

PARUL UNIVERSITY
FACULTY OF APPLIED SCIENCE
Department of Biochemistry
SYLLABUS FOR 1st Sem M.Sc. PROGRAMME
CHEMISTRY OF BIOMOLECULES (11203110)

Type of Course: M.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs/Week)			Credit	Examination Scheme					Total
L	T	P		External		Internal			
				Theory	Practical	Theory	*C.E.	Practical	
4	-	-	4	60	-	20	20	-	100

S.No	Content	Weightage	Hours
1	<p>UNIT-I Stereochemistry: Relation between chirality and optical activity. Representation of chiral structure by Fishers projection, perspective, Newman and Sawhare formulas, molecular models. Classification of chiral compounds –DL, RS methods. Geometrical isomerism (E and Z nomenclature). Porphyrins: Sturcture, properties and Identification. Structure of metalloporphyrins-heme, cytochromes and chlorophylls</p>	18%	11
2	<p>UNIT-II Carbohydrates: Classification of carbohydrates, reactions of monosaccharides, structural elucidation of starch and glycogen. Structure and biological importance of aminosugars, Glycoproteins, proteoglycons, Bacterial cell wall polysaccharides, blood group substances and Lectins. Lipids: classification, physicochemical properties of fats and oils. Characterization of natural fats and oils, structure and biological role of triacyl glycerol, phospholipids, sphingolipids, gangliolipids. Prostaglandins, thromboxanes, leucotrines – steroids – cholesterol, and bile acids.</p>	22%	13
3	<p>UNIT-III Aminoacids and proteins: Classification of amino acids, acid base properties of amino acids, pKa of functional groups of amino acids, chemical reaction of aminoacids, Nonprotein amino acids. Peptide bond – structure and conformation-Ramachandran plot. Merrifield solid phase peptide synthesis, naturally</p>	18%	12

	occurring peptides. Isolation and purification of proteins. Criteria of purity of proteins.		
4	UNIT-IV Structural organization of proteins, elucidation of primary structure, secondary structure alpha,beta pleated sheet structure and triple helical structure. Tertiary structural features of myoglobin, lysozyme, ribonuclease, chymotrypsin, Quaternary structure – Hemoglobin – protein folding (Molecular chaperones) Denaturation and renaturation of proteins. Chemical modification of proteins.	20%	11
5	UNIT-V Nucleic acids: Structure of nucleic acids – purine and pyrimidine bases – nucleosides, nucleotides, polynucleotides – secondary and tertiary structure of DNA, different types of DNA, types of RNA – structures of RNAs. Isolation, fractionation and characterization of nucleic acids, properties of nucleic acids in solution denaturation and renaturation, hypo and hyper chromic effects, T _m , cot curves. Enzymatic hydrolysis of Nucleic acids. DNA sequencing methods: Maxam and Gilbert's method. Sanger's dideoxy chain termination method.	22%	13

Books Recommended:

1. Lehninger's Principles of Biochemistry (2000) by Nelson, David L and Cox, M M, Macmillan/worth, NY.
2. Fundamentals of Biochemistry (1999) by Donald Voet, Judith G Voet and Charlotte W Pratt, John Wiley & Sons, NY.
3. Biochemistry III ed (1994) by Lubert Stryer, WH Freeman and Co., San Francisco.
4. Outlines of Biochemistry (1987) by Eric E Conn, P K Stumpf, G Bruening and Ray H Doi, John Wiley & Sons, NY.
5. Principles of Biochemistry General aspects 1983 Smith etal. (McGraw Hills)
6. Biochemistry (4 th edition) – Thomas M.Devlin.
7. Text book of Biochemistry (1908) west and Todd. (Mac Milan)
8. Text book of Biochemistry – Zubay.
9. Biochemistry – Garret and Girsham

PARUL UNIVERSITY
FACULTY OF APPLIED SCIENCE
Department of Biochemistry
SYLLABUS FOR 1st Sem M.Sc. PROGRAMME
BIOPHYSICAL CHEMISTRY (11203109)

Type of Course: M.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs/Week)			Credit	Examination Scheme					Total
L	T	P		External		Internal			
				Theory	Practical	Theory	*C.E.	Practical	
4	-	-	4	60	-	20	20	-	100

S.No	Content	Weightage	Hours
1	<p>UNIT-I</p> <p><i>Basic Techniques</i> Buffers; Methods of cell disintegration; Enzyme assays and controls; Detergents and membrane proteins; Dialysis, Ultrafiltration and other membrane techniques</p> <p><i>Spectroscopy Techniques</i> UV, Visible and Raman Spectroscopy; Theory and application of Circular Dichroism; Fluorescence; MS, NMR, PMR, ESR and Plasma Emission spectroscopy</p>	25%	15
2	<p>UNIT-II</p> <p><i>Chromatography Techniques</i> TLC and Paper chromatography; Chromatographic methods for macromolecule separation - Gel permeation, Ion exchange, Hydrophobic, Reverse-phase and Affinity chromatography; HPLC and FPLC; Criteria of protein purity</p> <p><i>Electrophoretic techniques</i> Theory and application of Polyacrylamide and Agarose gel electrophoresis; Capillary electrophoresis; 2D Electrophoresis; Disc gel electrophoresis; Gradient electrophoresis; Pulsed field gel electrophoresis</p>	25%	15
3	<p>UNIT III</p> <p><i>Centrifugation</i></p>	25%	15

	Basic principles; Mathematics & theory (RCF, Sedimentation coefficient etc); Types of centrifuge - Microcentrifuge, High speed & Ultracentrifuges; Preparative centrifugation; Differential & density gradient centrifugation; Applications (Isolation of cell components); Analytical centrifugation; Determination of molecular weight by sedimentation velocity & sedimentation equilibrium methods		
4	UNIT-IV Blotting techniques: Southern blot, western blot, and northern blot – general methodology and applications. Spectroscopic techniques: Principles of Spectroscopy; Beer-Lambert's Law. Instrumentation and biological applications-colorimetry, Spectrophotometry, Fluorimetry, Flame photometry, Atomic absorption Spectroscopy (AAS), I.R. Spectroscopy.	25%	15

Books Recommended:

1. The tools of Biochemistry – Terrace.E.Cooper (John Willey).
2. A Biologists guide to Principles and Techniques of practical Biochemistry – Ed.Bryan, L.Willians & Keith Wilson (Edward Arnold).
3. Biochemical research techniques – A practical introduction. Ed. John M.Wriggelsorth.
4. Principles & Techniques of Practical Biochemistry – Wilson and Walker.
5. Analytical Biochemistry. David. J.Home & Hazelpack. (Longman).
6. Practical Clinical Biochemistry, (5 th edition) – H.Varley, A.H.Cowenlock & M.Bell
7. A manual of Radiology. J.C.Steward & D.M. Hawcroft. (Sidgwick)
8. Instrumental methods of chemical analysis – B.K. Sharma publications)
9. Physical principles and Techniques of Protein chemistry – Leach. (Parts A, B, C)
10. Text book of biochemistry – west and Todd
11. Physical Biochemistry (II ed 1983) by D Friefelder, WH Freeman & Co., USA
12. Biophysical chemistry – Upodhya and Nath (Himalaya publications)
13. Physical Biochemistry (II ed 1985) by van Holde KE, Prentice Hall Inc., New Jersey.
14. Chromotography: A laboratory handbook of chromatographic and electrophoretic methods. (IIIrd 1975) by Erich Heftman, van Nostrand Reinhold, NY.

PARUL UNIVERSITY
FACULTY OF APPLIED SCIENCE
Department of Biochemistry
SYLLABUS FOR 1st Sem M.Sc. PROGRAMME
CELL BIOLOGY AND PHYSIOLOGY (11203113)

Type of Course: M.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs/Week)			Credit	Examination Scheme					Total
L	T	P		External		Internal			
				Theory	Practical	Theory	*C.E.	Practical	
4	-	-	4	60	-	20	20	-	100

S.No	Content	Weightage	Hours
1	<p><i>Cell Theory & Methods of Study</i> Microscope and its modifications – Light, phase contrast and interference, Fluorescence, Confocal, Electron (TEM and SEM), Electron tunneling and Atomic Force Microscopy, etc.</p> <p><i>Membrane Structure and Function</i> Structural models; Composition and dynamics; Transport of ions and macromolecules; Pumps, carriers and channels; Endo- and Exocytosis; Membrane carbohydrates and their significance in cellular recognition; Cellular junctions and adhesions; Structure and functional significance of plasmodesmata.</p>	20%	12
2	<p>UNIT-II</p> <p><i>Organelles</i> Nucleus – Structure and function of nuclear envelope, lamina and nucleolus; Macromolecular trafficking; Chromatin organization and packaging; Cell cycle and control mechanisms; Mitochondria – structure, organization of respiratory chain complexes, ATP synthase, Structure- function relationship; Mitochondrial DNA and male sterility; Origin and evolution; Chloroplast– Structure-function relationship; Chloroplast DNA and its significance; Chloroplast biogenesis; Origin and evolution.</p>	20%	12
3	<p>UNIT-III</p> <p><i>Endo-membrane System and Cellular Motility</i></p>	18%	11

	Structure and function of microbodies, Golgi apparatus, Lysosomes and Endoplasmic Reticulum; Organization and role of microtubules and microfilaments; Cell shape and motility; Actin-binding proteins and their significance; Muscle organization and function; Molecular motors; Intermediate filaments; Extracellular matrix in plants and animals		
4	UNIT-IV <i>Cellular Movements and Pattern Formation</i> Laying of body axis planes; Differentiation of germ layers; Cellular polarity; Model plants like Fucus and Volvox; Maternal gene effects; Zygotic gene effects; Homeotic gene effects in Drosophila; Embryogenesis and early pattern formation in plants; Cell lineages and developmental control genes in Caenorhabditis	18%	11
5	Unit V <i>Differentiation of Specialized Cells</i> Stem cell differentiation; Blood cell formation; Fibroblasts and their differentiation; Cellular basis of immunity; Differentiation of cancerous cells and role of proto-oncogenes; Phase changes in Salmonella; Mating cell types in yeast; Surface antigen changes in Trypanosomes; Heterocyst differentiation in Anabaena; Sex determination in Drosophila. <i>Plant Meristem Organization and Differentiation</i> Organization of Shoot Apical Meristem(SAM); Organization of Root Apical Meristem(RAM); Pollen germination and pollen tube guidance; Phloem differentiation; Self-incompatibility and its genetic control; Embryo and endosperm development; Heterosis and apomixis.	24%	14

Books recommended:

1. Cell biology – De Robertis and DeRobertis.
2. Cell and Molecular biology – Shieler and Bianchi.
3. Cell biology (1991) – David E.Sadva (Johnes & Barrette, C. H Best & B.T.Taylor.
4. Biochemistry –West et al.
5. Principles of Biochemistry. – A.L.Lehninger.
6. Text book of Biochemistry with clinical correlations (ed.)Thomas M.Devlin, (John Wiley).
7. Harper’s review of Biochemistry – Martin et al (Longman)
- 8.BiochemistryL.Stryer. (Freeman)
- 9.Dynamics of Biological Membranes – M.D.Houseley and K.K.Stainless (John wiley).
10. Introduction to Biological membranes (2nd edn 1988) M K Jain, John Wiley & Sons, NY.
11. Comprehensive introduction to membrane biochemistry (1987) by D B Datta.
12. Biological membranes: Their structure and function (2 nd edn 1980) Harrison R.

13. Text Book of Medical Physiology (10th edn 2001) by A G Guyton and Hall
J E. Harcourt, Asia.

14. Review of Medical Physiology (12th ed, 1985) Ganong W F Lange Medical Pub.

15. Cell biology Karp et al.

PARUL UNIVERSITY
FACULTY OF APPLIED SCIENCE
Department of Biochemistry
SYLLABUS FOR 1st Sem M.Sc. PROGRAMME
ADVANCED ENZYMOLOGY (11203108)

Type of Course: M.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs/Week)			Credit	Examination Scheme					Total
L	T	P		External		Internal			
				Theory	Practical	Theory	*C.E.	Practical	
4	-	-	4	60	-	20	20	-	100

S.No	Content	Weightage	Hours
1	UNIT-I Introduction of enzymes-Classification of enzymes (IUB), Remarkable properties of enzymes catalytic power, specificity, Formation of Enzyme Substrate complex – Fischer and Koshland models. Holoenzyme, apoenzyme, coenzyme and cofactors. Purification of enzymes, enzyme assay- coupled kinetic assay, ELISA, RIA and manometric assay and Enzyme units. Isoenzymes, multienzyme complexes (pyruvate dehydrogenase complex), Ribozyme and Abzyme.	18%	11
2	UNIT-II Enzyme kinetics-Velocity of a reaction, order of a reaction, progress curve for enzyme catalyzed reactions. Transition state theories, methods use in the investigation of kinetics of enzyme catalyzed reactions – initial velocity studies, ionselective electrode studies and rapid reaction technology. Factors affecting enzyme catalysis – pH, Temperature and substrate concentration on enzyme kinetics. