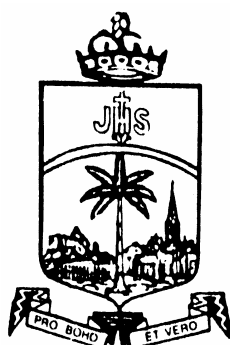




M.Sc. BIOCHEMISTRY
SYLLABUS : 2012

CHOICE BASED CREDIT SYSTEM
(CBCS)



St. JOSEPH'S COLLEGE (Autonomous)

Re-accredited with 'A' Grade (3rd Cycle) by NAAC

College with Potential for Excellence by UGC

TIRUCHIRAPPALLI - 620 002, INDIA.



FEATURES OF CHOICE BASED CREDIT SYSTEM

PG COURSES

The Autonomous (1978) St. Joseph's College, accredited with Five Star status in 2001, Re-accredited with **A+ Grade** from NAAC (2006), Re-accredited with **A Grade** from NAAC (3rd cycle), had introduced the Choice Based Credit System (CBCS) for PG courses from the academic year 2001-2002. As per the guidelines of Tamil Nadu State Council of Higher Education (TANSCHHE) and the Bharathidasan University, the College has reformulated the CBCS in 2008-2009 by incorporating the uniqueness and integrity of the college.

OBJECTIVES OF THE CREDIT SYSTEM

- * To provide mobility and flexibility for students within and outside the parent department as well as to migrate between institutions
- * To provide broad-based education
- * To help students learn at their own pace
- * To provide students scope for acquiring extra credits
- * To impart more job oriented skills to students
- * To make any course multi-disciplinary in approach

What is credit system?

Weightage to a course is given in relation to the hours assigned for the course. Generally one hour per week has one credit. For viability and conformity to the guidelines credits are awarded irrespective of the teaching hours. The following Table shows the relation between credits and hours.

Sem.	Specification	No. of Papers	Hour	Credit	Total Credits
I - IV	Core Courses (Theory & Practical)	14	6	14 x 5	70
	Project	1	--	1 x 5	05
I - IV	3 - Core Electives	3	4	3 x 4	12
	1 - Soft Skill Course (Common) (IDC-1)				
	1 - Inter Dept. Courses (IDC-2)	2	4	2 x 4	08
I - IV	SHEPHERD - Extension Activity	~	70	5	05

Total Minimum Credits **100**

Other Additional Credits (Dept. Specific) **....**

However, there could be some flexibility because of practicals, field visits, tutorials and nature of project work.

For PG courses a student must earn a minimum of 100 credits. The total number of courses offered by a department is 20. However within their working hours a few departments can offer extra credit courses.

Course Pattern

The Post Graduate degree course consists of three major components. They are Core Course, Elective Course and Inter Departmental Course (IDC). Also 2 compulsory components namely Project / Project related items and SHEPHERD, the extension components are mandatory.

Core Course

A core course is the course offered by the parent department, totally related to the major subject, components like Practical, Projects, Group Discussions, Viva, Field Visits, Library Record form part of the core course.

Elective Course

The course is also offered by the parent department. The objective is to provide choice and flexibility within the department. The student can choose his/her elective paper. Elective is related to the major subject. The difference between core course and elective course is that there is choice for the student. The department is at liberty to offer three elective courses any semester. It must be offered at least in two different semesters. The staff too may experiment with diverse courses.

Inter Departmental Course (IDC)

IDC is an inter departmental course offered by a department for the students belonging to other departments. The objective is to provide mobility and flexibility outside the parent department. This is introduced to make every course multi-disciplinary in nature. It is to be chosen from a list of courses offered by various departments. The list is given at the end of the syllabus copies. Two IDCs must be taken by students which are offered in Semester II & III. In

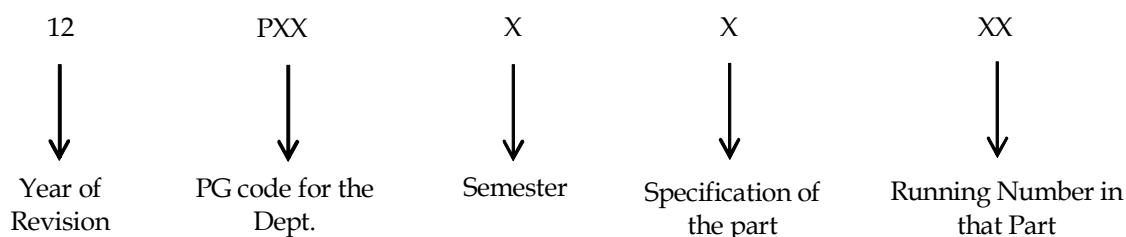
semester II, a common IDC, Soft Skills is to be offered by JASS (Joseph Academy of Soft Skills).

Day College (Shift-I) student may also take an IDC-2 from SFS (Shift-II) course and vice versa

The IDC are of application oriented and inter-disciplinary in nature.

Subject Code Fixation

The following code system (9 characters) is adopted for Post Graduate courses:



01 – Core Courses: Theory & Practical

02 – Core electives

03 – Additional Core Papers (if any)

04 – Inter Departmental Courses

05 – Project

06 – SHEPHERD

CIA Components

The CIA Components would comprise of two parts: (1) Test Components conducted by Controller of Examination (COE) and (2) Teacher specific component. The two centralized tests will be conducted by the COE (Mid-Semester Test & End-Semester Test) for 30% each administered for 2 hours duration. The remaining 40% would comprise of any three components as listed below and will be carried out by the faculty concerned for that paper.

- * Assignment, Quiz (Written / Objective), Snap Test, Viva-Voce, Seminar, Listening Comprehension, Reading Comprehension, Problem Solving, Map Reading, Group Discussion, Panel Discussion, Field Visit, Creative Writing, Open Book Test, Library Record, Case Study, etc.

- * As a special consideration, students who publish papers in referred journals would be exempted from one of the teacher specific internal components in one of the papers. At the beginning of each semester, the four internal components would be informed to the students and the staff will administer those components on the date specified and the marks acquired for the same will be forwarded to the Office of COE.

Evaluation

For each course there are formative continuous internal assessment (CIA) and semester examinations (SE) in the weightage ratio 50:50.

Once the marks of CIA and SE for each course are available, the Overall Percentage Mark (OPM) for a student in the programme will be calculated as shown below:

$$OPM = \frac{\sum_i C_i M_i}{\sum_i C_i} \text{ where } C_i \text{ is the credit earned for that course in any}$$

semester and M_i is the marks obtained in that course.

The Scheme of Over-all Results is as follows:

	PG	
Class	Arts (OPM)	Science (OPM)
SECOND	50 to 59.99	50 to 59.99
FIRST	60 to 74.99	60 to 79.99
DISTINCTION	75 & Above	80 & Above

Declaration of Result

Mr./Ms. _____ has successfully completed M.Sc./M.A. degree course in _____. The student's overall average percentage of marks is _____ and has completed the minimum 100 credits. The student has also acquired _____ (if any) additional credits from courses offered by the parent department.

M.Sc. Biochemistry - Course Pattern

Sem	Subject Code	Subject Title	Hrs/ Week	Credits	
I	12PBI1101	Biomolecular Chemistry	6	5	
	12PBI1102	Research Methodology	6	5	
	12PBI1103	Microbiology	6	5	
	12PBI1104	Laboratory Course - I	8	5	
	12PBI1201A	Life Sciences for competitive exams I OR	4	4	
	12PBI1201B	Biochemistry of Natural Products			
	TOTAL FOR SEMESTER - I			30	24
II	12PBI2105	Enzymology and Bioenergetics	6	5	
	12PBI2106	Cytogenetics and Molecular Biology	6	5	
	12PBI2107	Laboratory Course - II	10	5	
	12PBI2202A	Life Sciences for competitive exams II OR	4	4	
	12PBI2202B	Molecular Diagnostics			
	12PSK2401	Soft Skills (IDC I - Common Syllabus)	4	4	
	TOTAL FOR SEMESTER - II			30	23
III	12PBI3108	Clinical Biochemistry	5	4	
	12PBI3109	Immunology	4	4	
	12PBI3110	Human Physiology	5	4	
	12PBI3111	Laboratory Course - III	8	5	
	12PBI3203A	Life Sciences for competitive exams III OR	4	4	
	12PBI3203B	Drug Biology			
	12PBI3112	Review of Literature	-	3	
	12PBI3402	IDC - II: First Aid Management	4	4	
	TOTAL FOR SEMESTER - III			30	28
IV	12PBI4113	Biotechnology	6	5	
	12PBI4114	Advanced Endocrinology	6	5	
	12PBI4115	Environmental Toxicology	6	5	
	12PBI4501	Project Dissertation and <i>Viva Voce</i>	12	5	
	TOTAL FOR SEMESTER - IV			30	20
	12PBI4601	Extension Service - SHEPHERD		5	
	TOTAL FOR ALL SEMESTERS			120	100

BIOMOLECULAR CHEMISTRY

Objectives

- ✿ To study the structure, properties and metabolism of different biomolecules.
- ✿ To know the interrelationships between different metabolisms.

