SHRIMATI INDIRA GANDHI COLLEGE

(Nationally Accredited at "A" Grade (3rd Cycle) by NAAC)

Chatram Bus Stand, Tiruchirappalli – 620002.

CRITERION - II

2.6.2. PO CO MAPPING FOR BIOCHEMISTRY

Shrimati Indira Gandhi College, Tiruchirappalli - 620 002

(Nationally Accredited at 'A' Grade (3rd Cycle) By NAAC)

Department of Biochemistry

B.Sc Biochemistry

Programme Outcome of B.Sc. Biochemistry (PO)

PO1: Enhance knowledge in the subject of Science and apply the principles of the same to the needs of the Employer / Institution / own business.

PO2: Enhance the skills in handling scientific instruments, chemical, glassware, planning and performance in laboratory experiments.

PO3: Understand the basic concepts, scientific phenomena and their relevance in day-to-day life.

PO4: Acquire the Analytical skills in the field/ area of Science.

PO5: Acquire knowledge with facts and figures related to various subjects in pure sciences.

Programme Specific Outcome of B.Sc. Biochemistry (PSO)

On completion of the Programme, the student will be able to:

PSO1: Communicate the fundamental concepts of specific molecules, enzymes, cells, organ systems and metabolism of compounds

PSO2: Apply the knowledge and expertise in industries, diagnostic laboratories and various research fields

PSO3: Impart practical skills and scientific knowledge in domains of molecular biology, enzymology, genetics, clinical biology and immunology

PSO4: Develop problem solving ability by utilising the conceptual knowledge, analytical techniques, computational and statistical approaches.

PSO5: Facilitate to pursue post-graduation in related fields in life sciences and contribute their knowledge to the betterment of the society in various research and health care sectors.

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Department of Biochemistry

Year: I **Semester: I**

Subject Code: 16SCCBC1

CORE COURSE I

BIOMOLECULES

Objectives:

To understand the basis of macromolecules and their structure.

Unit I

Carbohydrates: Classification - structural elucidation of glucose and fructose. Interconversion of sugars. Structure Properties and biological functions of mono,di, oligo and polysaccharides. Homoglycans and Heteroglycans.

Unit II

Amino acids: Structure, classification, physical and chemical properties. Peptides-peptide bond, peptide synthesis, biologically important peptides. Proteins:classification, physical and chemical properties, Biological importance. Primary structure, Secondary, tertiary and quaternary structure- forces stabilising the structure of proteins.

Unit III

Lipids: Classification and Biological significance. Simple lipids: types of fatty acids, triglycerides, waxes. Compound lipids-structure and functions- Phospholipids, sphingolipids and glycolipids. Lipoproteins- classification and composition. Steroids and prostaglandins-structure and functions. Characterization of oils: Reichert-Meisel value, Iodine number, saponification value, acid number and

determination of acetyl value.

Unit IV

Vitamins- Definition and classification. Source, Structure and biological role, daily requirement and deficiency manifestation of the fat soluble vitamins A,D,E & K. Water soluble

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vitamins-Ascorbic acid, thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, lipoicacid, biotin, folic acid and vitamin B12.

Unit V

Nucleic acids: Components of mono nucleotides- pyrimidines, purines, nucleosides, nucleoside. 5'diphosphates and 5' triphophates. Polynucleotides: DNA and RNA-Composition, structure- and biological importance. Properties -hydrolysis of nucleic acids by acids, bases and enzymes. Denaturation and renaturation. Isolation, separation and purification of DNA and RNA

CO

1. Know and understand the structure, properties and biological functions of carbohydrates with examples.
2. Know, understand and draw the basic structure of amino acids, peptides, proteins, four structure levels of proteins and their properties.
3. Understand the classification, structure, functions, characterization and biological significance of lipids, phospholipids, sphingolipids, glycolipids, lipoproteins, steroids and prostaglandins.
4. Explain the classification, Source, structure, biological role, daily requirement and deficiency manifestation of vitamins.
5. Know, understand and describe the basic structure and functional role of nucleic acids.

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Department of Biochemistry

Year: I **Semester: I**

Subject Code: 16SCCBC1

CORE COURSE I - BIOMOLECULES

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

I B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SCCBC1: 1	3	2	1	2	3	3	3	2	1	3
16SCCBC1: 2	3	3	2	2	3	3	2	2	2	3
16SCCBC1: 3	3	2	3	2	2	2	3	2	1	3
16SCCBC1: 4	3	3	2	2	3	3	3	2	2	3
16SCCBC1: 5	3	2	2	3	2	3	3	3	2	3
Average	3	2.4	2	2.2	2.6	2.8	2.8	2.2	1.6	3

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Department of Biochemistry

Year: II **Semester: III**

Subject Code: 16SCCBC3

CORE COURSE III

BIOCHEMICAL TECHNIQUES

Objectives:

1. To enable the students to have a deep knowledge on the techniques for measurement of biophysical factors in living organisms.
2. To enable the students to get an insight on the usage of various techniques and their applications in industry and R&D.

Unit I

Colorimetry: Beer Lambert's Law, Light absorption and its transmittance, Absorption Spectroscopy - Principle, instrumentation and applications of colorimetry and UV-Vis spectrophotometer. Emission Spectroscopy – Spectrofluorometer - Principle, instrumentation and applications. Flame photometry - principle and applications.

Unit II

Chromatographic Techniques: Chromatography - Principle, method and applications of paper, thin layer, ion exchange, affinity chromatography, gel permeation chromatography and Gas liquid chromatography.

Unit III

Centrifugation Techniques: Cell disruption and homogenization-Media for homogenization, methods of cell disruption. Centrifugation - principle sedimentation coefficient, RCF. Types of centrifuges and rotors. Preparative centrifugation differential, density gradient centrifugation. Analytical ultracentrifugation – instrumentation and applications- Determination of molecular weight.

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Unit IV

Electrophoretic techniques: Electrophoresis - Principles and applications of electrophoresis, Factors affecting electrophoretic mobility. Types of electrophoretic techniques – zonal, capillary, paper and agarose gel. PAGENative- PAGE and SDS PAGE. (Staining method used in electrophoretic technique.) Isoelectric focusing.

Unit V

Radio isotopic techniques: Types of radioactive decay, rate of radioactive decay, decay constant, Units of radioactivity, measurement of radioactivity based on ionization- GM counter and excitation- Scintillation counter. Autoradiography. Applications of radioisotopes in biology. Hazards of radioactivity.

CO

1. Gain deep knowledge on the principles, instrumentation and applications of colorimetry, and UV-Vis spectrophotometer, spectrofluorimeter, flame photometry

2. Know and understand the principle, method and applications of paper, thin layer, ion exchange, affinity, gel permeation and gas liquid chromatography.

3.Gain deep knowledge on the types, methods and applications of centrifugation techniques

4.Understand the principles, types, methods and applications of electrophoretic techniques

5.Gain knowledge on the radio isotopic techniques, measurements, types, applications, and hazards of radioactivity.

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Department of Biochemistry

Year: II **Semester: III**

Subject Code: 16SCCBC3

CORE COURSE III- BIOCHEMICAL TECHNIQUES

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

II B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SCCBC3:1	3	2	3	1	3	3	2	1	2	3
16SCCBC3:2	3	2	3	1	2	3	2	1	2	3
16SCCBC3:3	3	2	3	1	3	3	2	1	2	3
16SCCBC3:4	3	2	3	1	3	3	2	1	2	3
16SCCBC3:5	3	2	3	1	2	3	2	1	2	3
Average	3	2	3	1	2.6	3	2	1	2	3

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Department of Biochemistry

Year: II **Semester: III**

Subject Code: 16SACBIO1

SECOND ALLIED COURSE I

BIOLOGY - I

Objective:

The study of biology aims to increase understanding of living systems and to consider the systems in relationship to the self and other organisms in the natural environment.

UNIT I

Molecular Biology - Structure of atoms, molecules and chemical bonds. Composition, structure and functions of biomolecules: carbohydrates, proteins, lipids and nucleic acids. Stabilising interactions: Vanderwaals, electrostatic, hydrogen bonding and hydrophobic interactions.

UNIT II

Cell Biology – Membrane: structure of membrane, lipid bilayer, osmosis, ion channels, and membrane pumps, active transport, electrical properties of membranes.

UNIT III

Cell Biology – Structure and function of cellular organelles – cell wall, nucleus, mitochondria, golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, chromosomes, chromatin, mitosis and meiosis and cell cycle.

UNIT IV

Developmental Biology – Animal: Production of gametes, zygote formation, blastula, gastrula and formation of germ layers in animals, embryogenesis. Programmed cell death, ageing and senescence.

UNIT V

Developmental Biology – Plants: Double fertilization in plants, seed formation, germination, organization of shoot and root apical meristem, shoot and root development, flowering.

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CO

1. Understand the basics of atoms and molecules. know the fundamental structure and functions of biomolecules.
2. Know the outline of the cell membrane and its properties.
3. Gain knowledge regarding the structure and functions of cellular organelles and cell cycle.
4. Explore the developmental processes in plants.
5. Describe plant development biology related to fertilisation, morphogenesis and flowering.

Year: II **Semester: III**

Subject Code: 16SACBIO1

SECOND ALLIED COURSE I - BIOLOGY - I

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
If there is no correlation, put "-"

II B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SACBIO1:1	3	2	1	2	3	2	3	2	3
16SACBIO1:2	3	2	1	1	3	1	3	2	3
16SACBIO1:3	3	1	1	1	3	2	2	1	3
16SACBIO1:4	3	1	1	2	2	1	2	2	3
16SACBIO1:5	3	1	1	2	3	2	3	1	3
Average	3	1.4	1	1.6	2.8	1.6	2.6	1.6	3

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Department of Biochemistry

Year: III **Semester: V**

Subject Code: 16SCCBC5

CORE COURSE V

BIOENERGETICS AND METABOLISM

Objectives:

To understand the energy transformation and metabolic pathways in living organism.

Unit I

Bioenergetics: Free energy and entropy changes in biological system, coupling of endergonic and exergonic processes. High energy phosphate compounds-Structure and importance of ATP. Biological oxidation-Enzymes involved in oxidation and reduction- oxidases, dehydrogenases, hydroperoxidase and oxygenases. Cytochrome P-450 monooxygenases system.

Unit II

Mechanism of oxidative phosphorylation- Chemiosmotic theory, ATPases. Oxidative phosphorylation – uncouplers, inhibitors, ionophores. Electron transport chain. Inhibitors of ETC. Malate and glycerophosphate shuttles.

Unit III

Carbohydrate metabolism: Glycolysis and its energetic. gluconeogenesis, oxidation of pyruvate to acetyl CoA, TCA cycle and its energetics -anaplerotic reactions; Hexose monophosphate pathway, glycogenesis and glycogenolysis, glucuronic acid cycle; glyoxalate cycle; metabolism of galactose and fructose.

Unit IV

Lipid metabolism: Biosynthesis of fatty acids- biosynthesis and catabolism of triglycerides, phospholipids and glycolipids. Oxidation of fatty acids - α, β and γ oxidation; Cholesterol-synthesis and degradation. Ketogenesis; plasma lipoproteins.

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Unit V

Protein, nucleic acid and porphyrins metabolism: catabolism of amino acids - Deamination, decarboxylation, transamination-Glycogenic and ketogenic amino acids, urea-biosynthesis. Metabolism of purine and pyrimidine nucleotides. Biosynthesis and degradation of porphyrins, Heme.

CO

1.Explain the role of free energy and importance of high energy phosphate compounds, enzymes involved in biological oxidation.

2.Illustrate the mechanism of oxidative phosphorylation and the Electron transport chain.

3.Know and understand the metabolic pathways involved in carbohydrate metabolism.

4.Outline and understand the metabolic pathway involved in Lipid metabolism and Ketogenesis.

5. Illustrate the pathway involved in Protein, nucleic acid and porphyrins metabolism.

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Department of Biochemistry

Year: III **Semester: V**

Subject Code: 16SCCBC5

CORE COURSE V - BIOENERGETICS AND METABOLISM

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

III B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SCCBC5:1	3	2	2	2	3	3	2	-	-	3
16SCCBC5:2	3	2	2	-	3	3	2	2	1	3
16SCCBC5:3	3	2	2	3	3	3	2	2	1	3
16SCCBC5:4	3	2	2	2	3	3	2	3	2	3
16SCCBC5:5	3	2	3	3	3	3	2	3	2	3
Average	3	2	2.2	2	3	3	2	2	1.2	3

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Department of Biochemistry

Year: III **Semester: V**

Subject Code: 16SCCBC6

CORE COURSE VI

CELL AND MOLECULAR BIOLOGY

Objectives:

1. To study the structural and functional organisation of cells
2. To acquire basic fundamental knowledge and explore skills in molecular biology and become aware of the complexity and harmony of the cells

Unit I

An Overview of cells: Origin and evolution of cells. Cell theory, Classification of cells – Prokaryotic and Eukaryotic cells. Comparison of prokaryotic and eukaryotic cells. Cell Membrane – Fluid mosaic model of membrane structure and its composition. Cell cycle.

