KONGUNADU ARTS AND SCIENCE COLLEGE
(AUTONOMOUS)

Re-accredited by NAAC with 'A' Grade Status – 3.64 CGPA out of 4 (3rd Cycle)
College of Excellence (UGC)
COIMBATORE – 641029, TAMIL NADU, INDIA.

SYLLABUS FOR

PG & RESEARCH DEPARTMENT OF BIOCHEMISTRY

CURRICULUM AND SCHEME OF EXAMINATIONS (CBCS)
(2017 - 2018 and onwards)

PBC – 1

KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

Re-accredited by NAAC with 'A' Grade Status – 3.64 CGPA out of 4 (3rd Cycle)

College of Excellence (UGC)

COIMBATORE – 641029,TAMIL NADU, INDIA.

Course Name: M.Sc. Biochemistry

Curriculum and Scheme of Examination under CBCS

(Applicable for the Students Admitted during the Academic Year 2017-2018)

Semester	Subject code/ Question paper code	Title of the paper	Instructions hours/cycle	Exam Marks			Duration of Exam (Hrs)	Credits
				CIA	ESE	Total		
I	17PBC101	C.P.1 Biomolecules	6	25	75	100	3	4
	17PBC102	C.P.2 Bioanalytical Techniques	6	25	75	100	3	4
	17PBC103	C.P.3 Enzymes and Enzyme Technology	6	25	75	100	3	4
	17PBC104	C.P.4 Molecular Cell Biology	6	25	75	100	3	4
	17PBC1CL	C.Pr.1 Biochemistry Practical - I	6	40	60	100	6	4
II	17PBC205	C.P.5 Metabolic Regulation	5	25	75	100	3	4
	17PBC206	C.P.6 Plant Biochemistry and Biotechnology	5	25	75	100	3	4
	17PBC207	C.P.7 Human Physiology and Endocrinology	5	25	75	100	3	4
	17PBC208	C.P.8 Molecular Biology	5	25	75	100	3	4
	17PBC2CM	C.Pr.2 Lab in Plant Biotechnology, Physiology and Molecular biology	5	40	60	100	5	4
	17PBC2E1	E.P.1 Major Elective- I	5	25	75	100	3	5
III	17PBC309	C.P.9. Immunology	5	25	75	100	3	4
	17PBC310	C.P.10 Genetic Engineering	5	25	75	100	3	4
	17PBC311	C.P.11 Clinical Biochemistry	5	25	75	100	3	4
	17PBC312	C.P.12 Biostatistics and Research Methodology	5	25	75	100	3	5
	17PBC3CN	C.Pr.3 Lab in Immunology and Clinical biochemistry	5	40	60	100	5	4
	17PBC3N1	E.P.1 Non-major Elective –I	5	25	75	100	3	5
IV	17PBC413	C.P.13 Drug Biochemistry	5	25	75	100	3	4
	17PBC4E2	E.P.2 Major Elective- II	6	25	75	100	3	5
	17PBC4N2	E.P.2 Non-major Elective –II	6	25	75	100	3	5
	17PBC4Z1	Project and Viva-voce	13	40	160	200	-	5
*Project record 120 marks + Viva-voce examination 40 marks								

ADVANCED LEARNERS COURSE UNDER SELF STUDY SCHEME

17PBCOD1	Bionanotechnology
17PBCOD2	Nutraceuticals and Functional foods
17PBCOD3	Stem cell biology

JOB ORIENTED COURSE

17PBCOJ1	Bioenterpreneurship
17PBCOJ2	Food safety and Quality control

PBC – 2

Tally Table:

Subjects	Total Marks	Total Credits
Core Paper/Practical/Project (17)	1800	70
Major Elective (2)	200	10
Non – Major Elective (2)	200	10
Grand Total	2200	90

Note: JOC, ALC are offered to the students admitted during the academic year 2017-18 and will be considered as extra credit courses

CBCS - Choice Based Credit System
C.P - Core Paper
C.Pr. - Core Practical
JOC – Job Oriented Course
ALC – Advanced Learners Course
CIA - Continuous Internal Assessment
ESE - End of Semester Examination
25 % CIA is applicable for all theory papers
40% CIA is applicable for all practical papers

Major Elective Papers

1. Biotechnology
2. Microbiology
3. Bioinformatics

Non – Major Elective Papers

1. Clinical and therapeutic nutrition
2. Bioethics, biosafety and IPR
3. Environmental toxicology

Students must select two major electives and two non-major electives from the above list of papers.

PBC - 3
SEMESTER – I
C. P. 1 BIOMOLECULES

17PBC101
Total teaching hours: 90
Total Credits: 4

Objectives :

- To learn about the chemistry and structures of biomolecules
- To know the properties of different biomolecules
- To know the physiological functions of biomolecules

UNIT-I **(18 Hrs)**

Carbohydrates: Structure, occurrence, properties and biological functions of monosaccharides, disaccharides and polysaccharides. Homoglycans: Structure, occurrence, properties and biological functions of glycans, chitin, fructans, mannans, arabinans and galacturonans. Heteroglycans and complex carbohydrates: Structure, occurrence, properties and biological functions of mucopolysaccharides, bacterial cell wall polysaccharides and sialic acid. Lectins – characteristics and uses, blood group antigens. Major classes of glycoproteins – O-linked and N-linked oligosaccharides.

UNIT-II **(18 Hrs)**

Proteins: Orders of protein structure. Primary structure – determination of amino acid sequence of proteins. The peptide bond – The Ramachandran plot. Secondary structures – α-helix, β-sheet and β-turns. Pauling and Corey model for fibrous proteins. Reverse turns and super secondary structures. Collagen triple helix. Tertiary structure – α and β domains. Conformational properties of silk fibroin. Quarternary structure of proteins. The structure of haemoglobin. Models for haemoglobin allostery.

UNIT-III **(18 Hrs)**

Lipids: Introduction, fate of dietary lipids, simple lipid, compound lipids and derived lipids –structure and functions. Fatty acids – saturated, unsaturated and hydroxy fatty acids. Phospholipids and glycolipids- structure and functions. Eicosanoids- structure and biological actions of prostaglandins, prostacyclins, thrombaxanes, leucotrienes and lipoxins. Lipoproteins – classification and composition. Amphipathic lipids – membranes, micelles, emulsions and liposomes. Lipid and protein composition of biomembranes.

UNIT-IV **(18 Hrs)**

Nucleic acids I: Structure of nucleic acids, DNA double helical structure – Watson and Crick model. A, B and Z forms of DNA. DNA sequencing procedures – Maxam Gilbert method and Sanger's Dideoxy method. Triple and quadruple structures. DNA supercoiling and linking number. Properties of DNA – buoyant density, viscosity, denaturation and renaturation – The cot curve – Chemical synthesis of DNA. Major classes of RNA – mRNA, rRNA, tRNA, sn RNA, hn RNA – structure and biological functions. DNA bending: The wedge model and Junction model. Protein induced binding.

UNIT-V **(18 Hrs)**

Nucleic acids II:DNA Supercoiling: supercoiled forms of DNA, DNA knots and catanenes. The energetics of supercoiled DNA, effect of temperature and salt on helical winding and DNA supercoiling. Alternative conformations of DNA: slipped mispaired DNA, Parallel Strand DNA, four stranded DNA, anisomorphic DNA, Nodule DNA, Higher order Pu-Py structure. Triplet repeats, DNA structure and human genetic disease. DNA and protein interaction. Nucleic acid binding proteins, specific DNA protein interactions.

Text books:

1. Murray *et al.*, (2015). Harpers Illustrated Biochemistry 30th edition, McGraw Hill Professional.
2. Sinden S R (1994). DNA Structure and Function. 1st edition. Academic Press.

PBC – 4

Reference books:

1. David L Nelson, Micheal M Cox (2013), Lehninger's Principles of Biochemistry, 6th edition, W H Freeman Publishers.
2. Voet, D., Voet, J.G. and Pratt, C.W. (2013).Principles of Biochemistry. 4th edition. John Wiley & Sons, New Delhi, 110002.
3. Garrette R.H and Grisham, C. M. (2013), Principles of Biochemistry, 5thedition, Saunders college publishers.

PBC - 5

SEMESTER – I

C.P.2. BIOANALYTICAL TECHNIQUES

17PBC102

Total teaching hours: 90

Credits: 4

Objectives:

- To learn the principle and instrumentation of various separation techniques
- To know the applications of various separation techniques in biological fields
- To learn the concept of radioactivity and explore its role in various fields.

UNIT-I (18 Hrs)

Chromatography: Principle, technique and applications of paper, TLC, ion-exchange, molecular sieve, affinity and adsorption chromatography. Special types of affinity chromatography- immune affinity, metal chelate, dye ligand and covalent chromatography. Principle, components, limitations and applications of GLC and HPLC.

UNIT-II (18 Hrs)

Electrophoresis: Principle, technique and applications of paper, Agarose gel, SDS-PAGE, 2D-PAGE electrophoresis. Isoelectric focusing- technique and application. Cellulose acetate electrophoresis- detection, recovery and estimation of proteins in gels. Principle, instrumentation, technique and applications of Capillary electrophoresis and pulse-field gel electrophoresis.

UNIT-III (18 Hrs)

Spectroscopy: Principle, technique, instrumentation and applications of UV-Visible, Near and far IR, mass spectrophotometry, spectrofluorimetry, flame photometry, nephlometry, turbidometry, molecular luminescence, fluorimetry, atomic absorption & atomic emission spectrophotometry, Electron spin resonance, and Nuclear Magnetic Resonance.

UNIT-IV (18 Hrs)

X-rays and Radioactivity: X-rays, X-ray diffraction, crystals and detectors – quantitative analysis and applications. ORD and circular dichroism – principles and applications. Radioactivity: nature, types of Radioactive decay, Units of radioactivity (Curie, Rutherford and Becquerrel), detection and measurement of radioactivity by scintillation counter: solid and liquid scintillators, counting efficiency and factors affecting counting efficiency. Advantages and disadvantages of scintillation counting. Cerenkov counting. Autoradiography: principle, technique, types and applications. Applications of radioisotopes in biology.

UNIT-V (18 Hrs)

Centrifugation: Principle, technique, instrumentation and applications of ultracentrifuge: preparative and analytical centrifugation, differential centrifugation, density gradient centrifugation, Rate zonal and isopynic centrifugation. Methods of disrupting cells and tissues – fractionation and homogenization. Organ and tissue slice techniques.

Text books:

1. Upadhyay, Upadhyay and Nath (2012). Biophysical Chemistry – Principles and Techniques, 4thRevised edition, Himalaya Publishing House Pvt. Ltd.
2. Keith Wilson, John Walker (2000). A biologist's guide to Principles and Techniques of Practical Biochemistry,5th edition , Cambridge University Press, New York.

Reference books:

1. Analytical Biochemistry. D. J. Homie and H. Peck (2003). Rastogic CBS Publishers, 1sted.
2. Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, (2008),Fundamentals of Analytical Chemistry, 4th edition, Barkha Nath Printers, India.
3. Keith Wilson and John Walker (2011), Principles and Techniques of Biochemistry and Molecular Biology, 7thedition, Cambridge University Press, New York.

PBC – 6

SEMESTER – I

C.P.3. ENZYMES AND ENZYME TECHNOLOGY

17PBC103

Total Credits: 4

Total teaching hours: 90

Objectives:

- To know the classification and properties of enzymes
- To learn about the mechanism of enzyme action
- To know the applications of enzymes in clinical and diagnostic fields

UNIT I **(18 Hrs)**

Enzymes- Introduction, Classification of enzymes, Factors affecting enzyme activity. Active site - Definition: investigations of active site structure, Trapping ES complex, use of substrate analogues. Modification by using chemicals procedures, enzyme modification by treatment with proteases, enzyme modification by site directed mutagenesis. Isoenzymes, Multienzyme complex.

UNIT II **(18 Hrs)**

Enzyme catalysis: Acid base catalysis, covalent catalysis, Mechanisms of reaction catalyzed by enzyme lysozyme, chymotrypsin. Metal activated, enzymes & metallo enzyme. Role of metal ions in mechanism of carbonic anhydrase, superoxide dismutase, carboxy peptidase, Coenzymes and cofactors in enzyme catalysed reaction. Enzyme regulation- feedback inhibition, feed forward stimulation, sequential feedback.

UNIT III **(18 Hrs)**

Enzyme kinetics: MM Kinetics, LB plot, Eadie-Hofstee plot and Hanes plot. Allosteric enzymes- Cooperavity, Hill plot, K & V series of Enzyme. R & T states. Bisubstrate reaction. Concerted, Sequential Enzyme & enzyme inhibition - Types & kinetic differentiation of competitive, uncompetitive, non-competitive inhibitions. Allosteric inhibition and regulation.

UNIT IV **(18 Hrs)**

Enzymes as diagnostic reagents: therapeutic enzymes, enzyme inhibitors and drug design, enzyme therapy. Immobilised enzymes- Techniques of immobilization and applications of immobilized enzyme. Enzymes as diagnostic reagents. Biosensors: calorimetric biosensors: potentiometric biosensors: Amperometric biosensors; immunosensors; optical biosensors. Applications of Monoclonal antibodies.

UNIT V **(18 Hrs)**

Application of enzymes in industry; Industrial scale enzyme extraction, purification and stabilization. Industrial application of carbohydrases, proteolytic enzyme, lignocellulose degrading enzyme, pectin and pectic enzyme. Enzyme in animal nutrition. Non-catalytic industrial proteins, Animal & microbial proteins. Sweet and taste modifying proteins. Application of enzymes in food Industry. Ribozyme, abzyme.

Text books:

1. Trevor Palmer(2001). Enzymes: Biochemistry, Biotechnology and Clinical Chemistry. Horwood Chemical Science Series. Horwood Publishers.
2. Lewis Stevens and Nicholas C. Price (1989). Fundamentals of Enzymology,2nd edition, Oxford University Press.

Reference books:

1. Chapline and Bucke (1990). Enzyme Technology 1st edition . Cambridge University Press.
2. Balasubramanian *et al.,* (2005). Concepts in Biotechnology, Universities Press India Ltd.
3. Robert J. Whitehurst, Maarten Van Oort (2010).Enzymes in Food Technology. 2nd edition, John Wiley and Sons Ltd.
4. David L Nelson, Micheal M Cox (2008), Lehninger's Principles of Biochemistry, Replika Press (P) Ltd, India.

PBC- 7

SEMESTER – I

C.P.4. MOLECULAR CELL BIOLOGY

17PBC104

Total teaching hours: 90

Credits: 4

Objectives:

- To learn the models and functions of biological membrane
- To learn the mechanism of membrane transport in cells
- To learn about the cell cycle and cancer

UNIT-I **(18 Hrs)**

Membrane bilayer Models, Fluid mosaic model- composition and functions. Membrane lipids- fluidity, Asymmetry phase transition, Liposome experiments. Membrane proteins - Types, Orientation, Mobility Experiments, flippases, proteins of RBC membrane, Bacteriorhodopsin, Porins-aquaporin. RBC ghosts, solubilisation of proteins, lipid anchored proteins. Cell surface carbohydrates – Lectins, selectins. Blood group antigens.

UNIT II **(18 Hrs)**

Membrane transport - Overview, Passive transport: osmosis, simple diffusion and facilitated diffusion; active transport: Ca^{2+} ATPase, $Na^{+}K^{+}$ATPase, Gastric $H^{+}K^{+}$ATP ase, ATP ases that transport peptides and drugs. ABC superfamily - Bacterial PM permeases, Mammalian MDR proteins: Transport process driven by light and ion gradients, Carriers and Ion-Channels. Ion concentration gradients. Bulk transport: exocytosis, phagocytosis and Receptor mediated endocytosis.

UNIT III **(18 Hrs)**

Mitochondria: structure and functions, Reduction potentials, electron transport chain: Overview, Complexes, Q-cycle, Cyt.C oxidase complex, Translocation of Protons and the establishment of proton motive force, Machinery for ATP formation. Chemi-osmotic mechanism, ATP Synthase -Experiments, Inhibitors and Uncouplers of oxidative phosphorylation. Microfilaments–Actin-Structures, Assembly, Myosin. Microtubules- Organisation and dynamics, Kinesin and dynein. Striated muscle -structure, excitation-contraction.

UNIT IV **(18 Hrs)**

Cell-Cell and Cell-matrix adhesion: An overview. Cell-Cell interaction: ECM; Collagen, hyaluronan & proteoglycans, laminin, integrins and fibronectins. Cell-Cell adhesion: Specialised junctions- Desmosomes, Gap junctions, Adhesion molecules –Cadherins, Connexins. Cell-Cell signaling - Signaling molecules and their receptors: functions of cell surface receptors, pathways of intracellular signal transduction, second messengers - G-protein coupled receptors, receptor tyrosine kinases, Ras, MAP kinases.

UNIT V **(18 Hrs)**

Cell cycle and cancer: Cell Cycle: Overview of cell cycle and its control. Genetic studies with yeasts. Cell cycle Control in mammalian cells, Checkpoints in cell -cycle regulation. Apoptosis - Pathways, regulators & effectors in apoptosis. Cancer: Properties of tumor cells, Genetic basis and onset of cancer. Tumor viruses - DNA & RNA viruses as transforming agents - mechanism. Tumor suppressor genes and functions of their products. Carcinogenic effect of chemicals and radiation.

Text books:

1. P.S. Verma and V.K. Agarwal (2014). Cell Biology, Genetics, Molecular biology, Evolution and Ecology, S. Chand and Company, New Delhi.
2. Geoffrey M.Cooper and Robert E. Hausman (2009). The Cell: A Molecular Approach. 5^{th} edition. ASM Press, Washington D.C.

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Reference books:

1. Harvey Lodish, Arnold Berk *et al*., (2007), Molecular Cell Biology, 6th edition., W H Freeman and Company, New York.
2. Garrette R.H and Grisham, C. M (2013), Principles of Biochemistry, 5thedition, Saunders College Publishers.
3. Alberts *et al.*, (2014) Molecular biology of the cell 6th edition, Garland Publishers.
4. Murray *et al.*, (2015). Harpers Illustrated Biochemistry 30th edition, McGraw Hill Professional.

PBC - 9

SEMESTER – I

C.Pr. 1 Biochemistry Practical – I

17PBC1CL

Credits: 4

Total teaching hours: 90

Objectives:

- To get practical experience in analysing the biochemical metabolites in biological samples.
- To perform the separation of biological compounds by chromatography and electrophoresis.

1. Estimation of Fructose in Fruits
2. Isolation and Estimation of Starch in Potato
3. Isolation and Estimation of Glycogen in Liver
4. Estimation of Ascorbic acid in Fruits.
5. Estimation of Thiamine
6. Estimation of Riboflavin
7. Estimation of Total Free Amino acids in Plant tissue
8. Estimation of Vitamin – E
9. Estimation of β – Carotene from Carrot
10. Separation of Amino acids by Circular Paper Chromatography
11. Separation of Amino acids by Ascending Paper Chromatography
12. Separation of Amino acids by Descending Paper Chromatography
13. Separation of Sugars by Ascending Paper Chromatography
14. Separation of Lipids by Thin Layer Chromatography
15. Separation of Purines and Pyrimidines by Paper Chromatography
16. Separation of Plant Pigments by Column Chromatography
17. Agarose gel electrophoresis of DNA
18. Separation of serum proteins or lipoproteins by PAGE

Reference Books

1. Jayaraman. J. (1992), Laboratory Manual in Biochemistry, 4th reprint, Wiley Eastern Ltd, New Delhi
2. Gupta. R.C and Bharghava. S.(1992), Practical Biochemistry, CBS Publishers and Distributors, New Delhi.
3. David. T. Plummer, (1995), An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Company Ltd, New Delhi.

PBC –10

SEMESTER – II

C. P. 5 METABOLIC REGULATION

17PBC205

Total teaching hours: 75

Total Credits: 4

Objectives:

- To learn the metabolism of various biomolecules in our system
- To know the regulation of metabolic pathways at various positions of metabolism
- To study the interrelationship of various metabolic pathways

UNIT I (15 Hrs)

Carbohydrate Metabolism: An overview & energetics of glycolysis and gluconeogensis - Regulation of glycolysis and gluconeogenesis - phosphofructokinase, hexokinase and pyruvate kinase as regulatory enzymes in glycolysis; hormone regulation. Anaplerotic reactions. Gluconeogenesis: Regulation by allosteric and substrate level control mechanisms. TCA cycle- steps: Regulation at branch points: Pyruvate dehydrogenase. α- keto glutarate dehydrogenase and citrate synthase. Glycogen metabolism -Regulation of glycogen phosphorylase; glycogen synthase by effectors, covalent modification and hormones.

UNIT II (15 Hrs)

Lipid metabolism: An overview of fatty acid anabolism and catabolism. Regulation of fatty acid synthesis - Control of acetyl CoA carboxylase line on fatty acid synthetase complex: Role of hormones; effect of diet on fatty acid synthesis. Regulation of biosynthesis of triacylglycerols, cholesterol, phosphotidyl choline, phosphotidyl ethanolamine and sphingomyelin Biosynthesis and regulation of prostaglandins, Eicosanoids, Thromboxanes leukotrienes.

UNIT III (15 Hrs)

Amino acid metabolism: An overview on ɣ-glutamyl cycle. An overview: Methionine as methyl donor (SAM pathway). An overview & regulation of urea cycle. Regulation of α-keto glutarate family, pyruvate family. 3- Phosphoglycerate family, aspartate family and aromatic family of amino acids. Allosteric regulation of glutamine synthase.

UNIT IV (15 Hrs)

Nucleic acid metabolism: Pathways of purines and pyrimidines biosynthesis (both de novo and salvage pathways) & degradation. Regulation of purine biosynthesis: PRPP aminotransferases. Regulation of pyrimidine biosynthesis: Aspartate carbamoyl transferase. Regulation of deoxyribonucleotides by activators and inhibitors.

UNIT V (15 Hrs)

Integration of metabolism. Interconversion of food stuffs. Metabolic profile of the liver, adipose tissue and brain. Altered metabolism in starvation. Compartmentalization of metabolic pathway in the cell. Metabolic fuels: definition. Caloric value of metabolism: fuels, use, metabolic relationship of tissues in various nutritional and hormonal states.

Text books:

- Satyanarayana, U. and Chakrapani, U. (2013) Biochemistry, 4th ed., Books and Allied Pvt. Ltd, Kolkata, 700 010.
- Voet, D., Voet, J.G. and Pratt, C.W. (2013), Fundamentals of Biochemistry, Life at the Molecular Level, 4th ed., John Wiley & Sons, New Delhi, 110002.

Reference books:

- Robert K. Murray, Daryl K. Granner and Victor W. Rodwell (2008), 29thed., Harper's Illustrated Biochemistry. McGraw Hill Companies, Inc. New Delhi.
- Garrette R.H and Grisham, C. M (2012), Principles of Biochemistry, 5thed, Saunders college publishers.
- David L. Nelson, Micheal M. Cox (2008), Lehninger's Principles of Biochemistry, Replika press (P) Ltd, India

PBC –11
SEMESTER – II
C.P.6. PLANT BIOCHEMISTRY AND BIOTECHNOLOGY

17PBC206
Total teaching hours: 75
Total Credits: 4

Objectives :

- To learn the mechanism and importance of photosynthesis in plants
- To learn the role of hormones in the growth metabolism of plants
- To know the latest genetic engineering techniques for plant development

UNIT I (15 Hrs)

Photo synthesis: Overview, Pigments and factors affecting photosynthesis. Light reactions: Red drop and Emerson's enhancement effect, Hill's reaction, Arnons work, pigment systems I and II, photo oxidation of water, production of assimilatory powers, electron transport chain, cyclic and non-cyclic photophosphorylation. Dark reactions: C3, C4 and CAM pathway. Photorespiration.

UNIT II (15 Hrs)

Nitrogen metabolism: Significance of nitrogen. Ammonification, nitrification, nitrate reduction, Physical and biological nitrogen fixation – symbiotic, non-symbiotic. Symbiotic nitrogen fixation in leguminous plants, biochemistry of nitrogen fixation, denitrification and nitrogen cycle.

UNIT – III (15 Hrs)

Plant hormones: Factors affecting the growth of plants, characteristics and classification of plant hormones. Chemistry, biosynthesis, physiological effects, applications of auxins, gibberellins, cytokinins, abscicic acid, ethylene and brassinosteroids.

UNIT – IV (15 Hrs)

Embryogenesis and Seed Germination: Gametogenesis, Fertilization, Fruit Development, Embryogenesis, Seed Germination and Photomorphogenesis. Meristems: Shoot Apical Meristem, Root Apical Meristem and Root Development Leaf Development: Leaf Structure and Leaf Development Patterns. Flower Development: Floral Evocation and Floral Organ Identity and the ABC Model. Hormone Physiology and Signal Transduction: Seven Plant Hormones and Their Actions, Plant Hormone Signal Transduction - Auxin and GA Signaling, Cytokinin and Ethylene Signaling, Brassinosteroid Signal Transduction.

UNIT-V (15 Hrs)

Techniques for plant transformation: Agrobacterium mediated gene transfer and its applications, The T_i plasmid, the process of T-DNA transfer and integration. Agrobacterium mediated gene transfer in tobacco. Transformation methods: Particle bombardment, polyethyleneglycol (PEG) mediated transformation and electroporation, Silicon Carbide Whiskers, Viral Vectors, Laser Micropuncture and Nanofiber Arrays. Validation of transformation – resistance genes, marker genes and transgene DNA.

Text books:

- Fundamentals of Plant Physiology (2016). V.K. Jain. 18th edition, S. Chand and Company Pvt. Ltd, New Delhi.
- A textbook of plant physiology, biochemistry and biotechnology (2008). S. K. Verma and Mohit Verma. 2nd edition. S. Chand and Company Pvt. Ltd, New Delhi.

Reference books:

- Plant biotechnology: The genetic manipulation of plants (2008). Adrian Slater, Nigel W. Scott, Mark R. Fowler Oxford University Press.
- Plant biotechnology and genetics –principles, techniques and applications (2008). C. Neal Stewart, Jr. John Wiley and sons Publishers, UK.
- William G. Hopkins, Introduction to Plant Physiology, 2nd ed., John Wiley and sons Publishers, UK.

PBC –12

SEMESTER – II

C.P.7 HUMAN PHYSIOLOGY AND ENDOCRINOLOGY

17PBC207

Total teaching hours: 75

Total Credits: 4

Objectives:

- To learn about the system of hormonal functioning in biological systems
- To know the regulation and action of different hormones at different conditions
- To get an indepth knowledge on diabetes mellitus

UNIT I **(15 Hrs)**

Principles of endocrinology: Scope of Endocrinology, Nature of Hormones, Receptor Families, Synthesis and Processing, Hormone Secretion, Transport, and Degradation. Hormone Action through Receptors - Membrane Receptors, Nuclear Receptors. Functions of Hormones – Growth, Maintenance of Homeostasis and Reproduction. Hormonal Feedback Regulatory Systems - Paracrine and Autocrine Control, Hormonal Rhythms. Pathologic Mechanisms of Endocrine Disease: Causes of Hormone Excess, Causes of Hormone Deficiency, Hormone Resistance.

UNIT II **(15 Hrs)**

Pituitary endocrinology: anatomy, pituitary development, hypothalamic and anterior pituitary insufficiency, developmental and genetical causes of hypopituitarism, acquired pituatarism, presentation and diagnosis. Synthesis, secretion, action and deficiency disorders of prolactin, growth hormone, adrenocorticotropin hormone, gonadotropins: FSH & LH, thyroid stimulating hormone. Synthesis, secretion, metabolism and deficiency disorders of hypo and hyper vasopressin secretions. Oxytocin.

UNIT – III **(15 Hrs)**

Diabetes mellitus: classification, epidemiology, diagnosis, screening, pathogenesis of type 1 DM and type 2 DM and their genetic considerations, acute complications: diabetic ketoacidosis, hyperglycemic hyperosmolar state. Chronic complications: mechanism, complications in glycemic control, ophthalmic and renal function. Neuropathy, Gastrointestinal/Genitourinary Dysfunction, Cardiovascular Morbidity and Mortality, Lower Extremity Complications, Infections and Dermatologic Manifestations. Long term treatment, complications of therapy of DM. special considerations in DM.

UNIT – IV **(15 Hrs)**

Bone and mineral metabolism: Calcium metabolism: Etiology, clinical manifestations and diagnostic approach of hypercalcemia and hypocalcemia. Osteoporosis: Definition, epidemiology, pathophysiology – bone remodelling, calcium nutrition, vitamin D, estrogen status, physical activity, chronic disease, medications. Glucocorticoid-Induced Osteoporosis: pathophysiology and prevention. Phosphorus Metabolism: causes, clinical findings and treatment for Hypophosphatemia and Hyperphosphatemia. Magnesium Metabolism: causes, clinical findings and treatment for Hypomagnesemia and Hypermagnesemia.

UNIT-V **(15 Hrs)**

Reproductive endocrinology: Male reproductive system: androgens: Source, synthesis, chemistry, metabolism, Physiological roles, mechanism of action and pathophysiology. Female reproductive system: Synthesis, physiological role and mechanism of action of ovarian steroid hormones. Neuroendocrine control of ovarian function, Pathophysiology. Endocrinology of pregnancy, parturition and lactation, Hormonal contraception, menopause and pathophysiology.

Textbooks:

- Instant notes: Neuroscience 1st Indian edition (2002). A. Longstaff. BIOS Scientific Publishers Ltd, UK.
- Harrison's Endocrinology 2nd edition (2002). Edited by J. Larry Jameson. The McGraw-Hill Companies, Inc. USA.

Reference books:

- Endocrinology 4th edition. Mac E. Hadley (1996). Prentice Hall International Inc.
- Guyton & Hall Textbook of Medical Physiology. 2016. John E. Hall, Mario Vaz , Anura Kurpad, Tony Raj. 2nd South Asian edition. Elsevier publications.
- William's Textbook of endocrinology 12th edition (2011). Shlomo Melmed et al.,. Philadelphia: Elsevier/Saunders.

PBC – 14
SEMESTER – II
C.P.8 MOLECULAR BIOLOGY

17PBC208
Total teaching hours: 75
Total Credits: 4

Objectives:

- To understand the molecular organization of genes and chromosomes
- To learn the process of DNA synthesis, repair and function
- To learn the various molecular events occuring in DNA with proposed theories

UNIT-I (15 Hrs)

Molecular structure of genes and chromosomes; molecular definition of gene – prokaryotic and eukaryotic transcription units. Chromosomal organization of genes and noncoding DNA – protein coding genes. Tandemly repeated genes, single sequence DNA. Mobile DNA – mobile elements. Bacterial insertion sequence, bacterial transposons, viral retrotransposons, non-viral retrotransposons. Structural organization of eukaryotic chromosomes – histone proteins, chromatin. Functional elements of eukaryotic chromosomes. Mutations – types.

UNIT-II (15 Hrs)

DNA replication, repair and recombination. General features of chromosomal replication. DNA replication machinery – eukaryotes and prokaryotes. Role of topoisomerases in DNA replication. DNA damage and repair – all types. Recombination – Holliday model, Rec BCD enzyme, Rec A protein, Messelson model, site specific recombination

UNIT-III (15 Hrs)

Prokaryotic transcription – initiation, elongation and termination (rho dependent and rho independent). Lac operon and trp operon. Transcriptional control of gene expression. Overview of eukaryotic gene control and RNA polymerases. Regulatory sequences in protein coding genes – TATA box, initiators, proximal elements, distant enhancer sites. Transcription initiation by RNA polymerase II, I and III. Regulation of transcription – factor control, lipid soluble hormones and polypeptide hormones Transcription of HIV genome – antitermination mechanism. Mitochondrial and chloroplast DNA – transcription by organelle specific RNA polymerases

UNIT-IV (15 Hrs)

Post RNA transcriptional gene control. Processing of eukaryotic pre mRNA, hnRNA proteins, RNA binding motifs, splicing, snRNA, spliceosome. RNA editing, macromolecular transport across the nuclear envelope. Nuclear pore complex, cytoplasmic polyadenylation, degradation of mRNA, regulation of processing of rRNA and tRNA

UNIT-V (15 Hrs)

Genetic code – wobble hypothesis. Protein sorting and targeting of mitochondria and chloroplast proteins. Synthesis and targeting of peroxisomal proteins. Overview of secretory pathway. Translocation of secretory products across ER membrane. Insertion of proteins into ER membrane. Posttranslational modification – protein glycosylation in ER and Golgi complex. Receptor mediated endocytosis.

Text books:

1. Molecular biology of the gene 5th edition – Watson, Pearson Education, 2004
2. Molecular cell biology 5th edition – Freeman Publishers, 2003

Reference books:

1. Advanced molecular biology – Twyman, Viva publication, 1998
2. Genes VIII – Lewin, Printice Hall, 2004
3. Molecular biology of the cell 4th edition – Alberts et al., Garland Science Publications, 2002
4. Biochemistry Cohn and stump
5. Molecular and Cell biology - Baltimore

PBC – 15

SEMESTER – II

C.Pr.2 Lab in PLANT BIOTECHNOLOGY, PHYSIOLOGY and MOLECULAR BIOLOGY

17PBC2CM

Total teaching hours: 75

Credits:4

Objectives:

- To learn the techniques of plant tissue culture
- To enumerate the various blood components
- To get an hands-on-training on molecular techniques

PLANT BIOTECHNOLOGY

1. Preparation of plant tissue culture media and sterilization*
2. Initiation of callus culture*
3. Estimation of chlorophyll
4. Estimation of flavonoids
5. Estimation of total phenols

PHYSIOLOGY

1. Enumeration of RBCs.
2. Enumeration of total WBCs.
3. Differential count of WBCs.

MOLECULAR BIOLOGY

1. Estimation of DNA by diphenylamine method
2. Estimation of RNA by Orcinol method
3. Isolation of genomic DNA from animal tissue*
4. Isolation of Plasmid DNA from bacteria*
5. Restriction digestion of DNA *
6. PCR- Instrumentation and preparation*

*Demonstration

Reference Books

1. Jayaraman. J. (1992), Laboratory Manual in Biochemistry, 4th reprint, Wiley Eastern Ltd, New Delhi
2. Gupta. R.C and Bharghava. S.(1992), Practical Biochemistry, CBS Publishers and Distributors, New Delhi.
3. David. T. Plummer, (1995), An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Company Ltd, New Delhi.

PBC – 16
SEMESTER – III
C.P.9 IMMUNOLOGY

17PBC309
Total Teaching Hours: 75
Credits:4

Objectives;

- To know the different cells involved in immune system
- To learn the mechanism of immune protection in body cells
- To learn about the recent developments in the field of immune research

UNIT-I **(15 Hrs)**

Cells of the immune system-Macrophages, B and T lymphocytes, Dendritic cells, Natural killer and Lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells. Organs of the immune system: Thymus, Bone marrow, Spleen, lymph nodes, MALT, GALT. Haemopoiesis and differentiation, lymphocyte trafficking. Antigen- biology, structure and functions of different classes of Immunoglobulin. Biology of Superantigens.

UNIT-II **(15 Hrs)**

Antigen antibody reactions, Applications of Immunological techniques, genetic control of immune response, effector mechanisms, MHC, antigen recognition and presentation, activation of B and T lymphocytes.

UNIT-III **(15 Hrs)**

Humoral and cell mediated immunity. Cell mediated Cytotoxicity: Mechanism of T cell and NK Cell mediated lysis, Antibody dependent cell mediated Cytotoxicity and macrophage mediated Cytotoxicity. Cytokines and their role in immune regulation, Biology of Complement system, Complement fixation test and assessment of immune complexes in tissues. Immune suppression and immune tolerance.

UNIT-IV **(15 Hrs)**

Hyper sensitivity reactions, Autoimmune disorders, Transplantation immunology- MLR, HLA Typing, Bone marrow transplantation, Organ transplants. Immunity to Infectious agents - Bacteria, Viruses, Malaria, and Helminthes. Tumor immunology, Tumor antigens, immune response to tumors, cancer immunotherapy, Vaccines. AIDS and other immunodeficiencies, Structure of HIV, envelope glycoproteins, destruction of T cells: immunologic symptoms of AIDS, AIDS vaccine.

UNIT-V **(15 Hrs)**

Vaccine technology and recombinant vaccines, Identification of B and T epitopes for vaccine development. *In situ* characterization of cells from tissues, Immunoscreening of Recombinant library, Hybridoma – Monoclonal Antibody production and applications ; MAbs in diagnosis and therapy.

Text books:

1. J.Kuby, 2003, Immunology 5th edition , W.H. Freeman and Company, Newyork..
2. C.V.Rao. 2002, An Introduction to Immunology, Narosa Publishing House, Chennai.

References Books:

1. K.M.Pavri. 1996, Challenge of AIDS, National Book Trust, India.
2. I.R.Tizard, 1995, Immunology: An Introduction , 4th edition , Saunders College Publishers, New York.
3. I.Roitt, 1994, Essential Immunology, Blackwell Science, Singapore. A. Bul and K.Abbas, 1994, Cellular and Molecular immunology.

PBC – 17
SEMESTER – III
C.P.10 GENETIC ENGINEERING

17PBC310
Total Teaching Hours: 75
Credits:4

Objectives:

- To get an brief idea on the fundamentals of genetics
- To learn the techniques for the study of different biomolecules
- To learn the cloning strategies and genetic manipulation with devised technologies

UNIT-I **(15 Hrs)**

Introduction to genetics. Transmission genetics. Mendelian genetics. Mendelian analysis of inheritance. Genes, chromosomes, alleles, homozygous, heterozygous and mechanism of Mendelian inheritance. Mendel's laws. Linkage – definition, simple measurement and salient features. Salient features of autosomal dominant, recessive, codominance; X-linked recessive, codominant and dominance; Y-linked characters. Extranuclear inheritance.

UNIT-II **(15 Hrs)**

Restriction endonucleases – types and functions; restriction mapping Nucleic acid probes and their applications – cloned probes, oligonucleotide probes; labeling of nucleid acid probes. Nucleic acid hybridization techniques – liquid and dot blot technique; Southern and Northern hybridization; in situ hybridization; whole mount in situ hybridization. FISH. Polymerase chain reaction – types and applications. DNA fingerprinting, Chemical synthesis of genes, DNA sequencing.

UNIT-III **(15 Hrs)**

Cloning vectors – salient features. Plasmids as vectors – properties, natural plasmids, pBR 322, pSC 101, pUC, bluescript. Mechanism of cloning in plasmid vectors. Bacteriophage vectors – λ phage, X-vector – packing of X-vector in vitro. Cosmid vectors, cosmid cloning DNA (single stranded) vectors – development of M13 vector, PEMBL vector, λ 2AP viral vectors. SV 40, retrovirus, adenovirus, recombinant vaccinia virus vectors. Baculo virus vector for insects. Transposons as vectors. High capacity cloning vectors – bacterial artificial chromosomes, phage P1, yeast aritificial chromosomes and PACs.

UNIT-IV **(15 Hrs)**

Cloning strategies – genomic and cDNA cloning. cDNA library. Expression vectors – vectors for maximizing protein synthesis, fusion proteins. Expression vectors – expression of cloned genes in E. coli. Cloning and expression of cloned genes in Bacillus subtilis. Cloning in yeasts; yeast expression vectors, overexpression in yeast. Expression in baculovirus system. Cultured insect cell expression systems; mammalian cell expression systems. Recombination, selection and screening methods and processes.

UNIT-V **(15 Hrs)**

Gene transfer methods in animal cells – calcium phosphate copreceipitation, electroporation, microinjection, using viral vectors. Transfer, cotransfer, selectable markers like TK, PSV, PRSV and reporters genes. Gene targeting in animal cells; transfer and expression of cloned genes in Drosophila. Gene knockout. Methods for production of transgenic animals (mice, sheep, goat, fish, pig, cow etc.,) – retroviral, DNA microinjection and engineered stem cell methods. Applications of transgenic animals; transgenic animals as models/in the prevention of human diseases like cystic fibrosis, muscular dystrophy and anticancer therapy.

Text books:

1. Genetics 4th edition – Elrod, Stansfield, 2002
2. Genes VIII – Lewin, Printice Hall, 2004

Reference books:

1. Molecular cell biology 5th edition – Lodish et al., Freeman Publishers, 2004
2. Molecular biology of the gene 5th edition – Watson, Pearson Education, 2004
3. Molecular biotechnology 3rd edition – Glick, Paternak, Panima Publishers, 2003
4. Principles of gene manipulation 6th edition – Primrose et al., Blackwell Scientific Publishers, 2001

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SEMESTER – III

C.P.11 CLINICAL BIOCHEMISTRY

17PBC311

Total Teaching Hours: 75

Credits:4

Objectives:

- To learn the methodologies for the detection of abnormalities in blood
- To learn the process of different sample collection and processing
- To know about the markers in the various metabolic disorders like cancer

UNIT I (15 Hrs)

Serology and hematology: C- reactive protein test, immunological test for pregnancy. Rhumatoid arthritis (RA) test. ESR.,Coagulation test, prothrombin test. Hemoglobin: Normal and abnormal Hb, Seperation of hemoglobin. Thalasemia, Hemoglobinopathies. Erythrocyte metabolic pathways, Disorder of erythrocyte metabolic pathways,. Porphyrins and porphyrias.

UNIT II (15 Hrs)

Specimen collection and processing:- Collection of blood vein puncture, collection with syringe, collection with evacuated tube, skin puncture, arterial puncture and anticoagulants. Collection of urine:- Timed urine specimens, urine preservatives. Test for urinary compounds. Clinical significance of urinary components with reference to sugars,proteins,ketone bodies, bilirubin and porhyrins. CSF:- Composition and collection ,chemical examination and infections, spinal cord infections. Amniotic fluid:- Origin, collection,composition and analysis of amniotic fluid.

