Mother Theresa Women's University

Kodaikanal

M.Sc Biochemistry

Course Structure (CBCS)

Papers offered in each semester/Scheme of Examinations.

P. No.	Paper Code	Course Title	Hours	Credits	Continuous Internal Assessment (CIS)	End Semester Exam (ESE)	Total
	Semester I						
1.	PBCT11	Core I (Theory) Chemistry of Biopolymers	6	5	25	75	100
2.	PBCT12	Core II (Theory) Enzyme and Enzyme Technology	6	5	25	75	100
3.	PBCT13	Core III (Theory) - Cellular Biochemistry	6	5	25	75	100
4.	PBCP11	Core IV- Lab in Biochemical techniques and Biochemical analysis	8	5	25	75	100
5	PBCE11	Elective-I (Theory) Biophysical Methodology/ Elective-II (Theory) Bioprocess technology	4	5	25	75	100
		Total	**30**	**25**			**500**
	Semester II						
6.	PBCT24	Core V (Theory) - Endocrinology & Metabolic regulation	6	5	25	75	100
7.	PBCT25	Core VI (Theory) Clinical Biochemistry	6	5	25	75	100
8.	PBCT26	Core VII (Theory) - Immunobiology	6	5	25	75	100
9.	PBCP22	Core VIII - Lab in Immunobiology	8	5	25	75	100

		& Clinical Biochemistry					
10.	PBCE22	Elective-III (Theory) - Biostatistics/ Elective-IV(Theory) - Research methodology	4	5	25	75	100
		Total	**30**	**25**			**500**

	Semester III						
11.	PBCT37	Core IX (Theory) Microbiology & its applications	6	5	25	75	100
12.	PBCT38	Core X (Theory) Molecular biology	6	5	25	75	100
13.	PBCT39	Core XI (Theory) Plant Biochemistry	6	5	25	75	100
14.	PBCP33	Core XII- Lab in Microbiology and Molecular biology	8	5	25	75	100
15.	PBCE33	Elective-V (Theory) - Basic Bioinformatics/ Elective-VI (Theory) Bioethics, Biosafety and IPR	4	5	25	75	100
		Total	**30**	**25**			**500**
	Semester IV						
16.	PBCT410	Core XIII (Theory) Biotechnology	6	5	25	75	100
17.	PBCT411	Core XIV (Theory) Environmental Toxicology	6	5	25	75	100
18.	PBCP44	Dissertation/Project	16	5	25	75	100
		Library	2				
		Total	**30**	**15**			**300**
Grand Total				**90**			**1800**

SEMESTER I

CORE I (THEORY) - CHEMISTRY OF BIOPOLYMERS

PBCT11 **5 hrs/5 credits**

Objectives:

- To gain the knowledge about the chemical structure of biopolymers, and their classification
- To learn the techniques for isolation and purification of polysaccharides and can understand its biological function.
- To study the primary, secondary, tertiary protein structure, metalloprotein, nucleic acid and their functions.
- Students can learn the basic concept, structure and function of biopolymer.

UNIT I

Introduction to Biopolymer chemistry

Chemistry of monomeric units, polysaccharides, proteins and nucleic acids (structure and function only). Determination of molecular weight and shape of polysaccharides, proteins and nucleic acids, protein – nucleic acid interaction and protein – other biological polymers interaction.

UNIT II

Polysaccharides

Basic structure determination, methylation, acetylation, degradation of acid hydrolysis, enzymatic hydrolysis and oxidation methods.

Homoglycans:

Occurrence, structure, isolation, purification, properties and biological functions of glycans. A brief account of chitin, fructans, mannans, xylans, arabinans, galactons and galacturonans.

Heteroglycans and complex carbohydrates:

Occurrence, structure, isolation, purification, properties and biological functions of mucopolysaccharides. A brief account of polysaccharides with a xylose backbone polysaccharides with glucose and mannose backbone, chemical synthesis of polysaccharides (glycan).

UNIT III

Proteins I

Terminology-peptide bond, peptide, polypeptide and protein. Functions of protein. Structures-levels of structure of protein (primary structure, Determination, secondary, tertiary, and quaternary) conformation of proteins structure their analysis and forces. Molecular modeling.

Properties of proteins in aqueous solutions. Isoelectric pH, acid base properties, electrophoretic mobility, influence of ionic concentration on the protein solubility hydrolysis of proteins, denaturation and renaturation of proteins.

UNIT IV

Proteins II

Metalloprotein – A case study metal and protein components of metalloprotein. A hierarchy of behavior from metal in metalloprotein. Conformationals study on the structure of keratin, collagen and hemoglobin.

UNIT V

Nucleic Acids

Nucleic acid - structure of nucleic acid, structural transition, kinetics of nucleic acid interaction. Chemical and enzymatic methods of sequence analysis, properties of DNA in aqueous solution. Sedimentation behavior, viscosity, hyper chromic effect, melting point of DNA and hydrolysis of nucleic acids. Hybridization techniques and chemical synthesis of nucleic acid.

REFERENCE

1. Introduction to protein and protein engineering Barry Robson & Hean Garrier, Elsevier science publishers, Amsterdam, 1986.
2. Biochemistry- stryer 14th edition, freeman 2012.
3. Complex Carbohydrates – Nathan Sharon, 1974
4. Polymers in nature – E.A.Macgregor and C.T.Greenwood 1980
5. Biochemistry – David Rawn, 1994

CORE II (THEORY) - ENZYMES AND ENZYME TECHNOLOGY

PBCT12 **5 hrs/5 credit**

Objectives

- To learn the classification and properties of enzymes and its application in various field.
- To study the enzyme kinetics and mechanisms of enzyme action.
- To learn the enzyme activity and immobilization methods and the application of immobilized enzymes
- Student can able to understand the nomenclature of enzyme, enzyme action, role of enzymes in biosensor, and their advantages.

UNIT I

Enzyme structure: X-ray diffraction & enzyme structure. Chemical modification by active site directed reagents – Modifications of serine protease active site. Affinity labeling, other probes for enzyme structure. Site directed mutagenesis.

Cofactor as carriers (Biotin): Redox carriers (NAD/NADP, flavo protein, lipoate, glutathione, ascorbic acid, quinines, cytochromes). Carriers of one carbon group: Tetra hydrofolate homocysteine, Aldehyde carrier, Adenosine triphosphate, Glycosyl carriers (UDP)

UNIT II

Enzyme kinetics – General kinetic principles: Steady – state enzyme kinetics, MM equation and linear transformation of MM equation – reversible reactions – fast reactions and methods of study-rate equation by King and Altmann Enzyme inhibition. Reactions of two substrates – isotope exchange.

