

**RAJAH SERFOJI GOVT COLLEGE,(AUTONOMOUS)**

**THANJAVUR –613 005**

**(Reaccredited with “A”Grade by NAAC)**



**AFFILIATED TO BHARATHIDASAN UNIVERSITY ,**

**TRICHIRAPPALLI –24**



**DEPARTMENT OF BIOCHEMISTRY**

**M.Sc BIOCHEMISTRY SYLLABUS**

**(For the students admitted from 2018–2019 onwards)**

Credits	5	Hrs/week	6	Sub Code	S1PBC1	Semester	I	Medium of Instruction	English
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**SEMESTER – I- CORE COURSE -1**  
(For the students admitted from 2018 onwards)

**CHEMISTRY OF BIOMOLECULES**

**Objective**

**To understand the major biomolecules and its properties and its functions.**

**Unit I- Carbohydrates-** Definition, structure and biological functions, - mono, oligosaccharides. Homopolysaccharide-chitin, fructans, mannans, xylans, and galactans. Heteropolysaccharides. Structure and biological importance of sugar derivatives- glycosaminoglycans, proteoglycans. Glycoprotein – Blood group and bacterial cell wall polysaccharides, O- linked and N- linked oligosaccharides.

**Unit II-Proteins-**Proteins– Peptide bond ,general properties, denaturation and renaturation. Orders of protein structure – Primary structure – Ramachandran plot, Secondary structure– the  $\alpha$ -helix,  $\beta$ - pleated sheet. Collagen triple helix, Super secondary structure– helix– loop helix, the hairpin  $\beta$  -motif and the  $\beta$ - $\alpha$ - $\beta$ -motif. Forces stabilizing tertiary and quaternary structure. Structure of haemoglobin. Tertiary Structure of myoglobin.

**Unit III- Lipids-**Lipids- general properties, Types of Fatty acids-Essential, Non essential. Structure and biological functions of phospholipids, sphingolipids, glycolipids. Steroids–functions of cholesterol, bile acids, sex hormones, ergosterol. Structure and biological role of prostaglandins, thromboxanes and leukotrienes. Lipoproteins- classification, composition and Functions.

**Unit IV- Nucleic acids-**Structure of purines, pyrimidines, nucleosides and nucleotides. DNA double helical structure. A, B and Z forms of DNA. Triple and quadruple structures. DNA supercoiling and linking number. Properties of DNA: buoyant density, viscosity, hypochromicity, denaturation and renaturation– the cot curve. RNA– types and biological role. Secondary, tertiary structures of RNA.

**Unit V- Minerals, Vitamins and antioxidants-**Minerals in Biological systems and its importance –Iron, calcium, Phosphorous, Iodine, Copper, Zinc. Fat and water soluble Vitamins – Sources, function and deficiency diseases. Antioxidants-enzymic and nonenzymic antioxidants. Alkaloids and flavanoids- types and their biological importance.

**Text books and Reference books**

1. Biochemistry Zubay 4th edition 1998 William C.Brown Publication.
2. Harper’s Biochemistry 25th edition McGraw Hill.
3. Biochemistry Stryer 4th edition Freeman.
4. Principles of Biochemistry. Lehninger Nelson Cox Macmillan worth, Publishers, 2000.
5. Biochemistry. Davidson and Sittmann, NMS 4th ed. Lippincott Williams and Wilkins, 1999

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	5	Hrs/week	6	Sub Code	S1PBC2	Semester	I	Medium of Instruction	English
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**SEMESTER – I- CORE COURSE 2**  
(For the students admitted from 2018 onwards)

**ANALYTICAL BIOCHEMISTRY**

**Objective**

**To know about the instruments used in biochemistry lab with its applications**

**Unit I**-Ultracentrifuges– Analytical ultracentrifuge– instrumentation and applications. Preparative ultracentrifuge– types, instrumentation and applications of preparative rotors. Analysis of subcellular fractions and determination of relative molecular mass– sedimentation velocity and sedimentation equilibrium.

Units of radioactivity. Detection and measurement of radioactivity– solid and liquid scintillation counting, Autoradiography. Applications of radioisotopes in biology. Radiation hazards and safety measures.

**Unit II** – Principle, instrumentation and applications of thin layer, gas chromatography, Ion-exchange chromatography, Column chromatography-packing, loading, eluting and detection., Chromatofocusing. Molecular exclusion chromatography-principle, gel preparation, operation and applications. Affinity chromatography– principle, materials, procedure and applications. HPLC– principle, materials, instrumentation and applications.

**Unit III**- Laws of absorption and absorption spectrum. Principle, instrumentation and applications of UV-Visible spectrophotometry, IR, Mass spectrometry, NMR, ESR and spectrofluorimetry. Atomic spectroscopy – principle, method and applications. Plasma emission spectroscopy.

**Unit IV** -*Electrophoresis*: General principles. Support media. Electrophoresis of proteins– SDS-PAGE, native gels, gradient gels, isoelectric focusing, 2-D PAGE. Detection, estimation and recovery of proteins in gels. Electrophoresis of nucleic acids– agarose gel electrophoresis, pulsed field gel electrophoresis. Capillary electrophoresis and its applications.

**Unit V** – PCR– basic principle, RT-PCR, quantitative PCR and in situ PCR. Diagnostic and laboratory applications of PCR. Comet assay. Mutagenicity testing– Ames test. DNA finger printing, DNA foot printing. Membrane blotting and hybridization of nucleic acids- Southern, Western, Northern blot and fluorescent insitu hybridization.

**Text Books & Reference books**

1. Wilson and Walker. A biologist's guide to principles and techniques of Practical biochemistry. 5th ed. Cambridge University Press 2000.
2. Boyer, R. Modern Experimental Biochemistry. 3rd ed. Addison Wesley, Longman, 2000.
3. Upadhyay, Upadhyay and Nath. Biophysical Chemistry Principles and Techniques. Himalaya Publ. 1997

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit)

**Signature of HOD**

Credits	5	Hrs/week	6	Sub Code	S1PBC3	Semester	I	Medium of Instruction	English
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**SEMESTER – I- CORE COURSE 3**  
**(For the students admitted from 2018 onwards)**

**CELL BIOLOGY AND PHYSIOLOGY**

**Objective**

**To learn the cell biology and membrane structure , functions.**

**Unit I** –Major classes of cell junctions – anchoring, tight and gap junctions. Major families of cell adhesion molecules (CAMs) – the cadherins (classical and desmosomal). The integrins, connexins. The extracellular matrix of epithelial and nonepithelial tissues. ECM components – collagen, elastin, fibrillin, fibronectin, laminin and proteoglycans.

**Unit II-** Membrane assembly – importins and exportins. Membrane transport. Diffusion (passive and facilitated) active transport (symport, antiport, Na<sup>+</sup> K<sup>+</sup> ATPase), ion gradients, ion selective channels, group translocations, porins, endocytosis and exocytosis. Programmed cell death – Brief outline of apoptosis. Differences between apoptosis and necrosis.

**Unit III-** Composition and functions of blood. Separation of plasma and serum. Plasma proteins in health and disease. Red blood cells – formation and destruction. The RBC membrane – principle proteins (spectrin, ankyrin, glycophorins). Anaemias. Composition and functions of WBCs. Types of Blood groups . Blood coagulation – mechanism and regulation. Fibrinolysis. Anticoagulants.

**Unit IV** –Lymph – composition and functions. CSF – Composition and Clinical significance. Formation of urine – structure of nephron, glomerular filtration, tubular reabsorption of glucose, water and electrolytes. Countercurrent multiplication, tubular secretion. Composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions.

**Unit- V** - Structure of neuron. Propagation of action potential: structure of voltage – gated ion channels. Neurotransmitters- examples and functions, release and cycling of neurotransmitters. The neuromuscular junction – activation of gated ion channels. The acetylcholine receptor. Structure of skeletal muscle. Muscle proteins – myosin, actin, troponin and tropomyosin. Source of energy for muscle contraction.

***Text books and Reference Books :***

1. Lodish et.al. Molecular Cell Biology 5th ed. 2003, WH Freeman (for unit 1,2,5).
2. Murray et al. Harper’s Biochemistry 26th ed. McGraw Hill 2003
3. Smith et al. Principles of Biochemistry. Mammalian Biochemistry. McGraw, Hill 7th ed.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S1PBCP1	Semester	I	Medium of Instruction	English
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**SEMESTER – I- CORE COURSE 4**  
**(For the students admitted from 2018 onwards)**

**PRACTICALS-I**

**Estimation**

1. Isolation and estimation of starch from potato.
2. Isolation and estimation of glycogen from liver.
3. Estimation of ascorbic acid from fruit.
4. Estimation of  $\beta$ -Carotene from carrot.
5. Estimation of thiamine from cereals/fruits.
6. Estimation of riboflavin.
7. Estimation of lactose from milk.
8. Estimation of lecithin from egg Yolk.
9. Estimation of maltose by calorimetric method.
10. Estimation of RNA –UV and visible methods.
11. Estimation of DNA from spleen /liver – UV and visible methods.
12. Estimation of fructose in fruits.

**Demonstration**

1. Separation of amino acids by circular , ascending and descending chromatography.
2. Separation of plant pigments by column chromatography.
3. Separation of lipids by TLC.

**Questions paper pattern**

Internal – 40marks , External – 60marks

Major experiment – 30 marks, Minor experiments – 20 marks, Record – 10 marks

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S1PBCEL1A	Semester	I	Medium of Instruction	English
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**SEMESTER – I-ELECTIVE COURSE – 1 (A)**  
**(For the students admitted from 2018 onwards)**

**ENVIRONMENTAL BIOLOGY**

**Objective**

**To explore basic knowledge on evolution and environmental biology**

**UNIT-I-Evolutionary biology:** Origin of life, concepts of evolution, theories of organic evolution- Lamarchism theory and Darwins theory, Natural resources – Forest resources, Afforestation, Deforestation, Hazards of deforestation, Water resources, Terrestrial resources, Soil fertility, conservation of soil fertility.

**UNIT -II-Environmental Biology - basic concepts, atmosphere, hydrosphere, lithosphere and biosphere.:** Concepts of ecosystem, components, food chain and Food web, types of ecosystems, Ecological pyramids, population ecology and biological control, economic importance of microbes, plants and animals.

**UNIT-III -Biodiversity:-** Definition, megabiodiversity of India, hots spots of biodiversity in India, value of biodiversity, distribution and threats to biodiversity, benefits of biodiversity, conservation of biodiversity – insitu and ex situ conservation methods, cryopreservation.

**UNIT- IV-Environmental Pollution-** causes, effects and control of soil, air, water, noise and radioactive pollution. E –Waste and its management. Pollution monitoring and measurements, Bioassays in environmental monitoring, Biosensors in environmental monitoring, biotechnological methods for management of pollution, management of metal pollution.

**UNIT-V- Biogeological cycles - nitrogen, carbon, phosphorus and sulphur cycles.** Heavy metal toxicity – sources, effects of cadmium, lead and mercury. Global environmental problems- Green house gases, Green House effect and global warming and its impact on biodiversity, Role of human to control green house effect, Problem of ozone, effects of ozone depletion, acid rain.

**Text books and Reference books**

1. Environmental biology by P.D. Sharma.
2. Text book of environmental science by Richard.
3. Text book for environmental studies by Erach bharucha.
4. Environmental science by Daniel.
5. Environmental science by William P. Cunningha.
6. Environmetal science by Arvind kumar.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S1PBCEL1B	Semester	I	Medium of Instruction	English
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**SEMESTER – I-ELECTIVE COURSE – 1 (B)  
(For the students admitted from 2018 onwards)**

**ECOLOGY**

**Objective**

**To explore basic knowledge on ecology and environment.**

**UNIT – I-** Ecology and Environment: Scope - Environmental Science as interdisciplinary Subject - Earth, Man and Environment Relationship - Importance of biological cycles in the environment.

**UNIT - II** -Earth -its interior and surface -The Universe -Big Bang theory -Meteors -The Origin, shape and size of the earth -The solar system -Planets -Eclipse -Solar, Lunar - Rotation and Revolution of the earth -Seasons -Latitude and Longitude -Layers of the earth -Sial, Sima, Nife - History of the Earth's surface -Precambrian, Paleozoic, Mesozoic, Neozoic and Quaternary era.

**UNIT - III** - Habitat and ecological niche -Pond, grass -land, forest, mangrove ecosystem - concept of energy, food chain, food web and ecological pyramids, Ecological succession.

**UNIT – IV-** Animal Association -Interspecific interactions and Intraspecific interactions - Symbiosis, Mutualism, Antagonism, Commensalisms, Predation and Parasitic relationship.

**UNIT -V** -Diversity of plant species -Trees, shrubs, herbs, grasses -halophytes, hydrophytes, mesophytes and xerophytes, Conservation of Biodiversity, Value of biodiversity, Threats Biodiversity – global, National and local levels.

**Text Books and Reference books**

1. Odum E.P., Fundamentals of Ecology, WB Saunders Co., London (1971).
2. Sharma P.D., Ecology and Environment, Rastogi Publications, Meerut (1994)
3. Daniel D Chiras, Environmental Science, The Benjamin/Cummings Publishing Co. Inc (1994).

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S1PBCEL1C	Semester	I	Medium of Instruction	English
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**SEMESTER – I-ELECTIVE COURSE – 1 (C)**  
**(For the students admitted from 2018 onwards)**

**DEVELOPMENTAL BIOLOGY**

**Objectives:**

Developmental Biology is an experimental science, which provides understanding of the processes of early embryonic development.

**UNIT I-** Gametogenesis: Spermatogenesis – Cells in seminiferous tubules, Spermiogenesis, structure and types of sperm. Oogenesis – Growth of oocyte, vitellogenesis, organization of egg cytoplasm. Polarity and symmetry – Maturation of egg, egg envelopes - Types of eggs.

**UNIT II**

Fertilization: External and Internal fertilization, sperm – egg interaction, physiological changes in the organization of egg cytoplasm - Theories of fertilization. Cleavage – Patterns of cleavage – radial, spiral and bilateral; Types – meroblastic, holoblastic and superficial - Factors affecting cleavage - Chemodifferentiation.

**UNIT III**

Blastulation – Types of blastula. Fate maps. Presumptive organ forming areas in Frog and Chick. Gastrulation in Frog and Chick - Morphogenetic movements - Development of brain and eye in Frog. Developmental stages of Chick embryo up to 96 hours and organogenesis.

**UNIT IV**

Foetal membranes in Chick and Mammals - Placentation in Mammals- types and physiology. Organizer concept and embryonic induction. Regeneration in Planarians and Amphibians. Metamorphosis in Amphibians.

**UNIT V**

Precautions and health care during Human Pregnancy and Gestation infertility. Artificial Insemination – Concept of test-tube baby - Birth control methods - Factors involved in Teratogenesis.

