



M. Sc.
BIOCHEMISTRY
SYLLABUS (2007-2010)

under
CHOICE BASED CREDIT SYSTEM
(CBCS)



ST. JOSEPH'S COLLEGE (AUTONOMOUS)

(Nationally Reaccredited with A+ Grade/
College with Potential for Excellence)

TIRUCHIRAPPALLI - 620 002



FEATURES OF CHOICE BASED CREDIT SYSTEM (PG COURSES)

The Autonomous St. Joseph's College (1978) Reaccredited with A+ Grade from NAAC (2007) has introduced the choice based credit system (CBCS) for UG and PG courses from the academic year 2001-2002.

OBJECTIVES of Credit System:

- * To provide mobility and flexibility for students within and outside the parent department
- * 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. However, there could be some flexibility because of practicals, field visits and tutorials. The following Table shows the relation between credits and hours.

Hours in a week	Hours (2-3)	Hours (4)	Hours (5-6)
Theory Credits	1	3	4
Practicals Credits	1	2	3

For PG courses (2 years) a student must earn a minimum of 100 credits. For MCA course (3 years) the student must earn 140 credits to get a pass. For a two year PG degree course the minimum number of papers offered by a department is 18.

COURSE PATTERN

The Postgraduate degree course consists of three major components. They are Core Course, Optional Course and Extra Department Course (EDC).

Core Course

A core course is the course offered by the parent department, totally related to the major subject, components like Practical, Projects, Group Discussion, Viva, Field Visit, Library record form part of the core course. All the students of the course must take the core courses.

Optional Course

The optional 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 optional. The optional is related to the major subject. The difference between core course and optional course is that there is choice for the student. The department is at liberty to offer optional course every semester or in any two semesters. It must be offered at least in two semesters. The staff too may experiment with diverse courses.

Extra Department Course (EDC)

EDC is an interdepartmental 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 EDCs must be taken by students.

Day College student may also take an EDC from PG SFS Course and vice versa. This provision enables students to earn extra credits. The EDCs are offered in the II and III semesters. For the day college student it is offered in the last hour and for the PG SFS course students in the first hour or zero hour. The EDCs are expected to be application oriented and inter-disciplinary.

For Two Year Degree Programme

	Credits
Core	- 84
Optionals	- 8 (2 semesters)
EDC	- 6
Shepherd	- 2
Total	- 100

For Three Year MCA Programme

	Credits
Core	- 121
Optionals	- 8 (2 semesters)
EDC	- 9
Shepherd	- 2
Total	- 140

Credit System Codes:

The various papers in the different courses are coded. The following code system is adopted.

Each code indicates the following particulars

- 1) The year of introduction/revision of syllabus (07)
- 2) Whether it is undergraduate or postgraduate course (U or P)
- 3) The discipline's name is indicated by two letters as shown below:

Sl. No.	Course	Subject Code
1.	Biochemistry	BI
2.	Biotechnology	BT
3.	Business Administration	BU
4.	Chemistry	CH
5.	Commerce	CO
6.	Computer Applications	CA
7.	Computer Science	CS
8.	Economics	EC
9.	English	EN
10.	English - General	GE
11.	Electronics	EL
12.	Foundation Course	FC
13.	French	FR
14.	Hindi	HI
15.	History	HS
16.	Human Resource Management	HR
17.	Information Technology	IT
18.	Mathematics	MA
19.	Physics	PH
20.	Plant Biology & Plant Biotechnology	PB
21.	Personnel Management & Industrial Relations	PM
22.	Sanskrit	SA
23.	Statistics	ST
24.	Tamil	TA
25.	Tamil - General	GT
26.	Transport Management	TM
27.	Journalism (EDC)	JO
28.	Law (EDC)	LA
29.	Short Hand (English) (EDC)	SH

- 4) The semester number (1 or 2 or 3 or 4 for 2-year course)
- 5) The paper number: The courses in the discipline fall into three categories

Core papers-numbers : 20 to 39

Optional papers - numbers : 41 to 49

EDC's : 61 to 70

For MCA course offered by Department of Computer Science, the following paper numbers used:

Core papers : 51 to 80

Optional Papers : 81 to 90

The following examples illustrate the above concept.

The first semester Core papers in Chemistry is given the code 07PCH121

The EDC offered by Chemistry department in Semester III is given the code 07PCH362

Evaluation:

For each course there is formative continuous internal assessment (CIA) and semester examinations (SE) in the weightage ratio 50:50. The following table illustrates how one evaluates the Overall Percentage Marks (OPM) for a student in Chemistry PG course in the all papers put together

$$\text{OPM} = (a_1b_1 + a_2b_2 + \dots + a_{23}b_{23}) / (b_1 + b_2 + \dots + b_{23})$$

Where a_1, a_2, \dots, a_{23} indicate the marks obtained in the 4 semesters for 23 papers and b_1, b_2, \dots, b_{23} indicate the corresponding credits for the 23 courses.

For example if total credit points in 23 papers is 6860 then the OPM is given by

$$\text{OPM} = 6860 / \text{total number of credits} = 6860.0 / 98 = 70.0$$

If OPM is between 50 and 60, the student gets II class. If OPM is 60 and more, then the student is placed in I class. If the OPM score is 75 and more the student gets first class with distinction.

The performance in shepherd programme is indicated by a pass and is not taken into account for computing OPM.

Declaration of result

_____ has successfully completed M. Sc. degree course with FIRST CLASS. The student's overall average percentage of marks is 70. The student has acquired 2 more credits in SHEPHERD programme.

M. Sc. BIOCHEMISTRY – COURSE PATTERN.

Sem	Subject code	Subject Title	Hrs/Week	Credits
I	07PBI121	Proteins And Nucleic Acids	5	5
	07PBI122	Carbohydrates And Lipids	5	5
	07PBI123	Microbiology	4	4
	07PBI124	Practicals-I	8	6
	07PBI141	Cell Biology / or		
	07PBI142	Advanced Nutrition	4	4
		Library	4	
		TOTAL FOR SEMESTER-I	30	24
II	07PBI225	Molecular Physiology	5	5
	07PBI226	Enzymology & Bioenergetics	5	5
	07PBI227	Analytical Chemistry & Research Methodology	4	4
	07PBI228	Practicals-II	8	6
	07PBI243	Environmental Biology / or		
	07PBI244	Genetics	4	4
	*	EDC I	4	3
		TOTAL FOR SEMESTER-II	30	27
III	07PBI329	Clinical biochemistry	5	5
	07PBI330	Immunology	5	5
	07PBI331	Advanced Endocrinology	4	4
	07PBI332	Practicals-III	8	6
	07PBI345	Pharmacology / or		
	07PBI346	Pharmacognosy	4	4
	07PBI333	Review of Literature		2
	*	EDC II	4	3
		TOTAL FOR SEMESTER-III	30	29
IV	07PBI434	Molecular Biology	5	4
	07PBI435	Biotechnology	5	4
	07PBI436	Project Work	20	10
		TOTAL FOR SEMESTER-IV	30	18
		Extension Service-SHEPHERD		2
		TOTAL FOR ALL SEMESTERS	120	100

* The code for EDC (Extra Departmental Course) will depend on the choice of the students (see in the last two pages of the syllabus copy)

Sem-I
07PBI121

Hours/week: 5
Credits: 5

PROTEINS AND NUCLEIC ACIDS

Objectives

- i.) To study the three dimensional structure ,properties of proteins and nucleic acids.
- ii) To understand the mechanism of synthesis of purines and pyrimidines and their disorders.

Unit - I

Amino acids – structure, classification, characteristics and optical activity. Acid- base properties; standard and non-standard amino acids. Naturally occurring peptides – glutathione, peptide hormones, peptide antibiotics, receptors, cyclosporin.
Protein- classification and types - characteristics.

Unit - II

Protein structure - amino acid composition, cleavage of disulfide bonds, specific peptide cleavage reactions. Secondary structure- alpha helix and beta pleated structure. Tertiary and quaternary structures- subunit interactions, symmetry and functional properties-haemoglobin and multienzyme complexes.Molecular Chaperones, Protein folding- role of chaperones. Protein denaturation and renaturation. Ramachandran plot. Isolation,fractionation and purification of proteins. Solid state synthesis of peptides, sequence determination and peptide mapping. Methods for determining protein conformation- x-ray diffraction analysis.

Unit - III

Protein degradation- degradation specificity. Biosynthesis of amino acids- aspartate, pyruvate and aromatic amino acid family. Degradation of amino acids- oxidative and non-oxidative deamination, transamination and decarboxylation. Deammonification - urea cycle and its significance. Amphibolic activity of amino acids - ketogenic and glucogenic amino acids. Special products of Amino acids.

Unit - IV

Nucleic acids- bases, nucleosides and nucleotides; structure- double helical structures and forces stabilizing nucleic acid structures. Nucleic acid fractionation, sequencing, and chemical synthesis of oligonucleotides. Nucleic acid types- DNA and RNA; denaturation and hybridization. Mitochondrial DNA and Chloroplast DNA.

Unit - V

Synthesis of purine and pyrimidine – *de novo* and salvage pathways. Synthesis of deoxy and oxy-ribonucleotides,. Inhibitors of nucleotide synthesis and their role in chemotherapy. Biosynthesis of nucleotide coenzymes. Nucleotide degradation- catabolism of purines and pyrimidines. Disorders in purine and pyrimidine metabolism.

Books for study and reference

1. Caret *et al.* (1993), Inorganic, Organic & Biological Chemistry (WMC Brown Pub. USA)
2. West, E.S. and Todd , W.R.,Mason H.S., and Bruggen J.T. (1963): Text Book of Biochemistry (Macmilan Co. London)
3. Lehninger,A.L. *et al* (1993) : Principles of Biochemistry (Worth Publ. Inc. USA)
4. Rawn, J.D. (1989) : Biochemistry (Neil Patterson Publ. North Carolina)
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)
7. Zubey, GL (1998) : Biochemistry, WCB Publishers. Robert K.Murray *et al.* (2000) : Harper’s Biochemistry (25th edition). (Appleton and Lange Stamford Connecticut)

Sem-I
07PBI122

Hours/week: 5
Credits: 5

CARBOHYDRATES AND LIPIDS

Objectives

- i) To study the structure, properties and metabolism of different types of carbohydrates and lipids.
- ii) To know the interrelationships between different metabolites.

Unit – I Carbohydrates

Carbohydrates- occurrence, chemical properties and classification. stereo isomerism and optical isomerism. Monosaccharides- structure, mutarotation, general reactions and their derivatives like phosphate esters, amino sugars, deoxy sugars, inositols. Oligosaccharides: structure and general reactions. Homoglycans: starch, glycogen, cellulose, dextrin, inulin. Structure and properties of heteroglycans, agar, alginic acid (seaweed polysaccharides), pectins, glycosaminoglycans (mucopolysaccharides) and glycocalyx oligosaccharides

Unit – II Carbohydrate Metabolism

Metabolism of carbohydrates- glycolysis, citric acid cycle and its regulation highlighting the following key enzymes- hexokinase, phosphofructokinase and pyruvate dehydrogenase complex. Pentose phosphate pathway, gluconic acid pathway, gluconeogenesis, glyoxylate cycle, glycogenesis and glycogenolysis. Regulation of glycolysis and gluconeogenesis. Metabolism of amino sugars, sialic acids, mucopolysaccharides and glycoproteins.