Unit II

Cell differentiation in plants and animals - Structure and function of cell membranes and organelles- Endoplasmic reticulum, Ribosomes, Mitochondria, Chloroplast, lysosomes, Golgi apparatus- structure and their functions.

Unit III

DNA as a genetic material: Identification of DNA as genetic materials- Griffith, Hershey – Chase experiment. DNA replication in Prokaryotes and Eukaryotes - enzymes and accessories proteins involved in DNA replication - Types of DNA damage and repair (Direct enzymatic repair, Base excision repair, Nucleotide excision repair, Mismatch repair- Double-strand break repair Non-homologous end joining Homologous recombination)

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Unit IV

Transcription: prokaryotic and eukaryotic transcription, RNA polymerase, general and specific transcription factors, regulatory elements and mechanisms of transcription and regulations - Post transcriptional modification-Capping, polyadenylation, splicing, RNA editing.

Unit V

Translation: Protein synthesis in prokaryotic and eukaryotes- activation, initiation, elongation and termination of protein synthesis. Inhibitors of protein synthesis, Post translational modification, Gene regulation- Operon model – lac and trp operons, transposans and their functions.

CO

1.Understand the origin and evolution of cells. Structure and functions of cell membranes.

2.Understand cell differentiation and know about plant and animal cell organelles.

3.Explore DNA as genetic material, replication and repair mechanism.

4.Describe DNA transcription in prokaryotes and Eukaryotes.

5.Know about DNA translation and gene regulation.

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Department of Biochemistry

Year: III **Semester: V**

Subject Code: 16SCCBC6

CORE COURSE VI - CELL AND MOLECULAR BIOLOGY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

III B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SCCBC6: 1	3	2	1	2	2	3	2	2	1	3
16SCCBC6: 2	3	2	1	2	2	3	2	2	1	3
16SCCBC6: 3	3	3	1	2	2	3	2	3	1	3
16SCCBC6: 4	3	3	1	2	2	3	2	3	1	3
16SCCBC6: 5	3	3	1	2	2	3	2	3	1	3
Average	3	2.6	1	2	2	3	2	3	1	3

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Department of Biochemistry

Year: III **Semester: V**

Subject Code: 16SCCBC7

CORE COURSE VII

MICROBIOLOGY

Objective:

To understand the structure of different kinds of micro organisms and their isolation and characterization it helps the student to gain basic information about microbiology

Unit I

Bacteria. Eubacteria, cyanobacteria, Archaebacteria, Bergey's classification scheme for bacteria. Staining of bacteria. Size and shape of bacterial cells. Modes of reproduction, enumeration, bacterial growth curve, synchronous growth, physical and chemical methods of controlling bacterial growth. Cultivation of bacteria. Nutritional requirements. Types of media. Factors affecting growth of microbes. Choice of media and conditions of incubation. Isolation and maintenance of pure cultures.

Unit II

Fungi, Algae and viruses. Fungi- classification, cultivation and morphology of yeasts and moulds. Control of fungal growth. Algae- occurrence, characteristics, classification and biological, importance. Viruses of bacteria, bacteriophages, general characteristics.

Unit III

Food Microbiology- Food spoilage, food preservation, fermented foods. Infected foods and human illness- botulism, Clostridium welchi poisoning, Staphylococcal poisoning, Salmonella- infection. Dairy microbiology- contamination of milk by bacteria. Bacterial count. Reactions occurring in milk. Pasteurisation and sterilisation, fermented milk products, cheese.

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Unit IV

Medical Microbiology. Infection- sources and transmission of infection. Types of infection and factors influencing infection. Harmful microbes - endo and exotoxins. Antimicrobial agents. Sterilisation and disinfection.

Unit V

Microscopical examination of microorganism-Bright field, Dark field principle and applications of fluorescent and phase contrast, scanning electron microscope and transmission microscopy.

CO

1. Understand the different kinds of microorganisms and factors affecting its growth.

2. Gain basic information about classification and features of fungi and viruses.

3. Know the information and food spoilage, food preservation and dairy microbiology.

4. Discuss about infection and its transmission and gain knowledge about antimicrobial agents.

5. Describe the working principle and examination of various microscopes.

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Department of Biochemistry

Year: III **Semester: V**

Subject Code: 16SCCBC7

CORE COURSE VII - MICROBIOLOGY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

III B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SCCBC7: 1	3	3	2	3	3	1	3	2	2	3
16SCCBC7: 2	3	2	3	1	2	3	3	2	1	2
16SCCBC7: 3	3	2	2	3	3	2	3	2	3	3
16SCCBC7: 4	2	3	3	3	3	1	3	3	2	3
16SCCBC7: 5	2	3	3	3	3	1	2	1	3	2
Average	2.6	2.6	2.6	2.6	2.8	1.6	2.8	2	2.2	2.6

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Department of Biochemistry

Year: III **Semester: V**

Subject Code: 16SCCBC3P

CORE PRACTICAL III

FOOD AND ENZYME BIOCHEMISTRY (P)

Objective:

To enhance the production, nutritional value, safety, tastes of foods. This course emphasises techniques in food analysis.

Practical:

1. Moisture content of food materials
2. Ash Content of food materials.
3. Estimation of carbohydrate by anthrone method in food samples.
4. Estimation of protein by Lowry's method in food samples.
5. Estimation of fat content in food samples (wheat, rice flour, gram flour and milk)
6. Estimation of nitrogen, iron, phosphorus and calcium
7. Determination of specific activity, pH and temperature of alkaline phosphatase and amylase

CO

1.Gain knowledge regarding moisture and ash content of food materials.

2. Estimate the amount of biochemical parameters in food samples.

3. Determine the specific activity of salivary amylase and phosphatases.

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Department of Biochemistry

Year: III **Semester: V**

Subject Code: 16SCCBC3P

CORE PRACTICAL III
FOOD AND ENZYME BIOCHEMISTRY (P)

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

III B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SCCBC3P	3	3	2	3	3	3	3	3	2	3

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Department of Biochemistry

Year: III **Semester: V**

Subject Code: 16SMBEBC1

MAJOR BASED ELECTIVE I

PHARMACEUTICAL BIOCHEMISTRY

Objectives:

1. To make a detailed study about the action of drugs on living systems.
2. To understand the ADMET (Absorption, Distribution, Metabolism, Excretion and Toxicity) properties of drugs.

Unit I

Pharmacodynamics and Kinetics: History of Drugs, Classification of drugs, routes of drug administration, absorption and distribution of drugs, factors influencing drug absorption and elimination of drugs. Toxicity assessment: acute, sub chronic, chronic exposure, determination of ED50 and LD50 values.

Unit II

Drug- Receptor interactions: Receptor- definition, Agonist and antagonist. Types of receptor - G-protein coupled receptor, Receptors with intrinsic ion channel, Enzymatic receptors, receptors regulating gene expression, involvements of binding forces in drug receptor interaction, drug action not mediated by receptors.

Unit III

Drug metabolism: Phase I reactions - role of Cytochrome P450. Microsomal and Non microsomal reactions. Phase II reactions-Conjugation reactions. Physiological importance of xenobiotic metabolism.

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Unit IV

Chemotherapy: Basic concept. Mode of action of antimicrobial drugs antibacterial, antifungal, antiviral and antimalarial drugs. Cancer chemotherapy: Cancer and principles of cancer chemotherapy. Mode of action of anticancer drugs- antimetabolites, antibiotics, alkylating agents and other agents.

Unit V

Drugs acting on various systems: CNS-sedative- hypnotic, GI tract drugs for peptic ulcer, diarrhoea and constipation. Miscellaneous drugs - antiseptic, disinfectant, chelating agents. Adverse drug reactions and drug induced side effects, biological effects of drug abuse and drug dependence, drug tolerance and intolerance.

CO

1. Explain the fundamentals in pharmacology. understand basic terms in drugs, routes of administration, and the classification of drugs.
2. Know and understand the Drug - receptors mediated interactions and non receptors mediated interactions.
3. Explain the key concepts underlying the drug metabolism - phase I and II reactions.
4. Understand how the body responds to anticancer drugs.
5. Understand how drugs act on different systems in the body and drug abuse.

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Department of Biochemistry

Year: III **Semester: V**

Subject Code: 16SMBEBC1

MAJOR BASED ELECTIVE I - PHARMACEUTICAL BIOCHEMISTRY

MAPPING

CO - PO – PSO matrices of course

PHARMACEUTICAL BIOCHEMISTRY- 16SMBEBC1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SMBEBC1:1	2	2	1	3	3	2	2	2	1	3
16SMBEBC1:2	2	2	1	3	3	2	2	2	1	3
16SMBEBC1:3	2	2	1	3	3	2	2	2	1	3
16SMBEBC1:4	2	2	1	3	3	2	2	2	1	3
16SMBEBC1:5	2	2	1	3	3	2	2	2	1	3
Average	2	2	1	3	3	2	2	2	1	3

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Department of Biochemistry

B.Sc Biochemistry

Programme Outcome of B.Sc. Biochemistry (PO)

PO1: Enhance knowledge in the subject of Science and apply the principles of the same to the needs of the Employer / Institution / own business.

PO2: Enhance the skills in handling scientific instruments, chemical, glassware, planning and performance in laboratory experiments.

PO3: Understand the basic concepts, scientific phenomena and their relevance in day-to-day life.

PO4: Acquire the Analytical skills in the field/ area of Science.

PO5: Acquire knowledge with facts and figures related to various subjects in pure sciences.

Programme Specific Outcome of B.Sc. Biochemistry (PSO)

On completion of the Programme, the student will be able to:

PSO1: Communicate the fundamental concepts of specific molecules, enzymes, cells, organ systems and metabolism of compounds

PSO2: Apply the knowledge and expertise in industries, diagnostic laboratories and various research fields

PSO3: Impart practical skills and scientific knowledge in domains of molecular biology, enzymology, genetics, clinical biology and immunology

PSO4: Develop problem solving ability by utilising the conceptual knowledge, analytical techniques, computational and statistical approaches.

PSO5: Facilitate to pursue post-graduation in related fields in life sciences and contribute their knowledge to the betterment of the society in various research and health care sectors.

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Department of Biochemistry

Year: I **Semester: II**

Code: 16SCCBC2

CORE COURSE II

HUMAN PHYSIOLOGY

Objectives:

To understand fundamental mechanisms underlying normal function of cells, tissues, organs, and organ systems of the human body

Unit I

Body fluids: Extracellular fluid-plasma, interstitial fluid and transcellular fluid. Intracellular fluid: Lymph & Blood-composition, functions, osmolarity of the body fluids, ionic composition, electrolytes, body buffers. Blood cells, haemoglobin, haemopoiesis, blood coagulation and blood groups.

Unit II

Circulation: Structure of Heart and blood vessels, cardiac cycles, cardiac factors controlling blood pressure, electrocardiogram. Functions of heart. Respiration: Anatomy, and physiology of respiration, pulmonary surfactant, exchange of gases between lung and blood and between blood and tissues. Role of lung in acid-base balance.

Unit III

Digestive system: Anatomy of the digestive system, Salivary, Gastric and Biliary Secretions-composition and functions. Intestinal hormones, movements in Gastro intestinal tract, Secretion, digestion and absorption in the small intestine. Absorption in the large intestine; Digestion and absorption of carbohydrates, lipids and proteins.

Unit IV

Excretory system: Structure and functions of kidney. Urine- composition and formation. Renal regulation of acid-base balance. Muscle: Kinds of muscle, structure. Mechanism and theories of muscle contraction.

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Unit V

Central nervous system- General organization. Functional units. Resting and action potential-conduction of nerve impulse. Synaptic transmission. Brain chemical composition, metabolism, metabolic adaptation, neurotransmitters and cAMP. Biochemical aspects of learning and memory. Enkephalins and endorphins.

CO

1. Understand the fundamental mechanisms of body fluids, composition, functions, osmolarity, ionic composition, electrolytes, body buffers and blood cells.
2. Know and understand the structure and functions of heart, blood vessels, and lungs
3. Draw and understand the anatomy of the digestive system, composition and functions of salivary, gastric and biliary Secretion and digestion and absorption of carbohydrates, lipids and proteins.
4. Understand the Structure, functions of Excretory system and muscular system
5. Understand the Structure, functions of the central nervous system- General organisation and biochemical aspects of learning and memory.

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Department of Biochemistry

Year: I **Semester: II**

Code: 16SCCBC2

CORE COURSE II- HUMAN PHYSIOLOGY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

I B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SCCBC2:1	3	3	2	3	3	3	3	3	3	3
16SCCBC2:2	3	3	2	3	3	3	3	3	3	3
16SCCBC2:3	3	3	2	3	3	3	3	3	3	3
16SCCBC2:4	3	3	2	3	3	3	3	3	3	3
16SCCBC2:5	2	3	1	3	3	3	3	2	3	3
Average	2.8	3	1.8	3	3	3	3	2.8	3	3

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Department of Biochemistry

Year: I **Semester: I & II**

Code: 16SCCBC1P

CORE PRACTICAL I

BIOMOLECULES

Objectives:

1. To understand principles, theory and calculations of each experiment.
2. To gain hands on preparation of all the solutions and to standardise solutions individually.

Qualitative analysis

1. Weighing of reagents, Preparations of Normal and Molar solutions.
2. Handling of Microscope
3. Qualitative analysis of carbohydrates (glucose, fructose, maltose,galactose, sucrose, lactose), Identification of both monosaccharides and disaccharides in mixtures.
4. Qualitative analysis of amino acids (Tryptophan, Tyrosine, Arginine, Proline and Histidine)
5. Qualitative analysis of Lipids-Solubility, acrolein test for unsaturation,Libermann Burchard test for cholesterol Quantitative analysis
6. Estimation of reducing sugar by Benedict's quantitative method.
7. Estimation of amino acid by formal titration
8. Estimation of ascorbic acid by titrimetric method using 2,6 - dichlorophenol indophenol.
9. Estimation of acid number of Edible oil.
10. Determination of saponification number of edible oil.
11. Estimation of Iodine value of oil.

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CO

1. Understand principles, theory, calculations and gain practical skill on each experiment.

2. Gain technical experience, handling of weighing balance, microscope and gain hands on preparation of all the solutions and to standardise solutions individually.

3. Perform qualitative and quantitative analysis of carbohydrates, amino acids, and lipids.

4. Gain technical knowledge in the estimation of ascorbic acid.

5. Gain technical experience in the characterization of oils - acid number, saponification number, Iodine value.

Year: I **Semester: I & II**

Code: 16SCCBC1P

CORE PRACTICAL I - BIOMOLECULES

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

I B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SCCBC1P	3	3	2	2	3	3	3	2	2	3

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Department of Biochemistry

Year: II **Semester: IV**

Code: 16SCCBC4

CORE COURSE IV

ENZYMES

Objectives

1. To understand the basic concepts of enzymes.
2. To study the enzyme kinetics and applications.

Unit I

Enzymes- Definition, nomenclature and classification of enzymes, Properties, Structure and functions of coenzymes. Metallo enzymes and metal activated enzymes. Units of enzyme activity, turn over number. Non protein enzymes - ribozymes and abzymes.

Unit II

Isolation and purification of enzymes: Isolation – Localization and Extraction of Free and membrane bound enzymes. Methods of purification. Separation procedures based on molecular size, solubility difference and electric charge and selective adsorption. Criteria of purity of enzymes.

Unit III

Enzyme kinetics: Factors influencing enzyme activity, Derivation of MichaelisMenton equation, Line weaver-Burk plot, activators, Inhibitors kinetics - Types of inhibition - Competitive, noncompetitive, uncompetitive, feedback inhibition and allosteric inhibition.

Unit IV

Mechanism of enzyme action- active site Characteristics, Lock and Key model, induced fit hypothesis. Mechanism of enzyme catalysis, enzyme-substrate complex formation, mechanism of bisubstrate reactions. Mechanism of action of chymotrypsin, lysozyme and carboxypeptidase.

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Unit V

Multienzyme complex- pyruvate dehydrogenase, Isoenzymes of lactate dehydrogenase. Immobilized enzymes- principles and applications: Enzymes as a marker in clinical diagnosis. Industrial applications of enzymes.

CO

At the end of the course students will able to

1.Understand the structure, functions and classifications of enzymes and coenzymes.

2.Understand, derive enzyme kinetics and explain the types of inhibition

3.Gain knowledge regarding isolation and purification of enzymes

4.Understand the mechanism of enzyme action

5.Describe the multienzyme complex, principles and applications of immobilised enzymes.

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Department of Biochemistry

Year: II **Semester: IV**

Code: 16SCCBC4

CORE COURSE IV - ENZYMES

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

II B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SCCBC4:1	3	3	2	2	2	3	2	2	2	3
16SCCBC4:2	3	3	3	3	3	3	3	2	3	3
16SCCBC4:3	3	3	2	2	2	3	2	2	3	3
16SCCBC4:4	3	2	3	3	3	3	2	3	2	2
16SCCBC4:5	3	3	3	3	3	3	3	3	3	2
Average	3	2.8	2.6	2.6	2.6	3	2.4	2.4	2.6	2.6

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Department of Biochemistry

Year: II **Semester: IV**

Code: 16SACBIO2

SECOND ALLIED COURSE III

BIOLOGY - II

Objective:

The study of biology aims to increase understanding of living systems and to consider the systems in relationship to the self and other organisms in the natural environment.

UNIT I

Taxonomy – Concepts of species of hierarchical taxa, biological nomenclature, classical and quantitative methods of taxonomy, classification of plants, animals and microorganisms.

UNIT II

Inheritance Biology – Mendelian principle, allele, multiple allele, pseudo allele, codominance, incomplete dominance, pleiotropy, linkage and crossing over, sex linkage, sex limited and sex influenced characters. Inheritance of Mitochondrial and chloroplast genes, maternal inheritance.

UNIT III

Plant Physiology – Photosynthesis, C3, C4 pathway, photorespiration, nitrate and ammonia assimilation, plant hormones, Phytochemicals; alkaloids, flavonoids, saponins, quinones, terpenes , phenols, nitrogenous compounds - functions.

UNIT IV

Environmental Biology – Physical environment, biotic and abiotic, Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement energy flow and mineral cycling in ecosystem. Terrestrial and aquatic ecosystem.

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UNIT V

Evolutionary Biology – Lamarck; Darwin–concepts of variation, adaptation, struggle, fitness and natural selection; Spontaneity of mutations; the evolutionary synthesis. The evolutionary time scale; Eras, periods and epoch; Origins of unicellular and multicellular organisms; Hardy – Weinberg law.

CO

1. Understand the concepts of living systems and classification of plants, animals and microorganisms.
2. Elaborate on the principles of mendelian concepts and inheritance.
3. Study the physiology of plants and know the pathways of plant metabolism.
4. Understand the knowledge about the environment, study of mineral cycling and variousecosystems.
5. Brief the basic concepts of evolution, mutation and time scale.

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Year: II **Semester: IV**

Code: 16SACBIO2

SECOND ALLIED COURSE III - BIOLOGY - II

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

II B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SACBIO2:1	3	3	2	1	2	3	1	1	2	1
16SACBIO2:2	3	2	1	2	1	3	2	1	1	1
16SACBIO2:3	3	2	2	1	2	3	3	2	2	3
16SACBIO2:4	3	3	1	1	1	3	2	1	1	3
16SACBIO2:5	3	2	1	1	1	3	2	2	2	3
Average	3	2.4	1.4	1.2	1.4	3	2	1.4	1.6	2.2

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Department of Biochemistry

Year: II **Semester: III & IV**

Code: 16SCCBC2P

CORE PRACTICAL II

BIOCHEMICAL TECHNIQUES AND INSTRUMENTATION

Objectives:

1. To study the techniques used in understanding the biological process 2. To understand the principle and application of Bioinstrumentation. Practical: 1. Preparation of buffers and measurement of pH.

2. Titrable acidity of amino acids

3. Measurement of BP

4. Calculate BMI

5. Handling of Colorimeter and Spectrophotometer

6. Estimation of RNA by orcinol method.

7. Estimation of DNA by Diphenylamine method. Demonstration

8. Paper chromatography for separations and detections of simple sugars and amino acids.

9. Separation of plant pigments by column chromatography.

10. Thin layer chromatography of amino acids.

CO

1. Gain skill on the preparation of buffers and measurement of pH.
2. Understand the concept and calculation of BMI.
3. Estimate colorimetrically the amount of compounds present in the sample.
4. Separation and identification of compounds by chromatographic techniques.
5. Able to separate plant pigments by chromatographic techniques.

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Department of Biochemistry

Year: II **Semester: III & IV**

Code: 16SCCBC2P

CORE PRACTICAL II

BIOCHEMICAL TECHNIQUES AND INSTRUMENTATION

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SCCBC2P	3	3	3	2	3	1	3	2	2	3

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Department of Biochemistry

Year: II **Semester: III & IV**

Code: 16SACBIO1P

SECOND ALLIED PRACTICAL I

MICROBIAL, PLANT AND CELL BIOLOGY (P)

Objective:

To identify, study and analyse the microbial, plant and animal specimens.

Practical:

1. To learn use of microscope, principle of fixation and staining.
2. Study of various plant cell types.
3. To carry out gram staining for identifying bacteria.
4. To prepare squash mounts of onion root tips to study mitosis.
5. To study meiosis through permanent slides.
6. Separation of chloroplast pigments by paper chromatography.
7. To study the cytochemical distribution of nucleic acids and mucopolysaccharides within cells/tissues from permanent slides.
8. To raise the culture of E.coli and estimate the culture density by turbidity method. Draw a growth curve from the data.
9. Observation of various stages of chick embryo.
10. Measurement of Physico – Chemical parameters in aquatic environment. A. Dissolved Oxygen B. Salinity C. pH (Using pH paper (or) pH meter or Lovidbond Comparator). Free Carbon –di-oxide, carbonates and bicarbonates.

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CO

At the end of the practical course the students will be able to.

1. Identify and analyse microbial, plant and cell specimens.
2. Understand the working principle of microscope and staining techniques.
3. Know the basic knowledge of mitosis and meiosis using permanent slides.
4. Explore the growth curve of microorganisms.
5. Determine the physico-chemical parameters of the aquatic environment.

Year: II **Semester: III & IV**

Code: 16SACBIO1P

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

II B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SACBIO1P	3	3	-	2	3	3	3	2	-	3

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Department of Biochemistry

Year: III **Semester: VI**

Code: 16SCCBC8

CORE COURSE VIII
IMMUNOLOGY

Objectives:

To study about immune response and immunological techniques

Unit I

The Immune system- Primary and Secondary Lymphoid organ, Lymphocytes- their origin and differentiation, NK cells. Antigen presenting cells-macrophages, dendritic cells, langerhans cells- their origin and function. Mechanism of phagocytosis. Complement –characteristic features- biological function-activation, types of immune responses, immune tolerance.

Unit II

Immunity: Types of immunity- Innate immunity- classification- mechanism of nonspecific immunity. Acquired immunity- active and passive, vaccine-active immunisation, passive immunisation. Immunity to infection- bacteria, virus and protozoa. Immune response. Humoral and cell mediated immunity –induction mechanism-cytokines -interleukins- Interferon-their role in immune response.

Unit III

Immunoglobulins- Structure, types, biological functions - generation of diversity. Antigen- Types –factors determining antigenicity. Antigen- antibody interactions agglutination, complement fixation - opsonization, bacteriolysis and precipitation. Antitoxins.

Unit IV

Immunity to infection: Hypersensitivity reactions- types and mechanism. Transplantation- types-allograft rejection mechanism and prevention of graft rejection- immune-suppressive

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drugs. HLA-immune response genes- HLA molecules, Autoimmune diseases- pathogenesis – treatment.

Unit V

Immunochemical techniques. Production of antisera- the precipitation reaction, immunodiffusion, immunoelectrophoresis, immunofluorescence, complement fixation test. Principle, technique and applications of RIA and ELISA. Hybridomas –monoclonal antibody production-uses.

CO

1. Understand the structure of lymphoid organs. Types of cells present in the immune system and its mechanism.
2. Know about types of immunity and its classification.
3. Describe the structure, types and biological functions of immunoglobulins.
4. Understand the concepts of hypersensitivity and Transplantation immunology.
5. Illustrate techniques related to immunology, principle and working procedure.

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Department of Biochemistry

Year: III **Semester: VI**

Code: 16SCCBC8

CORE COURSE VIII - IMMUNOLOGY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

III B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SCCBC8: 1	3	2	2	2	2	3	3	3	2	3
16SCCBC8: 2	3	3	3	2	2	3	-	2	2	3
16SCCBC8: 3	2	2	-	2	-	3	3	3	2	3
16SCCBC8: 4	3	3	3	-	-	3	3	3	3	3
16SCCBC8: 5	3	3	3	3	2	3	3	3	3	3
Average	2.8	2.6	2.2	1.8	1.2	3	2.4	2.8	2.4	3

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Department of Biochemistry

Year: III **Semester: VI**

Code: 16SCCBC9

CORE COURSE IX

CLINICAL BIOCHEMISTRY

Objectives:

1. To know the clinical aspects of various metabolic disorders
2. To understand the significance of Diagnostic Biochemistry

Unit I

Basic concepts of Clinical Biochemistry: A brief review of units and abbreviations used in expressing concentrations and standard solutions. Specimen collection and processing (Blood, urine, faeces). Anticoagulant preservatives for blood and urine. Transport of specimens. Blood coagulation - disturbances in blood clotting - haemophilia A and haemophilia B. Blood groups, haemoglobin in anaemias, sickle cell anaemia, thalassemia, Porphyrias and porphyrinuria. Blood banking.

Unit II

Homeostasis, Disorders of fluids, electrolyte balance and gastrointestinal system, disorder involving change in hydrogen ion concentration. Liver function tests, jaundice, haemolytic, hepatic and obstructive jaundice. Renal function tests, normal and abnormal constituents of urine.

Unit III

Disorders of carbohydrate metabolism: Sugar level in normal blood, maintenance of blood sugar concentration – endocrine influence on carbohydrate metabolism, hypoglycemia, glycosuria, renal threshold value, diabetes mellitus – classification, complications, glucose tolerance test (GTT), diabetic coma, diabetic ketoacidosis, glycogen storage diseases, fructosuria, galactosemia, and hypoglycemic agents.

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Unit IV

Disorders of protein, amino acid and nucleic acid metabolism: plasma proteins, their origin, significance and variation in diseases. Nitrogen balance, proteinuria, multiple myeloma, Wilson's disease. Phenylketonuria, alkaptonuria, tyrosinosis, albinism, Hartnup's disease. Fanconi syndrome, cystinuria, Gout.

Unit V

Disorders of lipid metabolism: lipid metabolism in liver and adipose tissue, plasma lipoproteins, cholesterol triglycerides and phospholipids in health and diseases, fatty liver, atherosclerosis, lipid storage diseases, hyperlipoproteinemia and hyperlipoproteinemia.

CO:

1. Understand the basic concepts of units used in clinical biochemistry, biological specimen collection, and preservatives. Gain knowledge on blood coagulation, its related disorders, and blood banking.
2. Discuss homeostasis of body fluids, liver and kidney function tests.
3. Gain knowledge in disorders of carbohydrate metabolism.
4. Understand and interpret the disorders of protein, amino acid and nucleic acid metabolism.
5. Gain knowledge on clinical features of disturbance in lipid metabolism.

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Year: III **Semester: VI**

Code: 16SCCBC9

CORE COURSE IX - CLINICAL BIOCHEMISTRY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

III B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SCCBC9: 1	3	3	2	3	3	3	3	3	1	3
16SCCBC9: 2	2	3	2	3	2	3	3	3	1	3
16SCCBC9: 3	2	3	2	3	1	3	3	2	1	3
16SCCBC9: 4	2	3	1	3	1	3	3	3	1	3
16SCCBC9: 5	2	3	2	3	2	3	3	3	1	3
Average	2.8	3	1.8	3	1.8	3	3	3	1	3

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Department of Biochemistry

Year III **Semester VI**

Code: 16SCCBC4P

CORE PRACTICAL IV

HAEMATOLOGY AND CLINICAL BIOCHEMISTRY (P)

Objective:

To impart thorough knowledge about the biochemical basis of various diseases and Disorders.

Practical:

1. Collection of blood and urine, Types of preservative and anticoagulants
2. Blood grouping, haemoglobin content, PCV, TC/DC count and ESR
3. Qualitative tests of urine. Abnormal constituents- sugar, protein (albumin), ketone bodies, bile pigments and bile salts.
4. Quantitative estimation in blood a. Glucose b. Cholesterol c. Calcium d. Urea. e. Iron f. Bilirubin g. Uric acid h. Creatinine
5. Quantitative estimations in urine a. Glucose b. Urea c. Uric acid d. Creatinine

CO

At the end of the practical course the students will be able to.

1. Gain Knowledge on Collection, preservation and in blood & urine.
2. Understand the principles, estimation, determination, calculations and interpretations of experiments related to complete blood count.
3. Gain Knowledge on Qualitative analysis of Abnormal constituents present in the urine.
4. Quantitative analysis Biochemical components in blood & urine.

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Department of Biochemistry

Year: III **Semester: VI**

Code: 16SCCBC4P

CORE PRACTICAL IV
HAEMATOLOGY AND CLINICAL BIOCHEMISTRY (P)

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SCCBC4P	3	3	2	3	3	3	3	3	2	3

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Department of Biochemistry

Year: III **Semester: VI**

Code: 16SMBEBC2

MAJOR BASED ELECTIVE II

ENDOCRINOLOGY

Objective:

Clinical endocrinology plays a vital role in clinical biochemistry and metabolism.

This syllabus substantiates understanding of other subjects.

Unit I

Thyroid hormones- definition, classification, biosynthesis and circulation in blood. Mechanism of hormone action. Plasma membrane receptors. Adenylate cyclase, Role of G-proteins. Protein kinases, tyrosine, kinase, Inositol phosphate. Calcium, calmodulin. Mechanism of steroid hormone receptors- Mechanism of action of steroid hormone.

Unit II

Hormones of the thyroid Biosynthesis and biological actions of thyroid hormones. Antithyroid agents. Thyroid disease- thyrotoxicosis, Goiter, Grave's disease, Hashimoto's thyroiditis. Parathyroid hormone- Biological actions regulation of calcium and phosphorus metabolism. Calcitonin. Calcitriol- Biosynthesis and functions. Hyper and hypocalcemia. Hyperparathyroidism, hypoparathyroidism, Paget's disease. Rickets and osteomalacia.

Unit III

Hypothalamus and pituitary hormones: Vasopressin and oxytocin- synthesis and biological effects. Hypothalamic releasing factors. Anterior pituitary hormones actions. Growth promoting and lactogenic hormones. Glycoprotein hormones the POMC family. Endorphins, MSH. Gigantism, Acromegaly, Dwarfism and Diabetes insipidus.

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Unit IV

Pancreatic hormones- Insulin- Biosynthesis, regulation of secretion and biological actions. Mechanism of action of insulin. Glucagon, somatostatin and pancreatic polypeptide. Insulin like growth factors.

Unit V

Adrenal hormones - Glucocorticoids, Mineralocorticoids- synthesis and biological effects. Catecholamines: biosynthesis and biological effects. Gonadal hormones-Androgens and estrogens. Ovarian cycle. Abnormal secretion of adrenal hormones-Addison's disease. Cushing's syndrome, congenital adrenal hyperplasia,pheochromocytoma.

CO

1. Discuss the definition of a hormone in terms of its general properties. Describe the different classes and chemical structures of hormones.

2. Explain the glands, organs, tissues and cells that synthesize and secrete thyroid hormones.

3. Explain about the secretion and regulation of pituitary hormones. Consequences of under- and overproduction of pituitary hormones.

4. Explain about the secretion and regulation of pancreatic hormones. Consequences of hypo- and hyper of pancreatic hormones.

5. Describe the secretion and regulation of pancreatic hormones. Consequences of hypo- and hyper of adrenal and reproductive hormones.

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Department of Biochemistry

Year: III **Semester: VI**

Code: 16SMBEBC2

MAJOR BASED ELECTIVE II - ENDOCRINOLOGY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

III B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SMBEBC2:1	3	2	3	2	3	3	2	2	1	-
16SMBEBC2:2	3	3	3	3	2	2	3	2	2	2
16SMBEBC2:3	3	3	3	3	2	2	3	3	2	1
16SMBEBC2:4	3	3	3	3	3	3	3	3	2	1
16SMBEBC2:5	3	3	3	3	3	3	3	3	2	1
Average	3	3	3	2.8	2.6	2.6	2.8	2.6	1.8	1

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Department of Biochemistry

Year: III **Semester: VI**

Code: 16SMBEBC3

MAJOR BASED ELECTIVE III

BASIC BIOTECHNOLOGY

Objective:

To understand the technological aspect applied to molecular and microbial biology.

Unit I

Fermentation Biotechnology –Biotechnology – scope and importance, Basic principles of microbial growth, Bioreactor- batch and continuous bioreactor, fermentation culture medium, downstream processing. Fermentation production of penicillin and vitamin B12.

Unit II

Food and Industrial Biotechnology – Fermentation production of yoghurt and cheese. Production of single cell protein; spirulina: cultivation and uses. Biofertilizers – blue green algae: cultivation and uses. Production of amylase and protease.

Unit III

Molecular Biotechnology - Basic principles of cloning, Introduction of foreign DNA into hosts by particle bombardment gun, electroporation and microinjection. Basic Polymerase Chain Reaction (PCR), applications, Micro arrays, the human genome project.

Unit IV

Animal and Plant Biotechnology – Elementary details of Animal cell and tissue culture, medium, transfection, targeted gene transfer, transgenic animals. Plant cell and tissue culture, medium, totipotent, pluripotent cells, protoplast culture, artificial seeds, and transgenic plants.

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Unit V

Environmental Biotechnology – Biological fuel generation- ethanol and methane from biomass. Sewage treatment. Bioremediation: oil spill cleanup, bioleaching, IPR, Biosafety and hazards of environmental engineering.

CO

1.Illustrate the various aspects of Biotechnological applications in Fermentation Industries. Describe the principles underlying design of fermenters, fermentation process and downstream processing and fermentation products. .

2. Understand the methods in food biotechnology and production of enzymes - amylase and protease.

3. Understand the methods to introduce the foreign DNA into the host cells and the working principle of instruments involved in this method.

4. Explain the applications of transgenic plants and animals.

5.Understand the biological fuel generation. Explain the IPR and handling of GMO's

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Department of Biochemistry

Year: III **Semester: VI**

Code: 16SMBEBC3

MAJOR BASED ELECTIVE III - BASIC BIOTECHNOLOGY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

III B.Sc. Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
16SMBEBC3:1	3	2	3	3	3	1	3	2	1	3
16SMBEBC3:2	3	2	3	3	2	1	3	2	1	3
16SMBEBC3:3	3	2	3	3	1	1	3	2	1	3
16SMBEBC3:4	3	2	3	3	1	1	3	2	1	3
16SMBEBC3:5	3	2	3	3	1	1	3	2	1	3
Average	3	2	3	3	1.6	1	3	2	1	3

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Department of Biochemistry

M.Sc Biochemistry

Program Outcome of M.Sc Biochemistry (PO)

Develop professional foundations through activities such as teaching, internship and fellowships.

PO1: Attained profound Expertise in Discipline.

PO2: Acquire the basic tools needed to carry out independent research.

PO3: Proficient in their specialized area and successfully complete an advanced research project.

PO4: Develop skills in problem solving, critical thinking and analytical reasoning as applied to scientific problems.

PO5: Acquired ability to Function in Multidisciplinary Domains

Program Specific Outcome of M.Sc Biochemistry (PSO)

On completion of the Programme, the student will able to:

PSO1: The course aims in gaining an understanding of the processes of metabolic transformation at the molecular level and how these processes are studied.

PSO2: Understand the basic principles about the structure and function of macromolecules and their regulation in biological pathways.

PSO3: Students will gain conceptual understanding of subject matter, scientific reasoning skills, laboratory manipulative skills.

PSO4: Apply their skills in various clinical laboratories by experiencing a skillful knowledge during practical.

PSO5: Develop critical thinking skills to be capable of designing, carrying out interpreting scientific experiments.

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Department of Biochemistry

Year: I **Semester: I**

Subject Code: P16BC11

CORE COURSE I

CHEMISTRY OF BIOMOLECULES

Objectives:

To understand the basis of macromolecules and their structure.

Unit I:

Carbohydrates: Structure and biological functions of Mono, di and Polysaccharides. Types of polysaccharides: Homo polysaccharides -chitin, fructans, mannans, xylans, and galactans. Structure and biological importance of Hetero polysaccharides- sugar derivatives glycosaminoglycans, proteoglycans. Glycoprotein – Blood group and bacterial cell wall polysaccharides, O- linked and N- linked oligosaccharides, marine polysaccharides and Lectins.

Unit II:

Aminoacids and its general properties. Classification of amino acids. The peptide bond– Chemical synthesis of peptides –Merrifield method. Proteins– classification and general properties. Orders of protein structure, PrimaryRamachandran plot, Secondary structure– the α-helix, β- pleated sheet. Collagen triple helix. Protein sequencing methods.

Unit III:

Super secondary structure– helix– loop helix, the hairpin β -motif and the β-α-β-motif. Tertiary and quaternary structure- Forces stabilizing tertiary and quaternary structure- Structure of myoglobin, Structure of haemoglobin– oxygen binding and changes in conformation. Methods of isolation, characterization and purification of proteins.

Unit IV:

Lipids: Definition and classification of lipids. Biological significance of lipids. Types of Fatty acids-Essential, Non essential. Structure and biological functions of phospholipids, sphingolipids, glycolipids. Steroids – structure and functions of cholesterol, bile acids, sex

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hormones, ergosterol. Structure and biological role of prostaglandins, thromboxanes and leukotrienes.

Unit V:

Nucleic acid: 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. DNA sequencing– chemical and enzymatic methods. Chemical synthesis of DNA. RNA– types and biological roleSecondary, tertiary structures of RNA.

Course outcome

1. Understand the source, chemical structure, properties, function and uses of various polysaccharides.
2. Understand amino acid structures, their physical and chemical properties,
3. Explain primary, secondary, tertiary and quaternary structure of protein
4. Comprehend the classification, structure and biological significance of lipids.
5. Explain the structure of nucleic acids and its chemical synthesis.

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Department of Biochemistry

Year: I **Semester: I**

Subject Code: P16BC11

CORE COURSE I - CHEMISTRY OF BIOMOLECULES

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

I M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BC11:1	3	2	2	3	3	3	3	2	3	3
P16BC11:2	3	2	2	3	3	3	3	2	3	3
P16BC11:3	3	2	2	2	3	3	3	2	3	3
P16BC11:4	3	2	2	3	2	3	2	2	3	3
P16BC11:5	3	2	2	3	2	3	2	2	3	3
Average	3	2	2	2.8	2.6	3	2.6	2	3	3

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Department of Biochemistry

Year: I **Semester: I**

Subject Code: P16BC12

CORE COURSE II

ANALYTICAL TECHNIQUES

Objectives:

1. To understand the working principles, construction and applications of the instruments used in the studies related to various disciplines of biological sciences.
2. To apprise the importance of research and to learn the art of publication.

Unit I

Electrochemical techniques – Principles, Electrochemical cells and reaction – pH and buffers. Measurement of pH – glass electrode and titration curves. Ion selective and gas sensing electrodes, oxygen electrodes, and their applications. Methods for studying cells and organelles. Methods for lysis of plant, animal and microbial cell Subcellular fractionation. General scheme for purification of bio-components.

Unit II

Chromatographic techniques – General principle; adsorption and partition chromatography. Techniques and application of paper, column, thin layer, normal phase and reverse phase - ion-exchange chromatography, exclusion chromatography, affinity chromatography, GLC and HPLC, HPTLC.

Unit III

Centrifugation: Principles, differential and analytical centrifugation, density gradient centrifugation; Analysis of subcellular fractions, ultracentrifuge and its application. Tracer technique: Nature of Radioactivity: Patterns of decay, half life and its application, Geiger Muller Counter- principle and applications. Scintillation counter – Principle, types and applications. Use of isotopes in biological studies.

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Unit- IV

Electrophoresis: Principles, electrophoretic mobility, factors influencing electrophoretic mobility – paper, disc, slab gel electrophoresis. Isoelectric focusing, 2D PAGE, blotting techniques, capillary electrophoresis. Pulse field Electrophoresis, Isotachophoresis.

Unit - V

Spectroscopy: Laws of absorption and absorption spectrum.CD, ORD, Principle, instrumentation and applications of UV-visible spectrophotometry, ESR, NMR, IR and spectrofluorimetry. Basic principles of turbidimetry and nephelometry. Principle, instrumentation and applications of luminometry. Atomic spectroscopy – principle and applications of atomic flame and flameless spectrophotometry. Use of lasers for spectroscopy. MALOF TOF.

Course outcome

1. Understand the working principle of pH meter, biological role of buffers, and protocol for the purification of compounds.
2. Familiar with working principles, instrumentation and applications of various chromatographic techniques.
3. Understand the types and principle of centrifugation. Also the basics of radioisotopes and the biological applications of isotopes.
4. Familiar with working principles, instrumentation and applications of various electrophoretic techniques.
5. Familiar with working principles, instrumentation and applications of various spectrophotometry.

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Department of Biochemistry

Year: I **Semester: I**

Subject Code: P16BC12

CORE COURSE II - ANALYTICAL TECHNIQUES

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

I M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO 5
P16BC12:1	3	3	2	3	3	3	-	2	2	3
P16BC12:2	3	3	2	3	3	3	-	2	2	3
P16BC12:3	3	3	2	3	3	3	-	2	2	3
P16BC12:4	3	3	2	3	3	3	-	2	2	3
P16BC12:5	3	3	2	3	3	3	-	2	2	3
Average	3	3	2	3	3	3	-	2	2	3

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Department of Biochemistry

Year: I **Semester: I**

Subject Code: P16BC13

CORE COURSE III

ENZYMES AND ENZYME TECHNOLOGY

Objectives:

1. To understand the concepts and classes of enzymes
2. To study enzyme kinetics and applications of enzymes.

Unit I

Historical aspects of enzymology. Nomenclature and classification of enzymes, according to IUB-EC-1964. Intracellular localization of enzymes, homogenization techniques, isolation and fractionation of enzymes - classical methods of purification and crystallization - separation based on molecular size, electric charge, solubility difference and selective adsorption, criteria of purity, units of enzyme activity. Turn over number, specific activity. Active site definition, organization and determination of active site residues.

Unit II

Thermodynamic terms and basic concepts - types of thermodynamic systems. Enthalpy and biochemical reactions, biological thermodynamic standard state, activation energy and free energy. Biological oxidation, redox reactions. High-energy phosphate compounds, role of ATP in biological system; energy transfer; acyl-phosphate group transfer. Types of energy transformation in living systems; energy in photosynthesis. Phosphorylation types. Organization of electron carriers and enzymes in mitochondria, chloroplast and microsomes and their inhibitors, cyanide resistant respiration.

Unit III

Kinetics of catalyzed reaction: Single substrate reactions, bisubstrate reactions, Concept and derivation of Michaelis – Menten equation, Lineweaver burk plot, Briggs Haldane relationship. Determination and significance of kinetic constants, Limitations of Michaelis-Menten Kinetics. Inhibition kinetics - competitive, non-competitive and uncompetitive. Allosteric inhibition, cooperative, cumulative, feedback inhibition.

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Unit IV

Criteria of chemical reactions - Collision & transition state theories, specificity of enzymes. Mechanism of catalysis: Proximity and orientation effects, general acid-base catalysis, covalent and electrostatic catalysis - nucleophilic and electrophilic attacks, catalysis by distortion, metal ion catalysis.Theories on mechanism of catalysis. Coenzymes - structure and function, Mechanism of enzymes action: mechanism of action of lysozyme and chymotrypsin. Multienzymes system - Mechanism of action and regulation of pyruvate dehydrogenase, and fatty acid synthase complex. Isoenzymes.

Unit V

Applications of enzymes in Industry. Immobilization and Immobilized enzymes. Various methods of immobilization - ionic bonding, adsorption, covalent bonding (based on R groups of amino acids), microencapsulation and gel entrapment. Applications of immobilized enzymes. Biosensors – glucose oxidase, cholesterol oxidase, urease and antibodies as biosensors. Abzymes and Ribozymes. Enzymes of clinical importance - diagnostic significance and therapeutic effects. Enzyme Engineering.

Course Outcome

1. Explain the classification, isolation of enzymes and basic units of enzyme activity.
2. Understand the basic laws of thermodynamics and synthesis of energy rich molecules by mitochondria and chloroplast.
3. Understand the kinetics of enzyme catalysed reactions and the types of enzyme inhibition.
4. Interpret the structure/function interaction of an enzyme catalysed reactions, coenzymes and multienzyme complex.
5. Comprehend the application of enzymes in medicine, food industry and paper industry.

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Department of Biochemistry

Year: I **Semester: I**

Subject Code: P16BC13

CORE COURSE III - ENZYMES AND ENZYME TECHNOLOGY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

I M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BC13: 1	3	3	3	3	3	3	3	2	3	2
P16BC13: 2	3	3	2	3	2	3	3	3	2	2
P16BC13: 3	3	2	2	3	3	3	2	3	3	3
P16BC13:4	3	3	3	3	3	3	3	3	2	2
P16BC13: 5	3	3	3	3	3	3	2	2	3	3
Average	3	2.8	2.6	3	2.8	3	2.6	2.6	2.6	2.4

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Department of Biochemistry

Year: I **Semester: I**

Subject Code: P16BC14

CORE COURSE IV

CELL BIOLOGY AND PHYSIOLOGY

Objectives:

To understand integrative physiology at several levels of organization from molecules to living organisms, microscopic structures to macroscopic organization, and cellular properties to organ functions.

Unit I

Tissues: Types of tissue. Epithelium – organization and types. The basement membrane. Bone and cartilage. Major classes of cell junctions – anchoring, tight and gap junctions. Major families of cell adhesion molecules (CAMs) – the cadherins (classical and desmosomal). The integrins. The extracellular matrix of epithelial and nonepithelial tissues. ECM components – collagen, elastin, fibrillin, fibronectin, laminin and proteoglycans and tubulins.

Unit II

Biomembranes, cell cycle, cell death: Membrane assembly – importins and exportins. Membrane transport. Diffusion (passive and facilitated) active transport (symport, antiport, Na+ K+ ATPase), ion gradients, ion selective channels, group translocations, porins, endocytosis and exocytosis. The cell cycle : phases, regulation by cyclins and cyclin – dependent kinases. Checkpoints in cell cycle regulation. Programmed cell death – Brief outline of apoptosis. Differences between apoptosis and necrosis.

Unit III

Blood: Composition and functions of blood. Separation of plasma and serum. Plasma proteins in health and disease. Red blood cells – formation and destruction. Important aspects of RBC metabolism. The RBC membrane – principle proteins (spectrin, ankyrin, glycophorins).

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Anaemias. Composition and functions of WBCs. Blood coagulation – mechanism and regulation. Fibrinolysis. Anticoagulants.

Unit IV

Body Fluids: 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. Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids.

Unit V

Neuromuscular System: Structure of neuron. Propagation of action potential: structure of voltage – gated ion channels. Neurotransmitters - examples, 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 and other proteins. Sequence of events in contraction and relaxation of skeletal muscle. Pathophysiology of Duchenne muscular dystrophy. Cardiac muscle – Ca2+ - Na+ exchanger, Ca2+ -ATPase. Brief outline of channelopathies. Cardiac myophathy. Smooth muscle – regulation by Ca2+ and nitric oxide. Source of energy for muscle contraction.

Course outcome

1. Understand the structure and functions of tissues and cell junctions.
2. Explain the transport of molecules across various membrane bound channels and stages of cell cycle.
3. Understand the composition of blood. Able to draw the various types of blood cells. Familiar with functions of blood cells and the mechanism of blood coagulation.
4. Explain the functions and composition of body fluids & digestive juices and, formation of urine,
5. Understand the structure and functions of neuromuscular junctions, synopsis and role of neurotransmitters.

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Year: I **Semester: I**

Subject Code: P16BC14

CORE COURSE IV - CELL BIOLOGY AND PHYSIOLOGY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

I M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BC14: 1	3	2	1	3	1	3	3	1	3	3
P16BC14: 2	3	2	1	3	3	3	3	1	3	3
P16BC14: 3	3	2	1	3	3	3	3	2	3	3
P16BC14: 4	3	2	1	3	3	3	3	2	3	3
P16BC14: 5	3	2	2	3	2	3	3	2	3	3
Average	3	2	1.2	3	2.4	3	3	1.6	3	3

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Department of Biochemistry

Year: I **Semester: I**

Subject Code: P16BC15P

CORE PRACTICAL I

BIOCHEMICAL TECHNIQUES AND ENZYMOLOGY

Objectives:

1. To assay the activity of enzymes from different sources.

2. To stimulate their interest in learning the structure, function and kinetics of enzyme and their role as catalyst and regulator of cell metabolism and to serve as foundation for more advanced enzymology courses

1. Estimation of proteins by Lowry / Brad ford method
2. Estimation of phospholipids by phosphorous assay
3. Estimation of sodium and potassium by Flame photometry
4. Effect of pH, temperature and substrate concentration for amylase and urease and determination of Vmax & Km
5. Effect of inhibitor on activity of any one enzyme
6. Effect of activator on activity of any one enzyme
7. Desalting of proteins by dialysis
8. Separation of polar and non polar lipids by TLC
9. Rf value calculation of various amino acids using TLC and PC
10. Separation of serum proteins by paper electrophoresis

Course Outcome

1. Assay the activity of enzymes from different sources.
2. Integrate the structure, function and kinetics of enzyme.
3. Estimate the amount of biochemical compounds in samples.
4. Perform the separation of aminoacids and lipids by chromatography techniques.
5. Perform the separation of proteins by electrophoresis and dialysis.

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Department of Biochemistry

Year: I **Semester: I**

Subject Code: P16BC15P

CORE PRACTICAL I - BIOCHEMICAL TECHNIQUES AND ENZYMOLOGY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

I M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BC15P	3	3	2	2	3	3	2	3	3	3

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Department of Biochemistry

Year: II **Semester: III**

Subject Code: P16BC31

CORE COURSE VII

IMMUNOLOGY

Objectives:

To understand about immune response and immunological techniques

Unit I

Elements of Immunology. 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. Antigens vs immunogens – types – determinants – Haptens - Factors influencing immunogenicity. Immunoglobulins structure, classification and functions. Isotypes, allotypes and idiotypes.