Unit - I

The molecular logic of life: The chemical unity of diverse living organisms, composition of living matter. Physiochemical properties of water. Macromolecules and their monomeric subunits. Carbohydrates - Classification, Structure and Isomerism. Monosaccharide - types, general reactions & derivatives like esters, Aminosugars, Deoxysugars and Inositols, Oligosaccharides - types and General reactions. Homoglycans: Structure and Properties of Starch, Glycogen, Cellulose, Dextrin, Inulin. Heteroglycans - Structure and Properties of Glycosaminoglycans, Pectins and Glycocalyx oligosaccharides.

Unit - II

Introduction to Metabolism - Anabolism and Catabolism, Experimental approaches to study metabolism. Metabolism of Carbohydrates - Glycolysis, Citric acid cycle, HMP shunt, Glucuronic acid pathway, Gluconeogenesis, Glycogenesis, Glycogenolysis, Glyoxylate cycle. Regulations of Glycolysis and Gluconeogenesis. Metabolism of Amino sugars, Sialic acids, Mucopolysaccharides and Glycoproteins.

Unit - III

Aminoacids - structures, classification and properties. Naturally occurring peptides, Glutathione, Peptide antibiotics, Cyclosporin. Biosynthesis of Aspartate, Pyruvate and Aromatic amino acids families. Amphibolic activity of amino acids.

Proteins - classification, types and characteristics. Primary, Secondary, Tertiary and Quaternary structures. Methods for

determining protein conformations. Symmetry and functional properties - Protein folding, Denaturation & Renaturation. Ramachandran plot, Solid state synthesis of peptides, Sequence determination. Degradation of proteins and amino acids. Urea cycle and its significance.

Unit - IV

Nature of Fatty acids and acyl glycerols - Sources and biological functions. Biosynthesis of fatty acids and its regulation, Hydroxy fattyacids, Acylglycerols. Membrane lipids - Phospholipids, Sphingolipids & Eicosanoids. Cholesterol biosynthesis and its regulation. Fatty acid degradation. Lipoproteins - types and functions. Methods of inter organ transport of fatty acids. Formation of ketone bodies.

Unit - V

Nucleic acids - bases, nucleosides & nucleotides, Structure of RNAs and DNA, Forces stabilizing nucleic acid structures. Fractionation, sequencing and chemical synthesis of oligonucleotides. Denaturation and Hybridization. Biosynthesis and degradation of Purines and Pyrimidines, Synthesis of Deoxy ribonucleotides. Biosynthesis of nucleotide coenzymes.

Books for study and reference

1. Zubey, GL (1998): Biochemistry, WCB Publishers.
2. Robert K. Murray *et al.* (2000): Harper's Biochemistry (25th edition). (Appleton and Lange Stamford Connecticut).
3. West, E.S. and Todd, W.R., Mason H.S. and Bruggen J.T. (1963): Text Book of Biochemistry (Macmilan Co. London).
4. Lehninger, A.L. *et al.* (1993): Principles of Biochemistry (Worth Publ. Inc. USA).
5. Stryer, I. (1988): Biochemistry (II Ed), W.H. Freeman & Co., New York.
6. White, A. *et al.* (1959): Principles of Biochemistry (McGraw Hill Book Co., New York).

RESEARCH METHODOLOGY

Objectives

- ✱ To learn the strategies of biochemical research.
- ✱ To study the principles of biochemical techniques.

Unit - I

Electrochemical techniques - principles, electrochemical cells and reactions. pH and buffers. Measurement of pH - glass electrode, and titration curves. Ion selective and gas sensing electrodes, oxygen electrode and their applications. Chromatographic techniques - general principle; Techniques and applications of paper, column, thin layer and paper, adsorption, partition, normal phase, reverse phase - liquid chromatography; ion-exchange chromatography, exclusion chromatography, affinity chromatography, GLC and HPLC - Types - LC MS, FPLC and their applications.

Unit - II

Centrifugation: Principles, differential and analytical centrifugation, density gradient centrifugation; Analysis of sub-cellular fractions, ultracentrifuge and its application.

Electrophoresis: Principles, electrophoretic mobility, factors influencing electrophoretic mobility - paper, disc, slab gel electrophoresis. Isoelectric focussing, 2D PAGE, blotting techniques, capillary electrophoresis. Radioactivity; application - clinical diagnosis. Autoradiography and its application.

Unit - III

Spectroscopy - basic principles of light, absorption spectrum, UV and visible spectroscopy, IR, ESR, NMR, mass spectrometer, MALDI - TOF. Spectrofluorimetry, CD spectroscopy, X-ray diffraction, atomic spectroscopy: Laser: principle, production and biological applications of CO₂ laser, and Nd - YAG laser.

Unit - IV

Selection of research problems - hypothesis - definition, characteristics and testing. Experimental approaches - biological,

physical and chemical methods. Proposal writing - selection of journals. Review writing: Sources of information: Journals, e-journals, books, biological abstracts. Bio-informatics. Preparation of index cards. Article writing - structure of article (Title, introduction, methods, specimens and techniques of statistics, results, discussion, acknowledgements, references, abstracts). Testing: Large samples (Z), small samples t, Chi-square, ANOVA - one & two way. Applications of SPSS and DMRT in biological research. Ethics in research.

UNIT V

Introduction to Bioinformatics, Bioinformatics and its applications, Information networks - EMB net and NCBI. Databases; Primary Nucleic acid databases - EMBL; Gene Bank and DDBJ. Structure of Gene bank entries.

Protein sequences databases; primary databases PIR, MIPS, SWISS - PROT, TrEMBL, NRL-3D. Structure of SWISS - PROT entries. Secondary Databases; PRO SITE, PROFILES, PRINTS, Pfam, BLOCKS and IDENTITY. Composite protein Databases.

Books for study and reference

1. Braun, R.P. (1987): Introduction to Instrumental Analysis (McGraw Hill).
2. West, E.S. and Todd, W.R., Mason, H.S. and Van Bruggan, J.T.: Textbook of Biochemistry.
3. Edsall, J.T., Wyman, J.: Biological Chemistry - Vol. I and II (Academic Press).
4. Research methodology for biological sciences by N.Gurumani: MJP publications (2006).
5. Principles of Biophysical chemistry by Upadhye and upadhye nath.
6. Practical Biochemistry: Principles and Techniques by Keith Wilson and John Walker: 5th Edition (2005).
7. Biophysical chemistry: Part I, Part II and Part III by Cantor and Schimmel: 2004 edition.
8. Biostatistics by Wayne W. Daniel: Seventh edition (2006).

MICROBIOLOGY

Objectives

- i) To understand the applications of different microbes.
- ii) To study the applications of microbiology in various industries.

Unit - I General microbiology

Introduction and scope of microbiology. Brief study of structure and organization of major groups of microorganisms - Archaeobacteria, Cyanobacteria, Eubacteria, Fungi, Algae, Protozoa and Viruses. Culture of microorganisms - batch, continuous and pure cultures. Control of microorganisms - physical, chemical and chemotherapeutic agents.

Unit - II Environmental microbiology

Microbiology of soil - soil microflora - role of soil microbes in biogeochemical cycles (C, N, S) - Marine and fresh water microbiology. Contamination of domestic and marine waters. Water purification and sewage treatment. Role of microbes in waste water treatments. Microbiology of air.

Unit - III Industrial microbiology

Selection of industrially useful microbes. Fermentors and fermentation technology. Bioreactors, Down stream processing. Industrial production of alcohol, vinegar, lactic acid, antibiotics, enzymes and amino acids. Microbiology of food - sources of contamination - food spoilage - food preservation methods.

Unit - IV Clinical microbiology

Epidemic, endemic, pandemic and sporadic diseases. Pathogenicity, virulence and infection. Epidemiology of infectious diseases. Bacterial diseases of human (typhoid, cholera, syphilis, gonorrhoea and pertusis). Fungal diseases of human (superficial, cutaneous, subcutaneous and systemic mycoses). Viral diseases of

human (AIDS, hepatitis, polio, rabies and measles). Mycoplasmal, Chlamydial, Rickettial and protozoan diseases of human. Mycotoxins.

Unit - V Applied Microbiology

Microbial sources as antibiotics and vaccines. Microorganisms as biofertilizers. Microbes as foods - SCP production. Role of microbes in bio-gas production, petroleum industry, mining and bioleaching. Microbial degradation of lignin, cellulose and pesticides. Microbial immobilization. Microbes in biological warfare.

Books for study and reference

1. Pelczar *et al.* (1998): Microbiology. Tata McGraw-Hill publishing company Ltd. - New Delhi.
2. Prescott *et al.* (1996): Microbiology (WMC Brown Publishers, USA).
3. Martin Alexander (1969): Introduction to soil microbiology. Wiley international edition - New York.
4. Wayne *et al.* (1962): Modern microbiology.
5. Adams and Moss: Food microbiology.
6. Gladwin and Trattler: Clinical microbiology.
7. Greenwood: Medical Microbiology.

LABORATORY COURSE - I

1. Estimation of liver glycogen.
2. Estimation of amino acids by Sorenson's formal titration.
3. Estimation of Iodine value of oil.
4. Estimation of Acid value of oil.
5. Estimation of Reducing sugars by Benedict's titration.
6. Estimation of Water content of food samples.
7. Estimation of Ash content
8. Estimation of Magnesium
9. Estimation of phosphorus
10. Estimation of Tryptophan
11. Estimation of Total lipids
12. Estimation of Vitamin C (Titration)
13. Extraction of DNA and RNA
14. Estimation of DNA and RNA
15. Biochemical techniques
 - Column chromatography of plant Pigments
 - Separation of phospholipids by TLC.
 - Paper chromatography of amino acids

Microbiology

1. Media preparation and Culture techniques.
2. Staining techniques (simple, differential and capsular)
3. Biochemical Characterization of Microbes.
 - Amylase activity
 - Methyl Red test
 - TSI Agar test
 - Citrate Utilization test
4. Potability test of water.

5. Qualitative test for Milk.
 - Methylene Blue Reductase Test.
 - Phosphatase test.
6. Antibiotic sensitivity test.

**LIFE SCIENCES FOR
COMPETITIVE EXAMINATIONS – I
(Biodiversity and Plant Physiology)**

Objectives

- i) To help the students to prepare for competitive exams, along with regular curriculum.
- ii) To introduce the students the concepts of biodiversity and physiology of plants.

Unit I

Principles & methods of taxonomy: Concepts of species and hierarchical taxa, biological nomenclature, classical & modern methods of taxonomy of plants, animals and microorganisms. Levels of structural organization: Unicellular, colonial and multicellular forms. Levels of organization of tissues, organs & systems. Comparative anatomy, adaptive radiation, adaptive modifications. Herbarium preparation.

Unit II

Outline classification of plants, animals & microorganisms: Important criteria used for classification in each taxon. Classifications of plants (Bentham and Hooker), animals (Whittaker's) and microorganisms. Evolutionary relationships among taxa. Natural history of Indian subcontinent: Major habitat types of the subcontinent, geographic origins and migrations of species. Common Indian mammals, birds. Seasonality and phenology of the subcontinent.

Unit III

Organisms of health & agricultural importance: Common parasites and pathogens of humans, domestic animals and crops. Organisms of conservation concern: Rare, endangered species. Conservation strategies.

Plant hormones - Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action. Sensory photobiology - Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks

Unit IV

Respiration and photorespiration - Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory pathway.

Nitrogen metabolism - Nitrate and ammonium assimilation; amino acid biosynthesis.

Photosynthesis - Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO₂ fixation - C₃, C₄ and CAM pathways.

Unit V

Solute transport and photoassimilate translocation - uptake, transport and translocation of water, ions, solutes and macromolecules from soil, through cells, across membranes, through xylem and phloem; transpiration; mechanisms of loading and unloading of photoassimilates. Secondary metabolites - Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles. Stress physiology - Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses.

Books for study and reference

1. Lawrence, GHM, 195, The taxonomy of vascular plants, central Book Department, Macmillan, New York.
2. Jude, W.S, C.S. Campbell, E.A. Kellogg, P.F. Stevens & M.J. Donoghue, 2007. Plant systematics: A Phylogenetic approach, 3rd Ed. Sinauer associates, Inc. Sunderland, USA.
3. Noggle, GR and Fritz, GJ, 1976, Introductory plant physiology, Prentice-Hall, India.
4. Pandey, S.N. & Sinha, 1972, Plant physiology, Vikas publishing, New Delhi.

BIOCHEMISTRY OF NATURAL PRODUCTS

Objectives

- ✿ To study the occurrence, properties and economic importance of natural products from plants, animals and microbes.
- ✿ To discover the therapeutic importance of those natural products.

Unit I

General aspect of sources of natural medicinal plant products: Introduction to primary and secondary metabolites, types of secondary metabolites, production under stress, isolation of active constituent from plant material.

Unit II

Alkaloids: Definition, general properties, classification based on nitrogen heterocyclic ring, types - phenylalkylamines, pyridine alkaloids, tropane alkaloids, quinolizidine and pyrrolizidine alkaloids, isoquinoline alkaloids, quinoline, monoterpene, indole alkaloids, purine alkaloids, ruta alkaloids, medicinal importance of each type. Role of alkaloids in plants.

Unit III

Saponins and Steroids: Definition, general properties, medicinal importance of saponins. Important saponins of plant origin - diosgenin, hecogenin, glycyrrhizin, aescin and ginseng. Steroids: Definition, general properties, classification, introduction and medicinal importance of - cardiac glycosides from *Digitalis*, *Strophanthus*, *Urginea*, steroids from *Withania somnifera*, *Holarrhena* and *Solanum*.

Unit IV

Terpenoids: Definition, general properties, classification, introduction and medicinal importance of terpenoids. General account and medicinal importance of myrcene, ocimene, citronellol, menthol and camphor. Tannins, lignin and pectin: Definition, general properties and classification. Terpenes: Definition, general properties and classification.

Unit V

Plant pigments: Occurrence, classification, introduction and applications of carotenoids, xanthophylls, anthocyanins, flavones, flavonols. Acetate pathway and Shikimic acid pathway. Pyrethroids and rotenones of plant origin: Definition, general properties and importance. Natural products of therapeutic importance from animals. Zotherapy.

Books for study and reference

1. Biotechnology - secondary metabolites: K.G. Ramawat and J.M. Merillon (Eds.) (Oxford & IBH publishing Co. Pvt. Ltd.).
2. Natural products - chemistry and biological significance: J.Mann, R.S. Davidson, J.B. Hobbs, D.V. Banthrope and J.B. Harbonne (Longman).
3. New trends in natural product chemistry: Ata-ur-Rahman and M.L. Choudhary (Harwood Academic Publishers).
4. Pharmacognosy: G.E. Trease and W.C. Evans (ELBS)
5. Text book of pharmacognosy: T.E. Wallis (CBS Publishers)
6. Organic chemistry of natural products: Gurdeep Chatwal (Himalaya publishing House).
7. Indian medicinal plants: Kirthikar and Basu
8. Materia medica: Henry G. Greenish (Scientific Publishers)
9. Agrochemicals from natural products: C.R.A. Godfrey (Ed.) (Marcel Dekker, Inc.)
10. The Total synthesis of natural products: John ApSimon (Ed.) (John Wiley & Sons, Inc.).
11. Introduction to flavonoids: B. A. Bohn (Harwood Academic Publishers).
12. Insecticides of natural origin: Sukh Dev (Harwood Academic Publishers).
13. Chemistry and biology of herbal medicine: V.P. Agrawal and V.P. Khamboj (Eds.) (Society of Biosciences).
14. Foye's Principles of medicinal chemistry: T.L. Lemke, D.A. Williams, V.F. Roche and S.W. Zito (Wolters Kluwer/ Lippincott Williams & Wilkins).
15. Biopharmaceuticals - biochemistry & biotechnology: G.Walsh (Wiley).

ENZYMOLGY AND BIOENERGETICS

Objectives

- ✿ To impart thorough knowledge about enzymes and enzyme kinetics.
- ✿ To understand the various concepts of bioenergetics.

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

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, LDH and fatty acid synthase complex. Isoenzymes.

Unit - III

Kinetics of catalysed reaction: Single substrate reactions, bisubstrate reactions, Concept and derivation of Michaelis - Menten equation, Briggs Haldane relationship, Determination and

significance of kinetic constants, Limitations of Michaelis-Menten Kinetics. Inhibition kinetics - competitive, non-competitive and un-competitive. Allosteric inhibition, cooperative, cumulative, feed back inhibition.

Unit - IV

Relative practical and economic advantage for industrial use, effect of partition on kinetics and performance with particular emphasis on charge and hydrophobicity (pH, temperature and K_m). Various methods of immobilization - ionic bonding, adsorption, covalent bonding (based on R groups of amino acids), microencapsulation and gel entrapment. Immobilized multienzyme systems. Applications of immobilised 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.

Unit - V

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. Organisation of electron carriers and enzymes in mitochondria, chloroplast and microsomes and their inhibitors, cyanide resistant respiration.

Books for study and reference

1. Bohinski, R.C. (1987): Modern concepts in Biochemistry (Alllyn and Bascon Inc. Boston).
2. Caret *et al.* (1993): Inorganic, Organic and Biological Chemistry (W.M.C. Brown Publ. USA).
3. Dixon, M. and Webb, J.F. (1979): Enzymes (Longman, London)

4. Lehninger, A.H. *et al.* (1993): Principles of Biochemistry (Worth Publ. Inc. USA)
5. Montgomery, R. *et al.* (1990): Biochemistry: A case Orientede Approach (The C.V. Mosby Co., St. Louis)
6. Rawn, J.D. (1989): Biochemistry (Neil Patterson Publ. North Carolina)
7. Stryer, I. (1988) : Biochemistry (II Ed) W.H. Freeman & Co., New York)
8. Voet, D. and Voet, J.G. (1990): Biochemistry (John Wiley & Sons Inc., New York)
9. White, A. *et al.* (1959): Principles of Biochemistry (McGraw Hill Book Co., New york)
10. Price and Stevens (1999): Fundamentals of Enzymology (Oxford University Press)

CYTOGENETICS AND MOLECULAR BIOLOGY

Objectives

- ✿ To study the structural and functional organization of cells and their genetic make up.
- ✿ To understand the different techniques employed in cell biology and their recent advancements and to study the concepts of molecular genetics.

Unit - I

Architecture of Cell, Cells into tissues, Purification of cells and their parts, Cell wall - structure and function. Cellular organelles - structure and functions of chloroplast, mitochondria, Golgi complex, endoplasmic reticulum, Ribosomes and nucleus. Compartmentalization of higher cells, Cell cycle, Cell divisions and Apoptosis. Cell adhesion molecules - types functions. Cell motility: Microtubules - structure and composition, Molecular motors, Micro tubular associated proteins, MTOCs, factors influencing assembly and disassembly. Microfilament's assembly and disassembly.

Unit - II

Origins of genetics: Mendelism - Mendelian laws, gene interactions, chromosomal theory of heredity, non-mendelian inheritance, X-linked inheritance, Extrachromosomal inheritance. Mutations - somatic and germ line mutations, Chromosomal mutations - changes in structure and number, mitochondrial mutations and human diseases. Population genetics: Hardy Weinberg law - applications and influencing factors. Non-random mating - inbreeding, pedigree analysis and population analysis

Unit - III

DNA - the genetic material - the proofs - properties of genetic material. DNA replication: semiconservative replication of double stranded DNA, Enzymology of DNA replication, discontinuous replication, replication of circular and linear DNA. Bidirectional replication. Replication in eukaryotic chromosomes. Replication of

RNA genome - replicase and reverse transcriptase. Repair - alterations in the DNA molecule and its repair. Methylase and mismatch repair, excision, recombination and SOS repairs, damage to DNA, Mutation - types of mutation and the biochemical basis. DNA amplification (PCR).

Unit - IV

Transcription in Prokaryotes and Eukaryotes. Post transcriptional processing, Regulation of transcription and antibiotic inhibitors. RNA interference; anti sense RNA; Ectopic transcription. Genetic code - major features of genetic code, organization and deciphering of genetic code, elucidation of codons, mRNA. Ribosomes, amino acyl tRNA synthases; initiation, elongation and termination - prokaryotes and eukaryotes. Inhibitors of translation and post translational modification of proteins.

Unit - V

Protein targeting - translocation, Heat shock proteins, glycosylation; SNAPs and SNAREs. Bacterial signal sequences. Mitochondrial, chloroplast and nuclear protein transport. Endocytosis - viral entry. Gene expression and regulations - molecular mechanism of regulation, prokaryotes - operon model, *lac*, *trp*, *arabinose* operons. C-value paradox, gene dosage and gene amplifications.

Books for study and reference

1. Gerald Karp, (1996): Cell and Molecular Biology - Concepts and Experiments (John Willy and Sons Inc.)
2. Harvey Lodish *et al.* (2000): Molecular Cell Biology - 4th ed. W.H. Freeman and Co., New York.
3. Lewin, B. (2000): Genes- VII. (Oxford University Press).
4. David Freifelder' (2005) - Essentials of Molecular Biology, Narosa publishers.
5. Harvey Lodish, *et al.* (2000) : Molecular Cell Biology (4th edition), W.H. Freeman and Co., New York.
6. Weaver and Hedrick (1997): Genetics (3rd edition), W.M.C. Brown Publishers.
7. David T. Suzuki, *et al.* (1986): An Introduction to Genetic Analysis (3rd Edition). (W.H. Freeman and Co., New York).

LABORATORY COURSE - II

1. Assay of Acid Phosphatases.
1. Assay of Salivary amylase.
2. Factors influencing reaction rates of Acid Phosphatases,
 - Effect of Temperature
 - Effect of Time
 - Effect of pH
 - Effect of Enzyme concentration
 - Effect of substrate concentration
 - Measurements of V_{max} & K_m
3. Agarose gel electrophoresis of Nucleic acids (DNA & RNA)
4. Polyacrylamide gel electrophoresis (protein)
5. Isolation of chromosomal DNA from blood samples by Phenol-Chloroform method.
6. Preparation of genomic DNA from Plant tissue by CTAB method
7. Preparation of genomic DNA from bacteria
8. Plasmid DNA isolation
9. Plant Tissue culture techniques (Callus induction)
10. Synthetic seed preparation
11. Denaturation of DNA and UV absorption studies.
12. Absorption spectra of Nucleic Acids. Determination of melting temperature of calf thymus DNA.
13. Restriction digestion.
14. PCR

**LIFE SCIENCES FOR
COMPETITIVE EXAMINATIONS – II
(Evolution and Ecology)**

Objectives

- ✿ To introduce the students to the basic concepts of evolution and ecology.
- ✿ To help the students to prepare for competitive exams, along with regular curriculum.

Unit - I

Emergence of evolutionary thoughts - Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiment of Miller; The first cell; Evolution of prokaryotes; Evolution of unicellular eukaryotes Origin of eukaryotic cells; Anaerobic metabolism, and aerobic metabolism. Theories on evolution.

Unit - II

Paleontology and Evolutionary History: The evolutionary time scale; Eras, periods and epoch; Major events in the evolutionary time scale; Origins of unicellular and multi cellular organisms; Major groups of plants and animals; Stages in primate evolution including Homo. Molecular Evolution: Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny, classification and identification.

Unit - III

Mechanisms of speciation and behaviour : Population genetics, migration and random genetic drift; Adaptive radiation; Isolating mechanisms; Speciation; Allopatricity and Sympatricity; Convergent evolution; Sexual selection; Co-evolution. Approaches and methods in study of behavior; Proximate and ultimate causation; Altruism and evolution; Neural basis of learning, memory, cognition,

sleep and arousal; Biological clocks; Social communication; Social dominance; Use of space and territoriality; Mating systems, Parental investment and Reproductive success; Parental care; Aggressive behavior; Habitat selection and optimality in foraging; Migration, orientation and navigation; Domestication and behavioral changes.

Unit - IV

Environmental ecology; biotic and abiotic interactions. Concept of habitat and niche; Population Ecology; concept of metapopulation. Species Interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.

Community Ecology: Nature, structure and attributes; levels of species diversity and its measurement; edges and ecotones. Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax.

Unit - V

Ecosystem: Ecosystem structure, function; energy flow and mineral cycling (C, N, and P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, esturine). Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India. Conservation Biology: Principles and management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

Books for study and reference

1. Verma P.S. & V.K. Agarwal, 2003, Cytology, Genetics, Evolution and Ecology. S. Chand & Co. Ltd., New Delhi.
2. Sharma P.D., 1999, Ecology and Environment, Rastogi Publishers, Meerut.
3. Odum. E.P, 1970, Fundamentals of Ecology, 3rd edition, W.B. Saunders Ltd., UK.
4. Karl J. Nikias, 1981, Paleobotany, Paleoecology & Evolution, Praeger Pub., USA.

MOLECULAR DIAGNOSTICS

Objectives

- ✿ To explore the molecular mechanisms of diseases
- ✿ To study the various diagnostic tools available for these diseases.

Unit - I

Molecular mechanisms of diseases: Detection of genetic defects, Detection of infectious agents, tumor diagnosis markers and grading. Molecular genetics of B-cell neoplasia. Liver specific expression of cloned human genes, technology of carrier erythrocytes: a tool for diagnosis and therapy. Diagnosis of single gene disorders - Spinal muscular atrophy, DMD and BMD, Fragile X syndrome.

Unit - II

Restriction Fragment Length Polymorphism (RFLP) - DNA probes detection of mutations and deletions in gene. Eg: thalassemia, haemophilia, sickle cell anemia, retinoblastoma. DNA finger printing. Genetic disease probes: DNA analysis in Duchenne muscular dystrophy-chromosomal DNA probes for prenatal diagnosis of X-linked retinitis pigmentosa, prenatal sex determination.

Unit - III

Hereditary persistence of fetal hemoglobin: model for abnormal development regulation. Apolipoprotein genes, DNA polymorphism and hyperlipidemia, cDNA of human protein C for diagnosis of protein C deficiency. Prenatal diagnosis - carrier detection of phenylketonuria by gene, Fluorescent in situ hybridization (FISH) DNA probes - fluorescent labeling, chromosome painting and spectral karyotyping, peptide mapping.

Unit - IV

Approaches in hybridoma technology: Hybridoma variants affecting isotype, antigen binding and idiotype: isolation of class and subclass switch variants by selection. The MHC locus, HLA polymorphisms, HLA nomenclature, molecular analysis of the MHC, serological analysis DNA-based typing, combining typing results, HLA test discrepancies, coordination of HLA test methods, additional recognition factors, minor histocompatibility antigens, nonconventional MHC antigens, killer cell immunoglobulin-like receptors, MHC & its disease association.

Unit-V

Polymerase Chain Reaction - Its applications in diagnosis of infectious diseases - eg: HIV, hepatitis B and tuberculosis. Identification of gene mutations and deletions - eg: p53 mutations. Use in solving paternity disputes and crime detection. Molecular Oncology-Classification of Neoplasms, Molecular Basis of Cancer, Analytical Targets of Molecular Testing - Gene and Chromosomal Mutations in Solid Tumors, Microsatellite Instability, Loss of Heterozygosity. Enzyme linked immunosorbent assay (ELISA) - Diagnosis of infectious diseases and cancer antigens, HIV detection.

Books for study and reference

1. Biotechnology in Diagnostics, Kaporowski, H. *et al.* Elsevier publishers. Vol-21.
2. Gath, D.D. (1994), PCR - based diagnostics in infectious diseases, Black well scientific publishers.
3. Grom well, L. *et al.* (1994), Biomedical instrumentation & measurements, Addition weisly publishers.
4. Fazal Ahmed (1984), Advances in Gene technology: human genetic disorders, ICSU press.
5. Stanely, A. *et al.* (1994), Vaccines, W.B. Saunders & Co.
6. Lela Buckingham, Maribeth L. Flaws (2007), Molecular Diagnostics - Fundamentals, Methods & Clinical Applications, F.A. Davis & Company, Philadelphia.

IDC-I: SOFT SKILLS

Unit 1: Effective Communication & Resume Writing 12 Hours

Effective Communication

Definition of communication, Process of Communication, Barriers of Communication, Non-verbal Communication, Johari Window, The Art of Listening, Kinesthetic, Production of Speech, Organization of Speech, Modes of delivery, Conversation Techniques, Dialogue, Good manners and Etiquettes.

Resume Writing

What is Resume? Types of Resume? Chronological, Functional and Mixed Resume, Steps in preparation of Resume.

Unit II: Group Discussion, Interview Skills & Team Building

18 hours

Group Discussion (GD)

Group Discussion Basics, GD Topics for Practice, Points for GD Topics, Case-Based and Article based Group Discussions, Points for Case Studies, and Notes on Current Issues for GD.

Interview Skills

Common interview questions, Attitude, Body Language, The mock interviews, Phone interviews, Behavioral interviews.

Team Building

Team Vs Group - synergy, Stages of Team Formation, Dabbawala-Case Study-PPT, Broken Square-Exercise, Group dynamics, Win as much as you win- Exercise, Leadership - Styles, Work ethics.

Unit III: Personality Development, Attitude & Motivation 18 hours

Personality Development

Self awareness, Assertiveness, Goal setting, Problem-solving, Conflict and Stress Management, Decision-making skills, Positive and Creative thinking, Lateral thinking, Time management.

Attitude

Concept, Significance, Factors affecting attitudes, Positive attitude, Advantages, Negative attitude, Disadvantages, Ways to develop positive attitude, Difference between Personalities having positive and negative attitude.

Motivation

Concept of motivation, Significance, Internal and external motives, Importance of self-motivation, Factors leading to demotivation.

Unit IV: Numerical Ability

8 hours

- * Average, Percentage
- * Profit and Loss, Simple Interest, Compound Interest
- * Time and Work, Pipes and Cisterns
- * Time and Distance, Problems on Trains, Boats and Streams
- * Calendar, Ratios and Proportions.

Unit- V: Test of Reasoning

8 hours

Verbal Reasoning

- * Series Completion, Analogy
- * Data Sufficiency, Assertion and Reasoning
- * Logical Deduction

Non-Verbal Reasoning

- * Series
- * Classification

References

- * Aggarwal, R.S. *Quantitative Aptitude*, S.Chand & Sons.
- * Aggarwal, R.S. (2010). *A Modern Approach to Verbal and Non Verbal Reasoning*. S.Chand & Co., Revised Edition.
- * Alex, K. (2009). *Soft Skills*. New Delhi S. Chand & Company Ltd.

- * Covey, Stephen. (2004). *7 Habits of Highly effective people*, Free Press.
- * Egan, Gerard. (1994). *The Skilled Helper* (5th Ed). Pacific Grove, Brooks/Cole.
- * Khera, Shiv (2003). *You Can Win*. Macmillan Books , Revised Edition.
- * Murphy, Raymond. (1998). *Essential English Grammar*. 2nd ed., Cambridge University Press.
- * Prasad, L. M. (2000). *Organizational Behaviour*, S.Chand & Sons.
- * Ravindran, G., Elango, S.P.B., Arockiam, L. (2009). *Success through Soft skills*. IFCOT publications
- * Sankaran, K. & Kumar, M. *Group Discussion and Public Speaking*. M.I. Pub, Agra, 5th ed., Adams Media.
- * Schuller, Robert. (2010). *Positive Attitudes*. Jaico Books.
- * Thamburaj, Francis (2009). *Communication Soft skills*. Grace Publications.
- * Trishna's (2006). *How to do well in GDs & Interviews*, Trishna Knowledge Systems.
- ** Yate, Martin. (2005). *Hiring the Best: A Manager's Guide to Effective Interviewing and Recruiting**

CLINICAL BIOCHEMISTRY

Objectives

- ✿ To impart through knowledge about the biochemical basis of various diseases and disorders.
- ✿ To study the various diagnostic and therapeutic methodologies available for diseases and disorders.

Unit - I

Disorders of blood clotting - Haemophilia A and Haemophilia B. Anticoagulants. Blood groups, Haemoglobin in anaemias, Sickle cell anemia, Thallasemia, abnormal haemoglobins identifications, Systematic analysis of haemorrhage disorders. Porphyrrias and porphyrinurias. Hemolytic diseases of the new born. Blood banking .Adverse reactions of blood transfusions.

Unit - II

Blood sugar - Its maintenance, hyper and hypoglycemia. Regulation of blood glucose concentration - Diabetes mellitus - Types, Complications, secondary degenerative diseases. Laboratory diagnosis of early and latent diabetes. Glucose tolerance test. Dietary regimen in diabetes mellitus. Hypoglycemic agents. Galactosemia, Fructosuria and lactose intolerance. Hypo and hyper cholesteremia, Hypo and hyper lipoproteinemia, Hypocholesteremic agents, Hypertension. Lipid storage diseases, fatty liver, obesity.

Unit - III

Protein deficiency diseases, plasma proteins, their significance and variation in health and diseases. Agammaglobulinemia, Multiple myeloma, Proteinuria, Wilson's disease - Gout, Lesch-Nyhan syndrome. Orotic aciduria, and xanthinuria, cystinuria, Hartnup disease, Maple syrup Urine disease, Alkaptonuria, Albinism, Tyrosinosis, Phenylketonuria. Disorders of sulphur containing amino acid and urea cycle.

Unit - IV

Normal structure and functions of Liver - Diseases of the Liver - Hepatitis - types, Jaundice and types. Cirrhosis, Fatty liver, Alcoholic liver diseases. Cholestatic liver diseases. Hepatic Tumors and Biliary tract diseases - Clinical manifestation of liver diseases. Liver functions Tests. Disorders of Bilirubin metabolism. Enzyme released from diseased liver tissue. Pancreatic function Test; Gastric function Test. Biochemical parameters of CSF in health and disease.

Unit - V

Renal function tests - biochemical changes in acute and chronic renal failure. Normal and abnormal urinary constituents. Renal stress and its analysis. Enzyme parameters in pathological conditions. Cardiac pathology - Major manifestations of heart disease - Ischaemic heart diseases, Angina pectoris, myocardial infraction. Cardiac markers in infraction - LDH, Creatine kinase. Serological tests in infectious diseases . Serological diagnosis of viral infections. Amniotic fluid and maternal serum, ailment in pregnancies.

Books for study and reference

1. Henry. R. D: Clinical Chemistry- Principles and Techniques (Harfer and Row).
2. Cantrow and Trumper: Clinical Biochemistry.
3. King. E.J. & Wooden I.A.P. : Clinical Biochemistry, Church Hill & Co.
4. Devlin (1997): Textbook of Biochemistry (with clinical correlation) (John Wiley and Sons Publishers).

IMMUNOLOGY

Objectives

- ✿ To study in detail the components of immune system.
- ✿ To learn the biochemical basis of immune disorders.

Unit - I

Infection- types, factors influencing infection - pathogenecity. Sources and carriers of infectious agents. Immune system - definition and properties. Cells of the immune system. Lymphoid organs - primary and secondary; structure and functions.

Natural defences of the body (Innate Immunity) - skin, mucous membrane, lysozyme and phagocytes. Reticuloendothelial system and its components.

Unit - II

Antigens: definition, properties- antigenicity and immunogenicity, antigenic determinants and haptens. Types of antigens- flagellar, somatic, capsular, soluble, heterophile, tumour and autoantigens. Antigen-antibody interactions - molecular mechanism of binding. Affinity, avidity, valency, cross reactivity and multivalent binding. Complement system; components- Alternate and Classical pathways, initiators and MAC. Inflammation- acute and chronic; mechanism and significance.

Unit - III

Immunoglobulins: Basic structure, classes and distribution of antibodies. Antibody diversity- genetic and other factors. Theories of antibody formation. Biosynthesis of antibodies; Acquired immunity- Humoral: B and T lymphocyte cooperation. Primary and secondary immune response. Cell Immunity - components of T lymphocytes, T cell receptor diversity and CD molecules. Role of antigen presenting cells. Regulation of immune response. Cytokines, types and role in immunity. Mitogens and immunosuppresants.

Immunological tolerance- at birth and in adults; induction and termination.

Unit - IV

Transplantation immunology- graft rejection and HLA antigens. Role of MHC and T cells. Prevention of graft rejection. Hypersensitivity - Immediate and delayed types; mechanism of reaction. Vaccines and toxoids: types, production and uses. Active and passive immunization, immunization schedule. Tumor immunology: tumor antigens, immunosurveillance and NK cells. Auto immunity-mechanism of breakdown, pathogenesis and specific diseases.

Unit - V

Immunological Techniques: Polyclonal antibodies- principle and production of antisera. Monoclonal antibodies - Hybridoma technique, applications, merits and demerits. Recombinant antibodies. Principle and applications of RIA, ELISA, FISH and Westernblot. Precipitation reaction - Immunodiffusion, immunoelectrophoresis, precipitin ring test. Agglutination tests - Hemagglutination, Febrile and Latex agglutination. Widal, VDRL, Pregnancy and Rheumatoid factor tests.

Books for study and reference

1. Ivan Roitt, Jonathan Brostoff and David Male (1998): Immunology- 5th Edition. (Churchil Livingstone Publishers)
2. Janis Kuby (1998) : Immunology - 3rd and 4th Edition (W.H. Freeman)
3. Weir, D.N. (1997) : Immunology (8th edn) (Churchil Livingstone)

SEM-III
12PBI3110

Hours/Week - 5
Credits - 4

HUMAN PHYSIOLOGY

Objectives

- ✿ To study the functional mechanism of body organ systems.
- ✿ To understand the homeostatic mechanism of each organ system.

Unit - I: General and Cellular Physiology

Cell as the living unit of the body. The internal environment- Homeostasis. Control systems, Functional systems in the cells, Blood - Composition of body fluids. Homeostasis. Formed elements - Development and function. Hemoglobin - structure and function. Homeostasis and coagulation of blood, Mechanism of clotting - Clotting factors, clot retraction, fibrinolysis.

Unit - II: Gastro-intestinal System

General principles of GI function - Mastication & swallowing, esophageal motility, Composition and functions of - Salivary, Gastric, Pancreatic and biliary secretion, Gastrointestinal motility, Digestion & absorption - carbohydrates, fats and proteins, vitamins, water and electrolytes. Functions of Colon, Pathophysiology of peptic ulcer, Gastrointestinal hormones and their actions.

Unit - III: Cardio-vascular and Respiratory Physiology

Properties of cardiac muscle, Cardiac cycle, Heart as a pump, Cardiac output, specialized tissues of the heart, Coronary circulation, Generation & conduction of cardiac impulse, Control of excitation & conduction, Electrocardiogram-Arrhythmias. Cardiac failure, Circulatory shock. Principles of Hemodynamics, Neurohumoral regulation of cardiovascular function, Microcirculation and Regional circulations, Respiration - Functional anatomy of respiratory system, Pulmonary ventilation, Alveolar ventilation, Mechanics of respiration, Pulmonary circulation, Principles of gaseous exchange - Oxygen & carbon-dioxide transport, Regulation of respiration, Hypoxia, Oxygen therapy & toxicity, Artificial respiration.

Unit - IV: Nerve and Muscle Physiology

Classification and Properties of nerve fibers, Nerve conduction, Functional anatomy of skeletal muscle, Neuro-muscular transmission and blockers, Excitation-contraction coupling. Mechanisms of muscle contraction, Smooth muscles.

General design of nervous system, Classification of somatic senses, Sensory receptors, Sensory transduction, Information processing, Dorsal column & medial lemniscal system, Thalamus, Somatosensory cortex, Somatosensory association areas, Pain, Organization of spinal cord for motor function and Motor cortex.

Special Senses - Vision, Hearing, Smell, Taste and their Perceptions. Autonomic nervous system, Limbic system and hypothalamus. EEG, Sleep, Emotions & Behavior. Learning & Memory.

Unit -V: Renal and Environmental Physiology

Structure and function of kidney - Structure of nephron, glomerular filtration, tubular reabsorption of glucose, water and electrolytes. Tubular secretion. Homeostatic regulation of water and electrolytes, Acid- base balance. Body fluid compartments, Urine formation, Regulation of extracellular sodium & osmolarity, Renal mechanisms for the control of blood volume, blood pressure, Micturition, Diuretics, Renal failure.

Environmental Physiology - Physiology of hot and cold environment, High altitude, Aviation physiology, Space physiology, Deep sea diving & hyperbaric conditions.

Books for study and reference

1. West, E.S. and Todd, W.R. (1985), Textbook of Biochemistry (McMillan).
2. Guyton (1999), Medical Physiology (WB Saunders's Company)
3. Zubay (1998), Biochemistry 4th Edition (WMC Brown Publishers)
4. Physiological basis of Medicine (Best & Taylor)
5. Human Physiology Vol I and Vol II. C.C Chatterjee 11th edn, Kalyani mukerjee Publications, Kolkata.

LABORATORY COURSE - III

I. Hematological studies

1. Estimation of hemoglobin content. (Sahli's and Cyanmethemoglobin Method)
2. Total RBC count.
3. Total WBC count.
4. Determination of Packed Cell Volume and MCV.
5. Differential WBC count (DC).
6. Absolute Eosinophil count (AEC).
7. Total platelet count.
8. Determination of clotting time
9. Determination of Prothrombin time
10. Determination of ESR.
11. Grouping of blood and Rh typing.
12. Pathological examination of blood film.

II. Biochemical analysis of blood

1. Estimation of blood glucose (2 methods)
2. Estimation of serum proteins
3. Estimation of plasma fibrinogen
4. Estimation of A: G ratio in serum
5. Estimation of blood urea (2 methods)
6. Estimation of serum uric acid
7. Estimation of serum creatinine.
8. Estimation of serum triglycerides.
9. Estimation of serum cholesterol.
10. Estimation of serum phospholipids.
11. Estimation of serum calcium.
12. Estimation of serum bilirubin.
13. Estimation of Vit-A, E & C

III. Enzyme assays

1. Determination of serum alkaline phosphatase
2. Determination of serum acid phosphatase
3. Determination of serum LDH

V. Immunological techniques

1. Widal test – rapid slide test for typhoid
2. VDRL test – test for syphilis
3. Latex agglutination test for rheumatoid factor and Pregnancy
4. Immunoelectrophoresis
5. Skin Prick Test.

IV. Urology

1. Quantitative determination of urinary Glucose, Urea and Creatinine.
2. Identification of abnormal constituents
3. Screening of inborn errors of metabolism

V. Andrology

1. Total sperm count.
2. Motility Test.
3. Fructose estimation.

VI Miscellaneous

1. Blood Pressure - Measurement – Effect of exercise and postural variation on BP.
2. ECG recording

VII Visit to National Research Institutes.

Books for study and reference

1. Praful B. Godkar and Darshan P. Godkar (2010): Text Book of Medical Laboratory Technology 2nd edition, Bhalani Publishing House, Mumbai, India.
2. Harold Varley, Alan H. Gowenlock and Maurice Bell (1991): Practical Biochemistry Vol. 1 and Vol. 2, 5th edition, CBS Publishers and Distributors, Delhi, India.
3. Kanai, L. Mukherjee (Chief Editor) (2006): Medical Laboratory Technology - A Procedure Manual for Routine Diagnostic Tests, Vol. I, Vol. II and Vol. III, Tata McGraw Hill Publishing Company Limited, New Delhi, India.

**LIFE SCIENCES FOR
COMPETITIVE EXAMINATIONS – III
(Methods in Biology)**

Objectives

- ✿ To introduce the students to the techniques in biology.
- ✿ To help the students to prepare for competitive exams, along with regular curriculum.

Unit I

Microscopic methods: Visualization of cells and sub cellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze- fracture methods for EM, image processing methods in microscopy.

Unit II

Electrophysiological methods: Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI, fMRI, CAT.

Unit III

Molecular Biology and rDNA methods: Molecular cloning of DNA and RNA fragments in bacterial and eukaryotic systems, Expression of recombinant proteins using bacterial, animal and plant vectors. Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants. *In vitro* mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms. Marker assisted breeding in plants and animals.

Unit IV

Environmental hazards and management : Environmental pollution; global environmental change; biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. Bioremediation; Phytoremediation; Solid waste management: toxic effects and treatments, methods, technologies for management of hospital waste – incineration, autoclaving, mechanical/chemical, microwave, plasma torch, detoxification, advanced wet oxidation and thermal dry heat.

Unit V

Methods in field biology: Methods of estimating population density of animals and plants (quadrant and line transit method), ranging patterns through direct, indirect and remote observations, sampling methods in the study of behavior, habitat characterization: ground and remote sensing methods.

Books for study and reference

1. De.Robertis &De.Robertis, 1990.Cell and Molecular biology, Saunders College, Philadelphia,USA.
2. R.C.Dubey, A text book of Biotechnology, S.Chand &Co.Ltd.
3. Medical physiology by Guyton.
4. Sharma.M.K, 1986, Remote sensing and Forest Surveys, International Book Distributors, Dehra Dun.
5. Johnson, PI, 1969, Remote sensing in Ecology, University of Georgia press, Athens.

DRUG BIOLOGY

Objectives

- ✱ To make a detailed study of drugs, particularly their actions on living systems
- ✱ To know their chemotherapeutic value

Unit I

Drugs - definition, source and nature, types of classification and nomenclature, dose response curve - ED50 and LD50. Role of drugs, Drug - protein interactions, routes of drug administration.

Unit II

Drug targets - Enzymes, receptors, carrier proteins. Structural proteins, nucleic acids, lipids and carbohydrates. Forces involved in drug - receptor interaction, Receptor theories.

Unit III

Drug absorption, distribution, metabolism- Phase I and Phase II reactions, excretion and dosing. Pharmacokinetic oriented drug design - Drug solubility and drug stability.

Unit IV

Biological testing and bioassays - testing drugs *in vitro* and *in vivo*. Drug discovery. Lead compounds - natural sources and synthetic sources. Drug for various diseases (Malaria, Typhoid and Hepatitis). Antiviral drugs. Drug abuse.

Unit V

Drug development. Target - oriented drug design, computer aided drug design, Quantitative structure, activity relationship - binding interaction, Functional groups and Pharmacophore. High throughput screening and Molecular docking.

Books for study and reference

1. G.Patrick (2002) Medicinal Chemistry-, Instant notes series, Viva Books.
2. Barar F.S.K. (2004), Essentials of Pharmacotherapeutics, S. Chand & Co. Ltd., New Delhi.
3. Trends in Molecular Pharmacology, Eisiver Publications.
4. Molecular graphics in drug design, Marshall and Motoc.

IDC-II: FIRST AID MANAGEMENT

Objectives

- ✿ To enable the students to perform a basic assessment of an emergency situation.
- ✿ To demonstrate an awareness of signs, symptoms and treatment for common medical emergencies.

Unit - I

Basic knowledge about human body organs and their functions. Principles of first aid, Causality assessment. Priorities of first aid, Unconsciousness and recovery positions. Resuscitation, Control of major bleedings, choking, and treatment of Shocks. Emergency Aid in Schools and Others.

Unit - II

Patient management and care, Labeling of Causalities. Approach to a Causality. Handling and Transport of Injured Persons. Disaster Management and Multiple Causalities.

Unit - III

Internal and external bleeding, Injuries to muscles, Joints and Bones, Stroke. Miscellaneous injuries, Splinting skill tests, head, neck, back, chest, abdomen injuries. Poisoning - Bites - Stings. Drug abuse. Frostbite and cold exposure. Burns and Scalds. Heat Stroke, Heat Cramps and Heat Exhaustion.

Unit - IV

Accident reporting, First Aid to Victims of Road Accidents. Patient assessment and management, breathing emergencies, Oxygentherapy - resuscitation, defibrillation. Sudden Illness - Heart attack, Stroke, Fainting, Convulsion Epilepsy, Prevention of Heart Attack and Apoplexy.

Unit- V

First Aid rooms and equipments, First aid kits, Cleaning of Wounds, Dressing and Bandages. Antiseptics - Types and Action. Injury assessment in Factories and in Rural Areas. Psychological First Aid.

Books for study and reference

1. First Aid Manual - St. John Ambulance Guide.
2. Standard First Aid and Personal Safety 8th edition - American Red Cross.

BIOTECHNOLOGY

Objectives

- ✿ To study the techniques used in genetic engineering.
- ✿ To explore the possible applications and future potentiality of biotechnology.

Unit - I

Basic principles - mechanism of natural gene transfer by *Agrobacterium*; Generation of foreign DNA molecules - Enzymes used in Genetic Engineering - restriction enzymes - their types and target sites; cutting and joining DNA molecules - linkers, adapters, homopolymers; Cloning vehicles and their properties - natural plasmids, *in vitro* vectors, phages, cosmids and T-DNA based hybrid vectors. Human genome project (HGP) - the objectives and approaches; Genomics and genome prospecting - the controversies.

Unit - II

Cloning with sstr. DNA vectors; Cloning strategies - cDNA cloning and genomic libraries; Recombinant selection and screening methods. Expression of cloned genes - problems and solutions, shuttle vectors; Hybridization - Southern, Northern and Western blotting; Polymerase chain reactions; Methods of measuring nucleic acid and protein interactions. Issues of biotechnology - Social and scientific. Genetic use Restriction Technology (GURT) and the terminator; IPR, its concepts and conditions - patenting of genes, cells and life forms - evaluation of life patenting; deliberate release of GMOs.

Unit - III

Techniques of tissue culture - culturing explants and haploids, protoplasts fusion and embryoids. Animal cell culture, Methods of gene transfer to plants, animals and bacteria - Ca-transfection, electroporation, shotgun, Microinjection, Biolistics lipofection and others. Transgenic plants, GM foods and biopesticides. Gene knockouts and transgenic animals - animal pharming and xenografting. Biodegradation stimulation and its applications and bioleaching.

Unit - IV

Principles of gene therapy. Methods for insertion and expression of gene in a target cell or tissue. Methods for repairing or inactivating pathogenic genes in a cell or tissue. Prospects of gene therapy in treating endocrine diseases. Applications of biotechnology; Potential hazards - biological weapons and biosafety of GM foods and GMOs - *substantial equivalence* and safety testing. Gene drain - the tangled genes - Uniformity and genetics loss: Eugenics - decline of human genome, human evolution - possible approaches - Overriding expression, directed recombination and RDT. Cloning of organisms and advances in reproductive biology.

Unit - V

Stem cells, Embryonic stem cells, Adult stem cells, the problem of differentiation, stem cell location and classification of stem cell niches - germ line, epithelial, epidermal, neuronal niche - Uses of stem cells - Stem cells and cancer treatment, stem cells in tissue engineering, Gene therapy and embryonic stem cells, Therapeutic cloning, Ethical and social consideration of stem cell research. Microarrays/DNA chips and gene expression profiling. Gene cascades and molecular pathways: Cluster analysis and co-regulated genes. Applications of microarrays.

Books for study and reference

1. Lewin B. (2000): Genes - VII, Oxford University Press, New York.
2. Old R.W. and Primrose, S.B. (1989): Principles of Gene Manipulations, Blackwell Scientific Publication, London.
3. Primrose, S.B. (1989): Animal Biotechnology Blackwell Scientific Publication, London.
4. Watson, J.D. *et al.* (1987): Cell and Molecular Biology, John Wiley.
5. Freifelder, D. (1993): Molecular Biology, Jones and Bartlett, USA.
6. Ho, M.W. (1997): Genetic Engineering Dreams or Nightmares? - RFSTE/TWN, New Delhi.
7. Mulongoy, K.J. (1997): Transboundary Movement of LMOs. Intl. Acad. Envir., Geneva.

ADVANCED ENDOCRINOLOGY

Objectives

- ✿ To study the hormonal regulations of various physiological functions.
- ✿ To explore the various hormonal cell signaling mechanisms.

Unit-I - Introduction and Genetic Control of Endocrinology

Hormones - Definition; Classical and nonclassical endocrinology. Pituitary hormones and their control by the hypothalamus. Thyroid Metabolic hormones. Adrenocortical hormones. Feed back mechanisms (HPA & HPG). Inactivation and degradation of hormones. Hypothalamus - Neurohypophyseal hormones. Hormone resistant syndrome and multiendocrine neoplasia - different types. Melatonins and serotonin - light and dark cycles. Genetic control of hormone formation.

Unit-II - Hormones acts through cell surface receptors

Hormones acting through cell surface receptors. Hormone - Receptor interaction; multiple hormone subunits, Scatchard analysis; Peptide hormone receptors: Types of receptors- regulation, transmembrane signaling - adaptor proteins second messengers- effector kinases- transcription factors. Structure of beta - adrenergic receptor and Insulin Receptor. Internalization of receptors. Intracellular action; Protein kinases. Insulin receptor - Transduction through Tyrosine kinase; Vasopressin - Protein Kinase - A; GnRH - Protein Kinase-C; Atrial natriuretic factor - Protein kinase G . Signal Transducers and second messenger; Adrenalin, G-Protein, Adenylate cyclase system-cAMP. Second messengers and glycogen phosphorylase kinase; DAG and inositol tri phosphate - Calcium ions.