UNIT III (15 Hrs)

Clinical enzymology and endocrinology: Principles of diagnostic enzymology - Factors affecting enzyme levels in blood. Principle, assay, and clinical significance of transaminases, creatine kinase, lactate Dehydrogenase, phosphatases, isocitrate dehydrogenase, 5'nuclotidase, gamma –glutamyl transferase, amylase, lipase, trypsin, chymotrypsin, choline esterase, glutamate dehydrogenase, glucose -6-phosphate dehydrogenase and ceruloplasmin. Enzyme pattern in diseases: Myocardial infarction, hepatobiliary diseases. Overview of clinical significance of steroid, protein and thyroid hormones. (Expt. details not required).

UNIT IV (15 Hrs)

Liver function test and related disorders:-Jaundice ,cirrhosis, hepatitis, fatty liver and gall stones. Renal function test and related disorder:- Acute renal failure.glomerular disease,tubular diseases, analysis of urinary calculi. Gastric and pancreatic function test. Hyper and hypo lipoproteinemias and diagnostic test for lipoprotein disorders.

UNIT V (15 Hrs)

Oncology:- Apoptosis (Programmed cell death) -- Pathways, regulators ,& effectors in apoptosis. Cancer markers for oral cancer. Prostate cancer,.Colorectal cancer.breast cancer and gastrointestinal tract cancer. Alpha fetoproteins,carcino embryonic antigens, leukemia. Cancer: Properties of tumor cells & Genetic basis and onset of cancer. Tumor suppressor genes and functions of their products. Carcinogenic effect of chemicals and radiation. Molecular diagnosis of cancer. Free radicals in diseases:- Introduction , Types of free radicals. Free radical induced lipid peroxidation and antioxidants(Enzymic – SOD, Glutathione Peroxidase, Glutathione Reductase; Non Enzymic-Ascorbic acid, Tocopherol, Reduced Glutathione) .

Text book:

Fundamentals of clinical chemistry – Teitz, W.B.Saunders company, 1994

Reference books:

1. Clinical chemistry in diagnosis and treatment 6th edition – Mayne, ELBS Publications, 1994 3. Practical clinical biochemistry, volume I and II, 5th edition – Varley et.al., CBS Publishers, 1980

2. Teitz Textbook of Clinical Biochemistry 3rd ed. Burtis et al., William Heinmann Medical Books Ltd., 1999

3. Clinical biochemistry – Metabolic and clinical aspects, Pearson Professional Ltd.1995

4. Harrison's Principles of internal medicine Vol. I and II. 14th edition, McGraw Hill

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SEMESTER – III

C.P.12 BIOSTATISTICS AND RESEARCH METHODOLOGY

17PBC312

Total Teaching Hours: 75

Credits:5

Objectives:

- To know the methods of data collection and processing
- To learn the methods of analysis of collected data
- To know about the way of report writing and publishing research works

UNIT I **(15 Hrs)**

Organising a statistical survey - Planning and executing the survey. Source of data - Primary and secondary data, Collection - observation; interview; enquiry forms, questionnaire schedule and check list. Classification and tabulation of data. Diagrammatic & graphic presentation of data.

UNIT II **(15 Hrs)**

Measures of central tendency; arithmetic mean, median, mode, quartiles, deciles and percentiles. Measures of variation: range, quartile, deviation, mean deviation, standard deviation. Correlation analysis: Scatter diagram, Karl Peason's coefficient of correlation and Spearman's rank method. Regression analysis.

UNIT III **(15 Hrs)**

Probability - definition, concepts, theorems (proof of the theorems not necessary) and calculations of probability. Theoretical, distributions. Binomial - 'Poisonn and normal distribution. Normal -importance, properties, conditions and constants of the distribution (proof not necessary). Simple problems.

UNIT IV **(15 Hrs)**

Sampling distribution and test of significance: Testing of hypothesis errors in hypothesis testing, standard error and sampling distribution. sampling of variables (large samples and small samples). Student's 't‟ distribution and its applications. Chi - square test & goodness of fit. Analysis of variance one way and two-way classification, Duncans Multiple Range Test. Design of experiment - completely randomized block design randomized clock design

UNIT V **(15 Hrs)**

Thesis writing, Publication in a scientific journal, Preparation of Abstract and manuscript. Contents-Preamble, the problem, objectives, hypothesis to be tested, study,design, setup, measurement procedures, analysis of data, organization of report; Displaying data tables, graphs and charts – preparation of project proposal: Thrust area – funding agencies (National and International) – kinds of research program in India and abroad – career development in laboratory research – principle and method of patenting.

Text books:

1. Statistical Methods, S.P.Gupta 28th Edition
2. Biostatistics – A foundation for analysis in health science Danien. 3.Biostatistical analysis - Jerrold H.Zar. Pearson Education, 4th Edition

Reference Books:

1. Sundar Rao, Jesudian Richard – An Introduction to Bio-Statistics
2. Alwi E. Lewis. Bio-statistics, East West Press.
3. S.P.Gupta – Fundamentals of Statistics, Sultan Chand.
4. MS office; Sexena S, Vikas Publishing House.
5. Statistical methods; Snedecor GW and Cohran WG, Oxford and IBH publishing CO Pvt. Ltd.
6. Biometry; Sokal RR and Rohlf FJ, Freeman WH publishing House.
7. Biostatistical analysis; Zar JH, Prentice Hall Publishing Hous

PBC – 20

SEMESTER – III

C.Pr.3 LAB IN IMMUNOLOGY AND CLINICAL BIOCHEMISTRY

17PBC3CN

Total Teaching Hours: 75

Credits:4

Objectives:

- To learn the simple techniques of immunological tests
- To learn the methods of estimation of biochemical parameters
- To get an exposure to a clinical laboratory with a visit

IMMUNOLOGY

1. Single radial immunodiffusion
2. Double immunodiffusion
3. Immunoelectrophoresis
4. Rocket immunoelectrophoresis
5. C-reactive protein by ELISA method

CLINICAL BIOCHEMISTRY

Estimation of the following parameters in urine

1. Urea
2. Creatinine
3. Glucose
4. Total protein
5. Albumin and Globulin
6. Phosphorous

Estimation of the following parameters in serum

1. SGOT
2. SGPT
3. Triglycerides
4. Total cholesterol
5. Catalase
6. Reduced glutathione

Demonstration

1. Gel Documentation
2. HPLC
3. Visit to a Clinical laboratory

Reference Books

1. Jayaraman. J. (1992), Laboratory Manual in Biochemistry, 4th reprint, Wiley Eastern Ltd, New Delhi
2. Gupta. R.C and Bharghava. S.(1992), Practical Biochemistry, CBS Publishers and Distributors, New Delhi.
3. David. T. Plummer, (1995), An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Company Ltd, New Delhi.

PBC -21
SEMESTER – IV
C.P.13 DRUG BIOCHEMISTRY

17PBC413
Total teaching hours:75
Credits: 4

Objectives:

- To learn the mechanism of drug action in various diseases
- To learn about different drugs available for treatment
- To learn about the designing mechanisms for drug development

UNIT I **(15 hrs)**

Pharmacology: History, classification, drug sources and preparation; natural source, synthetic drugs, drug preparation: crude drug, pure drug compounds, pharmaceutical preparations. Routes of drug administration: sublingual, buccal, oral, rectal, intravenous, intramuscular, subcutaneous, transdermal, inhalational and topical administration. Pharmacokinetics: Overview, drug absorption, drug distribution, drug biotransformation (role, formation and phases), drug excretion: quantitative pharmacokinetics, drug-plasma concentration curve, bioavailability, volume of distribution, drug clearance. Single dose pharmacokinetics, continuous and multiple dose kinetics, dosage calculations.

UNIT - II **(15 hrs)**

Pharmacodynamics: Definition. Drug receptors: Types, classification, drug-receptor interaction (binding and affinity, signal transduction, efficacy, receptor regulation and drug tolerance). Dose-response relationships (gradal and quantal). Drug development and safety: Drug discovery and characterization, preclinical studies, clinical trials, drug safety and efficacy laws, drug abuse prevention laws. Adverse effects of drugs. Factors affecting drug safety and efficacy. Antidepressant drugs: Overview and mechanism. Mechanism of action, therapeutic uses, kinetics and adverse effects of tricyclic antidepressants and monoamine oxidase inhibitors.

UNIT – III **(15 hrs)**

Mechanism of action, therapeutic uses, pharmacokinetics and adverse effects of Anti-inflammatory drugs - aspirin and colchicine and Anti-peptic ulcer drugs - H_2 receptor antagonists and inhibitors of H^+K^+ ATP-ase pump. Antihypertensive drugs: Overview, mechanism of controlling blood pressure, treatment strategies. Action, therapeutics uses, kinetics, adverse effects of β-adrenoceptor-blocking agents and ACE inhibitors.

UNIT – IV **(15 hrs)**

Treatment of neurodegenerative diseases: overview, neurotransmission in CNS, synaptic potentials, overview and drugs used for Alzheimer disease and Parkinson disease. Mechanism of action, therapeutic uses, kinetics and adverse effects of Hypnotic drug(barbiturates). Anesthetics: patient factors in selection of anesthesia, induction, maintenance and recovery from anesthesia, features, potency, uptake, distribution, action and adverse effects of inhalation anesthetics. Intravenous and local anesthetics.

UNIT – V **(15 hrs)**

Anticancer drugs: overview and principles of chemotherapy, treatment strategies, treatment regimens and scheduling, limitations of chemotherapy. Mechanism of action, therapeutic uses, pharmacokinetics and adverse effects of antimetabolites(Methotrexate and 5–fluorouracil), antibiotics (Dactinomycin and Bleomycin), alkylating agents (Cyclophosphamide), microtubule inhibitor (Vincristine and Vinblastine), steroid hormones and their antagonist (Tamoxifen), monocloncal antibody (Rituximab) and interferons.

Text books:

1. Lippincott's illustrated reviews: pharmacology 3rd edition. Richard. D. Howland, Mary. J. Mycek. Lippincott William and Wilkins. Wolters Kluwer health (India) Pvt. Ltd., New Delhi. 2006.
2. Pharmacology and Pharmacotherapeutics. R. S. Satoskar, Nirmala N. Reje, S. D. Bhandarkar. 22nd edition. Popular Prakashan Pvt. Ltd., 2011.