Unit II

Complement activation and its biological consequences. Theories of Antibody formation. – Factors influencing antibody production – Genetic basis of antibody diversity. T-cell, B-cell receptors, Antigen recognition- processing and presentation to T-cells. Interaction of T and B cells. Immunological memory. Effector mechanisms- macrophage activation. Cell mediated cytotoxicity, immunotolerance, immunosuppression.

Unit III

MHC genes and products. Polymorphism of MHC genes, role of MHC antigens in immune response, MHC antigens in transplantation. Transplantation types. Immune responses to infectious diseases- Viral, bacterial and protozoal. Tumor antigens-immune response to tumor antigens-immunotherapy. AIDS and other immunodeficiency disorders. Autoimmunity - Autoimmune diseases – pathogenesis - treatment. Hypersensitivity - types & Mechanism.

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Unit IV

Immunization practices- active and passive immunization. Vaccines- killed, attenuated-toxoids. Recombinant vector vaccines- DNA vaccines, synthetic peptide vaccines- anti idiotype vaccines. Hybridomas - production of polyclonal and monoclonal antibodies. Principles, techniques and application. Genetically engineered antibodies

Fractionation of leucocytes by density gradient centrifugation. Identification of lymphocytes and their subsets in blood. Leukocyte migration inhibition technique. Delayed type hypersensitivity technique.

Unit V

Agglutination and precipitation: Techniques - Immuno-electrophoresis, RIA, immunoblotting assay, Avidin- biotin mediated immuno assay. Immunohistochemistry- immunofluorescence, immunoferritin technique. Cytokines assay: ELISA and ELISPOT, Abzymes. Experimental animal models: inbred strains, SCID mice, nude mice, knockout mice cell culture system: Primary lymphoid culture cloned lymphoid cell lines.

Course Outcome

1. Explain the structure and functions of immune cells, lymphoid organs, antigens and antibodies.
2. Describe the mechanism of humoral and cell mediated immunity.
3. Explain how an Immunological response is triggered and regulated. Describe how the immune system is able to discriminate between self vs. non-self. And the mechanism of transplantation and graft rejection.
4. Understand the principles governing vaccination and the mechanisms of protection against infectious diseases
5. Principles and applications of various immunology techniques like immunofluorescence, western Blotting, ELISA, etc. Understand the experimental animal models.

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Department of Biochemistry

Year: II **Semester: III**

Subject Code: P16BC31

CORE COURSE VII - IMMUNOLOGY

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

II M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BC31:1	3	1	1	3	3	3	1	1	1	3
P16BC31:2	3	1	3	2	2	3	-	-	3	3
P16BC31:3	3	1	3	3	2	3	1	-	2	2
P16BC31:4	3	3	3	3	3	3	3	3	3	3
P16BC31:5	3	3	3	3	3	3	3	3	3	3
Average	3	1.8	2.6	2.8	2.6	3	1.6	1.4	2.2	2.8

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Department of Biochemistry

Year: II **Semester: III**

Subject Code: P16BC32

CORE COURSE VIII

CLINICAL BIOCHEMISTRY

Objectives:

1. To impart thorough knowledge about the biochemical basis of various diseases and disorders.
2. To study various diagnostic and therapeutic methodologies available for diseases and disorders.

Unit I

Disorder of carbohydrate and lipid metabolism 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, metabolic abnormalities, diagnosis and management. 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 and nucleic acid metabolism 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

Liver function test and gastric function test 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,NH3, aminopyrine) and metabolic (galactose) functions. Gallstones. Gastric function

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tests- Stimulation tests – insulin and pentagastrin. Peptic ulcer,gastritis and Zollinger Ellison syndrome.

Unit IV

Renal function test and metabolic disorders: 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 microglobulin. Tubular function tests – water load, concentration and acid excretion tests. Abnormal constituents of urine. Clinical enzymology - Serum enzymes and isoenzymes in health and disease – Transaminases (AST, ALT) acid. Alkaline phosphatases, amylase, LDH and CK.

Unit V

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.

Course outcome

1.Gain knowledge on clinical features of disorder of carbohydrate and lipid metabolism.

2.Understand and interpret the disorders of amino acid, nucleic acid metabolism and tests related to serology.

3. Gain and understand the tests and disorders related to Liver function and gastric functions.

4.Know and understand the tests and disorders related to kidney function and interpretation of clinical enzymology.

5.Gain knowledge on morphology, markers, agents, causes for the development of cancer cells.

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Year: II **Semester: III**

Subject Code: P16BC32

CORE COURSE VIII - CLINICAL BIOCHEMISTRY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

II M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BC32:1	3	3	2	3	3	3	3	3	2	3
P16BC32:2	3	2	3	2	2	3	2	2	3	3
P16BC32:3	3	2	3	3	2	3	2	3	3	3
P16BC32:4	3	3	3	3	3	3	3	3	3	3
P16BC32:5	3	3	3	3	3	3	3	3	3	3
Average	3	2.8	2.8	2.8	2.6	3	2.6	2.8	2.8	3

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Year: II **Semester: III**

Subject Code: P16BC33P

CORE PRACTICAL III

CLINICAL BIOCHEMISTRY

Objectives:

To study the various diagnostic and therapeutic methodologies available for diseases and disorders.

I. Hematological studies

1. Blood Grouping and Rh typing.
2. Estimation of haemoglobin content.
3. Total RBC count.
4. Total WBC count.
5. Determination of clotting time
6. Total platelet count.
7. Determination of Prothrombin time
8. Determination of ESR.

II. Biochemical analysis of urine & blood

Collection, preservation (blood and urine)

1. Estimation of blood glucose
2. Estimation of serum total proteins and A: G ratio
3. Estimation of serum cholesterol
4. Estimation of blood and urine urea
5. Estimation of serum and urine calcium
6. Estimation of serum and urine uric acid
7. Estimation of serum bilirubin.
8. Estimation of serum creatinine
9. Estimation of serum AST / ALT
10. Estimation of serum acid phosphatase / alkaline phosphatase

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III. Urology

Urine - Qualitative tests of urine. Abnormal constituents - Reducing sugar-Benedict test, protein: -Heat and acetic acid test, and sulfosalicylic acid method, Ketone bodies-Rothera's test, Bile pigment (Fouchet method), bile salt (Hay's test), Urobilinogen-Ehrlich aldehyde test and Bence Jones protein test.

Course outcome

1.Understand the principles, estimation, determination, calculations and interpretations of experiments related to complete blood count.

2. Gain Knowledge on Collection, preservation and analysis of biochemical component and marker enzymes in blood & urine

3. Gain Knowledge on Qualitative analysis of Abnormal constituents present in the urine and its interpretation.

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Department of Biochemistry

Year: II **Semester: III**

Subject Code: P16BC33P

CORE PRACTICAL III - CLINICAL BIOCHEMISTRY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

II M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BC33P: 1	3	3	3	2	3	3	2	3	3	3

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Department of Biochemistry

Year: II **Semester: III**

Subject Code: P16BCE3

ELECTIVE III

GENETIC ENGINEERING

Objective:

To understand and learn the emergence and early development and application of technology.

UNIT I

Introduction to genetic engineering and rDNA technology, gene cloning, specialized tools and techniques, benefits of gene cloning. Isolation and purification of DNA: Preparation of total Cellular DNA, plasmid DNA, bacteriophage DNA, plant cell DNA, isolation of mRNA from mammalian cells.

UNIT II

Vectors and enzymes in cloning: Cloning and Expression vectors- Plasmids pBR, pUC, phages (M3, λ), yeast vectors, cosmids, phagemids, agrobacterium, PAC, BAC, YAC, MAC, HAC vectors, Plant and Animal viruses as vector, binary and shuttle vectors, expression vectors for prokaryotes and eukaryotes, expression cassettes. Restriction endonucleases, ligases, S1 nuclease, reverse transcriptase, polymerase, alkaline phosphatase, terminal transferase, methods of ligation.

UNIT III

Construction of genomic and cDNA libraries, selection and screening of recombinants, probes-types, synthesis and uses of probes. Blotting techniques (Southern, Northern and Western), PCR- types and applications, Sequencing: DNA and RNA, site directed mutagenesis. Chromosome walking, jumping, DNA finger printing and foot printing.

UNIT IV

Methods of gene transfer: Microinjection, electroporation, particle bombardment gun (biolistic), ultrasonication, liposome mediated and direct transfer. Restriction analysis of DNA, molecular markers- RFLP, RAPD, VNTR, SSR, AFLP, STS, SCAR, SNP. Microarrays. Genomics (human genomic project) and proteomics – types and applications.

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UNIT V

Applications of Genetic Engineering: Recombinant insulin, somatotropin, vaccines, role of genetic engineering in diagnosis and cure of diseases, gene therapy, transgenic plants (herbicide resistant, pesticide resistant, and antisense RNA technology and its application). Transgenic animals. IPR, Patenting, Ethical, legal issues and hazards of genetic engineering.

Course Outcome:

1. The students will be able to know about the outline of rDNA technology and isolation of DNA.
2. To Understand the concept of vectors and its types.
3. To discuss the construction of rDNA and cDNA libraries, PCR and DNA sequencing.
4. Illustration of methodology of gene transfer and types of molecular markers.
5. Explain the applications of genetic engineering in humans, plants and animals.

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Year: II **Semester: III**

Subject Code: P16BCE3

ELECTIVE III - GENETIC ENGINEERING

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

II M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BCE3:1	3	1	3	3	3	3	3	3	3	3
P16BCE3:2	3	1	3	3	3	3	2	3	3	3
P16BCE3:3	3	1	3	3	3	3	2	3	3	3
P16BCE3:4	3	1	3	3	3	3	3	3	3	3
P16BCE3:5	3	3	3	3	3	3	2	3	3	3
Average	3	1.4	3	3	3	3	2.6	3	3	3

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Department of Biochemistry

Year: II **Semester: III**

Subject Code: P16BCE4

ELECTIVE IV

DEVELOPMENTAL BIOLOGY

Objectives:

1. To study the cellular basis of development.
2. To elucidate the early development process of humans.

Unit I

Basic concepts: General concept of organisms development: Potency, commitment, specification, induction, competence, determination & differentiation; morphogenetic gradients; cell fate & cell lineages; genomic equivalence and cytoplasmic determinants; imprinting. General principles of cell-cell communication in development: cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, paracrine factors.

Unit II

Fertilization, development and sex determination in humans: Gametogenesis - Sperm & Egg formation; ultrastructure of sperm and ovum, egg types, egg membrane. Fertilization, cleavage, Morula, Implantation, blastulation, gastrulation, formation of germ layers, axis formation - anterior and posterior. Sex determination - chromosomes and environment.

Unit III

Morphogenesis and organogenesis in animals: Cell aggregation and differentiation in Dictyostelium; axes and pattern formation in Drosophila, amphibia and chick; organogenesis – vulva formation in Caenorhabditis elegans; eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development-larval formation, metamorphosis; environmental regulation of normal development; sex determination.

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Unit IV

Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in Arabidopsis and Antirrhinum.

Unit V

Implications of developmental biology: Medical implications of developmental biology - genetic disorders in human development, environmental assaults on human development, Future therapies, Environmental regulation of animal development - Environment as a part of normal development, Polyphenisms, plasticity and Learning.

Course Outcome:

The students will be able to.

1.Understand the molecular and cellular mechanisms of development and learn about principles of cell communication,adhesion,and gap junctions related to development.

2.describe the concepts of Fertilization, development and Sex determination in humans.

3. Know the morphogenesis and organogenesis in animals and the concept of environmental regulation.

4.Summarize plant morphogenesis and organisation

5. Awareness of implications of developmental biology in research, particularly in relation to stem cells, *in vitro* fertilisation and assisted reproductive technologies

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Department of Biochemistry

Year: II **Semester: III**

Subject Code: P16BCE4

ELECTIVE IV - DEVELOPMENTAL BIOLOGY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

II M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BCE4:1	2	1	3	3	3	3	2	2	2	3
P16BCE4:2	2	1	3	3	3	3	2	2	2	3
P16BCE4:3	2	1	3	3	3	3	2	2	2	3
P16BCE4:4	2	1	3	3	3	3	2	2	2	3
P16BCE4:5	2	1	3	3	3	3	2	2	2	3
Average	2	1	3	3	3	3	2	2	2	3

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Department of Biochemistry

M.Sc Biochemistry

Program Outcome of M.Sc Biochemistry (PO)

Develop professional foundations through activities such as teaching, internship and fellowships.

PO1: Attained profound Expertise in Discipline.

PO2: Acquire the basic tools needed to carry out independent research.