UNIT III

Enzyme Regulation: Allosteric and covalent modification co-operative effective: concentrated model of Monod *et.al.*, and sequential model of Koshland *et.al*., principles of metabolic regulation: Feedback regulation of multifunctional pathway, NAD/NADH ratio, adenylate charge.

Lysozymes: A case study – structure, enzymatic activity mechanism of lysozyme action, the ionization states of side chains and denaturation of enzyme.

Mechanisms of Enzyme action: Acid – base catalysis, covalent catalysis chymotrypsin. Metal in enzyme catalysis pyruvate kinase, superoxide dismutase, creatine kinase, carboxy peptidase. Multienzyme complex.

UNIT IV

Immobilized enzyme: Techniques of Immobilization; effect of Immobilization on enzyme activity; applications of Immobilized enzymes with examples. Uses of enzymes in solution. Commercial production of enzymes amylases, pectinases, cellulases and catalases.

UNIT V

Enzyme Technology: Enzyme electrodes, Enzymes as biosensor: calorimetric biosensor, Potentiometric biosensor , optical and immunosensor. Recent advances & future prospects; Enzyme engineering and Artificial enzymes .

REFERENCES

1. Hand book of Enzymes Technology- Alan Wisemaan, 2nd Edition.
2. Enzyme Technology – Chapline & Bucke, Cambridge university press
3. The Enzymes – Boyer, 2012 Academic press 3rd edition.
4. Molecular Enzymology – Wharion
5. Enzyme Kinetics – Bowden & Wharton 2008, Portland press ltd.
6. The chemical kinetic of Enzymes action – Keith james, Laider Publishers, clarendon press.
7. Fundamentals of Enzymology – Nicholas c, Price 2000.

CORE III (THEORY) - CELLULAR BIOCHEMISTRY

PBCT13 **5 hrs/5 credits**

Objectives:

- To know the structure and function of membrane
- To study the structure and functions of cell organelles and cell division
- To understand the cell communication and cancer cells
- Student can gain the knowledge about cell organelle, cell division, cell communication and mutational changes in gene function.

UNIT I

Membrane structure and function:

Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracelllular transport, electrical properties of membrane.

UNIT II

Structural organization and function of intracellular organelles:

Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic recticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.

UNIT III

Cell Communication:

Host parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alternation of host cell behavior by pathogens, Virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.

Cell Communication: Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junction, extracellular matrix, integrins, neurotransmission and its regulation.

UNIT IV

Cell division and cell cycle:

Mitosis and Meosis, their regulation, steps in cell cycle, and control of cell cycle.

UNIT V

Cancer: Oncogens, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis,

REFERENCES

1. Biochemistry of lipids and membrane: Vance & Vance.
2. Molecular biology of the cell – Alberts, Bray, Lawims, Raff, 5th edition – 2007.
3. Molecular cell biology – J.Avers, Addison wesely in 1985.
4. Molecular biology of the gene – Waston Et AL (4th Edition)
5. Cellular & Molecular biology – Baltimore, Dainell & Lodish, 17th edition.
6. Molecular biochemistry- C.A. Smith
7. Molecular biology- Garland
8. Cell and molecular biology- Gerald karp – 5th edition.

CORE IV - LAB IN BIOCHEMICAL TECHNIQUES AND BIOCHEMICAL ANALYSIS

PBCP11 **5 hrs/5 credits**

Objectives:

- To know the methods for biochemical test and enzyme activity assay
- To know the chromatography techniques and develop the laboratory skills.
- Student can get the training to analyse the enzyme properties

1. Enzyme kinetics of urease and amylase.

1. Preparation of crude enzyme extract

   a) Effect of pH

   b) Temperature

   c) Substrate concentration

   d) Enzyme concentration

   e) Determination of km.

2. Assay of serum enzyme activity

a) Alkaline phosphatase

b) Acid phosphatase

c) Aspartate transaminase

d) Lactate dehydrogenase

e) Amylase

3. Lipid analysis

a) Determination of Saponification number

b) Determination of Acid number

c) Determination of Iodine number

d) Determination of RM number

4. Separation of lipids by TLC

5. Separation of Amino acids by Paper chromatography.

REFERENCE

1. An introduction to Practical Biochemistry, David t. Plummer, 1988 Tata Mc Graw- hill education
2. Laboratory manual in Biochemistry, Pattabiraman, All India Publishers and Distribution.

3. Pratical Biochemistry, J.Jayaraman, Narain series, New age
4. Methods in Enzymology, Dixon & web, 3rd edition CRC press
5. Biochemical methods – S.Sadasivam, A.Manickam , 3rd edition , New age international.
6. Practical Biochemistry- 4th edition, Jaypee by VK Malhotra.
7. Practical Biochemistry- 5th edition, RC Gupta.

ELECTIVE 1 (THEORY) - BIOPHYSICAL METHODOLOGY

PBCE11 **5hrs/5credit**

Objectives

- To study the properties of electromagnetic radiation
- To learn the principle and applications of UV, NMR, ESR spectroscopy.
- To know about radioactive isotopes and its biological application.
- Students can understand the instrumentation, principle, types and uses of spectroscopy, microscopy, radioisotopes techniques and centrifugation.

UNIT I

Spectroscopy; fundamentals, principles of spectroscopy – introduction, regions of electromagnetic radiation, properties of electro magnetic radiations. Molecular and atomic spectra, types and molecular spectra. Absorption spectroscopy – principle, instrumentation and applications of atomic absorption, UV visible spectroscopy, Infrared spectroscopy, Nuclear Magnetic Resonance Spectroscopy, Electron Spin resonance.

UNIT II

Emission spectroscopy – introduction, principle, method and application of Flame photometry. Fluorimetry – principle, instrumentation and application. Mass spectroscopy – principle, instrumentation and application. Light scattering Raman Spectroscopy; principles, method, application with reference to biological macromolecules such as proteins and nucleic acids.

Unit III

Electron microscopy – principle, instrumentation and application of SEM and TEM. Electron diffraction – principle and application.

UNIT IV

X – rays – Introduction, production and properties of X rays. X ray diffraction detection and application. Radioisotopes techniques – nature of radioactivity, measurement of radioactivity, applications of radioactive and stable isotopes in biological research. Autoradigraphy.

UNIT V

Centrifugation techniques – principles and types and applications. Ultracentrifugation – types, optical methods used and applications of preparative and analytical ultracentrifuges.