Unit – III Lipids

Chemical nature of fatty acids and acylglycerols- sources and biological functions. Biosynthesis of fatty acids, hydroxy fatty acids and acylglycerols. Methods of inter-organ transport of fatty acids and their primary products. Biosynthesis of phospholipids and their biological functions. Utilization of fatty acids for energy production, alpha, beta and gamma oxidation of fatty acids. Formation of ketone bodies. Peroxisomal oxidation of fatty acids.

Unit – IV Lipid Metabolism

Derived lipids: Biosynthesis of cholesterol, its regulation and excretion. Biosynthesis of sphingosine, ceramides, sphingomyelin, cerebroside, gangliosides, prostaglandins, thromboxanes, eicosatetraenoic acid and leucotrienes. Lipoproteins- Types and biological functions.

Unit – V

Overview of intermediary metabolism. Overview of starvation, fuel stress, enzymic changes in starvation, organ profile during starvation. Integration of metabolism by inter-relationship of tissues- brain, heart and skeletal muscles, adipose tissues, liver and pancreatic hormones.

Books for study and reference :

1. Bohinski, R.C.(1987): Modern concepts in Biochemistry (Allyn & Bascon Inc. Boston)
2. Caret *et al.*(1993): Inorganic, Organic and Biological Chemistry (WMC Brown Publ. USA)
3. West, E.S. and Todd, W.R., Mason H.S., and Bruggen J.T. (1963) : Text Book of Biochemistry (Macmillan Co. London.
4. Lehninger, A.H. *et al* (1993) : Principles of Biochemistry (Worth Publ. Inc. USA)
5. Montgomery, R. *et al* (1990): Biochemistry: A case Oriented 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)

Sem-I
07PBI123

Hours/week: 4
Credits: 4

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. Preservation of microorganisms

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. 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

Role of microbes in the manufacture of antibiotics and vaccines. Microorganisms as biofertilizers. Microbes as foods- SCP production. Role of microbes in bio-gas production, petroleum industry and mining. 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 Mc graw-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.
8. Sheeris. : Medical Microbiology.

Sem-I
07PBI124

Hours/week: 8
Credits: 6

PRACTICALS - I

Microbiology

1. Preparation of media (PDA, NA, NB and LB)
2. Pure culture techniques (poured, streak and spread plate)
3. Staining techniques (simple, differential and capsular)
4. Characterization of individual species.
Biochemical activities of microbes
5. Extracellular Enzymatic Activities of Microbes.
 - a) Carbohydrate Hydrolysis
 - b) Lipid Hydrolysis
 - c) Protein Hydrolysis
6. Intracellular Enzymatic Activities of Microbes.
 - a) Carbohydrate Fermentation
 - b) Litmus Milk Reactions
 - c) Citrate Utilization Test
7. Triple Sugar- Iron Agar Test.
8. Potability test of water.
9. Testing the microbiological quality of Milk.
 - a) Methylene Blue Reductase Test.
 - b) Phosphatase test.
10. Antibiotic sensitivity test.

Biochemistry

1. Qualitative analysis of carbohydrates.
2. Qualitative analysis of amino acids and proteins.
3. Qualitative analysis of lipids.
4. Estimation of liver glycogen.
5. Estimation of total mucopolysaccharides.
6. Extraction of nucleic acids from liver and spleen.
7. Estimation of DNA. And RNA.
8. Estimation of amino acids by Sorenson's formal titration.
9. Estimation of Iodine value of oil.
10. Estimation of acid value of oil.
11. Estimation of reducing sugars by Benedict's titration.

Sem-I
07PBI141

Hours/week: 4
Credits: 4

CELL BIOLOGY

Objectives

- i) To study the structural and functional organization of cells.
- ii) To understand the different techniques employed in cell biology and its recent advancements.

Unit – I

Cell – types; prokaryotic and eukaryotic types, organ and tissue slice techniques – methods for disrupting tissues and cells. Isolation of clones. Tissue culture techniques- (animal and plant). Cell division-types.

Unit – II

Cell fixation – fluid fixatives, freezing and section drying. Fixation for electron microscopy – buffered osmium. Solutions. Fixation of organic and inorganic substances. Staining techniques – acid and basic, fluorescent and radioactive dyes. Staining of lipids, steroids, nucleic acids proteins, minor components and enzymatic reaction products.

Unit – III

Cell adhesion – adhesion of cells to non-cellular substrates; cell to cell adhesion; Integrins, selectins and cadherins. Adhesion junctions and desmosomes: Tight junctions. Cell aging and death - apoptosis - role of free radicals; mechanism. Scavengers and antioxidant enzymes in cells.

Unit – IV

Cell motility - molecular motors - microtubules. Structure and composition. Microtubular associated proteins - Role in intracellular motility. Microtubule organizing centers (MTOCS). Factors influencing assembly and disassembly. Microfilaments assembly and disassembly actin and myosin.

Unit – V

Cellular organelles – structure and functional organization. Nuclear – cytoplasmic interactions. Histopathological studies – organ specific morphohistological examination; Identification of morphological changes related to pathology.