PO3: Proficient in their specialized area and successfully complete an advanced research project.

PO4: Develop skills in problem solving, critical thinking and analytical reasoning as applied to scientific problems.

PO5: Acquired ability to Function in Multidisciplinary Domains.

Program Specific Outcome of M.Sc Biochemistry (PSO)

On completion of the Programme, the student will able to:

PSO1: The course aims in gaining an understanding of the processes of metabolic transformation at the molecular level and how these processes are studied.

PSO2: Understand the basic principles about the structure and function of macromolecules and their regulation in biological pathways.

PSO3: Students will gain conceptual understanding of subject matter, scientific reasoning skills, laboratory manipulative skills.

PSO4: Apply their skills in various clinical laboratories by experiencing a skillful knowledge during practical.

PSO5: Develop critical thinking skills to be capable of designing, carrying out interpreting scientific experiments.

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Department of Biochemistry

Year: I **Semester: II**

Subject Code: P16BC21

CORE COURSE V

METABOLISM AND REGULATION

Objectives:

To understand the metabolic pathways and regulatory mechanisms.

Unit I

Bioenergetics: Free energy and entropy. Phosphoryl group transfers and ATP. Enzymes involved in redox reactions. The electron transport chain– organization and role in electron capture. Electron transfer reactions in mitochondria. Oxidative phosphorylation- F1/F0 ATPase- structure and mechanism of action. The chemiosmotic theory. Inhibitors of respiratory chain and Oxidative phosphorylation – uncouplers, ionophores. Regulation of oxidative phosphorylation. Mitochondrial transport systems- ATP/ADP exchange, malate /glycerophosphate shuttle.

Unit II

Carbohydrate metabolism: Glycolysis and gluconeogenesis– pathway, key enzymes and co-ordinate regulation. Pyruvate dehydrogenase complex and the regulation of this enzyme through reversible covalent modification. The citricacid cycle and regulation. The pentose phosphate pathway. Metabolism of glycogen and regulation.

Unit III

Lipid metabolism: Lipogenesis-Control of acetyl CoA carboxylase-Role of hormones-Effect of diet on fatty acid biosynthesis. Regulation of biosynthesis of triacylglycerol, phospholipids and cholesterol. Metabolism of triacylglycerol during stress. α, β,γ, Oxidation of fatty acids– Role of carnitine cycle in the regulation of β -oxidation. Ketogenesis and its control. Lipoprotein metabolism exogenous and endogenous pathways.

Unit IV

Metabolism of amino acids, purines and pyrimidines: Overview of biosynthesis of nonessential amino acids. Catabolism of amino acid– transamination, deamination, ammonia formation, the urea cycle and regulation of ureogenesis. Importance of glutamate dehydrogenase. Overview of Catabolism of carbon skeletons of amino acids. Metabolism of purines- de novo and salvage

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pathways for purine biosynthesis-Purine catabolic pathway. Metabolism of pyrimidines - biosynthesis and catabolism. Regulation of biosynthesis of nucleotides.

Unit V

Metabolic integration and hormonal regulation: Key junctions in metabolism– glucose-6-phosphate, pyruvate and acetyl CoA. Metabolic 13 profiles of brain, muscle, liver, kidney and adipose tissue. Metabolic interrelationships in various nutritional and hormonal states– obesity, aerobic, anaerobic endurance, exercise, pregnancy, lactation, IDDM, NIDDM and starvation.

Course Outcome

1. Learn bioenergetics and integration of biomolecules that take place in the human system.

2. Integrate the various aspects of carbohydrate metabolism & their regulatory pathways

3. Understand the fundamental energetics of Lipid metabolism.

4. Understand the metabolism of amino acids and nucleic acids.

5. Figure out the processes of metabolic integration and Hormonal control.

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Department of Biochemistry

Year: I **Semester: II**

Subject Code: P16BC21

CORE COURSE V - METABOLISM AND REGULATION

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

I M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BC21: 1	3	2	3	2	1	3	2	1	2	2
P16BC21: 2	3	2	2	3	2	3	3	2	2	2
P16BC21: 3	3	3	3	3	3	3	3	3	3	3
P16BC21: 4	3	3	3	3	3	3	3	3	3	3
P16BC21: 5	3	3	3	2	3	3	3	3	3	3
Average	3	2.6	2.8	2.6	2.4	3	2.8	2.4	2.6	2.6

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Department of Biochemistry

Year: I **Semester: II**

Subject Code: P16BC22

CORE COURSE VI

MOLECULAR BIOLOGY

Objectives:

1. To understand the basic structure and functioning of the genetic materials - DNA.
2. To emphasize the molecular mechanism of DNA replication, repair, transcription, protein synthesis and gene regulation in various organisms.

Unit I

Eukaryotic and Prokaryotic chromosomes: Structure of prokaryotic Chromosomes Structure of eukaryotic chromosomal DNA, banding pattern, c-value, complexity heterochromatin, centromere, nuclear organizer, telomeres, Kinetic complexity of DNA, cot curve, and classes of DNA sequences. Histones, Non-histone proteins, and their properties, structure of nucleosome, role of histones in chromatin folding, concept of gene.

Unit II

Replication: Review of replication in bacteria, plasmid and viruses, Models of DNA replication.DNA replication in prokaryotes and eukaryotes. Eukaryotic DNA polymerases and their roles, origin of replication, Autonomously Replicating Segments (ARS) in yeast, elongation, lagging strand synthesis, and termination. Recombination: DNA recombination: Homologous, site specific and transposition, Homologous recombination: Holliday Model, Messelsson - Radding Model, Rec BCD pathway. Site specific recombination: Lambda phage integration, and excision rearrangement, of immunoglobulin genes. Transposition: Prokaryotic transposition, conservative and replicative transposition. Eukaryotic transposable elements, yeast and Drosophila transposons.

Unit- III

Transcription: Review of prokaryotic transcription, transcription in eukaryotes: Eukaryotic RNA polymerases and their subunit structure, Class I, II and III promoters, upstream elements, enhancers and silencers, General transcription factors, Class I, II, III genes and their functions, elongation factors, TBP structure and its role in transcription, mediators. Structure of

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transcription activators, zinc fingers, homeodomains, helix loop helix, bZIP, beta barrels, Post transcriptional modification.

Unit - IV

Translation: genetic code and its features. Wobble hypothesis. Translation machinery, initiation, elongation and termination of translation in prokaryotes and eukaryotes. Translational proof reading, translational 15 inhibitors, post-translational modifications, chaperones and protein targeting- translocation, heat shock proteins, glycosylation; SNAPs and SNAREs. Bacterial signal sequences. Mitochondrial, chloroplast and nuclear protein transport. Endocytosis - viral entry. Ubiquitin TAG protein destruction.

Unit - V

Chromosomal changes and consequences: Changes in the chromosome number and chromosome structure and its related genetic disorders. Mutation: definition, chemical basis and types. Types of mutagens. Mutant types - lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis. DNA repair mechanism: thymine dimer, light activation, excision, recombinational, SOS and mismatch repair. Cancer Biology: genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

Course Outcome

1.Learn the structure, function and molecular mechanism of the genetic material.

2. Students were able to describe the general principles of replication and recombination in both prokaryotic and eukaryotic organisms.

3. Learn the basic concepts of transcription and regulation in both prokaryotic and eukaryotic organisms.

4. Enumerate the mechanism of translation and post translational modification in both prokaryotic and eukaryotic organisms.

5.Know about chromosomal changes and its consequences, DNA repair mechanism, stages of cell cycle and cancer biology.

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Department of Biochemistry

Year: I **Semester: II**

Subject Code: P16BC22

CORE COURSE VI - MOLECULAR BIOLOGY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

I M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BC22: 1	3	1	3	3	3	3	3	1	2	3
P16BC22: 2	3	1	3	2	3	3	3	1	1	3
P16BC22: 3	3	1	3	2	2	3	3	1	1	3
P16BC22: 4	3	1	3	2	2	3	3	1	1	3
P16BC22: 5	3	1	3	3	3	3	3	1	2	3
Average	3	1	3	2.4	2.6	3	3	1	1.4	3

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Department of Biochemistry

Year: I **Semester: II**

Subject Code: P16BC23P

CORE PRACTICAL II

MOLECULAR AND MICROBIAL TECHNIQUES

Objectives:

To introduce students to various practical aspects of Molecular biology.

Practical:

1. Isolation of plasmid & Genomic DNA
2. Estimation of DNA by diphenylamine method
3. Estimation of RNA by orcinol method
4. Separation of DNA by Agarose Gel Electrophoresis
5. Separation of protein by SDS-PAGE
6. Purification of enzyme by ammonium sulphate precipitation Microbial Techniques
7. Staining technique - Gram's staining
8. Determination of bacterial growth curve
9. Media preparation and Culture techniques - pour plate, spread plate and streak plate method
10. Antibiotic Resistance
11. Biochemical Characterization of Bacteria - 1. Indole test 2. Methyl Red test 3. Triple Sugar Iron Agar test 4. Voges Proskauer test 5. Citrate Utilisation test 6. Catalase test 7. Urease test 8. Oxidase test 9. Nitrate test

Course Outcome

1.Learn the skill of how to Isolate DNA from samples.

2.Students learn to handle all the equipment regularly that is used in DNA, RNA estimation, including balances, pipettes, electrophoresis and centrifuges and thereby obtain basic laboratory skills.

3.Learn the preparation of media, determination of bacterial growth curve

4.Understand the biochemical characterization of bacteria.

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Department of Biochemistry

Year: I **Semester: II**

Subject Code: P16BC23P

CORE PRACTICAL II - MOLECULAR AND MICROBIAL TECHNIQUES

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

I M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BC23P: 1	3	2	1	2	3	3	2	-	-	3

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Department of Biochemistry

Year: I **Semester: II**

Subject Code: P16BCE1

ELECTIVE I

BIOSTATISTICS

Objectives:

1. The course emphasizes on various statistical methods and its significance.
2. The students are expected to understand the concepts and solve relevant problems pertaining to each topic.
3. To provide sufficient background to be able to interpret statistical results in research.

Unit I

Statistical survey – Organizing, planning and executing the survey. Source of data - Primary and secondary data, collection, observation, interview, enquiry forms, questionnaire schedule and checklist. Classification and tabulation of data. Diagrammatic and graphic presentation of data.

Unit II

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

Unit III

Probability - Definition, concepts, theorems (proof of the theorems not necessary) and calculations of probability - Simple problems. Theoretical distributions – Binomial, Poisson and normal distribution - Simple problems (proof of the theorems not necessary).

Unit IV

Sampling distribution and test of significance – Concepts of sampling, 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 and goodness of fit. Analysis of variance - one way and two way classification. Duncan's Multiple Range test. Design of experiment- Completely randomized block design, Randomized block design.

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Unit V

Scientific Methodology: Selection of research problems – hypothesis – definition and characteristics. Experimental approaches – biological, physical and chemical methods. Sources of information: Journals, e-journals, books, biological abstracts, Preparation of index cards, Review writing, Article writing – structure of article. Selection of journals for publication-Impact factor – Citation index and H index. Proposal writing for funding.IPR and Patenting – Concept and types.

Course Outcome

1. Describe various applications of biostatistics, sampling techniques, methods of collection of data and presentation of data.
2. Calculate and interpret measures of central tendency, Compute and interpret the result of correlation and regression analysis.
3. Calculate problems in probability and associated theorems.
4. Explain Sampling distribution and calculate the problems in tests of significance. Compare different population samples using ANOVA.
5. Apply the biostatistical concept in research. Understand the art of writing research articles and techniques of writing research proposals.

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Department of Biochemistry

Year: I **Semester: II**

Subject Code: P16BCE1

ELECTIVE I - BIOSTATISTICS

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

I M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BCE1: 1	3	3	3	3	3	-	-	3	3	3
P16BCE1: 2	3	3	3	3	3	-	-	3	3	3
P16BCE1: 3	3	3	3	3	3	-	-	3	3	3
P16BCE1:4	3	3	3	3	3	-	-	3	3	3
P16BCE1: 5	3	3	3	3	3	-	-	3	3	3
Average	3	3	3	3	3	-	-	3	3	3

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Department of Biochemistry

Year: I **Semester: II**

Subject Code: P16BCE2

ELECTIVE II

MICROBIOLOGY

Objectives:

To understand the metabolic reaction occurs in the microbial cells, it helps the student to gain basic information about microbiology

Unit I

Morphology and Ultrastructure: Ultra structure of bacteria, fungi, algae and protozoa. Classification of microbes, molecular taxonomy. Cell walls of eubacteria (peptidoglycan) and related molecules. Outer membrane of Gram– negative bacteria. Cell wall and cell membrane synthesis, flagella and motility, cell inclusions like endospores, gas vesicles. Purple and green bacteria, cyanobacteria, homoacetogenic bacteria, Acetic acid bacteria, Budding and appendaged bacteria, spirilla, spirochaetes, Gliding and sheathed bacteria, Pseudomonads, Lactic and propionic acid bacteria. Endospore forming rods and cocci, Mycobacteria, Rickettsia and Mycoplasma. Archaebacteria.