Reference Books:

1. Principles of Pharmacology 2nd edn. H L Sharma and K K Sharma. Paras Medical Publisher, India. 2011.
2. Pharmacology 3rd edn. George M.Brunner, Craig W. Stevans. Saunders, an imprint of Elsevier Inc. 2011.

PBC-22

DISSERTATION WORK AND *VIVA-VOCE* WITH INTERNAL AND EXTERNAL EXAMINERS

Total Credits: 5

DIRECTIONS

- Students are allocated a dissertation topic individually under the supervision of faculty of the department.
- The dissertation must be similar to the thesis style and encompass:

  (i) Introduction / Rationale and Review of Literature

  (ii) Materials and Methods

  (iii) Results

  (iv) Discussion

  (v) Bibliography

- The dissertation should be submitted in type-written, bound form to the department for record.
- While evaluation of dissertation, 40 marks (20+20 as internal) should be based on oral presentation before the faculty members of department in the presence of concerned supervisor during the period of CIA examinations, and 160 marks (external) should include:

  (i) Evaluation of project work (100 marks) based on:

  (a) Scientific content (25marks)

  (b) Experiments and final outcome (50 marks)

  (c) Presentation (25 marks)

  (ii) Viva-voce by external examiner (30 marks)

  (iii) Assessment through presentation by internal examiner (30 marks) at the time of examination.

PBC - 23
MAJOR ELECTIVE I
BIOTECHNOLOGY

Total teaching hours:75
Credits 5

OBJECTIVES

- To provide knowledge about plant tissue culture and animal tissue culture.
- To acquire knowledge about various methods of genetic engineering of animal cells.
- To provide knowledge about gene therapy and *in vitro* fertilization.
- To know about the different fermentation technologies.

UNIT I **(15 hrs)**

Plant Biotechnology

Plant tissue culture media: composition, types and constituents. Applications of plant tissue culture. Plant tissue culture technique. Callus culture, suspension culture, protoplast culture (isolation, culture and regeneration). Somatic hybridization technique and its applications. Micropropagation: technique, applications and demerits. Production and implications of genetically modified cotton and brinjal.

UNIT II **(15 hrs)**

Animal Biotechnology

Animal cell culture: basic requirements and applications.

Animal cell culture media: physicochemical properties. Development, advantages and disadvantages of serum free media.

Characteristicsof cultured cells: cell adhesion, cell proliferation, cell differentiation,metabolism, initiation of cell culture, evolution and development of cell lines, characterization, identification of a specificcell line. Growth cycleof cultured cells. Primary cell culture technique. Artificial insemination and embryo transfer; *invitro* fertilization; transgenic mice.

UNIT III **(15 hrs)**

Medical Biotechnology

Gene therapy: *exvivo* and *invivo.* Antisense therapy for cancer and AIDS. Recombinant vaccines. Aptamers as therapeutic agents. DNA in disease diagnosis – tuberculosis, AIDS, cancer, cystic fibrosis, sickle cell anaemia.

UNIT IV **(15 hrs)**

Bioprocess Technology

Bioreactors: types, operation of conventional bioreactor, solid substrate fermentation, media for industrial fermentation, sterilization of culture media and gases, types of culture, stages of fermentation. Stages of Downstream processing. Production of Single cell protein, antibiotic (penicillin) and citric acid.

UNIT V **(15 hrs)**

Environmental Biotechnology

Biodegradation: Introduction, Biodegradation of hydrocarbons. Bioremediation: Types and reactions of bioremediation, GEMs in bioremediation, bioremediation of soil and waste lands. Biohazards and safety aspects. Ethical, legal and social implications of biotechnology. Patenting biotechnology inventions.

Text Books:

1. U. Sathyanarayana (2013), Biotechnology, Books and Allied (P) Ltd, Kolkata.
2. Biotol series, *In vitro* Cultivation of Animal Cells (2004), 1sted, ButlerworthHeineman, UK.

Reference Books:

1. R. Ian Freshney (2005), Animal cell culture; IRL press, UK.
2. Benjamin Lewin (2008), Genes IX , Jones and Barlet Publishers, USA.
3. Adrian Slater, Nigel W Scott, Mark R Fowler (2010). Plant Biotechnology : The genetic manipulation of plants. 2nd Edition. Oxford University Press. New York.

PBC - 24

MAJOR ELECTIVE II

MICROBIOLOGY

Total teaching hours:75

Credits 5

Objectives:

- To learn about the microbiological techniques for microbial studies
- To learn the energy process taking place in microbes
- To learn about the food poisoning and pathogenicity of microbes

UNIT-I **(15 hrs)**

Microbiological techniques: Culture techniques: Isolation of microbes from various sources, serial dilution techniques, pure culture techniques, Anaerobic culture methods – chemical and physical methods. Culture preservation techniques. Nutritional requirements: - different kinds of media,composition of media-carbon sources, nitrogen sources, vitamin and growth factors, mineral, inducers, precursors and inhibitors. Sterilization methods. Anaerobic fermentation-Alcoholic fermentation, propionic acid fermentation, formic acid fermentation.

UNIT-II **(15 hrs)**

Energy from inorganic compounds - ET in chemolithotrophs, production of reducing power in chemolithotrophs; Energy from visible radiation – photosynthesis in eukaryotes, blue-green algae, bacteria. Energy from aromatic compounds – two carbon compounds, one carbon compounds, endogenous reserve polymers). Energy from hydrocarbons – alkanes, alkenes, acyclic aromatic hydrocarbons.

UNIT-III **(15 hrs)**

Food poisoning – Food borne diseases- Bacterial and Non- Bacterial. Microbial quality and safety – Determining microorganisms in food culture, Microscopy and sampling methods – Chemical and immunological methods. Principles of food preservations: Asepsis, Preservation by use of High temperature, Low temperature, Canning, Drying, Radiation and Food additives.

UNIT-IV **(15 hrs)**

Medical Microbiology - Infectious Diseases process – Diagnosis – Process of sample collection, transport and examinations of the specimens. Antibiogram. Bacteriology: Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of Gram positive organisms - *Staphylococcus aureus, Mycoplasma*; Gram negative organisms: *E.coli.*

UNIT-V **(15 hrs)**

Pathogenicity and Laboratory Diagnosis : Virology -Basic concepts of virology - General properties of Human viruses, Approaches to viral diagnosis-Serological and Molecular techniques of viral infections - Hepatitis, Polio, Ebola, SARS. Mycology: General properties and approaches to laboratory diagnosis. Mycosis – Superficial, Subcutaneous and Systemic infections –*Candida allbicans*. Parasitology: Pathogenicity and laboratory diagnosis of *Entamoeba histolytica, Plasmodium vivax.*

Text books:

1. Microbial Physiology – S. Meenakumari
2. Microbiology by Pelczar M.J., Ried, RD and Chan, ECS

Reference Books:

1. Principles of Fermentation Technology – By Standby and Wittaker , second Edition.
2. Chemical microbiology – An introduction to microbial physiology – AH Rose, Butterworth, London
3. Food Microbiology by Frazier
4. Text Book of Microbiology by Ananthanarayanan and Jayaram Paniker

PBC - 25
MAJOR ELECTIVE III
BIOINFORMATICS

Total teaching hours:75
Credits 5

Objectives:

- To learn the role of computer programmes in studying the biological processes
- To know about the different software's for data analysis
- To learn about the methods of data retrieval from various databases

UNIT-I **(15 hrs)**

History and development of computers, mainframe, mini and super computer systems. Principles of computing: Operating systems, Basic word processing and database management soft wares: LOTUS, DBASE, Wordstar, and other scientific application packages. Data acquisition and management: Types of data-DNA, RNA and protein sequences, protein structure data, gene and protein expression data

UNIT-II **(15 hrs)**

Programming in PERL - introduction, variables and data types, Basic operators and control structures, scalars, arrays, lists, hashes, file manipulation, regular expression, patterns, input and output, HTML: basic codes for a web-page. Systems biology: Introduction - Integrating networks. Methods for prediction of tertiary structure of proteins-knowledge based structure prediction, fold recognition Suggested.

UNIT-III **(15 hrs)**

Databases: Biological databases (Eg. Genbank, SWISSPROT, PDB, etc) - searching and retrieving data form databases- FASTA – BLAST: parameters and its types. Sequence analysis with acquired data: Sequence comparison with pair wise and multiple sequence alignment. Deducing phylogenetic relationships from multiple sequence alignment. phylogenetic analysis. Genome sequencing projects.

UNIT-IV **(15 hrs)**

Bioinformatics in structure analysis: Format of a protein structure data - Primary, secondary (alpha helix and Beta sheet), Tertiary, quarternary structure of protein molecules molecular visualization tools: rasmol, SWISS PDB viewer. Predicting protein structure: comparative modelling. Profiles and motifs. Phi, psi angles. Ramachandran plot. Bioinformatics and drug discovery.

UNIT-V **(15 hrs)**

Basic knowledge of compuer systems software and programming languages. Application and advantages of Unix/Linux in bioinformatics.Programming in C: Basic algorithms – flowcharts - Arithmetic Examples.

Text books:

1. Bioinformatics-A beginner‟s guide by Jean – Michel Claverie and Cedric Notredame, Wiley- Dream Tech India Pvt. Ltd.
2. Developing bioinformatics computer skills by Cynthia Gibas and Per Jambeck, O‟ Reilly publications.

Reference Books:

1. Introduction to bioinformatics by T.K. Attwood and D.J. Parry –smith, Pearson Education Asia.
2. Bioinformatics by David.W.Mount, CBS publishers and distributers.
3. Instant notes in bioinformatics by D.R. Westhead, J.H.Parish and R.M.Twyman

PBC – 26

NON-MAJOR ELECTIVE –I

CLINICAL AND THERAPEUTIC NUTRITION

UNIT I (15 Hrs)

Guidelines for dietary planning - Weights and Measures. Nutritional Assessment. Nutritional care process. Nutritional intervention: Objectives of diet therapy, Therapeutic modification of the normal diet: diet prescription. Routine Hospital diet - regular diets, clear fluid diet, full fluid diet, soft diet, modifications of food and nutrient intake, Enteral nutrition, parenteral nutrition, Refeeding syndrome, Transitional feeding. Medical and nutritional care record types and uses, Format for medical and nutrition charting and documentation record

UNIT II (15 Hrs)

Dietician and Nutrition counselling: Role of dietician on hospitalized and outdoor patients and development of nutritional care plan. Specific functions of a therapeutic, administrative and consultant dietician. Team approach in patient care. Psychological considerations in feeding the patients. Inter personal relationship with patients. Nutrition counselling- concept, components, activities for behaviour changes, intervention counselling models, types of counselling session in patients.

