine the relative strength of any known redox couple by titration method
2	To study the factors affecting the amylase enzyme (from any source) activity: a) Presence and absence of activator (chloride ion) & inhibitors (Hg & Cu metal), b) Substrate concentration, c) Temperature, and d) pH
3	To study induction of invertase enzyme in green gram seeds.
4	To separate the isoenzymes of lactate dehydrogenase by polyacrylamide gel electrophoresis.
5	To estimate the glucose in blood by Folin-Wu method
6	To isolate the Cytochrome C from goat heart
7	To isolate chloroplast from spinach leaves and assay of Hill's reaction by spectrophotometer.
8	To estimate chlorophyll from spinach leaves and to separate photosynthetic pigment by paper chromatography.
9	To estimate the blood urea by DAM method
10	To separate the nucleotides by column chromatography
11	To determine the acid value of fat
12	To estimate the blood cholesterol by Liebermann-Burchard method
13	Determination of blood clotting time
14	Estimation of Hemoglobin
15	Total RBC counting
16	Total Leucocytes counting
17	Study of differential Leucocytes counting
18	Latex agglutination test
19	Coomb's test
20	Ouchterlony procedure
21	Counter current immunoelectrophoresis
22	Rocket immunoelectrophoresis
23	Widal Test
24	VDRL Test
25	Demonstration of malaria parasite
26	Visit to any recognized research institute to understand working in Biochemistry and Microbiology (or Pathology lab) laboratory.

References:

3. Laboratory manual in Biochemistry –J. Jayaraman.
4. Practical Biochemistry – David Plummer
5. Practical Manual (Biochemistry) – J. Aruna kumara, College of Agriculture, Hyderabad.
6. Biotechnology procedure and Experiments handbook – S. Harisha.
7. Biochemical methods – Sadasivan & Manikam.
8. Practical Immunology – Talwar
9. Experiments in Microbiology – Aneja