**Text Books and Reference Books:**

1. Beril., N. J.1974. Developmental Biology. Tata Mc Graw-Hill Publishing Company Ltd. New Delhi.
2. Berry.A.K.2007. An Introduction to Embryology, Emkay Publications, New Delhi-51.
3. Arumugam.N. 1998. Developmental Biology, Saras Publications,
4. Balinsky, B.I. 1981. An Introduction to Embryology. W.B. Saunders Company. Philadelphia.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**



Credits	5	Hrs/week	6	Sub Code	S2PBC4	Semester	II	Medium of Instruction	English
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**SEMESTER – II-CORE COURSE 5**  
(For the students admitted from 2018 onwards)

**METABOLISM AND REGULATION**

**Objective**

**To understand the basic metabolic pathway of biomolecules with its regulations.**

**Unit I**-Free energy and entropy. Oxidation and reduction reactions. Enzymes involved in redox reactions. High energy phosphate compounds. The electron transport chain-organization and role in electron capture. Oxidative phosphorylation- electron transfer reactions in mitochondria. F1-F0 ATPase- structure and mechanism of action. The chemiosmotic theory. Inhibitors of respiratory chain and oxidative phosphorylation- uncouplers, ionophores. Mitochondrial transport systems- ATP/ADP exchange, malate / glycerophosphate shuttle.

**Unit II**- Overview of intermediary metabolism . Glycolysis and gluconeogenesis– pathway, key enzymes and co-ordinate regulation. Mechanism of pyruvate dehydrogenase multienzyme complex and the regulation of this enzyme through reversible covalent modification. The citric acid cycle and regulation. The pentose phosphate pathway. Metabolism of glycogen and regulation

**Unit III**-Fatty acid biosynthesis and its regulation. Synthesis and Regulation of triacylglycerol, phospholipids and cholesterol.  $\alpha$ ,  $\beta$ ,  $\gamma$ , Oxidation of fatty acids– Role of carnitine cycle in the regulation of  $\beta$ - oxidation. Ketogenesis and its control. Lipoprotein metabolism - exogenous and endogenous pathways. Metabolism of prostaglandins and leukotriens.

**Unit IV**-Overview of biosynthesis of nonessential amino acids. Catabolism of amino acids- transamination, deamination, ammonia formation, the urea cycle and its regulation Importance of glutamate dehydrogenase. Metabolism of purines- de novo and salvage pathways for purine biosynthesis,. Purine catabolic pathway. Metabolism of pyrimidines biosynthesis and catabolism. regulation of biosynthesis of Purine and pyrimidine nucleotides.

**Unit 5**- Key junctions in metabolism– glucose-6-phosphate, pyruvate and acetyl CoA. Metabolic profiles of brain, muscle, liver, kidney and adipose tissue. Metabolic inter relationships in various nutritional and hormonal states– obesity, aerobic, anaerobic endurance, exercise, pregnancy, lactation, IDDM, NIDDM and starvation.

***Text books and reference Books***

1. Stryer. Biochemistry. Freeman. 5th ed. 2002.
2. Murray et al. Harper's Biochemistry. 5th ed. Mc. GrawHill, 2000.
3. Nelson Cox. Lehninger's Principles of Biochemistry. 3rd ed. McMillan Worth, 2000.
4. Donald Voet, J.G. Voet, John Wiley, Biochemistry, 1995.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	5	Hrs/week	6	Sub Code	S2PBC5	Semester	II	Medium of Instruction	English
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**SEMESTER – II-CORE COURSE 6**  
(For the students admitted from 2018 onwards)

**ENZYMES AND ENZYME TECHNOLOGY**

**Objective**

**To understand the classification, enzyme kinetics, enzyme applications**

**Unit I-** Enzymes- Nomenclature and classification of enzymes, Active site. Enzyme modification using chemicals. multienzyme complexes. Lock and Key model of enzyme action. Enzyme Specificity. Turnover number of enzymes. Measurement of enzymatic reactions - Spectrophotometry and radio assay. Units of enzyme activity. Affinity labeling.

**Unit II-** Enzyme kinetics- Factors affecting enzyme activity.- Effect of Substrate concentration, pH, temperature, activators. Derivation of Michaelis- Menten equation. Lineweaver- Burk plot. Significance of Km and Vmax. Allosteric enzymes- MWC and KNF models. Bisubstrate reactions- Types and mechanism . Covalent modification of enzymes.

**Unit III -** Source of enzymes – Microbial source, plant and animal source. Methods of Extraction of enzymes, Enzyme purification by ion exchange, gel filtration and affinity chromatography. Bulk enzyme production in industry. Enzyme inhibition- irreversible enzyme inhibition, Reversible enzyme inhibition - competitive, noncompetitive, uncompetitive. Mechanism of enzyme action- acid base catalysis (Lysozyme) covalent catalysis, (Chymotrypsin).

**Unit IV-** Coenzymes -Structure and functions of FAD, NAD, TPP, Biotin , pyridoxal phosphate. Isoenzymes. *Enzyme regulation*: General mechanism of enzyme regulation, feedback inhibition and feed forward stimulation. Zymogens – examples and activation. Immobilized enzymes – Techniques and applications . Biosensors – Types and Applications. Antioxidant enzymes.

**Unit V-** Enzymes as diagnostic reagents, Sale value of industrial enzymes, Applications of proteolytic enzymes in detergent industry, cheese manufacturing, meat tenderization, leather industry .Enzyme electrodes, Sources and applications of amylases, glucoamylase, glucose isomerases, cellulose, Enzymes as thrombolytic agents, anti-inflammatory agents, debriding agents, digestive aids. Therapeutic use of enzymes.

**Text book and Reference books**

1. T.Palmer. Understanding enzymes. Prentice Hall.
2. Principles of Biochemistry – Zubay 4th ed. 1998, William C.Brown Publ..
3. Dixon and Webb. Enzymes 3rd ed. Longmans, 1979.
4. Stryer. Biochemistry 5th ed. Freeman, 2002.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S2PBC6	Semester	II	Medium of Instruction	English
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**SEMESTER – II-CORE COURSE 7**  
(For the students admitted from 2018 onwards)

**MICROBIOLOGY**

**Objective :**

**To understand the structure of microbes, classification and its metabolism.**

**Unit I-** Ultrastructure of bacteria, fungi, algae and protozoa. Classification of microbes, molecular taxonomy. Cell membrane of gram positive and gram– negative bacteria. Cell wall and cell membrane synthesis, flagella and motility, cell inclusions like endospores, gas vesicles. Microscopy- types of microscope, and their application- simple, compound, phase contrast and SEM microscope.

**Unit II -** Microbial growth– definition. Mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, factors affecting growth. Microbial metabolism– overview. Role of chlorophylls, carotenoids and phycobilins, Chemolithotrophy, methanogenesis and acetogenesis, nitrogen fixation- mechanism and its importance.

**Unit III-** Methods in microbiology. Currents methods in microbial identification. Pure culture techniques. Theory and practice of sterilization. Principles of microbial nutrition, Preparation of culture media, Enrichment culture techniques for isolation of chemoautotrophs, chemoheterotrophs and photosynthetic microbes. Staining techniques.

**Unit IV-** Bacterial, plant, animal and tumor viruses. Classification and structure of viruses. Lytic cycle and lysogeny. DNA viruses; positive and negative strand, Double stranded RNA viruses. Replication- example of Herpes, pox, adenoviruses, Retroviruses. Viroids and prions.

**Unit V -** Disease reservoirs; Epidemiological terminologies. Infectious disease transmissions. Respiratory infections caused by bacteria and viruses; Tuberculosis, sexually transmitted diseases including AIDS; Vector borne diseases, Water borne diseases. Public health and water quality. Antimicrobial agents - Penicillins, Streptomycin, Tetracyclin and cephalosporins,

***Text Books and Reference Books***

1. Madigan et al. Brock Biology of microorganisms 10th ed. Prentice Hall, 2002.
2. Davis et al Microbiology 4th ed. Lippincott Williams and Wilkins, 1989.
3. Joklik et al. Zinsser’s Microbiology Mc Graw-Hill Professional, 1995.
4. Pelczar et al. Microbiology 5th ed. Mc Graw Hill, 2000.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S2PBCP2	Semester	II	Medium of Instruction	English
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**SEMESTER – II-CORE COURSE 8**  
**(For the students admitted from 2018 onwards)**  
**PRACTICAL - II**

**Enzyme kinetics**

1. Determination of total and specific activity of amylase.
2. Effect of pH on Amylase activity
3. Effect of temperature on Amylase activity .
4. Effect of substrate concentration on amylase activity and determination of Km value.
5. Effect of enzyme concentration on amylase activity.
6. Effect of inhibitor on activity of amylase/urease.
7. Effect of activator on activity of amylase/urease.
8. Determination of total and specific activity of alkaline phosphatase.
9. Determination of total and specific activity of acid phosphatase.