Unit-III - Molecular endocrinology of insulin resistance

Endocrinology of Adipose tissues - Leptin, Gherlin, Adiponectin, Resistin. Fetal endocrine programming of adult disorders (FEPAD): Adverse effects of glucocorticoids in programming events. Endocrinology of Insulin Like Growth Factors (IGF's) and its Binding proteins (IGFBP). Modulation of placental hormones and growth factors in FEPAD.

Unit-IV - Reproductive Endocrinology

Genetic, endocrine and biochemical aspects of testis and ovarian differentiation and development. Neuroendocrine perspectives of mammalian reproduction. Endocrine, paracrine and autocrine regulation of spermatogenesis, oogenesis, ovulation and steroidogenesis (Testosterone, 17 β -estradiol, Progesterone). Control of synthesis and release of steroid hormones. Structure, function and regulation of male and female accessory sex organs. Conception and contraception. Transport of steroid hormones in Blood. Apoptosis – steroid hormone action at cell level. Hormonal physiology of parturition and lactation. Functional and signaling role of Relaxin, Follistatin Inhibin. Placental Hormones and its neuronal control release.

Unit-V - Nuclear receptors (NR)

General features of NR, Ligands that act via nuclear receptor and its sub classes (Orphan receptor and variant receptors). Domain structure of NR - Hormone binding domain, Antigenic domain and DNA binding domain. Hormone response elements. Detailed study of Peroxisome proliferator activated receptor and Liver X Receptor (Structure, function and its signaling mechanisms). PPAR in Insulin Resistance. Nuclear receptor signaling mechanisms: Nuclear localization, Target gene recognition by NR. Receptor dimerization. NR regulation of gene transcription: Ligand dependent activation, ligand independent repression and ligand dependent negative regulation of transcription. Receptor activation – upregulation and down regulation. Selective Estrogen Receptor Modulator. Endocrine Responsive Cancer - Breast, Endometrial and Prostate Cancers. Endocrinology of Calcium.

Books for study and reference

- 1) Devlin (1997): Textbook of Biochemistry (with clinical correlation) (John Wiley and sons publishers).
- 2) Wilson and Foster (1992): Textbook of Endocrinology, (8th edn), (W.B. Saunders Company).
- 3) Robert, K. Murray et al.: Harper's Biochemistry (25th edn), (Appleton and Lange Stanford).
- 4) Arthur C. Guyton and Hall: Text Book of Medical Physiology (11th edn), Saunders Company.
- 5) Mac. E. Hadley and Jon. E. Levin: Endocrinology 6th ed. (Pearson Educational Press).

ENVIRONMENTAL TOXICOLOGY

Objectives

- ✿ To study the principles of toxicology and basis of toxicants.
- ✿ To understand the mechanism of toxicity induction and detoxification.

Unit I

Principles of toxicology: Basis for general classification and nature, definition and purpose of toxicology, dose response relationship, synergism and antagonism. Determination of ED50, LD50 and chronic exposures. Factors influencing toxicity. Principles and procedures of testing for acute toxic effects: Regulatory guidelines, mammalian system affected and the clinical signs of systemic toxicity. Factors affecting acute toxicity studies.

Unit II

Xenobiotic metabolism: Absorption and distribution, phase I reactions - oxidation, reduction, hydrolysis, hydration. Phase II reactions - conjugation, methylation, glutathione and amino acid conjugation. Toxicity testing: Test protocol, genetic toxicity testing and mutagenesis assays, *in vitro* test systems, bacterial mutation tests, preservation test, Ames test, *in vivo* mammalian mutation tests, host mediated assay and dominant lethal test. Use of *Drosophila* in toxicity testing. DNA repair assays, chromosome damage test, toxicological evaluation of recombinant DNA derived proteins.

Unit III

Biological effect of ionizing radiation and toxic effects of animals and plants toxins: Radiation carcinogenesis, acute radiation syndrome, properties and effects of animal toxins - snake and scorpion, plants toxins - ricin and mycotoxins (aflatoxin B1 & G1). Pesticide toxicity: Insecticides - organochlorines, anticholinesterases, organophosphates, carbamate. Fungicides and herbicides.

Environmental consequences of pesticide toxicity. Biopesticides - general introduction, scope and importance.

Unit IV

Metal toxicity: Toxicology of Arsenic, Mercury, Lead and Cadmium. Environmental factors affecting metal toxicity. Effects of light, temperature and pH. Toxicology and detoxification of pollutant: Common air pollutants and their sources. Air pollution and Ozone, air pollution due to chlorofluorocarbons (CFCS) and asbestos. Control of air pollution. Pollutants sources, adverse effects and control measures.

Unit V

Solid waste management: toxic effects and treatments, methods, technologies for management of hospital waste - incineration, autoclaving, mechanical/chemical, microwave, plasma torch, detoxification, advanced wet oxidation and thermal dry heat.

Books for study and reference

1. Casarett and Doull's toxicology: C.D. Klaassen, M.O. Amdur, J. Doull (Macmillan Publishing Co.).
2. Haye's principles and method of toxicology: A. Wallace and Hages (Eds.) (Raven Press).
3. Hamilton and Hardy's industrial toxicology: R.D. Harbison (Tampa).
4. Basic toxicology - fundamental target organs and risk assessment: F.C. Lu.
5. Environmental biology: K.C. Agrawal (Agor Botanica).
6. Introduction to environmental toxicology - impact of chemicals upon ecological systems: W.G. Landis and Ming-Ho Yu (Lewis Publishers Inc.).
7. Hamilton and Hardy's Industrial toxicology: R.D. Harbison (Mosby).
8. CRC handbook of toxicology: M.J. Derelanko, M.A. Hollinger (CRC Boca Raton).

9. Environmental toxicology – human exposure and their health effects: M. Lipmann (John Wiley & sons Inc.).
10. Principles and methods of toxicology: A.W. Hayes (Raven Press).
11. Toxic and hazardous waste disposal: R.B. Pojasek (Ann Arborscience Publisher).
12. Toxics A to Z – a guide to everyday pollution hazards: J. Harte, C. Holdren, R. Schneider and C. Shinley (Bishen Singh Mahendrapal Singh Publishers).
13. Environmental toxicology: M. Satake, Y. Mido, H. Yasuhisa, S. Taguchi, M.S. Sethi, S.A. Iqbal (Discovery Publishing House).
14. Fundamental toxicology for chemists: J.H. Duffus and H.G.J. Worth (Eds.) (The Royal Society of Chemistry).
15. Waste Management: R.K. Sinha and A.K. Sinha (INA Shree Publishers).

INTER DEPARTMENTAL COURSE – IDC

BIOCHEMISTRY

12PSK2401	SOFT SKILLS
12PBI3402	FIRST AID MANAGEMENT

BIOTECHNOLOGY

12PSK2401	SOFT SKILLS
12PBT3402	APPLIED BIOTECHNOLOGY

BOTANY

12PSK2401	SOFT SKILLS
12PBO3402	HORTICULTURE & LANDSCAPING

CHEMISTRY

12PSK2401	SOFT SKILLS
12PCH3402	HEALTH CHEMISTRY

COMMERCE

12PSK2401	SOFT SKILLS
12PCO3402	FINANCIAL ACCOUNTING FOR MANAGERS

COMMERCE (CA)

12PSK2401	SOFT SKILLS
12PCC3402	CAREER PLANNING AND MANAGEMENT

COMPUTER APPLICATIONS

12PSK2401	SOFT SKILLS
12PCA3402	COMPUTER APPLICATIONS FOR SOCIAL SCIENCES
12PCA3403	FUNDAMENTALS OF PROGRAMMING

COMPUTER SCIENCE

12PSK2401	SOFT SKILLS
12PCS3402A	FLASH
12PCS3402B	WEB DESIGN

ECONOMICS

12PSK2401	SOFT SKILLS
12PEC3402	INDIAN ECONOMY

ELECTRONICS

12PSK2401	SOFT SKILLS
12PEL3402	COMPUTER HARDWARE

ENGLISH

12PSK2401	SOFT SKILLS
12PEN3402	ENGLISH FOR MEDIA STUDIES

HISTORY

12PSK2401	SOFT SKILLS
12PHI3402	INDIAN CONSTITUTION

HUMAN RESOURCE MANAGEMENT

12PSK2401	SOFT SKILLS
12PHR3402	FUNDAMENTALS OF HRM

INFORMATION TECHNOLOGY

12PSK2401	SOFT SKILLS
12PIT3402A	FLASH
12PIT3402B	WEB DESIGN

MATHEMATICS

12PSK2401	SOFT SKILLS
12PMA3402	OPERATIONS RESEARCH

PHYSICS

12PSK2401	SOFT SKILLS
12PPH3402	MODERN PHOTOGRAPHY

TAMIL

12PSK2401	நுண்வகைமைத்திறன்கள்
12PTA3402	அரசுப்பணித்தேர்வுத் தமிழ் - I