Books for study and reference

1. Gerald Karp, (1996): Cell and Molecular Biology – Concepts and Experiments (John Wiley and Sons Inc.)
2. Harvey Lodish *et al*,(2000): Molecular Cell Biology – 4th ed. W.H.Freeman and Co., New York.
3. Jean Brachet and Alfred E.Mirsky : The Cell – Biochemistry, Physiology and Morphology, Academic Press, New York

Sem-I
07PBI142

Hours/week: 4
Credits: 4

ADVANCED NUTRITION

Objectives

- i) To study the proximate principles of Nutrition with reference to RDA.
- ii) To understand the disorders associated with nutrition intake.

Unit – I

Energy Metabolism

Basal metabolism – Basal metabolic rate – Factors affecting BMR, - determination of BMR, direct and indirect methods, - Benedict's Roth apparatus, - respiratory quotient – Biological oxygen demand. Anthropometry; Height, Weight, Skin fold thickness and arm circumference -Their importance in nutrition.

Unit – II

Introduction to nutritional Biochemistry. Carbohydrate ; Source of energy; Glycogen , Fibre in diet. Proteins – essential amino acids and non essential amino acids – sources, functions – relation with Marasmus, Kwashiorkor disease. Biological value of proteins. Fats: Sources- essential and non-essential fatty acids – disorders concerned with fatty acid metabolism – Repeum's disease, Atherosclerosis, - Saturated and unsaturated fatty acids.

Unit – III

Vitamins

Vitamins – Fat soluble and water soluble – B-complex vitamins – source, daily requirements – deficiency manifestations. Role of Vitamins as co-factors- in Electron transport chain; and enzyme reactions; Vitamins involved in haemopoiesis.; Role as antioxidants.

Unit – IV

Minerals

Micro, macro and trace elements – daily requirements – functions – deficiency manifestations – Role as electrolytes.- sodium and potassium.
Food fads and Facts

Unit – V

Nutrition at different Stages of life – during infancy, adolescence, pregnancy ;and aging. Therapeutic diet – Formulations for DM, Hypertension and Atherosclerosis. Assessment of nutritional status, - methods – intake, Biochemical and clinical methods.

Books for study and reference

1. Davidson and Passmore : Human Nutrition and Dietetics.
2. Swaminathan, M.S. (1985) : Principles of nutrition.J.L.Publishers,New Delhi.
3. Anthony A. Albanase (1972), Newer Methods of Nutritional Biochemistry (Academic Press, New York)

Sem-II
07PBI225

Hours/week: 5
Credits: 5

MOLECULAR PHYSIOLOGY

Objectives

- i) To study the functional mechanism of body organ systems.
- ii) To understand the homeostatic mechanism of each organ system.

Unit – I

Membrane biochemistry: membrane lipids, proteins and carbohydrates; their alignment; cytoskeleton of erythrocyte membrane. Membrane asymmetry, fluidity and mobility of proteins; isolation and characterization of plasma membrane proteins. Membrane transport; Facilitated transport; pores and channels; Ionophores; Liposomes and uses; transport proteins; periplasmic binding proteins; active transport- Na pump model; secondary active transport; Na –dependent glucose transport; transport in excitable cells; Large molecules- exocytosis and endocytosis.

Unit – II

Excitation and contraction of muscles – molecular organization of muscle, proteins of contractile element; their organization and role in contraction; Energy for contraction . Theories of contraction.

Cardiac physiology- circulation, electrophysiology of heart. Measurement of blood pressure, hypo and hypertension.

Unit – III

Blood gas analysis. Acid-base parameters – definitions and physiology. Acid-base balance and status. Buffer systems of body fluids and their role. Respiratory mechanism in acid-base balance. Respiratory response to acid-base balance. Conditions associated with abnormal acid-base status and abnormal electrolyte composition of blood- metabolic acidosis and alkalosis.

Unit – IV

Brain: chemical composition, metabolism and metabolic adaptation, neurotransmitters and cAMP. Biochemical aspects of learning and memory. Enkephalins and endorphins. States of brain waves, epilepsy and psychoses.

Nervous system: General organization- functional units; resting and action potential; conduction of nerve impulse, synaptic transmission, compounds affecting synaptic transmission, neuromuscular junction.

Structure and function of retina- hyperpolarizations in eye.

Unit – V

Nutrition: Human body composition; determination of body fat and body water. Energy metabolism: Basal metabolic rate – Factors influencing BMR; measurement of energy expenditure by direct and indirect calorimetry; respiratory quotient.

Mineral metabolism: Cells of bone and their biochemical characterization. Markers of bone metabolism . Synthesis of collagen and their matrix components- elastin and other fibres. Integrated control of mineral metabolism. Disorders of mineral metabolism. Interrelationship of calcium, vitamin D , Calcitonin and PTH.

Books for study and reference

1. West, E.S. and Todd, W.R. (1985) : Text book of Biochemistry(McMillan).
2. Guyton (1999): Medical Physiology (WB Saunder's Company)
3. Zubay (1998) : Biochemistry- 4th Edition (WMC Brown Publishers)
4. Talwar,G.P., Srivastava, L.M. and Momdgill, K.D. : Text book of Biochemistry and Human Physiology.

Sem-II
07PBI226

Hours/week: 5
Credits: 5

ENZYMOLGY AND BIOENERGETICS

Objectives

- i) To impart through knowledge about Enzymes and Enzyme kinetics.
- ii) To understand the various concepts of Bioenergetics.

Unit – I

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, and determination of active site residues.

Unit – II

Principles of catalysis: criteria of chemical reactions- collisions, activation barrier, transition state, specificity of enzymes . Coenzymes - structure and function, mechanism of enzyme catalysis-lock and key hypothesis, induced fit hypothesis. Active site definition and organization. Mechanism of action of carboxypeptidase, lysozyme and chymotrypsin. Enzyme kinetics; derivation of Michaelis – Menton equation, Lineweaver Burk plot.

Unit – III

Inhibition kinetics (competitive, non-competitive and un-competitive). Allosteric inhibition, cooperative, cumulative, feed back inhibition. Multienzyme complex- pyruvate dehydrogenase, isoenzymes, Abzymes, Ribozymes, LDH. Immobilized enzymes - principles, methods and applications (industrial, clinical, diagnostic, and biotechnological). Enzymes of clinical importance – diagnostic significance and therapeutic effects, Enzyme electrodes, Enzyme Engineering

Unit – IV

Thermodynamic terms and basic concepts – types of thermodynamic systems, intensive and extensive properties, state of system, reversible and irreversible thermodynamic processes. First law of thermodynamics, enthalpy and biochemical reactions; exothermic and endothermic reaction, biological thermodynamic standard state, activation energy. Biological oxidation, oxidation-reduction reactions. High-energy phosphate compounds, role of ATP in biological system; energy transfer; acyl group transfer.

Unit – V

Types of energy transformation in living systems; energy in photosynthesis. Light reactions in chloroplasts, phosphorylation types; inhibitors of electron transport. Organisation of electron carriers and enzymes in mitochondria; classes of electron transferring enzymes; Mitochondrial electron transport system; cyanide resistant respiration. Mechanism of oxidative phosphorylation; uncouplers and inhibitors of electron transport, microsomal electron transport.

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)

Sem-II
07PBI227

Hours/week: 4
Credits: 4

ANALYTICAL CHEMISTRY AND RESEARCH METHODOLOGY

Objectives

- i) To learn the strategies of biochemical research.
- ii) To study the principles of biochemical techniques.

Unit - I

Electrochemical techniques – principles, electrochemical cells and reaction - pH , buffers. Measurement of pH – glass electrode and titration curves. Ion selective and gas sensing electrodes, oxygen electrode, application. Manometry: Warberg manometer. General principle of biochemical investigations, whole organism studies- perfusion of isolated organs. Preparations of tissue homogenates. Elucidation of metabolic pathways.

Unit - II

Chromatographic technique –general principle; Techniques and application 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. Radioactivity; application - clinical diagnosis. Autoradiography and its application. Non- radioactivity in clinical diagnosis.

Unit - III

Centrifugation: Principles, differential and analytical centrifugation, density gradient centrifugation; Analysis of subcellular 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.

Unit - IV

Spectroscopy – basic principles of light, absorption spectrum, UV, and visible spectroscopy, IR, ESR, NMR, mass spectrometer, spectrofluorimetry, CD spectroscopy, X-ray diffraction, atomic spectroscopy: Laser: principle and application, population inversion, stimulated emission CO₂ laser, Nd – YAG laser , biological application.

Unit - V Research Methodology

Selection of research problems – hypothesis – definition and characteristics. Experimental approach – biological, physical and chemical methods.

Source of information: 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) .Journal Articles, Review writing, Different types of short communication. Review writing : preparation of review papers related to projects

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. Carl, A., Burtis and Edward R. Ashwood (1999) : Teitz Text Book of Clinical Chemistry (W.B.Saunders)

Sem-II
07PBI228

Hours/week: 8
Credits: 6

PRACTICALS - II

1. Enzyme studies with phosphatase

Effect of temperature, time, pH, enzyme concentration and substrate concentration on reaction, measurements of V_{max} and K_m .

Assay of Peroxidase, Catalase, Lipase

2. Food or tissue analysis

- a) Estimation of water content
 - b) Estimation of ash content
 - c) Estimation of magnesium
 - d) Estimation of phosphorus
 - e) Estimation of tryptophan
- Estimation of total lipids
Estimation of vitamin C (Titration)

3. Biochemical techniques:

- a) Column Chromatography for plant Pigments separation.
- b) Separation of phospholipids by TLC.
Histological and histochemical studies.
SDS-PAGE of Proteins .
Cell disruption.
Paper Chromatography.

Sem-II
07PBI243

Hours/week: 4
Credits: 4

ENVIRONMENTAL BIOLOGY

Objectives

- i) To understand the basic principles of Environment and Ecosystem,
- ii) To know the causative agents of environmental problems, their consequences and remedial measures.

Unit – I

Ecology and Environment: The Biosphere Concept. ecological Principles, Ecosystem Concept: structure and Function. Ecological Factors: Light, temperature, water, Soil, Wind and Biotic. Biochemical cycles: Hydrological cycle, Oxygen cycle, Carbon cycle, Nitrogen, Sulphur and Phosphorus Cycles.

Unit - II

Environmental pollutions: Water pollution, Eutrophication, Heavy metal pollution, Air pollution: Sulphur dioxide, Ozone, Fluorides, carbon monoxide, Nitrogen Oxides, Green house effect, Chlorofluoroicarbon, Photochemical smog, Acid rain, thermal pollution, Noise pollution, Radiation pollution..

Unit - III

Application and Technology: Remote Sensing – applications and limitations-Afforestation Programmes-social forestry, Chipko movement, Productive, commercial and Exploitative forestry. wild life management and its impact. soil reclamation, soil Solarization and Soil conservation methods.

Unit - IV

Energy and Environment: Renewable and non renewable energy sources-conventional and non conventional sources of energy: Coal, Solar energy<Solar ponds, Geothermal energy, Wave, Wind, Fusion, liquid Nitrogen, Biomass, Liquid Fuels from wastes, Biogas Technology, energy Plantations and Petrocrops.

Unit – V

Environmental Monitoring: Biosensors: Principle, Methodology and significance. Bioremediation-Biosorption, Pathways of degradation technology, Phyto remediation and their importance-biorecovery of metals Direct and indirect methods-Bioleaching Process and their uses. Bioindicators of pollution

Books for study and reference

- 1) Subramaniam N.S and Sambamurthy .A.V.S.S, Ecology.
- 2) Sharma .B.K and Kaur .H, An introduction to Environmental pollution.
- 3) Sharma.P.D, Ecology and Environment.
- 4) Odum.P, Fundamentals of Ecology.
- 5) Alan Scarg, Environmental Biotechnology.
- 6) Mukherjee, Environmental Biology.

Sem-II
07PBI244

Hours/week: 4
Credits: 4

GENETICS

Objectives

- i) To study the principle and mechanism of heredity
- ii) To study the body pattern, formation of mammals with reference to Homeobox gene regulation.

Unit - I

Mendelian genetics: genotype and phenotype, Inheritance: Theories of inheritance. Allele concept- principles of segregation and independent assortment. Chromosomal theory, X-linked inheritance. Dominance and recessiveness of genes. Common X- linked genetic diseases in human.

Unit - II

Molecular genetics- chemistry and fine structure of genes. Gene expression- Enhancers and silencers. Relationship between gene structure and expression- ICRs. Extra-chromosomal inheritance- Mitochondrial DNA- Role in gene expression.

Unit - III

Gene mutation- Types - Somatic and Germline; Morphological, conditional, biochemical, silent, resistant and lethal mutations. Chromosomal Mutations- a) Change in structure – deletion, duplication, Inversion and translocation. b) Changes in number- euploidy and aneuploidy. Missense and Nonsense mutations. Mitochondrial mutations and human diseases.

Unit - IV

Developmental genetics- expression of genes during embryonic development – *Drosophila* model. Cell-type and anteroposterior specification during embryogenesis. Mammalian developmental genetics. Overview of mammalian cell cycle- phases, molecular mechanism, genetic control, regulation and checkpoints- Cdks and Cyclins.

Unit - V

Cancer Genetics- Oncogenes, anti-oncogenes, Role of proto-oncogenes- function and loss of control. Oncogene induction and introduction. *c-src* product – Tyrosine protein kinases. Tumor suppression genes. Telomerase expression- role in cell immortalization.

Books for study and reference

1. Harvey Lodish, *et al.* (2000) : Molecular Cell Biology (4th edition), W.H. Freeman and Co., New York.
2. Weaver and Hedrick, (1997) : Genetics (3rd edition) , Wm.C. Brown Publishers.
3. David T. Suzuki, *et al.* (1986) : An Introduction to Genetic Analysis (3rd Edition). (W.H. Freeman and Co., New York)
4. Lewin, B. (2000) : Genes- VII. (Oxford University Press)

Sem-III
07PBI329

Hours/week: 5
Credits: 5

CLINICAL BIOCHEMISTRY

Objectives

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

Unit - I

Blood coagulation – its mechanisms, clotting factors and disturbances in 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. Blood banking. Hemolytic diseases of the new born. Adverse reactions of blood transfusions.

Unit - II

Blood sugars – Its maintenance, hyper and hypoglycemia. Regulation of blood glucose concentration – Diabetes mellitus – Complications, secondary degenerative diseases. Laboratory diagnosis of early and latent diabetes. Glucose tolerance test. Dietary regimes 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 leshnyan syndrome. oratic aciduria, and xanthinuria, cystinuria, Hartnup disease, Mapple syrup 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 varieties. Cirrhosis, 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. Hepatoprotective role medicinal plants. 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 infections. Cardiac markers in infection - 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)

Sem-III
07PBI330

Hours/week: 5
Credits: 5

IMMUNOLOGY

Objectives

- i) To study in detail the components of immune system.
- ii) 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 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- flagellae, somatic, capsular, soluble, heterophile, tumour and autoantigens. Antigen-antibody interactions- molecular mechanism of binding. Affinity, avidity, valancy, 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. Acquired immunity- Humoral: Biosynthesis of antibodies; 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 - Heamagglutination, 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)
4. Eli Benjamini and Sidney Leskowi : Immunology- A short course.

Sem-III
07PBI331

Hours/week: 4
Credit: 4

ADVANCED ENDOCRINOLOGY

Objectives

- i) To study the hormonal regulations of various physiological functions.
- ii) To explore the various hormonal cell signaling mechanisms.

Unit-I

Hormones-definition; classifications based on receptors. Hormone cascade system involving CNS – hypothalamus – anterior pituitary – target gland; Feed back mechanisms; Inactivation and degradation of hormones. Hypothalamus- Neurohypophyseal hormone - Classification of hormones of pituitary (polypeptides, glycoproteins and POMC peptides) - Multiple endocrine neoplasia – different types (only a basic idea).

Unit-II

Hormone – Receptor interaction; multiple hormone subunits, Scatchard analysis; 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

Synthesis of amino acid derived hormones; Epinephrine from phenylalanine & Tyrosine; Thyroxin synthesis - Melatonin and serotonin – light and dark cycles - Leptin and its physiological role - Insulin resistance and role of hormone resistin in Insulin Resistance.

Unit-IV

Structure of steroid Hormones. Biosynthesis and metabolic inactivation of steroid hormones (Cortisol, Aldosterone, Testosterone, 17B-estradiol, Progesterone). Control of synthesis and release of steroid hormones. Transport of steroid hormones in Blood.

Ovarian cycle and role of hormones. Apoptosis – steroid hormone action at cell level. Hormonal physiology of spermatogenesis, ova implantation, pregnancy, parturition, and lactation.

Unit-V

Nuclear receptors (NR): General features of NR, Ligands that act via nuclear receptor and its sub classes (Peroxisome proliferator-activated receptors, orphan receptor and variant receptors). Domain structure of NR-Hormone binding domain, Antigenic domain and DNA binding domain. Hormone response elements.

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.

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, Connecticut)

Sem-III
07PBI332

Hours/week: 4
Credits: 4

PRACTICALS - III

I. Haematological studies

1. Collection and storage of blood
2. Estimation of haemoglobin content.
3. Total RBC count.
4. Total WBC count.
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.
Estimation of serum bilirubin.
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
4. Determination of CPK

IV. Urology

1. Collection and preservation of urine.
2. Identification of abnormal constituents
3. Screening of inborn errors of metabolism

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. Immuno electrophoresis
ELISA – demonstration.
Skin Prick Test

Sem-III
07PBI345

Hours/week: 4
Credits: 4

PHARMACOLOGY

Objectives

- 1) To make detailed study of drugs, particularly their actions on living systems.
- 2) To know their chemotherapeutic value

Unit - I

Drug – definition; classification of drugs – based on their source – plant, animal, mineral and synthetic; based on action. Absorption of drugs, importance of drugs; drug distribution – role of drugs – drug-protein interaction; drug elimination – role of kidney. Pharmacological activities; consequences of non-specific interaction.

Unit - II

Drug metabolism; Chemical pathways of drug metabolism – Biotransformation reactions- Phase I and phase II reactions – Microsomal and non-microsomal metabolism of drugs - role of cytochrome p450. Introduction to drug metabolising enzymes, enzyme inductions and pharmacological activities.

Unit - III

Receptors – types and biological roles; factors and forces involved in drug receptor interactions . Receptor theories. Drug structure and activity relationship. Chemotherapy – definition . antimalarial, antiviral and anticancer chemotherapy- mechanism of action. Mode of action of sulfonamides. Psychiatric chemotherapy – anxiety and Parkinsonism; Anaesthetics- mode of action and application. Immunopharmacology- Immunostimulants and immunosuppressants.

Unit - IV

Clinical Toxicology- definition - classification of toxicity – occupational, environmental and pharmaceutical. Factors affecting toxicity. Specific drug toxicity – salicylates, analgesics, antihistamines, antidepressants and narcotics. Methods of detection. Dermatologic pharmacology . Therapeutics for GI tract diseases. Rational prescribing of drugs.

Unit - V

Neurotoxins – mechanism of action. Management of toxified patients – screening, decontamination and supportive care. Evaluation of new drugs – screening and toxicological trials. Drug abuse – commonly abused drugs and their biological effect. Drug tolerance, intolerance and allergy.

Books for study and reference

1. Prasun K. Das, Salil K. Bhattacharya and Parantap Sen : Pharmacology, BI Churchill Livingstone.
2. Munson, P. (1995): Principles of Pharmacology, Chapman and Hall.
3. Herfuidal and Gourley (1996): A Textbook of Therapeutics (Williams and Wilkins)
4. Leanord s. Jacob, (1992) : Pharmacology, National Medical Series for Independent Study.
5. Mant Timothy, G.K. Ritter, James, M and Lewis Lionel, D. : A text Book of Clinical - Pharmacology.

Sem-III
07PBI346

Hours/week: 4
Credits: 4

PHARMACOGNOSY

Objectives

- 1) To identify and characterize plant medicines.
- 2) To study their phytochemistry.

Unit – I

Traditional and alternative systems of medicine, Classification of crude drugs, Scheme for Pharmacognostic studies of a crude drug. Collection and processing of crude drugs.

Unit - II

Medicinal Plant Biotechnology- Medicinal Herbs and Transgenic Plants. Plant Tissue Culture as a source of biomedicinals-Introduction to biogenesis of Phytopharmaceuticals-Indian trade in medicinal and aromatic plants.

Unit - III

Analytical pharmacognosy-Drug adulteration, Methods of drug evaluation-biological testing of herbal drugs. Phytochemical investigation: Phytopharmaceuticals-Retrospect and Prospects.Ayurvedic Pharmacy.

Unit – IV

Pharmaceutical plant products: Carbohydrates and derived products. Drugs containing glycosides, Drugs containing tannins, Lipids, Terpenoids, Enzymes and protein drugs. Alkaloidal drugs.

Unit - V

Nutraceuticals and cosmeceuticals-Fibres, sutures and surgical dressing-Natural pesticides, Antibiotics and allergenic Extracts-immunomodulators-Adaptogens and Rasayana.

Books for study and reference

1. Peter B. Kaufmann, *et al.* (1999): Natural Products from Plants, C.R.C. Press.
2. Munson, P. (1995) : Principles of Pharmacology.
3. Indian Materia Medica.
4. Bernfeld: Biogenesis of Natural Compounds, 2nd ed.
5. Willis:A text book of Pharmacognosy.
6. Trees and Evans:Pharmacognosy,.

Sem-IV
07PBI434

Hours/week: 5
Credits: 5

MOLECULAR BIOLOGY

Objectives

- i) To know the central dogma of life.
- ii) To make detailed study on the blue print of life and the information centers called genes.

Unit - I

Transformation – competence, DNA uptake mechanism. Conjugation – HFr transfer, chromosomal transfer and the mediation by F plasmids, role of *rec* proteins. Transduction – mechanism of DNA transfer, cotransduction, classification and structure of viruses. Genetics of lytic cascade and lysogenic. Genome of Lambda and special features of T-phages. Oncogenic viruses, cellular oncogenes and activation of protooncogenes. Plasmids – features and types, mobile genetic elements – IS elements, transposons, retroposons in bacteria.