**Demonstration:**

1. Isolation of pure culture- serial dilution , pour plate , spread plate, and streak plate.
2. Staining techniques- simple, gram and acid fast staining.
3. Antibiotic sensitivity and assay of different microbes.

**Questions paper pattern**

**Internal – 40marks , External – 60marks**

**Major experiment – 30 marks, Minor experiments – 20 marks, Record – 10 marks**

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S2PBCEL2A	Semester	II	Medium of Instruction	English
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**SEMESTER – II- ELECTIVE COURSE – 2 (A)**  
(For the students admitted from 2018 onwards)

**ENDOCRINOLOGY**

**Objective**

**To understand the basics of endocrinology and its functions**

**Unit I-** Hormones – classification, biosynthesis, circulation in blood, modification and degradation. Hormone receptors – structure and regulation. Mechanism of hormone action. Hypothalamic and pituitary hormones. Anterior pituitary hormones : biological actions, and disorders of growth hormones, ACTH, gonadotrophins and prolactin. Posterior pituitary hormones – biological actions and regulation of vasopressin.Oxytocin. Hypopituitarism.

**Unit II** -Thyroid hormones – synthesis, secretion, regulation, transport, metabolic fate and biological actions. Antithyroid agents. Thyroid functions tests. Hyper and hypothyroidism. Secretion and biological actions of PTH, calcitonin and calcitriol. Hypercalcemia and hypocalcemia.

**Unit III** -Adrenal cortical hormones. Synthesis, regulation, transport, metabolism and biological effects. Adrenal function tests. Cushing’s syndrome, aldosteronism, congenial adrenal hyperplasia, adrenal hormone deficiency. Adrenal medullary hormones – synthesis, secretion, metabolism, regulation and biological effects of catecholamines. Pheochromocytoma.

**Unit IV-** Gonadal hormones : Biosynthesis, regulation, transport, metabolism and biological actions of androgens. Hypogonadism and gynecomastia. Biosynthesis, regulation, transport, metabolism and biological effects of oestrogen and progesterone. Ovulation- its Phases. Pregnancy – diagnostic tests and biochemical changes. Amenorrhoea. Pancreatic hormones – synthesis, regulation, biological effects and mechanism of action of glucagons, and insulin.

**Unit V** - Fundamentals concepts and definitions of signals, ligands and receptors, endocrine, paracrine and autocrine signaling. Receptors and signaling pathways – cell surface receptors, ion channels, G-protein coupled receptors, receptor kinases (tyr, ser/thr). Signal transduction through cytoplasmic and nuclear receptors. The Ras-raf MAP kinase cascade, second messengers – cyclic AMP, cyclic GMP, phosphotidyl inositol and calcium ions.

**Text Books and Reference Books**

1. Williams Textbook of Endocrinology – Wilson and Foster 8th ed.
2. Mechanisms of hormone action – Autind and Short.
3. Harper’s Biochemistry – Murray et al. 26th ed. McGraw Hill, 2003.
4. Principles of Biochemistry – Mammalian Biochemistry – Smith et al. McGraw Hill 7th ed.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S2PBCEL2B	Semester	II	Medium of Instruction	English
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**SEMESTER – II- ELECTIVE COURSE – 2 (B)**  
(For the students admitted from 2018 onwards)

**HERBAL MEDICINE**

**Objective :**

**To explore the history and importance of herbal medicine.**

**Unit I**

Ethnomedicine – definition, history and its scope – Inter disciplinary approaches in ethnobotany – Collection of ethnic information.

**Unit II**

Importance of medicinal plants – role in human health care – health and balanced diet (Role of proteins, carbohydrates, lipids and vitamins).

**Unit III**

Tribal medicine – methods of disease diagnosis and treatment – Plants in folk religion – *Aegle marmelos*, *Ficus benghalensis*, *Curcuma domestica*, *Cyanodon dactylon* and *Sesamum indicum*.

**Unit IV**

Traditional knowledge and utility of some medicinal plants in Tamilnadu –*Solanum trilobatum*, *Cardiospermum halicacabum*, *Vitex negundo*, *Adathoda vasica*, *Azadirachta indica*, *Gloriosa superba*, *Eclipta alba*, *Aristolochia indica* and *Phyllanthus fraternus*.

**Unit V**

Plants in day today life – *Ocimum sanctum*, *Centella asiatica*, *Cassia auriculata*, *Aloe vera*. Nutritive and medicinal value of some fruits (Guava, Sapota, Orange, Mango, Banana, Lemon, Pomegranate) and vegetables - Greens (*Moringa*, *Solanum nigrum* Cabbage).

**Text book and Reference Books**

1. Ethnobiology – R.K.Sinha & Shweta Sinha. Surabhe Publications – Jaipur. 2001
2. Tribal medicine – D.C. Pal & S.K. Jain Naya Prakash, 206, Bidhan Sarani, Calcutta, 1998
3. Contribution to Indian ethnobotany – S.K. Jain, 3rd edition, Scientific publishers, B.No. 91, Jodhpur, India. 2001 A Manual of Ethnobotany – S.K. Jain, 2nd edition, 199

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit)

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S2PBCEL2C	Semester	II	Medium of Instruction	English
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**SEMESTER – II- ELECTIVE COURSE – 2 (C)**  
(For the students admitted from 2018 onwards)

**FIRST AID AND MANAGEMENT**

**Objectives :**

**To know about first aid and its management, emergency care.**

**Unit I – First Aid -** Introduction— Issues in Providing Care — Primary Assessment & Basic Life Support — Secondary Assessment Circulatory Emergencies Respiratory Emergencies — Soft Tissue Injuries — Bone & Joint Injuries — Environmental Illness & Injury

**Unit II-** Circulatory Emergencies , External Bleeding , Internal Bleeding , Heart Attack & Angina — Stroke & TIA — Shock Of Tissue Injuries.

**Unit – III -** Burns , Electrocutation , Chest & Abdominal Injuries, Respiratory Emergencies , Anaphylactic Shock , Asthma & Hyperventilation , Obstructed Airway, Bone & Joint Injuries

**Unit – III -** Musculoskeletal Injuries , Immobilization ,Head & Facial Injuries, Suspected Spinal Injury, Environmental Illness & Injury

**Unit – IV-** Heat-Related Illness & Injury ,Cold-Related Illness & Injury ,Pressure-Related Illness & Injury Medical Conditions & Poisoning

**Unit – V -** Diabetes — Seizures — Mental Health Emergency — Poisoning, Wilderness First Aid — Marine First Aid — Extended Assessment, Airway Management — Oxygen Administration — Automated External Defibrillation — Triage first aid kits

**Text books and Reference books**

1. First Aid and Management of Minor Injuries by Jon Dallimore - Preppers , 2003
2. Anatomy of First Aid: A Case Study Approach by Ronald A. Bergman - Anatomy Atlases , 2004
3. First Aid and Beyond by Dan Wolfe - Smashwords , 2014

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	5	Hrs/week	6	Sub Code	S3PBC7	Semester	III	Medium of Instruction	English
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**SEMESTER – III- CORE COURSE - 9**  
(For the students admitted from 2018 onwards)

**IMMUNOLOGY**

**Objective ;**

**To learn the elements of immunology , immunotechniques**

**Unit I-** Types of immunity- innate and acquired. Humoral and cell mediated immunity. Central and peripheral lymphoid organs- Thymus, bone marrow, spleen, lymph nodes and other peripheral lymphoid tissues- GALT. Cells of the immune system- lymphocytes, mononuclear phagocytes dendritic cells, granulocytes, NK cells and mast cells, cytokines. Lymphokines, and interleukins. Antigens vs immunogens, Haptens. Factors influencing immunogenicity.

**Unit II-** Complement activation and its biological consequences. Clonal selection theory. T-cell, B-cell receptors, Antigen recognition- processing and presentation to Tcells. Immunological memory. Cell mediated cytotoxicity, immunotolerance, immunosuppression. Immunoglobulins structure, classification and functions. Isotypes, allotypes and idiotypes.

**Unit III -** MHC - Role of MHC antigens in immune response, MHC antigens in transplantation. Transplantation types and mechanism. Immune responses to infectious diseases- Viral, bacterial and protozoal. Hypersensitivity- types and mechanisms

**Unit IV-** Immunization practices- active and passive immunization. Vaccines- killed, attenuated- toxoids. DNA vaccines, synthetic peptide vaccines. Production of polyclonal and monoclonal antibodies- hybridoma technology. Principles, techniques and application. Genetically engineered antibodies. Autoimmunity- autoimmune disease in human and animal models.

**Unit V-** Immuno-electrophoresis,RIA, immunoblotting, Avidin-biotin mediated immune assay. Immunohistochemistry- immunofluorescence, Fluorescent immunoassay. ELISA and ELISPOT. Abzymes. Experimental animal models: inbred strains, SCID mice, nude mice, knock out Mice.

***Text books and Reference Books***

1. Roitt et al. Roitt's. Essential Immunology. 10th ed. Blackwell Sci. 2001.
2. Richard A. Goldsby et al. Kuby Immunology. 4th ed. WH Freeman & Co. 2003.
3. Abbas et al. Cellular and Molecular Immunology. W.B. Saunders Company, 2000.16
4. Eli Benjamini AU et al. Immunology: A short course. 4th ed. Wiley-Liss, 2000.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**



Credits	5	Hrs/week	6	Sub Code	S3PBC8	Semester	III	Medium of Instruction	English
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**SEMESTER – III- CORE COURSE 10**  
**(For the students admitted from 2018 onwards)**  
**CLINICAL BIOCHEMISTRY**

**Objective**

**To learn the disorders of biomolecule metabolism**

**Unit I-** Disorders of carbohydrate metabolism– glycogen storage diseases, galactosemia, fructose intolerance and fructosuria. Blood sugar homeostasis: Role of tissues and hormones in the maintenance of blood sugar. Hypoglycemia, hyperglycemia, glycosuria. Diabetes mellitus – classification, Complications, diagnosis and management. GTT. Disorders of lipid metabolism – lipoproteinaemias. Lipid storage diseases – Gaucher’s, Tay Sach’s Niemann Pick disease. Fatty liver. Atherosclerosis.

**Unit – II-** Disorders of amino acid metabolism– amino aciduria, Phenylketonuria, Hartnup disease, alkaptonuria, albinism, cystinuria, cystinosis, homocystinuria and maple syrup urine disease. Disorders of purine, pyrimidine metabolism: Hyperuricemia and gout. Hypouricemia. Orotic aciduria. Serology: C-Reactive protein test, Rheumatoid arthritis (RA) test.

**Unit III -** Jaundice- Causes, consequences, biochemical findings, treatment in jaundice, hepatitis and cirrhosis. Liver function test. Tests related to excretory (bile pigments) synthetic (plasma proteins, prothrombin time) detoxifying (hippuric acid, NH<sub>3</sub>, aminopyrine) and metabolic (galactose) functions. Gall stones. Gastric function tests- Stimulation tests – insulin and pentagastrin. Peptic ulcer, gastritis and Zollinger Ellison syndrome.

**Unit IV-** Kidney function- Biochemical findings in glomerulonephritis, renal failure and nephritic syndrome. Nephrolithiasis. Kidney function tests - Glomerular function tests – inulin, urea and creatinine clearance tests, renal plasma flow, plasma  $\alpha_2$ -microglobulin. Tubular function tests – water load, concentration and acid excretion tests. Normal and abnormal constituents of urine. Clinical enzymology - Serum enzymes and isoenzymes in health and disease – Transaminases (AST, ALT) acid, alkaline phosphatases, LDH and CK.

**Unit V-** Serological Diagnosis of viral infections, amniotic fluid and maternal serum, ailment in pregnancies. Oncology: Cancer cell – morphology and growth characteristics. Biochemical changes in tumor cells. Differences between benign and malignant tumors. Tumor markers – AFP, CEA and HcG Agents causing cancer – radiation, viruses, chemicals. Multistep carcinogenesis – initiation, promotion, progression. Oncogenes and proto-oncogenes – mechanisms of proto-oncogene activation. Tumor suppressor genes – p53.

***Text and Reference Books***

1. Clinical Chemistry in diagnosis and treatment Mayne ELBS.
2. Clinical Chemistry Marshall 3rd edition Mosby.
3. TietZ textbook of Clinical Chemistry – 1998 3rd edition Saunders.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit)

**Signature of HOD**

Credits	5	Hrs/week	6	Sub Code	S3PBC9	Semester	III	Medium of Instruction	English
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**SEMESTER – III- CORE COURSE 11  
(For the students admitted from 2018 onwards)**

**MOLECULAR BIOLOGY**

**Objective**

**To explore the replication, transcription and translation process.**

**Unit I-** Chromosomal organization of genes , Mobile elements (Transposons) - bacterial transposons, viral transposons, viral retro transposons, structural organization of eukaryotic chromosomes, histone proteins, chromatin , Telomeres and telomerase. Gene mutation and chromosomal aberration. DNA damage and DNA repair.

**Unit- II-** Replication of DNA: DNA in prokaryotes and eukaryotes. Enzymes involved in replication, events on the replication fork and termination, mechanism of replication. Inhibitors of DNA replication. Mutation - point mutation and frame shift mutation, Suppressor mutations , nonsense and missense mutation.

**Unit-III-** Basic principles of transcription- initiation, elongation and termination in prokaryotes. Inhibitors of transcription. Regulation of transcription in prokaryotes- Lac, Tryp and Ara operon. Eukaryotic RNA polymerases- structure and functions of RNA pol I, II and III. Post transcriptional processing of mRNA, rRNA and t-RNA. Alternative splicing.

**Unit IV -**The genetic code- general features. Components of protein synthesis, Mechanism of protein synthesis in bacteria and eukaryotes- amino acid activation, initiation, elongation and termination. Inhibition of protein synthesis. protein glycosylation in ER and Golgi complex. Protein targeting- the signal sequence hypothesis, targeting proteins to membranes, nucleus and intracellular organelles. Protein degradation: the ubiquitine pathway. Protein folding- models, molecular chaperones.

**Unit V-** Levels of gene expression. Principles of gene regulation, Upregulation, downregulation, induction, gene regulation by DNA methylation. Methods to study gene expression. Cytotoxicity and viability assays, molecular markers – markers based on DNA hybridization, Basic principle, Restriction fragment length polymorphism (RFLP), Random Amplified polymorphic DNA (RAPD), Cytogenetic bioassays- chromosomal damage micronuclease test, Ames test.

***Text books and Reference Books***

1. Lewin. Genes VII. Oxford University Press 2000.
2. Twyman. Advanced Molecular Biology Viva Publ. 2nd ed 1998.
3. Alberts. Molecular Biology of the Cell. 4th ed. Garland Sci. 2002.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S3PBCP3	Semester	III	Medium of Instruction	English
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**SEMESTER – III- CORE COURSE 12**  
**(For the students admitted from 2018 onwards)**

**PRACTICALS-3**

**CLINICAL BIOCHEMISTRY**

1. Preparation and preservation of blood and urine samples.
2. Estimation of HDL Cholesterol in serum
3. Estimation of triglycerides in serum
4. Estimation of LDH in serum
5. Estimation of Hemoglobin in Blood.
6. Estimation of ceruloplasmin in serum.
7. Estimation of blood sugar.
8. Estimation of urine creatinine.
9. Estimation of urea in urine.
10. Estimation of chloride in urine.
11. Estimation of serum total bilirubin.
12. Estimation of albumin in serum .

**Demonstration:**

1. Purification of enzyme by ammonium sulphate precipitation.
2. Extraction of nucleic acids from plant leaves.
3. Separation of DNA by agarose gel electrophoresis.
4. Separation of protein by SDS-PAGE
5. Isolation of mitochondria from plant leaves

**Questions paper pattern**

Internal – 40marks , External – 60marks

Major experiment – 30 marks, Minor experiments – 20 marks, Record – 10 marks

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S3PBCEL3A	Semester	III	Medium of Instruction	English
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**SEMESTER – III- ELECTIVE COURSE 3 (A)**  
**(For the students admitted from 2018 onwards)**

**GENETIC ENGINEERING**

**Objective**

**To enlighten the gene cloning and gene transfer methods .**

**UNIT I**

Introduction to gene cloning : Isolation and purification of plasmid DNA, bacteriophage DNA, restriction enzymes, ligases, basic principles of rDNA technology.

**UNIT-II**

Cloning and expression vectors: Plasmids, PBR322, bacteriophages, M13, Lambda and PUC vectors. Cosmid vectors, YAC, BAC, HAC , Ti plasmids.

**UNIT-III**

Cloning and expression strategies: DNA cloning, genomic library, cDNA library, expression of cloned genes in E.Coli and Yeast.

**UNIT- IV**

Gene transfer methods: Electrophoration, microinjection, liposome mediated methods, calcium phosphate method, nature gene transfer methods: transformation, transduction and conjugation.

**UNIT-V**

Applications of genetic engineering in agriculture, health and industry, stem cell and its applications. Gene therapy. GM Foods.

**Text books and Reference Books**

1. Primrose.S.B, Twyman and Old. Principles of gene manipulation, Blackwell Scientific Publications, 6th Edition, 2001.
2. Glick,B and Pasternack,J.J. Molecular Biotechnology, ASM Press, Third Edition, 2003.
3. Brown,T.A. Gene Cloning and DNA analysis –An introduction, Blackwell Science, Fourth Edition, 1995.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

<b>Credits</b>	<b>4</b>	<b>Hrs/week</b>	<b>6</b>	<b>Sub Code</b>	<b>S3PBCEL3B</b>	<b>Semester</b>	<b>III</b>	<b>Medium of Instruction</b>	<b>English</b>
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**SEMESTER – III- ELECTIVE COURSE- 3 (B)**  
**(For the students admitted from 2018 onwards)**

**DAIRY MICROBIOLOGY**

**Objective**

To know the quality of milk, microbial contamination and preservation of milk,

**Unit I-** Importance of Microbiological Quality and Safety Assurance System in Dairy Industry: Principles of Quality and Safety Management Systems; Plant hygiene and sanitation in dairy industry.

**Unit II** -General principles for the establishment and application of microbiological criteria for dairy foods: Definition, purpose and components of Microbiological criteria; Mandatory and advisory criteria; Establishment of microbiological standards, guidelines and specifications for different milk and milk products by BIS.

**Unit III** -Enumeration and detection of indicator organisms and dairy pathogens: Indicator Organisms; Selection criteria for their use as quality and safety indicators; Conventional and rapid detection methods including commercial detection kits for indicator organisms and pathogenic bacteria in milk and milk products.

**Unit IV** -Microbial bio-sensor for monitoring pathogens and non-microbial contaminants in dairy foods: components of microbial bio-sensors; Detector system i.e. Electrochemical; Optical; Mechanical devices; Application of microbial bio-sensor in monitoring pathogenic bacteria, antibiotic residues and aflatoxin M1 in milk and milk products.

**Unit V** -Establishment and accreditation of QA Lab in dairy processing unit: Introductory information on Quality assurance lab in dairy processing unit; Bio-safety definition, principles and safety levels; FDA requirements for establishing biosafety laboratory in dairy industry.

**Text Books and Reference Books**

1. Adams MR and Moss MO 2008 Food Microbiology. 3rd Ed. RSC Publisher, Cambridge, UK
2. Frances PD and Keith ITO 2001 Compendium of Methods for the Microbiological Examination of Foods. 4th Ed. American Public Health Association (APHA), Washington DC, USA.
3. JM Jay, Martin JL and David AG 2005 Modern Food Microbiology. 7th Ed. Food Sciences Text Series, New York, USA.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S3PBCEL3C	Semester	III	Medium of Instruction	English
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**SEMESTER – III- ELECTIVE COURSE- 3 (C)**  
**(For the students admitted from 2018 onwards)**

**INTELLECTUAL PROPERTY RIGHTS AND PATENTING**

**Objective :**

**To understand the basics of intellectual property rights**

**UNIT - I:** Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

**UNIT - II:** Trade Marks: Purpose and function of trade marks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

**UNIT - III:** Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

**UNIT - IV:** Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation. Unfair competition: Misappropriation right of publicity, False advertising.

**UNIT - V:** New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

**Text Books and Reference Books**

1. Intellectual property right, Deborah, E. Bouchoux, cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, prabuddha ganguli, Tata Mc Graw Hill Publishing Company Ltd.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	5	Hrs/week	6	Sub Code	S4PBC10	Semester	IV	Medium of Instruction	English
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**SEMESTER – IV- CORE COURSE 13**

**(For the students admitted from 2018 onwards)**

**ADVANCED PHARMACEUTICAL CHEMISTRY**

**Objective**

**To understand the drugs , metabolism and drug allergy and drug prescription.**

**Unit I-**Drugs –Sources and classification of drugs, dosage forms and routes of administration . Drugs – structural features and prodrug concept. Absorption , factors modifying drug absorption. Distribution of drugs. Mechanism of action of drugs. Different types of Dosage forms - Factors modifying drug action. Rational therapy & P drugs

**Unit –II-** Drug metabolism – General pathways of drug metabolism , reactions in Phase I and Phase II reactions, Role of Cytochrome P450 in Metabolism of Drugs. Excretion of drugs. Factors affecting drug metabolism. Drug receptors- types, model and theories. G-protein coupled receptors and ion channel linked receptors. Drug receptors interactions. Agonist and antagonists.

**Unit III-** Mechanism of action of drugs in therapy of Respiratory systems – cough, bronchial, asthma and tuberculosis. Antimicrobial drugs – sulfonamides, penicillins, tetracyclins, streptomycin, and chloramphenicol. Cancer chemotherapy - uses, mechanism of action , and side effects of Methotrexate, Vincristin, Cisplatin, Thyroid and antithyroid drugs, insulin and oral antidiabetic drugs, drug therapy in Alzheimers disease and infertility.

**Unit IV** History and Importance of medicinal plants, Use of herbs in our daily life. Principles and Development of drug discovery. Extraction and purification of active principles (alkaloids, flavonoids) from medicinal plants, Role of medicinal plants in drug industry. Genetically engineered protein and peptides. Anti AIDS drug development, Production of secondary metabolites . Drugs prescribing in old age, infants, children, pregnancy.