UNIT III (15 Hrs)

Weight imbalances, anorexia nervosa and Bulimia nervosa, cardio vascular disorders, Diabetes mellitus-Type I, II, GI Tract Disorders, Liver and gall bladder, Pancreatic disorders, renal disorder, gout, cancer, Musculo -skeletal disorders (Rheumatoid Arthritis, Osteoarthritis, Osteoporosis), Respiratory problems, hyper metabolic conditions- Burns, Sepsis, Surgery.

UNIT IV (15 Hrs)

Neurological disorders attributed to nutritional etiologies (Wernicke-Korsakoff syndrome and Stroke). Neurological disorders attributed to non nutritional etiologies (Parkinson's disease, epilepsy, Huntington's chorea, Amyotrophic lateral sclerosis, multiple sclerosis, myasthenia gravis, Alzheimer's disease and Wilson's disease). Immune – deficiency disorders - Infections and AIDS, Genetic disorders, in born errors of metabolism. Management of diet related health disorders- Food allergy, food poisoning, alcohol, drugs.

UNIT V (15 Hrs)

Food- Drug Interaction: Effect of Food on Drug Therapy. Effect of Drug on Food and Nutrition. Modification of Drug Action by Food and Nutrition. Effect of Drug on Nutritional Status. Excipients and Food-Drug Interaction. Medical nutritional therapy.

Text books:

1. Mahan, L.K. and Escott-Stump, S. (2008): Krause's Food Nutrition and Diet-Therapy, 12th Edition, W-13 Saunders Ltd., Canada.
2. Garrrow J.S, James W. P.T, Ralph A, (2000), Human Nutrition and Dietetics, 10th edition, Churchill Livingston, London.

Reference books:

1. Antia F.P. And Philip Abraham (2001) Clinical Nutrition and Dietetics, Oxford Publishing Company, New Delhi.
2. Williams, S.R. (2003): Nutrition and Diet Therapy, 7th Edition, Times Mirror/Mosby College Publishing
3. Esther A. Winter feldt, Margret L. Bogle, Lea L. Ebro. (2011). Dietetics: Practice & Future Trends. 3rd edition. Jones and Barlet Publishers.UK.

PBC - 27

NON-MAJOR ELECTIVE –II

BIOETHICS, BIOSAFETY AND IPR

Total teaching hours:75

Credits 5

Objectives:

- To learn about the demerits of biotechnological applications in recent research
- To know the ethical issues to be concerned in the course of biological research
- To know about the intellectual property rights of individual researchers

UNIT I **(15 hrs)**

Introduction to ethics/bioethics – framework for ethical decision making; biotechnology and ethics –benefits and risks of genetic engineering – ethical aspects of genetic testing – ethical aspects relating to use of genetic information – genetic engineering and biowarfare

UNIT II **(15 hrs)**

Ethical implications of cloning: Reproductive cloning, therapeutic cloning; Ethical, legal and socioeconomic aspects of gene therapy, germ line, somatic, embryonic and adult stem cell research-GM crops and GMO's – biotechnology and biopiracy – ELSI of human genome project

UNIT III **(15 hrs)**

Introduction to biosafety – biosafety issues in biotechnology – risk assessment and risk Management – safety protocols: risk groups – biosafety levels – biosafety guidelines and regulations (National and International) – operation of biosafety guidelines and regulations – types of biosafety containment

UNIT IV **(15 hrs)**

Introduction to intellectual property and intellectual property rights – types: patents, copy rights,Trade marks, design rights, geographical indications – importance of IPR - world intellectual Property rights organization (WIPO)

UNIT V **(15 hrs)**

What can and what cannot be patented? – Patenting life – legal protection of biotechnological Inventions – Patenting in India: Indian patent act.

Text book:

Principles of cloning, Jose Cibelli, Robert P. lanza, Keith H. S . Campbell, Michael D.West, Academic Press, 2002

References:

1. http://books.cambridge.org/0521384737.htm
2. http://online.sfsu.edu/%7Erone/GEessays/gedanger.htm
3. http://www.actahort.org/members/showpdf?booknrarnr=447_125
4. http://www.cordis.lu/elsa/src/about.htm

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NON-MAJOR ELECTIVE –III

ENVIRONMENTAL TOXICOLOGY

Total teaching hours:75

Credits 5

Objectives:

- To learn about the different toxicants of the environment
- To learn the impact of toxicity in the survival of various biological species
- To learn the various legislations available for environmental toxicology

UNIT – I **(15 hrs)**

Toxicology – Definitions, Major classes of environmental toxicants, Origin and Nature of Toxicants in Environment. Basic Probit analysis, concepts – Toxicants – Toxicity, Acute, sub acute, chronic, dose effect, LD_{50}, LC_{50} and response safe limits. Dose response relationship, graphs, concentration response relationship, Safe Limits. Biological, chemical Factors that influence. Influence of route of administration abnormal response to chemicals; basis of selective toxicity; laboratory determination of toxicity of chemicals.

UNIT – II **(15 hrs)**

Pest – Pesticides – Classification of pesticides – Pest surveillance, resistance, residual effects, toxic effects of insecticides on man and mammals. Metals- Toxicity, Properties, occurrence, Production, Industrial uses, Metabolism, Physiology, Toxicology, Prophylaxis and Therapy - Aluminium, arsenic, cadmium, chromium, lead and mercury. Mutagenesis and carcinogenesis - case studies. Emerging pollutants in environment- Pharmaceuticals and personal care products.

UNIT – III **(15 hrs)**

Chlorinated xenobiotics in environment – Bioconcentrations – Volatilization – Biological and nonbiological degradations, Detoxification. Chlorinated organics in environment and their fate. Short chained chlorinated hydrocarbons – Toxicity – Ecotoxicological relevants and degradation. PCB – Dioxins levels, fate, toxicity and their global distribution. Toxaphene – occurrence and degradation. Environmental risk assessments- Biomonitoring - Bioindicators- Environmental specimen banking.

UNIT – IV **(15 hrs)**

Bioaccumulation – Bioconcentration – Biomagnifications –mechanisms in biota – Significant influence, mechanisms and Kinetics of Bioconcentration. Cellular response to chemical stress – membrane process; intracellular fate of chemicals, cell receptors, cell injury and apoptosis. Long-term impact of chemicals in aquatic organisms, soil invertebrates and Avian species.

UNIT – V **(15 hrs)**

Ecotoxic modes of action of chemicals: Biotransformation of xenobiotics – Molecular mode of action – Toxicity Testing Methods – Microbiol, algal, invertebrates and alternative toxicity tests. Multimedia mass balance models – fugacity – nonfugacity models – applications of multimedia models. Future test strategies in Ecotoxicology – Legislative perspectives. Animal management in Toxicological Evaluation: Animal extrapolation; Animal ethics.

Text book:

1. Foye , W. O. Principles of Medicinal Chemistry, Waverks Pvt. Ltd., New Delhi, 1995.

References:

1. Mars and Turner, General and Applied Toxicology, Macmillan Press Ltd., 1995.
2. Corkerhem, L.G and Shane, S.S. Basic Environmental Toxicology, CRP Press, 1996.
3. Shivamato, R S et al., Pharmacology and Pharmacotherapeutics, Popular Prakasham Bombay, 1995.

PBC – 29
ALC – I
BIONANOTECHNOLOGY

Objectives:

- To get an idea about the application of nanotechnology in biological research
- To learn the properties and functions of nanomaterials in biological systems
- To learn the applications of nanomaterials in drug delivery and treatment

UNIT – I

Introduction to Nanotechnology: Definition: Nanotechnology - Nanobiotechnology - Nanomaterial - Nanocomposites - Classification of nanostructures – Top down and Bottom Up approach - Quantum dots - Bio-inspired nanomaterials.

UNIT – II

Synthesis Methods of Nanomaterials: Physical synthesis - Ball Milling - Thermal evaporation - Chemical synthesis - Solgel Process - Hydro thermal Synthesis - Biological Synthesis – Plant, Microbial compound based synthesis

UNIT – III

Properties of Nanomaterials: Physical properties - Optical, Magnetic, Surface Plasmon resonance - Electrochemical Properties of Nanoscale Materials, Intramolecular bonding, Inter-molecular bonding, Nanocatalysis, Self-assembly – DNA, Protein.

UNIT – IV

Characterization methods: X-ray diffraction (XRD) - Dynamic Light Scattering (DLS). Electron microscopes: Scanning Electron Microscope (SEM) - Transmission Electron Microscope (TEM) -UV - Visible Spectrophotometer - Fourier Transform InfraRed Spectrometer (FTIR).

UNIT – V

Applications of Nanoparticles: Drug delivery – Nanoparticles in cancer therapy, Biosensors - DNA Microarrays - Cell Biochips - Nanoparticles for Bioimaging - Military applications of Nanotechnology - Nanomaterials for food Applications - Toxicity of Nanoparticles - Future Perspectives.

Text books:

1. Nano: The Essentials: Understanding Nanoscience and Nanotechnology, T.Pradeep, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008.
2. Nanoscale Science and Technology, Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan, John Wiley & Sons, Ltd., UK, 2005.

Reference books:

1. Nanostructures & Nanomaterials: Synthesis, Properties & Applications, Guozhong Gao, Imperial College Press, 2004.
2. Encyclopedia of Materials Characterization, C. Richard Brundle, Charles A. Evans Jr., Shaun Wilson, Butterworth-Heinemann Publishers, 1992.
3. Nanotechnology: Basic Science and Emerging Technologies - Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse, Overseas Press, 2005.
4. Nanoparticles as Drug carriers, Vladimir P Torchilin, Imperial College Press, USA, 2006. 7. Nanobiotechnology: Concepts, Applications and Perspectives, Christ of M.Niemeyer, Chad A.Mirkin, Wiley-VCH, Weinheim, 2004.

PBC – 30
ALC – II
NEUTRACEUTICALS AND FUNCTIONAL FOODS

Objectives:

- To learn the concept of nutraceuticals and functional foods
- To know the available biochemical compounds in our system
- To prepare functional foods from nutraceutical compounds

UNIT -I

Introduction to Nutraceuticals as Science: Nutraceutical- Definition, Classification - Dietary supplements, Functional foods, Historical perspective, scope & future prospects. Applied aspects of the Nutraceutical Science. Sources of Nutraceuticals. Relation of Nutraceutical Science with other Sciences: Medicine, Human physiology, genetics, food technology, chemistry and nutrition (brief description).