REFERENCE

1. Biophysical chemistry, Part I and II, Cantor and Schimmel PR., 1980. W. H. Freeman and Co.
2. Biological Spectroscopy, Campbell I.D and Dewk. 1981. Benkjamin/Cumings Publishing Co.
3. Crystallography made crystals clear, Rhudes G. 1993. Academic Press.
4. Crystallography and Modeling methods in Molecular design Bugg C.E. Steven. 1990. Springer Verlag.
5. Instrumental methods of chemical analysis, Sharma B.K, Goel Publishing House, Meerut, 1976.
6. Experimental methods in Biophysical chemistry, Nicolau C., John Wiley, 1972

ELECTIVE II (THEORY) - BIOPROCESS TECHNOLOGY

PBCE11 **5hrs/5 credits**

Objectives

- To acquire the knowledge about bioreactors used for fermentation process and the recovery of end products.
- To know the production of valuable chemicals such as alcohol, antibiotics and protein from microbial fermentation.
- To study the food preservation methods and application of enzymes in biosensor by using enzymes
- The students can obtain the knowledge about the production and recovery of useful commercial product

UNIT I

Milestones of fermentation technology. Identification of industrially important microorganism, primary and secondary screening, strain development, product assays.

UNIT II

Designing and types of fermentor – liquid, solid state and immobilized, Media and ingredients for industrial fermentation, industrial sterilization of fermentor media and air. Types of heat exchangers, immobilization techniques, Bioreactor for cell cultures.

UNIT III

Instrumentation for monitoring bioreactor and fermentation process – PH, temperature pressure dissolved O2, air flow rate, shaft speed, foaming, viscosity and controlling.

UNIT IV

Downstream processing – recovery and purification of fermentation products – filtration, centrifugation, cell disdistruption, liquid- liquid extraction, Solvent extraction, precipitation, chromatography, ultrafiltration, drying, crystallization, lyophilization.

UNIT V

Industrial production of Antibiotics – pencilin, enzymes – protease, organic acids-citric acid, vitamins – b12, amino acids-glucamic acid, Ethanol, Beer, wine, Diary and food products.

<u>REFERENCES</u>

1. Stanbury, RF and Whitaker A., Principles of Fermentation Technology, Pergamon press, Oxford, 1997.

2. Shuler ML and Kargi F., Bioprocess Engineering: Basic concepts, Prentice Hall, Engelwood Cliffs, 2002.

3. Kalaichelvan and Arulpandi, Bioprocess Technology. MJP. Publishers 2008.

4. Doran. Bioprocess Engineering Principle. Elsevier. 2007.

5. Biotechnology: The Biological Principles (1990) Edited by M D Trevan, S Boffey, K H Goulding, and P Stanbury, Tata McGraw-Hill Publishing company Ltd, New Delhi, India.

SEMESTER - II

CORE V (THEORY) - ENDOCRINOLOGY AND METABOLIC REGULATION

PBCT24 **5 hrs/5credit**

Objectives

- To study the hormone classification and biosynthesis
- To learn the synthesis and biological functions of pituitary hormones, growth hormones and thyroid hormones.
- To study about function of pancreas, adrenal hormones, mechanism and role of pathophysiology.
- Student can acquire the knowledge about hormone secretion, function and metabolic regulations

UNIT I

Hormones- Definition classification biosynthesis & degradation. Mechanism of hormone action,. Feedback regulation of hormones. .second messengers

UNIT II

Pituitary hormones - Anatomy of pituitary gland, hormones of the pituitary, pathophysiology. Mechanism of action, Neurohypophysis neurohypophyseal hormone secretion. Hypothalamic releasing factors ,mechanism of action of oxytocin, vasopressin, Pathophysiology.

Growth hormones: somatotropins and somatomedins, biosynthesis, secretion, transport regulation and biological effect of growth hormone FSH LH TSH ACTH and prolactin acromegaly dwarfism

UNIT III

Thyroid - Synthesis and chemistry of hormones, control of thyroid hormone secretion, Circulation and metabolism, physiological roles, mechanism of action. Pathophysiology.

Parathyroid gland: synthesis, chemistry and metabolism of parathyroid gland hormones, control of secretion. Physiological role and vitamin D. Mechanism of action of calcium homeostasis, pathophysiology. Hypo hyper thyroidism antithyroid agents' role of parathyroid hormones calcition, calcitriol .calcium and phosphorous homeostasis. Hypo and hyperparathyroidism

UNIT IV

Pancreas:- Endocrine pancreas, islet of langerhans cell type's biosynthesis mechanism of action and biological effect of insulin, glucagons, somatostatin. Pancreatic peptide – chemistry, physiological roles and mechanim of action. Catecholamines - synthesis, chemistry and metabolism. Neurohormones:- endorphins-source, chemistry, control of secretion, physiologicalroles. Mechanism of action and pathophysiology.

UNIT V

Adrenal hormones biosynthesis secretion transport mechanism of action and excretion of glucocorticoids and mineralocorticoides, adrenal medullary hormones epinephrine and nor epinephrine steroid hormones. Androgens and estrogens source, synthesis, chemistry and metabolism of androgens, Physiological roles and mechanism of action. Pathophysiology. Ovarian steroid hormone synthesis, physiological role.

REFERENCES

1. Regulation in metabolism – Newsholme
2. Principles of Biochemistry – Whith Handlers, smith
3. Human Biochemistry – Frisell
4. Harrison's Endocrinology – 3rd edition by J.Larry Jameson, Mc Graw Hill.
5. Endocrinology and Metabolism- 4th edition, Philp Felig, Lawerence.

CORE VI (THEORY) - CLINICAL BIOCHEMISTRY

PBCT25 **5hrs/5credit**

Objectives

- To study the disorders caused due to the error in carbohydrate metabolism and regulation of blood glucose level.

- To know the disorders caused due to the defects in lipid, protein and nucleic acid metabolism.
- To train the clinical test such as tissue function tests, biochemical tests and renal disorders.
- Student can understand the clinical significance of diagnostic biochemistry.

UNIT I

Disorders of CHO metabolism:- Regulation of blood glucose level, Normal sugar level in blood, renal threshold, Hypoglycemia, Hyperglycemia, Diabetes Mellitus types and clinical pathology. Urine testing, random blood sugar, Acute and chronic complications of Diabetes mellitus

Glycosuria- Differential diagnosis of glycosuria, Fructosuria, Pentosouria, Galactosemia and Glycogen storage diseases clinical features, Diagnostic tests, glycogen storage disease.

UNIT II

Disorders of lipids metabolism - Plasma lipids and lipoproteins,

Hyperlipoproteinemia-Types, alpha lipoproteinemia

Hypolipoproteinemia- A beta lipoproteinemia, Hypo beta lipoproteinemia.

Tangier`s disease and LCAT deficiency. Atheroscelerosis, Fatty liver and hyper

Lipidemia, - hypo & hyper lipo proteinemias, hyper & hypocholesterolemia, Lipidosis and Xanthomatosis, Tay-Sach`s disease, Niemann-Pick disease

UNIT III

Disorders of proteins and amino acid metabolism – Total plasma protein, fibrinogen, albumin, Pre-albumin, and globulins. Cysteinuria , phenyl ketonuria, maple syrup urine disease, hartnup disease, multiple myloma bence jones proteins.

Disorders of Purine and pyrimidine metabolism

Disorders of Purine metabolism: Normal level of uric acid in blood and urine, hyper uricemia and Gout; Hypouricemia – Xanthinuria and Liathiasis.

Disorders of pyrimidine metabolism: Orotic acid urea.

UNIT IV

Liver and kidney function test, jaundice types- clinical features , diagonostic tests vanderberg fouchet test hay's test sulphur test renal clearence test such as urea glucose creatinine test and urea clearance test, Renal blood flow and filtration fraction.

Inulin pancreatic function tests, serum amylase and lipase.

UNIT V

Principle, assay, and clinical significance Alkaline phosphate, acid phosphatase, choline esterase, amylase, lipase, LDH, CPK, aspartate transaminase & alanine transaminase.

REFERENCE

1. Text Book Of Medical Biochemistry – M.N Chaterjee, 8th edition Jaypee.
2. Biochemistry With Clinical Correlation – Devlin 6th edition.
3. Clinical Biochemistry – William Hoffman
4. Harper's Biochemistry, 25th edition, Mac Millan, Mc Graw Hill , Robert k. Murray.
5. Clinical Biochemistry – Teity And Co
6. Introduction to clinical Biochemistry- Dr(Mrs) S.P.Dandekar (career) Publication.
7. Basic
8. Medical Biochemistry- Clippincott Williams and wilins- colleen smith.
9. Medical Biochemistry- Elsevier, Sucheta P.Dandekar.
10. Clinical Biochemistry- Nanda Maheswari, Jaypee.

SEMESTER III

CORE VII (THOERY)- IMMUNOBIOLOGY

PBCT26 **5hrs/credit**

Ojectives

- To get the knowledge about basic immune cells and organs of the immune system and function.
- To learn about the structure and function of immunoglobulin and immunogenicity.
- To gain the knowledge regarding the transplantation, auto immunity disorders ,vaccination and immunotechniques

- Student can able to understand the principles of immune stystem for the preparation of new vaccine

UNIT I

Science of Immunology : Historical development types of immunity.

Immunity to infectio*n* : Immunological and non immunological surface protective mechanisms, antibacterial resistance antiviral resistance,/ infection, antibacterial Antigens, self antigens, MHC, Foreign antigen Essential features of antigenicity – Factors that govern immune response, cross reactivity, Haptens, tumor antigens. Viral antigens, bacterial antigens. Cells that trap foreign material myeloid system mononuclear phagocytic system. Inflammation : Acute and Chronic inflammation.

UNIT II

Antibodies: Properties of antibody structure of IgG, isotopes, allotype,idiotype, classes, subclasses, Igs as antigens, Monoclonal antibodies (Hybridomas).

Ag – Ab Complex : Chemical basis of Ag – Ab bonding, affinity, valence, kinetics of Ag – Ab reactions. Theories of antibody formation; generation of antibody diversity; genetics. Complement system, components, classical and alternate pathway antigen recognition: T & B cell receptor interaction of T 7 B cells. Immunological memory. Immune tolerance self antigen. Theories of antibody formation lymphokines and cytokines.

UNIT III

Lymphocytes *:* T and B cells, Lymphocyte, mitogens. Response of B cells to antigens. Interaction between T and B cells. Macrophage co-operation, interleukins and other Factors. Triggering of B cells, plasma cells, Memory cell. Response of T cells to antigens-Antigens that provide T cell response lymphokines, interleukins, cytotoxicity.

UNIT IV

Vaccination – Passive and active immunization schedule, antibacterial, antitoxic and viral vaccines.

Serology: Precipitation, agglutination, immuno-electrophoresis, fluorescent antibody techniques,

RIA and ELISA. complement fixation tests, precipitiation , immunodiffusion, immunoelectrophoresis, agglutination tests, haemagglution latex agglutination (widal, VDRL). Allergy and hypersensitivity : Type I, II, III and IV hypersensitivity Unusual and adverse responses to drugs. Drug idiosyncrasy, drug intolerance.

UNIT V

Transplantation – Graft rejection, transplantation antigens, HLA mechanism of graft rejection, prevention of graft rejection, immune suppressive agents immunosurveillance. Acute intolerance. Autoimmunity : Mechanism of break down : Rheumatoid arthritis; myasthenia gravis, immunity and aging, disorders of immunoglobin synthesis.

REFERENCES

1. Immunology – An Introduction – Tizard, 4th edition.
2. Essential immunology – ROITT, 6th edition.
3. Stress, Immunity of aging – L Cooper.Marcel Dekkar Immunology – Roitt *et al*.

CORE VIII - LAB IN IMMUNOLOGY AND CLINICAL BIOCHEMISTRY

PBCP22 **5 hrs/5 credits**

Objectives:

- To learn the blood grouping and method to estimate hemoglobin level in blood.
- To acquire the practical knowledge for the estimation of blood sugar and uric acid level estimation
- To train the students to know the diagnostic methods in laboratory level.
- Students will be able to assess the laboratory test to find physiological conditions and diseases

1. Identifying blood group and Rh typing
2. Immunodiffusion – single radial, double diffusion and outerchlony
3. Immunoelectrophoresis
4. Rocket immunoelectrophoresis
5. Agglutination, Precipitation

Clinical Biochemistry

Blood analysis

1. Blood sugar – Asatoor and king's method
2. Blood urea - Dam method
3. Blood cholesterol – Zak's method
4. Blood uric acid – Caraway method
5. Creatitine – Picric acid method
6. Estimation of protein by biuret method
7. Calcium and phosphorous

Urine analysis

1. Urine urea
2. Uric acid
3. Quantitative test for urine sugar

Reference

1. T.N. Pattabiraman – Laboratory Manual In Biochemistry 3rd Edition
2. P.J Jayaraman – Laboratory Manual In Biochemistry New Age International
3. Pratical Clinical Biochemistry – Harold Varley 4th Edition

ELECTIVE II (THEORY)

Option 1: BIOSTATISTICS

PBCE22 **5hrs/5credit**

Objectives

- To understand the common statistical techniques and terminology used in this study and can applied for reaerch purpose.
- To know the concepts and solve relevant problems pertaining to each topic
- To learn numeric and graphical techniques to display and summarize medical and health related data
- Students can get knowledge to present the biological data accurately and effectively.

UNIT I

Statistics –Definition – kinds of biological data. Collection and organization of data. Representation of data. Sampling and Sampling Design. Tabulation, Diagrammatic and graphical representation.

UNIT II

Measures of Central Tendency – Mean, Median, Mode. Measures of Dispersion – Range, Mean Deviation, Standard Deviation and Variance – Problems and explanation. Probability – Distribution – Binomial, Poison and normal.

UNIT III

Measures of symmetry – Explanation and definition, Explanation of Skewness; Kurtosis of different types, Tests of Skewness, Measures of Skewness and Kurtosis. (problems not necessary).

UNIT IV

Correlation and regression – Explanation – Types of correlation – Positive and negative correlation – Simple partial and multiple correlation –Linear and non-linear correlation – Methods of studying Correlation using Karl Pearsons Coefficient of correlation (Simple problems related to correlation and regression).

UNIT V

Tests of statistical significance – Analysis of Variance – Chi square test – Student T test – Goodness of Fit.

REFERENCE

1. Gupta SP. 1997. Statistical Methods.
2. Bhaskar Rai T. 2001. Methods of Biostatistics.
3. Bliss C.I.K. 1967. Statistics in Biology. Vol I. McGraw Hill, New York.
4. Campbell R.C. 1974. Statistics for Biologists, Cambridge University Press.

ELECTIVE-II (THEORY) - RESEARCH METHODOLOGY

PBCE22 **5hrs/5credit**

Objectives

- To enable the students to learn the use of computer software for efficient data collection and representation of data.
- The students can enhance their computer knowledge for efficient research and to know the software for species identification and evolutionary studies.
- To know the scientific documentation methods, reference style and research paper publications and to learn the way to explore the research outcome for the use of society and patenting.
- The students can able to understand the overview of research and to evaluate the scientific problems and validate the research data.

Unit I

Research-Definition, Importance and Meaning of research, Characteristics of research, Types of Research, Steps in research- Identification, Selection and formulation of research problem, Research questions, Research design, Formulation of Hypothesis, Review of Literature. Sampling techniques: Sampling theory, types of sampling, Steps in sampling- Sampling and Non-sampling error -Sample size- Advantages and limitations of sampling. Collection of Data: Primary Data- Meaning- Data Collection methods -Secondary data - Meaning -Relevance, limitations and cautions. Research Report: Types of reports - contents - styles of reporting - Steps in drafting reports- Editing the final draft evaluating the final draft.

UNIT-II

Biostatistics: Definition, Principles of experimental design, collection, assembly, analysis and interpretation of experimental data. Data presentation - Tabular, graphical and diagrammatic representation of data. Measures of Central Tendency, standard deviation, standard error, analysis of variance, regression, coefficient of variation. Levels of significance, Chisquare test, students test (t), ANOVA.

UNIT III

Techniques separation techniques: Chromatography: adsorption, partition, paper,thin layer, paper, cellulose derivatives affinity. Electrophoresis: Moving boundary, zone, starch gel, paper, cellulose derivatives Isotachophoresis, Isoelectro focusing, high voltage electrophoresis. PAGE: Preparation of native & denaturing polyacrylamide gels and separation of proteins. Preparation of PAGE gels for DNA sequencing. Preparation of DNA fragments. Maxam and Gilbert and Sangers DNA sequencing methods. Generation of DNA sequence.

UNIT IV

Biological Databases and Data Retrieval: Nucleotide (Genbank- EMBL- DDBJ)- Sequence submission Methods and tools (Sequin, Sakura, Bankit)- Sequence retrieval. Biological Databases and Data Retrieval: Nucleotide (Genbank- EMBL- DDBJ) - Sequence submission Methods and tools (Sequin, Sakura, Bankit). Protein (Swiss-prot, PIR, Expasy)- Structural Databanks (PDB and NDB)- Protein structure classification(SCOP, CATH and ESSP)- Metabolic pathway db(KEGG)- Specialised -db(imgt, Rebase, COG).

UNIT V

Molecular sequence alignment- Global Alignment-Local alignment- Visual alignment- Dynamic Programming- Heuristic approach- scoring matrices and affine gap costs- Database search methods-Multiple Sequence Alignment methods. Gene prediction and phylogentic analysis: gene structure in prokaryotes and eukaryotes- Gene prediction methods- construction of phylogenetic trees- Distance methods- Maximum parsimony method- Maximum likelihood method. Molecular modelling and drug designing: introduction to protein structure prediction- rational drug discovery- recent advances in drug design methodologies- structure based drug design- Drug receptor N interactions- structure- activity relationships.

REFERENCES

1.Microbiology (2005), Sixth edition by L.M. Prescott, J.P. Harley and D.A. Klein, McGraw Hill, Boston.

2. Keith Wilson& John Walker (2003). Bioinstrumentation. John Wiley &sons, Ltd

3.Khan and Khan- Fundamentals of Biostatistics (1999). Bsp Books Pvt. Ltd.

5.S.P.Guptha-Statistical Methods (1969). Published by Sultan Chand & Sons.

6.Arora PN &Malhon PK, (1996) Biostatistics. Imalaya Publishing House, Mumbai.

7. C.R.Kothari (2004) Research Methodology. New Age International(P) Limited Publishers.

8. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. 3rd Edition. Andreas D. Baxevanis , B. F. Francis Ouellette . Wiley, John & Sons.2004.

9. Bioionformastics 2001. D. Mount. Cold Spring. Harbor Press.

SEMESTER III

CORE VII (THOERY) - MICROBIOLOGY & ITS APPLICATIONS

PBCT37 **5hrs/5credit**

Objectives

- To understand the basics of microbiology, classification and general characteristics of microbes.
- To study the structural organization ,growth,reproduction and morphological features of microorganisms.
- The students get knowledge about spoilage and food poisoning by microorganisms, food borne diseases and production of various commercial products
- Student can acquire the skill to isolate and identify the microbes from any sample and can effectively use the microbes for the society needs

UNIT I

Historical Milestones in Microbiology – Scope of Microbiology – Contributions of Leeuwenhoek, john Needham, Spallanzani, Tyndall, Lister, Jenner, Pasteur and Robert Koch. Binomial Nomenclature – Species concept – Kingdom, division, class, order, family and genus. Phototrophs, Heterotrophs, Lithotrophs, Chemotrphs and organotrophs. Prinicples of classification – morphological, physiological and biochemical basis of classification – chemataxonomy & numerical taxonomy.

UNIT II

Economic importance of agricultural microbes – biofertilizers – preparation and application – Biological nitrogen fixation – mechanism of nitrogen fixation genes – regulation. Types of waste – characterization of solid and waste – Eutrophication – waste treatment and useful by products – solid waste gasification, composting – liquid waste – aerobic and anaerobic treatment methods – potability of water.

UNIT III

Bacteriology – Morphology, pathogenesis and laboratory diagnosis of *Staphylococcus, E.coli, Mycobaterium, Vibrio cholerae.* Antimicrobial chemotherapy – development of chemotherapy – general characteristics of antimicrobial activity – mechanism of action of antimicrobial drugs – sulfonamides and sulfa drugs – penicillin – cephalosporin – tetracycline – factors influencing the effectiveness of antimicrobial drugs.

UNIT IV

Preparation of food products – yogurt, cheese, pickles, bread, vinegar – spoilage and general preservation methods.

UNIT V

Ethanol fermentation - by yeast and Zymomonas. Aerobic fermentation – penicillin production – Anaerobic fermentation – Wine, Beer, Industrial alcohol and lactic acid. Surface and solid state fermentation – Citric acid and amylase production. Down stream process.

REFERENCE

1. Presscott, Harley and Klein's. 2008. Microbiology, Mc Graw Hill.
2. Pelczar M.J., Chan E.C.S., Kreig N.R. Microbiology, Mc Graw Hill.
3. Stainer R. Y., Ingharam J.L., Wheelis M.L., Painter P.R (1999). General Microbiology, Macmillan Education Ltd. London
4. Brock T.D Madigan M.T. Biology of Microorganisms, Pentice Hall Inc.

CORE VIII (THEORY) - MOLECULAR BIOLOGY

PBCT38 **5hrs/5credit**

Objectives

- To study about the genetic material, mutation and genetic codon.
- To understand the bacterial genetic exchange, genetic maps, linkage and types of DNA replication in prokaryote and eukaryote.
- The students can understand the regulation of gene expression and mutation**.**
- Student can get the thorough knowledge which is essential for recombinant DNA technology.

UNIT I

Structure of chromatin, Histone and Non Histone proteins, nucleosomes. Structure of DNA, evidence for DNA as genetic material, Experimental proof. Bacterial transformation, conjugation and transduction.

DNA replication in prokaryotes, modes, steps and enzymes involved in DNA replication. Indicators of replications, Enzymology of DNA replication; Initiation, elongation and termination; Fidelity of Replication, Inhibitors of replication.

DNA damage and repair – all types.

UNIT II

Transcription in prokaryotes steps, enzymology, inhibitors of RNA synthesis. Reverse transcription, heat shock proteins & post transcriptional modification.

Role of eukaryotic RNA polymerases. RNA splicing and processing of mRNA, tRNA and rRNA.

Translation in prokaryotes steps - Initiation, elongation and termination of protein synthesis; Inhibitors of protein synthesis. Post - Translational modifications of proteins

UNIT III

Genetic code: - wobble hypothesis, Features of genetic code. Composition of

Prokaryotic and eukaryotic ribosome. tRNA - structure; activation of amino acids, coding and non - coding strands of DNA. Protein sorting and targeting of mitochondria and chloroplast Proteins. Synthesis and targeting of peroxisomal proteins. Overview of secretory pathway.

Posttranslational modification – protein glycosylation in ER and Golgi complex. Receptor mediated endocytosis.

UNIT IV

Recombination in bacteria: - Transformation, Transduction and Conjugation.

Recombination: - Mechanism; forms of recombination, Holiday model for homologous Recombination, Rec BCD Enzyme, Rec A protein, Messelson model, site specific recombination

Regulation of gene expression in prokaryotes operon concept lac operon, trp operon and arabinose operon.,

UNIT V

Gene mutations: - Types - Nutritional, Lethal, Conditional mutants. Mis sense mutation and other point mutations.

Spontaneous mutations- chemical and radiation – induced mutations – Ames tests;

Reversion techniques; selection of mutants, Auxotrophs; Replica plating; Penicillin Cycling. site directed mutagenesis.

Bacterial transposons: - Insertion sequences; Mechanism of transposition in bacteria.

REFERENCE

1. Weaver, F., Robert, Hedrick, W. Philip, Genetics, W.C. Brown Publishers 1997, 3rd Ed.
2. David Freifelder, Jones and Bartlett publishers, 2nd edition.
3. Molecular Biology of gene – J.D Watson (4th Edition)
4. Gene IV- Benjamin lewin

CORE IX (THEORY) - PLANT BIOCHEMISTRY

PBCT39 **5hrs/5credit**

Objectives

- To understand the photosynthesis process occurs in plants.
- To study the functions of natural and artificial plant growth regulators and hormones.

- To enlighten the students to get deep knowledge about plant nutrition, nitrogen fixation, the function of mineral, sulphur and nitrate metabolism in the plants.
- The students can understand about the plant physiology and reproduction.

UNIT I

Plant cell : Structure composition and functions of plant cell organelles, Including cell wall and cell membranes. Bio synthesis of cell wall. Transport mechanisms : Water movement, Ascent of say, mechanisms for movement of solutes. Translocation in xylem and phloem.

UNIT II

Photosynthesis: – photosynthetic apparatus, photosynthetic pigments and role of pigments in plants absorption and properties of light, quantum requirement and quantum yield, Red drop Emerson's enhancement effect. Two photosynthetic pigments, photo system I and II. Electron transport pathway in chloroplast membranes, ATP synthesis in chloroplast cyclic and non cyclic photophosphorylation.

Carbon reaction in C3, C4 and CAM plants, Hatch Slack pathway, photorespiration, and role of photorespiration in plants, significance of photorespiration, factors affecting photorespiration in plants. Pathway of glucose oxidation in plants, Synthesis and degradation of starch.

UNIT III

Nitrogen fixation: - Symbiotic and Non-symbiotic, Symbiotic Nitrogen fixation in legumes, biochemistry and molecular biology of nitrogen fixation- Enzymology of nitrogen fixation, regulation NIF and nod genes of nitrogen fixation. Nitrite assimilation sulphate activation & reduction, sulphite reduction, secondary metabolites- Alkaloids, glycosides terpenoids, phenols, steroids, phyto alexion.

UNIT IV

Plant growth regulators: - chemistry, biosynthesis, mode of action physiological role of auxin, gibberlin, cytokinin, ethylene and abcissic acid. Plant growth inhibitors.

Photo morphogenesis- photoperiodism, phytochrome growth and development. Seed germination & dormancy- physiological biochemical changes factors affecting - water, light, temp, stress. Plant disease resistance mechanism and bio chemical changes. Physiology of flowering, biochemistry of fruit ripening, senescence, and biochemical changes during senescence.

UNIT V

Structure of plant genes: - organization of plant chromatin, nuclear, chloroplast and mitochondrial genome. gene transfer to plants- agro bacterium mediated gene transformation Ti plasmid, Ri gene and DNA transfer to plants, protoplast transformation plant viruses as vectors caMV viruses, RNA viruses and uses of transgenic plants. Plant tissue culture.

REFERENCES

1. Plant Biochemistry – Bonner, Varner
2. Plant Biochemistry – Conn & stumpf
3. Introduction of Plant Biochemistry – Goodwin & Mercer, 2nd edition.
4. Chloroplast metabolism – Halliwell
5. Photosynthesis –Harry Wheeler
6. Pathogenesis –Harry Wheeler
7. Plant physiology – Bidwell G.S (2nd Edition)

CORE PRACTICAL III - LAB IN MICROBIOLOGY AND MOLECULAR BIOLOGY

PBCP33 5hrs/5credit

Objectives

- To gain the knowledge to identify and analyses the microbial, plant and animal specimens.
- To develop the laboratory skills and to learn the techniques to isolate plasmid DNA and amplification of DNA by PCR.
- To learn the transformation techniques,hanndling and gain knowledge to perform blotting, electrophoresis and ELISA methods.
- Students can obtain basic laboratory skills such as microscopy and molecular techniques

1. Microscope – components and its operation
2. Principles of Sterilization
3. Preparation of culture media

4. Inoculation techniques – Serial dilution, plating and single colony
5. Growth Curve of Bacteria – *E.coli*
6. Morphological characteristics of bacteria and identification of microbes – staining techniques – Simple, Gram's, Capsule and Spore.
7. Gene transfer in bacteria – Transformation, Conjugation, Transduction
8. Isolation and electrophoretic separation of DNA and plasmid DNA
9. PCR
10. PAGE

REFERENCE

1. Cappuccino, C. James and Natalie Sherman, Gram Stain, Microbiology A Lab Manual, 1999
2. Atlas, M. Ronald, Alfred E. Brown and Lawrence C. Parks, Gram Stain, Experimental Microbiology, 1995.
3. Handbook of Microbiological Media – HiMedia.
4. Biochemical Methods – Wilson & Walker

ELECTIVE III

Option 1: BASIC BIOINFORMATICS

PBCE33 **5hrs/5 credit**

Objectives

- To understand the sequencing methods, database searching tools and Phylogenetic construction tools.
- To obtain knowledge to submission process of protein and nucleotide sequence data to the databases.
- To learn the methods to found the structure of specific compounds, visualization tools and evolutionary tools.
- Enlighten the students about the basic concepts of bioinformatics and its application in various field.

UNIT I

History, development and types of computers. hardware and software (CPU and other peripheral devices, computer arithmetic, computer logic, programming languages – machine language, assembly language, higher level languages). Introduction – Email – World Wide Web – Surfing.

UNIT II

Sequence analysis – need and importance – pairwise alignment – dynamic programming – Global (Needleman – Wunsch) and Local (Smith Waterman) Alignment concepts – Database searching tools – Entrez, BLAST, FASTA – multiple alignment – Clustal – Construction of Phylogenetic trees.

UNIT III

Structural classification of proteins (SCOP, CATH and other classification) – Structural and functional genomics – Proteomics – Protein sequencing and Protein structure prediction.

UNIT IV

Evolutionary analysis; Distance – Clustering methods – Rooted and Unrooted tree representation – Bootstrapping strategies. Neural Networks – Concepts and Secondary Structure Prediction – Hidden Markov Models –Gene Identification and other application.

UNIT V

Microarray – types – Stanford Microarray Database –Microarray analysis – Hierarchical clustering and Self organizing Maps.

3D structural analysis of biomolecules – molecular visualization tools – RasMol, ChemSketch, and SPDBV. Protein Docking.

REFERENCE

1. Bioinformatics – Principles and potential of a new multidisciplinary tool, TIBITE, 1996.
2. Computing for biologists – A. Fielding. 1985. Benjamin/Cuming Publ.Co.
3. Sequence Analysis in molecular Biology – G.Von Heijne.
4. Sequence analysis – A pioneer – Devereux and Gtribskov.
5. Introduction of Bioinformatics – Attwood T and Parry, D. 2002. Pearson Education Asia.

ELECTIVE III
Option 2: BIOETHICS, BIOSAFETY AND IPR

PBCE22 **5hrs/5credit**

Objectives

- To understand the key concept and historical background of biosafety and to know the importance of biosafety levels.
- To know the biosafety guidelines and regulations and the function of institutional biosafety committee.
- To study the application of GMOs in various field and methods to release GMO's in the environment
    - Student can acquire the knowledge of biosafety and patenting process

UNIT I

Introduction to bioethics, concepts, ethical terms, issues on genetic modification and recombinant DNA technologies, ethics in agriculture and Environment benefits and risks, GM crops, Release of GMO to the environment. Risk of genetic engineering, Ecocide-Eco terrorism.

UNIT II

Animal rights, ethics of human cloning, Reproductive cloning, Ethical legal and Socio economic aspects of Gene therapy, Somatic, Embryonic and Adult stem cell research, ELSI of human genome project. Transgenic plants and animals.

UNIT III

Primary containments for biohazards, Biosafety levels, recommended biosafety levels for specific microorganism, infectious agents and Infected animals. Biosafety guidelines by Govt. of India, Role of Intuitional biosafety committee, GEAC, RCGM, Cartagena protocol. CPCSEA Guidelines

UNIT IV

Introduction to IPR – types; copy rights, patents, trade marks, trade secret design rights, geographical indication-patentable and non-patentable – PCT, importance of IPR, Types of

Patent applications, PCT cost, procedure and requirements for international patenting- patent infringement – scope, litigation, meaning, case studies & examples. Biopiracy.

UNIT V

Introduction to WTO, GATT,WIPO,TRIPS, Patenting in India, Indian patent act, WIPO treaty budaspest treaty, publication of patents-Gazette of India, Patenting by research students, lectures and scientist University/Organizational rules in India and aboard.

REFERENCES

1. Patents (2003), N.Subbaram, Pharma Book Syndicate, Hyderabad.
2. Bioethics and Biosafety in Biotechnology (2007), V.Sree Krishna, New Age International (P) Limited Publishers. ISBN (13): 978-81-224-2248-1
3. Molecular Biotechnology: Principles and Applications of Recombinant DNA (2010), 4th Edition, Glick, B.R., and Pasternack, J.J., ASM Press, Washington, DC.
4. Introduction to Plant Biotechnology (2001), 3rd Edition, H.S.Chawla, Oxford & IBH Publishing Co. Pvt. Ltd.
5. Bioethics and Biosafety (2008) M. K. Sateesh, I. K. International Pvt. Ltd, New Delhi, India.

1.Intellectual Property Rights (2008) Prabuddha Ganguly, Tata McGraw Hill Publishing Company, India. ISBN: 9780070077171 9. http://www.patentoffice.com/index.php

2.Recombinant DNA Safety Guidelines, Department of Biotechnology, Ministry of Science and Technology. Government of India.

3.Revised Guidelines for research in Transgenic Plants, Department of Biotechnology, Ministry of Science and Technology. Government of India.

4. Ethics and Biotechnology by Anthony Oakley Dyson, John Harris. Routledge. 1994.

SEMESTER IV

CORE X (THEORY) - BIOTECHNOLOGY

PBCT410 **5 hrs/5credits**

Objectives

- To study the DNA isolation methods, cloning vectors and restriction enzymes.

- To learn about southern, northern and western hybridization and gene transfer methods.
- To study about the application of transgenic plants and monoclonal antibodies
- Student can learn advance biotechniques and its application.

UNIT I

Generation for DNA fragments for cloning restriction enzymes random shear complementary DNA, synthetic DNA cloning vectors, , gene transfer vectors, expression vectors, plasmid vectors – PBR 322, phage vectors, , cosmid, yeast vectors – YIP , site directed mutagenesis

UNIT II

Isolation of nucleic acid, restriction mapping – Nucleic acid probes – cloning probes, oligo nucleotide probes and labeling nucleic acid probes and labeling nucleic acid probes.Transformation of E. coli – selection of Transformed cells – identification of recombinants. Introduction of phage DNA into Bacterial cell – identification of recombinant phage.

Genomic library and cDNA library.

Hybridization probes: - Nucleic acid hybridization, southern, northern and western hybridization and restriction fragments length polymorphism

UNIT III

DNA sequencing: - Sanger's method, finger printing –

PCR – Technique and application.

UNIT IV

Gene transfer in plants: - Electroporation, biolistics and protoplast fusion. Application: Transgenic plants – herbicide resistance, male infertility, virus resistance, Pest resistance.

UNIT V

Invitro fertilization, embryo cloning. Human embryo research, transgenic mice, Gene therapy, The Human Genome Project. Recombinant proteins from cell cultures: - Interferons, Viral vaccines, Hybridoma Technology- Monoclonal antibodies- production and applications.

REFERENCE

1. Bowtell, D and Sambrook, J.DNA Microarrays: A Molecular cloning manual. CSHL press
2. Glick, BR., Pasternak, JJ (1998) Molecular Biotechnology: Principles and Applications of recombinant DNA, ASM Press.

3. Grandi ,G (2004) Genomics,Proteomics and Vaccines.Wiley press.
4. Hannon, GJ, RNAi: A guide to gene silencing. CSHL Press
5. Kirby, LT (1990) DNA finger printing: An introduction, Stockton press.
6. Lewin, B (2004).Genes VIII. Pearson P- renticeH all Press
7. Principles of genetic manipulation; Ed. Old and Primrose, 6th Edition. Blackwell Science publication
8. T.A. Brown, 1995. (3rd Ed.) Gene cloning – an introduction Chapman and Hall

CORE XIV (THEORY) - ENVIRONMENTAL TOXICOLOGY

PBCT411 **5hrs/5credit**

Objectives

- To understand the harmful effect of pesticide and and merits of biopesticides
- Student will be able to know about rDNA technology and food toxicology.
- To learn the industrial effluent toxicology and metal toxicity and factors influencing metal toxicity.
- Students can obtain basic knowledge about xenobiotics in environmental segments (air, water, soil, biota), its metabolism and effects

UNIT I

Definition and scope of toxicology: Ecotoxicology and its environmental significance. Toxic effects : Basis for general classification & nature. Dose – response relationship: Synergism and antagonism, Determination of ED_{50} and LD_{50} . Acute and chronic exposures. Factors influencing toxicity. Pharmacogenomics & chemodynamics.

UNIT II

Xenobiotic metabolism: Absorption & distribution. Phase I reactions. Oxidation, reduction,hydrolysis and hydration. Phase II reactions/ conjugation : methylation, glutathione and aminoacid conjugations. Detoxification.

UNIT III

Toxicity testing: Test protocol, genetic toxicity testing & mutagenesis assays: Invitro test systems – Bacterial mutation tests: reversion test, Ames test, Fluctuation tests and Eukaryotic mutation tests. Invivo Mammalian mutation tests – Host mediated assay & Dominant lethal test. Use of Drosophila in toxicity in toxicity testing. DNA repair assays. Chromosome damage test. Toxicological evaluation of recombinant DNA – derived proteins.

UNIT IV

Pesticide toxicity: Insecticides: organochlorines, anticholinesterases – organophosphates and carbamates. Fungicides. Herbicides. Environmental consequences of pesticide toxicity. Biopesticides.

UNIT V

Food toxicology : Role of diet in cardiovascular diseases and cancer. Toxicology of food additives.

Metal toxicity: Toxicology of arsenic, mercury, lead, and cadmium. Environmental factors affecting metal toxicity – effect of light, temperature and pH.

Occupational toxicology & assessment of occupational hazards: Industrial effluent toxicology & environmental health.

REFERENCE

1. General and applied toxicology by Marrs and Turner, Macmillan Press Ltd.1995
2. Basic environmental toxicology by Lorris G.Corkerhem and Barbara.S.SShane CRP Press Inc.
3. Introduction to food technology by Takayuki Shibamato & Leonard F. Bzeldanes.
4. Molecular biotechnology 2nd ed 1994 by Barnard.R.Glick & J.J.Pasternak.

Dissertation/Project

PBCP44 **5hrs/5credit**