**Unit V-** General and local anaesthetics, Preservatives and antiinfectants, Antihypertensive drugs, Psychotropic drugs, antidepressant drugs, Parkinsons disease and drugs therapy for parkinsons disease, Antiinflammatory drugs, Treatment of acute poisoning, Method of prescription writing with examples. Heavy metal poisoning – Sources, harmful effects and management of cadmium, mercury and lead. Patenting of drug.

**Text books and Reference Books**

1. Text Book of pharmaceutical chemistry by Jayashree Ghosh , S.Chand publishers (2010) (For Unit 1 , 2 & 3)
2. Pharmaceutical chemistry by Tripathi, Jaypee Publishers, 6<sup>th</sup> edition (2008) (For Unit 4 &5)
3. Pharmacology by satorkar, Elsevier Publications (2008).

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	5	Hrs/week	6	Sub Code	S4PBCP4	Semester	IV	Medium of Instruction	English
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**SEMESTER – IV- CORE COURSE 14**

**(For the students admitted from 2018 onwards)**

**PRACTICALS – IV**

**Experiments**

1. Estimation of total phenols
2. Estimation of alkaloids
3. Estimation of anthocyanin in plant pigments
4. Determination of lipase from germinating seeds
5. Determination of protease from germinating seeds
6. Measurement of bacterial growth curve
7. Assay of TBARS.
8. Determination of SOD
9. Determination of Catalase
10. Estimation of vinegar in food samples
11. Isolation and estimation of phospholipids from egg yolk.
12. Biochemical tests for identification of bacteria
13. Determination of free amino acid content in germinating seeds.

**DEMONSTRATION**

14. Enzyme Linked Immunosorbent Assay
15. Isolation of Plasmid DNA.
16. Isolation of chromosomal DNA from blood samples
17. Restriction digestion.
18. Pregnancy test
19. Widal Test
20. Detection of adulterants in milk samples
21. Extraction of Caffeine from Tea
22. isolation of  $\beta$  -Amylase from Sweet Potato
23. Spotters

Industrial Visit to various Pharma/Research/ Clinical / Educational Institutions.

**Questions paper pattern**

Internal – 40marks , External – 60marks

Major experiment – 30 marks, Minor experiments – 20 marks, Record – 10 marks

**Signature of HOD**



Credits	4	Hrs/week	6	Sub Code	S4PBCEL4A	Semester	IV	Medium of Instruction	English
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**SEMESTER – IV- ELECTIVE COURSE 4 (A)**

**(For the students admitted from 2018 onwards)**

**BIOTECHNOLOGY**

**Objective**

**To learn microbial , medical biotechnology and its applications**

**UNIT I-** Bioreactors : types, operation of conventional bioreactor, fermentor, fermentation- solid substrate fermentation, media for industrial fermentation, sterilization of culture media. Safety measures of reactors. Types of culture. Downstream processing - solid-liquid separation, release of intracellular products, concentration, purification and formulation.

**UNIT II -** Isolation of microorganism, microbial metabolic products- primary and secondary metabolites, genetic improvement of strains. production of Organic solvents – alcohol, organic acids – citric acid and lactic acid, antibiotics – penicillin and streptomycin, vitamins – riboflavin and ascorbic acid. Single Cell Protein (SCP)

**UNIT III-** DNA in disease diagnosis : DNA probes, DNA in diagnosis of infectious diseases, genetic diseases, Pharmaceutical products of DNA technology : Human protein replacement, therapeutic agents for human diseases. Recombinant vaccines : subunit vaccines, DNA vaccines, attenuated recombinant vaccines, plants as edible subunit vaccines

**UNIT IV -** Plant cell and tissue culture: cell culture media, cell culture techniques , protoplast culture, protoplast fusion. Methods of gene transfer in plants: Agrobacterium mediated transformation. Animal cell culture : fundamentals and applications. Culture media for animal cells, cultured cells– Biology and characterization, primary culture and cell lines, cell viability and cytotoxicity,.

**UNIT V-** Environmental pollution : Types of pollution, pollution monitoring, biotechnological methods for management of pollution. Biodegradation : xenobiotic compounds. Bioremediation : Types of bioremediation, genetic engineering for efficient bioremediation, bioremediation of contaminated soil and waste land. Microbial mining.

**Text Books and Reference Books**

1. Satyanarayana, U. Biotechnology, Uppala Author - Publisher Interlinks, First Edition, 2005.
2. Singh, B.D. Biotechnology – expanding horizons, Kalyani Publishers, First Edition, 2004.
3. Cruger, W. and Cruger, A. Biotechnology – A text book of Industrial Microbiology, Panima Publishing Corporation, Second Edition, 2000.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S4PBCEL4B	Semester	IV	Medium of Instruction	English
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**SEMESTER – IV- ELECTIVE COURSE 4 (B)**

**(For the students admitted from 2018 onwards)**

**MARINE MICROBIOLOGY**

**Objective**

**To know about marine microflora, marine microbial plants**

**Unit I** - Marine Microbial Habitats and Diversity Marine environment–properties of seawater , chemical and physical factors of marine environment-Ecology of coastal, shallow and deep sea microorganism - significance of marine microflora. Diversity of microorganism - Archaea, bacteria, actinobacteria, cyanobacteria, algae, fungi, viruses and protozoa in the mangroves and coral environments

**Unit II**- Cultivation of Marine microbes and Nutrient cycling. Methods of studying marine microorganisms- sample collection- isolation and identification: Cultural, Morphological, physiological, biochemical and Molecular characteristics- Preservation methods of marine microbes.

**Unit III**-Marine extremophiles and Bioremediation Survival at extreme environments – starvation – adaptive mechanisms in thermophilic, alkalophilic, osmophilic and barophilic, psychrophilic microorganisms – hyperthermophiles, halophiles and their importance.

**Unit IV**- Seafood microbiology Pathogenic microorganisms, distribution, indicator organisms, prevention and control of water pollution, quality standards, International and National standards. Microbiology of processed finfish and shellfish products. Rapid diagnosis of contamination in seafoods and aquaculture products.

**Unit V**- Marine microbial products Marine microbial products – Carrageenan, agar-agar, sea weed fertilizers – Astaxanthin,  $\beta$  carotene – enzyme – antibiotics – antitumour agents- polysaccharide – biosurfactants and pigments. Preservation methods of sea foods. Quality control and regulations for microbial quality of fishes, shellfish and Marine living resources used for food and drugs .

**Text books and Reference books**

1. Belkin S and Colwell RR. Ocean and health: Pathogens in the Marine Environment, Springer. 2005.
2. Bhakuni DS and Rawat DS. Bioactive marine natural products. Anamaya Publishers, New Delhi. 2005.
3. Elay AR. Microbial food poisoning. Chapman and Hall, London. 1992.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S4PBCEL4C	Semester	IV	Medium of Instruction	English
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### SEMESTER – IV- ELECTIVE COURSE 4 (C)

(For the students admitted from 2018 onwards)

#### INDUSTRIAL POLLUTION AND SAFETY CONTROL

##### Objective

**To understand the industry, types of industrial pollution, safety management**

**UNIT I :** Tanneries and Distillary Production of leather, vegetable tanning and chrome tanning processes. Sources and characteristics of wastes. Effect of tannery effluent and other wastes on receiving bodies and treatment methods of the wastes. Sugar mills and Distilleries - their manufacturing processes, sources and characteristics of their wastes. On receiving bodies, Treatment of their wastes and disposal.

**UNIT II :** Paper and Pulp, and textile industries Manufacturing processes, sources and characteristics of wastes. Effect of wastes. Treatment processes of the wastes. Textile mills - manufacturing processes, sources and characteristics of wastes. Effects of the wastes on receiving bodies. Treatment of the wastes.