Unit - II

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.

Unit - III

Transcription – RNA types and functions, signals, transcriptase, chemistry of synthesis – initiation, elongation and termination. Post transcriptional processing of RNA types in bacteria and eukaryotes. Regulation of transcription and antibiotic inhibitors.

Unit - IV

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. Coupled transcription - translation inhibitors of translation and post transcriptional 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. Ubiquitin TAG protein destruction. Gene expression and regulations – molecular mechanism of regulation, prokaryotes – operon model, *lac*, *trp*, *arabinose* operons. Eukaryotes – C-value paradox, repetitive DNA, gene dosage and gene amplifications.

Books for study and reference

1. Darnell.J et al. (1986) : Molecular Cell Biology, Scientific American Books, USA.
2. Lewin. B. (1993) : Genes-V and VI, Oxford University Press, New York.
3. Weaver. R.F. and Philip. P.W. (1989) : Genetics, WMC Brown Publishing, USA.
4. Freifelder. D. (1987) : Molecular Biology, Jones and Bartlett Oubkushubg Inc., USA.

Sem-IV
07PBI435

Hours/week: 5
Credits: 5

BIOTECHNOLOGY

Objectives

- i) To study the techniques used in genetic engineering.
- ii) 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.

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; DNA sequencing strategies – Sanger's and Maxam-Gilbert's. Methods and applications of PCR and DNA hybridization – Southern, Northern and Western blotting.

Unit - III

Techniques of tissue culture – culturing explants and haploids, protoplasts fusion and embryoids. Methods of gene transfer to plants, animals and bacteria – Ca-transfection, electroporation, shotgun, Micri injection, 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

Gene therapy (somatic) – the principles and approaches; 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

Human genome research – the objectives and approaches; Genomics and genome prospecting – the controversies. Issues of biotechnology - Social and scientific. Genetic use RestrictionTechnology (GURT) and the terminator; IPR, its concepts and conditions – patenting of genes, cells and life forms – evaluation of life patenting ; Deleberate release of GMOs. Molecular techniques employed in genomic research.

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.
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**EXTRA DEPARTMENT COURSES (EDC)
OFFERED BY THE VARIOUS DISCIPLINES DURING II AND III SEMESTERS**

Sem	Code No.	Title of the Paper	Hr	Cr
Department of Biochemistry				
II	07PBI261	Applied Nutrition*	4	3
III	07PBI362	First Aid Management*	4	3
Department of Biotechnology				
II	07PBT261	Basics of Bioinformatics*	4	3
III	07PBT362		4	3
Department of Botany				
II	07PBO261	General Microbiology	4	3
III	07PBO582	Remote Sensing and Geographical Information System	4	3
Department of Chemistry				
II	07PCH261	Environmental Chemistry	4	3
III	07PCH362	Industrial Chemistry	4	3
Department of Commerce				
II	07PCO261	Fundamentals of Accounting for Managers	4	3
III	07PCO362	Principles of Management	4	3
Department of Computer Science				
II	07PCS261	Internet Concepts*	4	3
II	07PCS261	Internet Concepts	4	3
III	07PCS362	Computer Applications for Social Sciences*	4	3
III	07PCS362	Computer Applications for Social Sciences	4	3
Department of Economics				
II	07PEC261	General Economics	4	3
III	07PEC362	Indian Economy	4	3
Department of Electronics				
II	07PEL261	Electronics in Communication*	4	3
III	07PEL362	Computer Hardware*	4	3
Department of English				
II	07PEN261	English for Specific Purposes	4	3
III	07PEN362	Interviews and Group Dynamics	4	3
Department of French				
II	07PFR261	Beginners Course in French	4	3
III	07PFR362	Advanced Course in French	4	3

Department of Hindi

II	07PHI261	Beginners Course in Hindi	4	3
III	07PHI362	Advanced Course in Hindi	4	3

Department of History

II	07PHS261	Public Administration*	4	3
III	07PHS362	Applied Tourism*	4	3

Department of Human Resource Management

II	07PHR261	Sociology for Competitive Examinations	4	3
III	07PHR362	Human Resource Management	4	3

Department of Mathematics

II	07PMA261	Operations Research	4	3
III	07PMA362	Numerical Methods	4	3

Department of Physics

II	07PPH261	Physics for Rural Development	4	3
III	07PPH362	Medical Physics	4	3

Department of Sanskrit

II	07PSA261	Beginners Course in Sanskrit	4	3
III	07PSA362	Advanced Course in Sanskrit	4	3

Department of Statistics

II	07PST261	Statistics for Biomedical Sciences*	4	3
III	07PST362	Data Analysis*	4	3

Department of Tamil

II	07PTA261	Beginners Course in Tamil	4	3
II	07PTA261	அரசுப் பணித்தேர்வுத் தமிழ் - I*		
III	07PTA362	Advanced Course in Tamil	4	3
III	07PTA683	அரசுப் பணித்தேர்வுத் தமிழ் - II*	4	3

Non-Departmental Courses**Journalism**

II	07PJO261	Beginners Course in Journalism	4	3
III	07PJO362	Advanced Course in Journalism	4	3

Law

II	07PLA261	Beginners Course in Law	4	3
III	07PLA362	Advanced Course in Law	4	3

Shorthand

II	07PSH261	English Shorthand-I	4	3
III	07PSH362	English Shorthand-II	4	3

(* Offered by Self Financing Section)