UNIT -II

Classification, Properties and structure of various Nutraceuticals: Alkaloids, Terpenoids, Glycosides, Natural phenols, Isoprenoid derivaties, Glucosamine, Octacosanol, flavonoids, carotenoids, polyunsaturated fatty acids, lecithin, choline and spingolipids, Lycopene, Carnitine, Melatonin and Ornithine alpha ketoglutarate as neutraceuticals. Use of proanthocyanidins, grape products, flaxseed oil as Nutraceuticals.

UNIT -III

Nutraceuticals of plant and animal origin: Plant metabolites – Functions, sources - Alkaloids, phenols, Terpenoids. Applications with specific examples with reference to skin, hair, eye, bone, muscle, heart, brain, liver, kidney, general health and stimulants. Concept of cosmoceuticals and aquaceuticals. Animal metabolites – Functions, Sources - chitin, chitosan, glucosamine, chondroitin sulphate and other polysaccharides of animal origin. Uses and applications in preventive medicine and treatment.

UNIT -IV

Functional Foods : Definition. Applications of herbs to functional foods. Concept of free radicals and antioxidants; Nutritive and Non-nutritive food components with potential health effects. Soy proteins and soy isoflavones in human health; Role of nuts in cardiovascular disease prevention. Functional foods from wheat and rice and their health effects. Role of Dietary fibers in disease prevention. Vegetables, Cereals, milk and dairy products as Functional foods. Health effects of common beans, Capsicum annum, mustards, Ginseng, garlic,citrus fruits, fish oils, and sea foods.

UNIT -V

Food as remedies: Nutraceuticals bridging the gap between food and drug, Nutraceuticals in treatment for cognitive decline, Nutraceutical remedies for common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers etc. Brief idea about some Nutraceutical rich supplements e.g. Bee pollen, Caffeine, Green tea, Lecithin, Mushroom extract, Chlorophyll, Kelp and Spirulina etc.

Text books:

1. Swaminathan M., Essentials of Food and Nutrition, 2 nd Ed, 1985, Ganesh and Co.
2. Gopalan C., et al, Dietary Allowances for Indians, NIH, Hyderabad.

References:

1. Todd and others, Clinical Diagnosis and Management, 17 th Ed, W.B.Saunders, Philadelphia.
2. Anita F.P., Clinical Dietetics and Nutrition, 4 th Ed, 1997, Oxford Univ Press.
3. Krause's Food, Nutrition and Diet Therapy, 10th Edition by Mahan, L.K. & Ecott-Stump, S. (2000), W.B. Saunders Ltd.
4. Nutrition - Concepts & Controversies, 8"' Edition, by Sizer, F. & Whitney, E. (2000): Wadsworth Thomson Learning.

PBC – 31
ALC – III
STEMCELL BIOLOGY

Objectives:

- To learn about the technology of stem cells preparation
- To learn the properties of stem cells
- To prepare stem cells for gene therapy

UNIT I

Introduction and Scope of stem cells: definitions, Concepts of stem cells, differentiation , maturation, proliferation, pluripotency, self maintenance and self renewal, significations in measuring stem cells, preservation and storage protocols.

UNIT II

Intestinal stem cells, Mammary stem cells, Skeletal muscle stem cell, keratinocyte stem cells of cornea, skin and hair follicles, tumor stem cells, factors influencing proliferation and differentiation of stem cells, Role of hormone in differentiation.

UNIT III

Embryonic stem cells, blastocyst, innercell mass, Culturing of ES cells in lab, laboratory tests to identify ES cells, stimulation ES cells for differentiation, properties of ES cells, human ES cells, Monkey and Mouse ES cells.

UNIT IV

Identification, Manipulating differentiation pathways, stem cell therapy vs cell protection, stem cell in cellular assays for screening, stem cell based drug discovery platforms, drug screening and toxicology, stem cell banking.

UNIT V

Gene therapy, genetically engineered stem cells, stem cells and Animal cloning, transgenic animals and stem cells, Therapeutic applications, Parkinson's disease, Neurological disorder, limb amputation, heart disease, spinal cord injuries, diabetes, burns Matching the stem cell with trans plant recipient, HLA typing Alzheimer's disease, spinal cord injuries tissue engineering application, production of complete organ, kidney, eyes, heart ,brain, Stem cell case study

Text book:

Embryonic Stem cells by Kursad and Turksen. 2002.Humana Press

Reference books:

1.Stem cell and future of regenerative medicine. By committee on the Biological and Biomedical applications of Stem cell Research.2002.National Academic press.
2. Stem cells, Elsevier : CS Potten.

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JOC – I

BIO-ENTREPRENEURSHIP

Objectives:

- To learn about the concepts of entrepreneurship
- To study the various opportunities in launching and running a business
- To know the various strategies of effective enterpreneurship

UNIT I

Basics of Bioentrepreneurship Introduction to bioentrepreneurship – Biotechnology in a global scale, Scope in Bioentrepreneurship, Importance of entrepreneurship. Meaning of entrepreneur, function of an entrepreneur, types of entrepreneur, advantages of being entrepreneur. Innovation – types, out of box thinking, opportunities for Bioentrepreneurship. Entreprenuership development programs of public and private agencies (MSME, DBT, BIRAC, Startup and Make in India). Patent landscape, IP protection and commercialization strategies.

UNIT II

Management, Accounting and Finance Management principles of Henry Fayol. Business plan preparation: business feasibility analysis by SWOT, socio-economic costs benefit analysis, Sources of financial assistance – making a business proposal, approaching loan from bank and other financial institutions, budget planning and cash flow management, basics in accounting practices - balance sheet, P&L account, double entry book keeping, estimation of income, expenditure and Income tax. Collaborations and partnerships, information technology for business administration and expansion.

UNIT III

Knowledge Centre and R&D Knowledge centers - Universities, innovation centre, research institutions and business incubators. R&D - technology development and upgradation, assessment of technology development, managing technology transfer, industry visits to successful bio-enterprises, regulations for transfer of foreign technologies, quality control, technology transfer agencies, Understanding of regulatory compliances and procedures (CDSCO, NBA, GLP, GCP & GMP)

UNIT IV

Medium & Small Scale Industry Definition, characteristics, need and rationale, objectives, scope and advantages of small scale industries. Types of bioindustries – Pharma, Agri and Industry. Biofertilizers production - Azospirillium, Azolla, Cyanobacteria and its applications. Biopecticides production - Bacterial, fungal, viral and plant insecticides. Sericulture. Apiculture. Dairy farming. Single Cell ProteinProduction and applications. Vermicomposting and its applications. Mushroom cultivation and its application. Ancillary and tiny industries

UNIT V

Marketing and Human Resource Development Assessment of market demand for potential product(s) of interest, Market conditions, segments, prediction of market changes, identifying needs of customers including gaps in the market. Branding issues, developing distribution channels – franchising policies, promotion, advertising, branding and market linkages. Marketing of agro products. Recruitment and selection process, leadership skills, managerial skills, organization structure, training, team building and teamwork.

Text Books:

1. 1.“Principles of Management”, PC Tripati, PN Reddy,–Tata Mc Graw Hill.
2. “Dynamics of Entrepreneurial Development & Management” Vasant Desai Himalaya Publishing House.
3. “Entrepreneurship and Business of Biotechnology”, S. N. Jogdand, Himalaya Publishing Home, 2007.

Reference books:

1. “Management Fundamentals ”, Robert Lusier – Concepts, Application, Skill Development” Thomson .
2. “Entrepreneurship Development” S S Khanka , S Chand & Co .
3. “Management”, Stephon, Robbins, Pearson Education , 17th Edition (2003).

PBC – 33

JOC – II

FOOD SAFETY AND QUALITY CONTROL

Objectives:

- To learn the principles of food quality control
- To learn the methodologies to standardize and ensuring food safety
- To gain knowledge on the framed food safety regulations

UNIT-I

Principles of Quality control of food –Raw material control, processed control and finished product inspection. Leavening agents, classification, uses and optimum levels. Food additives - Preservatives, colouring, flavouring, sequestering agents, emulsifiers, antioxidants.

UNIT-II

Standardisation systems for quality control of foods-National and International standardization system, Food grades, Food laws-compulsory and voluntary standards. Food adulteration - Common adulterants in foods and tests to detect common adulterants.

UNIT-III

Standards for foods – Cereals and pulses, sago and starch, milk and milk products, Coffee, tea, sugar and sugar products.

UNIT-IV

Methods for determining quality - Subjective and objective methods. Sensory assessment of food quality-appearance, color, flavour, texture and taste, different methods of sensory analysis, preparation of score card, panel criteria, sensory evaluation room.

UNIT-V

Food safety, Risks and hazards: Food related hazards, Microbial consideration in food safety, HACCP-principles and structured approach. Chemical hazards associated with foods. FSSAI.

Text books:

1. Food chemistry-Lee
2. Food science-Srilakshmi (2001)2nd edition, New age international publishers-(2001)

Reference Books:

1. Food science-Norman potter
2. Food Technology-Presscott. S.C.and Procter
3. Food chemistry-Meyer
4. Food science, Chemistry and experimental foods-M. Swaminathan

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KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

Coimbatore – 641029, Tamil Nadu, India.

QUESTION PAPER PATTERN FOR CIA & END OF SEMESTER EXAMINATION

M. Sc., Biochemistry

1. THEORY

Time - 3 hrs Max Marks - 75

SECTION - A (10 x 1=10 marks)

Choose the correct answer type.

Q.No. 1 to 10 : Multiple choice type **alone** .

Questions with four alternative (distracter) answers each (Two questions from each unit).

SECTION - B (5 x 5=25 marks)

Short answer questions

Q.No. 11-15: Either (a) or (b) short note type (One question 'a' or 'b' from each unit)

SECTION - C (5 x 8=40 marks)

Essay type of questions:

Q.No. 16-20: Either (a) or (b) essay type (One question 'a' or 'b' from each unit)

2. BREAK UP OF INTERNAL MARKS (25 marks)

Internal marks (25) = CIA (out of 15) + Attendance (out of 5) + Assignment (out of 5)

*CIA marks (out of 15 marks) = I CIA marks + II CIA marks / 150 X 15

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3. PRACTICALS – Question Pattern & Break-up of marks

END OF SEMESTER PRACTICAL EXAMINATION

Max. Marks: 60

Duration: 6 hrs

I.	**Major**	(One question)	(1 x 20 = 20)
II.	**Minor**	(One question)	(1 x 10 = 10)
III.	**Spotters**		(5 x 3 = 15)

Examine, identify and critically comment on the spotters A, B, C, D and E.

IV.	**Viva**	(05)
V.	**Record / Observation***	(10)

*Record for ESE; Observation for CIA exam.

INTERNAL - PRACTICAL MARKS

From Model Practical Examination	-	25
Observation	-	10
Attendance	-	5
Total	-	40