**UNIT III :** Cement and energy Industries Manufacturing process, sources of pollution and wastes. Effect of wastes. Control technique of pollution. Oil refineries and thermal power plants processes involved. Sources of pollution characteristics of pollutants and their effects. Pollution control techniques.

**UNIT IV :** Fertilizer and pharmaceutical Industries Manufacturing processes, sources and characteristics of wastes and their effects. Treatment processes pharmaceutical plants: manufacturing processes sources and characteristics of wastes and their effects. Treatment of wastes.

**Unit V :** Safety Management and Industrial Acts Industrial safety- Causes of accident, Accident reporting system, Accident prevention, Disaster planning, Safety committee. Hazards control Elimination, Control, Isolation, Substitution, Personal protective equipment, medical first aid- management of medical emergencies.

##### Text books and Reference Books

1. Austin GT, Shreves, (1977). Chemical processes in industries. McGraw Hill Book Co., New York
2. Khudesia VP, (1986). Industrial pollution control. Pragati Prakasham, Meerut
3. Mahajan SP, (1986). Pollution Control in process industries. Tata McGraw Hill Co. Ltd., New Delhi
4. Rao MN and Datta, (1982). Wastewater treatment. Oxford and IBH, New Delhi.

##### Question paper pattern

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit)

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S4PBCEL5A	Semester	IV	Medium of Instruction	English
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**SEMESTER – IV- ELECTIVE COURSE 5 (A)**

**(For the students admitted from 2018 onwards)**

**BIOSTATISTICS AND RESEARCH METHODOLOGY**

**Objective**

**To understand the basics of biostatistics, research design and research methodology**

**Unit I-** Definition of Biostatistics , Data, sample, variable. Collection of data – Organization of statistical investigation, Planning of statistical investigation, Primary and secondary data,. Methods of data collection, Sampling – Methods of sampling, Advantages and disadvantages of sampling.

**Unit II-** Classification of data – Types of classification, Methods of classification, Frequency distribution, Types and illustration, Diagrammatic presentation of data- Line diagram, Bardigram, Pie diagram, Pictogram. Graphical presentation of data- Line graph, histogram, Frequency polygon, Frequency curve, Ogive curve.

**Unit III-** Measures of central tendency –Definition of Average, Arithmetic mean- Direct method and short cut method for continuous series, Discrete series, Median – Definition, Calculation of median for individual series, Discrete series, Continuous series, Difference between mean and median, Mode- Definition, Calculation of mode for individual series, Continous series, Discrete series.

**Unit V-**Measures of dispersion – Definition of dispersion, Properties and classification of dispersion. Standard Deviation – Definition, Calculation of Standard deviation for individual series, Discrete series, Continous series, Merits and demerits of S.D., Definition – Variance, Standard error, Coefficient of variation.

Correlation analysis –Definition, Uses, causation of correlation, Degree of correlation, Types of correlation-, Methods of studying correlation. Karl pearsons correlation for individual series, continous series and discrete series. Analysis of variance- one way ANOVA and Two way ANOVA.

**Unit V-** Principles and method of research designs –experimental and non experimental design, sectional, prospective and retrospective studies. Time scheduling – lab and field facilities, Research duration, choice of research topic, methodology procedure. Preparing, writing and documentation of research reports. Role of computers in biological research and practice.

**Text books and Reference Books**

1. Biostatistics analysis, zar, J.H, Prentice Hall, New Jersey (1984).
2. Statistical methods for biologists, Palanichamy. S and Manoharan. M (1990).
3. Statistical methods by S.P Gupta. S.Chand&Co., (2011)

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S4PBCEL5B	Semester	IV	Medium of Instruction	English
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**SEMESTER – IV- ELECTIVE COURSE 5 (B)**

**(For the students admitted from 2018 onwards)**

**NANOTECHNOLOGY**

**Objective**

**To learn the basic of nanotechnology and its applications**

**Unit I:** Introduction- Definition, about Bionanomachines, Molecular Bionanotechnology. History of Bionanotechnology; Richard Feynman and his contributions. Biotechnology versus Bionanotechnology. Natural Bionanomachines.

**Unit II:** Structural Principles of Bionanotechnology-Environment in which the Bionanomachines Functions. Principles behind design of Natural Bionanomachines- Covalent bonding, Dispersions and repulsion forces. Hydrogen bonding, Electrostatic Interaction, Hydrophobic effect. Hierarchical strategy in construction of Bionanomachines - Selfassembly, Self- organization. Concept of Molecular recognition.

**Unit III:** Functional Principles of Bionanotechnology- Information storage- Nucliec acid, Ribosomes as assembler to construct proteins. Energetics- Energy from Light, electron transport pathways, electrochemical gradient. Biocatalysts- Enzymes and its regulation. Biomaterials. Biomolecular motors. Molecular sensing- Biosensors.

**Unit IV:** Tools and technique required for Bionanotechnology- Recombinant DNA technology; site directed mutagenesis, Fusion proteins. X-Ray Crystallography, NMR, Electron Microscopy, Atomic force Microscopy. Bioinformatics- Molecular Modeling, Docking, Computer assisted Molecular design.

**Unit V:** Applications of Bionanotechnology- Nanomedicines; Immunotoxins, Liposomes as drug carriers, Gene therapy, Personalised Medicines; Lab on chip concept. DNA Computers, Artificial Life, Hybrid materials, Biosensors.

**Text books and Reference books :**

- 1.Goodsell – Bionanotechnology
- 2.Parag Diwan and Asish Bharadwaj, . - Nanomedicines Pentagon Press, 2006.
- 3.Vladimir P Torchilin, Nanoparticles as Drug Carriers. Imperial College Press, North Eastern University, USA. 2006

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**

Credits	4	Hrs/week	6	Sub Code	S4PBCEL5C	Semester	IV	Medium of Instruction	English
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**SEMESTER – IV- ELECTIVE COURSE 5 (C)**

**(For the students admitted from 2018 onwards)**

**ENVIRONMENTAL BIOTECHNOLOGY**

**Objective**

**To understand the environmental pollutions and its management .**

**UNIT – I :** Environmental pollution and its control measures. Renewable and NonRenewable resources of energy . Conventional and Modern fuels. Microbial hydrogen Production.

**UNIT – II :** Bioremediation of soil & water contaminated with oil spills, heavy metals and detergents. Degradation of lignin and cellulose using microbes. Degradation of pesticides and other toxic chemicals by micro-organisms. Degradation aromatic and chlorinated hydrocarbons and petroleum products.

**UNIT – III:** Treatment of municipal waste and Industrial effluents. Bio-fertilizers Role of symbiotic and asymbiotic nitrogen fixing bacteria. Algal and fungal bio-fertilizers (VAM).

**UNIT – IV :** Bioleaching Enrichment of ores by microorganisms ( gold, copper, and Uranium). Environmental significance of genetically modified microbes, plants and animals.

**UNIT – V :** Restoration of degraded land – reforestation through micro propagation. Development of stress tolerant plants – use of mycorrhiza in reforestation. Use of microbes in soil fertility ( N<sub>2</sub> fixing bacteria and Actinomycetes).

**Text books and Reference book s**

1. Microbial Biotechnology (1995) Alexander n. Glazer Hiroshi Nikaido W.H.Freeman and Company
2. Molecular biotechnology: Principles and Applications of Recombinant DNA – Bernad R. Glick and Jack J. Pasternak ASM Press. Washington, D.C (1994).
3. Fungal Ecology and Biotechnology (1993) Rastogi Publicaions, Meerut.

**Question paper pattern**

**Max Marks: 75**

**Exam duration : 3 hours**

Part A 10 x 2 = 20 Answer all questions (Two Questions from each unit)

Part B 5 x 5 = 25 Answer all questions (either or type two questions from each unit)

Part C 3 x 10 = 30 Answer any Three questions (one question from each unit )

**Signature of HOD**