Unit II

Microbial growth and metabolism: 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. Photosynthesis in microbes.Role of chlorophylls, carotenoids and phycobilins, Calvin cycle. Chemolithotrophy; Hydrogen– iron– nitrite oxidising bacteria; nitrate and sulfate reduction; methanogenesis and acetogenesis, fermentations– diversity, syntrophy-role of anoxic decompositions. Nitrogen metabolism, nitrogen fixation, hydrocarbon transformation.

Unit III

Microbiological Techniques: Methods in microbiology. Current methods in microbial identification. Pure culture techniques. Theory and practice of sterilization. Principles of microbial nutrition, construction of culture media, Enrichment culture techniques for isolation of chemoautotrophs, chemoheterotrophs and photosynthetic microbes.

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Unit IV

Viruses: 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

Medical Microbiology: 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. Pathogenic fungi. Antimicrobial agents, Antibiotics. Penicillins and cephalosporins, Broad spectrum antibiotics. Antibiotics from Prokaryotes, Antifungal antibiotics– Mode of action, Resistance to antibiotics. Lantibiotics.

Course Outcome

1. Understand the morphology, ultrastructure, classification of bacteria, fungi, algae and protozoa.

2. Describe the microbial growth and metabolism.

3. Discuss the basic principle and working procedure of microbial techniques.

4. Outline the structure and classification of viruses and its mechanism.

5. Explain the transmission of diseases caused by microorganisms and study of broad spectrum antibiotics.

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Year: I **Semester: II**

Subject Code: P16BCE2

ELECTIVE II - MICROBIOLOGY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

I M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BCE2: 1	2	1	3	1	2	3	1	-	3	2
P16BCE2: 2	2	2	3	2	2	3	1	-	3	2
P16BCE2: 3	2	2	3	2	2	3	1	-	3	2
P16BCE2: 4	2	1	3	2	2	3	1	1	3	2
P16BCE2: 5	3	3	3	2	2	3	2	1	3	2
Average	2.2	1.8	3	1.8	2	3	1.2	0.4	3	2

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Department of Biochemistry

Year: II **Semester: IV**

Subject Code: P16BC41

CORE COURSE IX

ENDOCRINOLOGY

Objective:

1. Inculcate through understanding the mechanism of action of Hormones.
2. Clinical endocrinology plays a vital role in clinical Biochemistry and Metabolism.
3. This syllabus substantiate understanding other subject

Unit I

Hypothalamic and pituitary hormones: Hormones – classification,biosynthesis, circulation in blood, modification and degradation. Hormone receptors – structure and regulation. Mechanism of hormone action.Hypothalamic and pituitary hormones. Hypothalamic releasing factors.Anterior pituitary hormones: biological actions, regulation and disorders of growth hormones, ACTH, gonadotropins and prolactin. Leptin. Posterior pituitary hormones – biological actions and regulation of vasopressin.Diabetes insipidus and SIADH secretion. Oxytocin. Hypopituitarism.

Unit II

Thyroid and parathyroid hormones: Thyroid hormones – synthesis, secretion, regulation, transport, metabolic fate and biological actions.Antithyroid agents. Thyroid functions tests. Hyper and hypothyroidism.Hormonal regulation of calcium and phosphate metabolism. Secretion and biological actions of PTH, calcitonin and calcitriol. Hypercalcemia and hypocalcemia Rickets and osteomalacia.

Unit III

Adrenal hormones: Adrenal cortical hormones.Synthesis, regulation, transport, metabolism and biological effects. Adrenal function tests.Cushing's syndrome, aldosteronism, congenital adrenal hyperplasia, adrenal cortical insufficiency. Adrenal medullary hormones – synthesis, secretion,metabolism, regulation and biological effects of catecholamines. Pheochromocytoma.

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Unit IV

Gonadal, G.I. and pancreatic hormones: 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. The menstrual cycle. Pregnancy – diagnostic tests and biochemical changes. Foetal monitoring. Amenorrhea. Pancreatic hormones – synthesis, regulation, biological effects and mechanism of action of glucagon, somatostatin and insulin. Insulin receptor. Brief account of gastrointestinal hormones.

Unit V

Signal transduction: Fundamental concepts and definitions of signals, ligands and receptors, endocrine, paracrine and autocrine signaling. Receptors and signalling pathways – cell surface receptors, ion channels, Gprotein coupled receptors, receptor kinases (tyr, ser/thr).Signal transduction through cytoplasmic and nuclear receptors. The Ras-raf MAP kinase cascade, second messengers – cyclic nucleotides, lipids and calcium ions. Crosstalk in signalling pathways.

Course Outcome

The students will be able to.

1.Understanding the mechanism of action and regulation of pituitary hormones.

2. Discuss the role of thyroid and parathyroid hormones and its regulatory mechanism.

3. Study the synthesis, regulation and pathophysiology of adrenal hormones.

4. Describe the functions and deficiency symptoms of GI and pancreatic hormones and study of foetal monitoring.

5. Understand the fundamental concepts of signal transduction and mechanism of receptor signalling.

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Year: II **Semester: IV**

Subject Code: P16BC41

CORE COURSE IX - ENDOCRINOLOGY

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

II M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BC41: 1	3	2	3	2	1	3	2	1	2	2
P16BC41: 2	3	2	2	3	2	3	3	2	2	2
P16BC41: 3	3	3	3	3	3	3	3	3	3	3
P16BC41: 4	3	3	3	3	3	3	3	3	3	3
P16BC41: 5	3	2	1	2	2	3	2	3	2	-
Average	3	2.4	2.4	2.6	2.2	3	2.6	2.4	2.4	2

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Year: II **Semester: IV**

Subject Code: P16BC42

CORE COURSE X

BIOINFORMATICS

Objective:

1. The purpose of studying this paper is to apply computational facility in different fields of life sciences, physical and chemical sciences.
2. After completion, students could learn drug designing through computer based modification programs using synthetic or natural source.
3. Most important application of Bioinformatics is in the field of drug discovery where it reduces more than 60% of the time, money and labor.

Unit I

Bioinformatics – An overview, Definition & History; Bioinformatics databases & tools on the Internet- NCBI, EBI, PIR, Swiss-Prot, GenBank; pattern and motif searches- BLOCKS, PRINTS, PFAM

Unit II

Proteins – Amino acids — Levels of protein structure – Ramachandran Map. Protein Secondary structure prediction - Chou-Fasmann rules, Gamier-OsguthorpeRobson (GOR) methods; Predicting 3D structure – homology modeling, threading - fold recognition and ab initio methods - Rosetta – CASP.

Unit III

Biological Sequence analysis – Pairwise sequence comparison – Sequence queries against biological databases – BLAST and FASTA - Multiple sequence alignments – Phylogenetic alignment. Algorithms and Matrices: Scoring matrices- PAM and BLOSUM; dynamic programming Algorithms, Needleman and Wunsch, Smith-Waterman.

Unit IV

Protein structure visualization tools – RasMol, HEX, Argus Lab Swiss PDB Viewer - Structure –Classification, alignment and analysis – SCOP, CATH, FSSP, UNIX.

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Unit V

Functional Genomics (Metabolism and Regulation) in Biochemistry – Sequencing genomes– Genome databases on the web, Prokaryotic Genome Database with comparison with Human genome, HGP, GENECLUSTER, DNA Microarray, SWISS2DPAGE Database, TIGR,WIT, CYTOSCAPE and DRUG DISCOVERY.

Course outcome

The students will be able to:

1. Know the relationship between computer and life science. Study the history and scope of Bioinformatics.
2. Understand the organisation of protein structure and methods of prediction of 3D structure of proteins.
3. Describe the methods of sequence alignment, algorithms and scoring matrices.
4. Clear concept about protein visualisation tools.
5. Discuss the outline of functional genomics and prokaryotic and 2D databases

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Year: II **Semester: IV**

Subject Code: P16BC42

CORE COURSE X - BIOINFORMATICS

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

II M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BC42:1	3	3	3	3	3	-	-	3	3	3
P16BC42:2	3	2	3	3	3	3	3	2	3	3
P16BC42:3	3	3	3	3	3	3	1	3	1	2
P16BC42:4	3	3	3	3	2	2	2	3	3	3
P16BC42:5	3	3	2	2	2	2	2	3	2	2
Average	3	2.8	2.8	2.8	2.6	2	1.6	2.8	2.4	2.6

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Department of Biochemistry

Year: II **Semester: IV**

Subject Code: P16BC43P

CORE PRACTICAL IV

PHYTOCHEMISTRY, SOIL ANALYSIS AND IMMUNOLOGICAL TECHNIQUES

Objectives:

1. To learn the strategies of biochemical research.
2. To provide ample opportunity for the students to specialize in basic and advanced methods used in investigation focusing on biology applications.

Practical:

1. Qualitative and quantitative phytochemical analysis - alkaloids, flavanoids, steroids, tannins, Saponins
2. Antibacterial activity by disc diffusion method
3. In vitro antioxidant activity – any two methods
4. Estimation of soil mineral contents-pH, nitrate, nitrite, sulphate, phosphate, calcium, magnesium, chloride, fluoride, silica and ammonia

Immunology

1. Laboratory safety precautions and good laboratory practices
2. Haemagglutination titration
3. Widal test - rapid slide test for typhoid
4. VDRL test - test for syphilis
5. Latex agglutination test for rheumatoid factor and Pregnancy
6. Immunoelectrophoresis
7. Skin Prick Test.

Course Outcome

1. Identify and estimate the phytochemicals.
2. Determination of Antibacterial activity
3. Analysis of in vitro antioxidants .
4. Knowledge about the estimation of mineral contents present in soil.
5. Know the techniques of Immunology like WIDAL, VDRL, Immunoelectrophoresis and skin prick test.

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Year: II **Semester: IV**

Subject Code: P16BC43P

CORE PRACTICAL IV - PHYTOCHEMISTRY, SOIL ANALYSIS AND IMMUNOLOGICAL TECHNIQUES

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

II M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BC43P	3	3	3	3	3	3	1	2	3	3

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Year: II **Semester: IV**

Subject Code: P16BCE5

ELECTIVE COURSE V

ECOLOGY & ENVIRONMENTAL SCIENCES

Objectives:

To study the physical and biological characters of the environment and the interrelationship between biotic and abiotic components of nature as well as relationship among the individuals of the biotic components

Unit I

Environment – Physical environment: atmosphere (air), hydrosphere, lithosphere properties, interelationship with living organisms. Abiotic and biotic environment and their interactions. Species interactions; types, interspecific competition, herbivory, carnivory, pollination, symbiosis. Population ecology – Population characteristics, population growth curve, population regulation, life history strategies (r and K selection); concept of meta population demes and dispersal, interdemic extinctions, age structured populations.

Unit II

Community ecology: Nature of communities, community structure and attributes, levels of species diversity and its measurement, edges and ecotones. Concept of habitat and niche, types of niche, niche width and overlap, fundamental and realized niche, resource partitioning, character displacement.

Unit III

Ecological succession and Ecosystem Ecology: Ecological succession types, mechanisms, changes involved in succession, concept of climax. Ecosystem structure, function, energy flow and mineral cycling (C, N, P, S), primary production and decomposition, structure and function of terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine) ecosystem.

Unit IV

Pollution: Environmental pollution, global environmental change, biodiversity; status, monitoring and documentation, major drivers of biodiversity change, biodiversity management approaches.

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Unit V

Biogeography and Conservation Biology ; Major terrestrial biomes, theory of island biogeography, biogeographically zones of India. Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

Course outcome

The students will be able to:

1.Study the physical and Biological characters of environment and relationship between biotic and abiotic components.

2.Understand the nature of communities, community structure and types of species diversity.

3.Discuss the concept of Ecological Succession, energy flow and mineral cycling.

4. Describe environmental pollution, changes in biodiversity and its management approaches.

5. Know about biogeography and conservation biology. Study of Biogeographic zones across India and its management.

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Year: II **Semester: IV**

Subject Code: P16BCE5

ELECTIVE COURSE V - ECOLOGY & ENVIRONMENTAL SCIENCES

MAPPING

CO - PO – PSO matrices of course

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

II M.Sc Biochemistry

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
P16BCE5: 1	3	-	3	2	2	1	3	3	1	3
P16BCE5: 2	3	-	3	2	3	1	3	3	2	3
P16BCE5: 3	3	1	3	2	2	1	3	3	2	3
P16BCE5: 4	3	1	3	3	3	2	3	3	2	3
P16BCE5: 5	3	-	3	3	3	2	3	3	2	3
Average	3	0.4	3	2.4	2.6	1.4	3	3	1.8	3

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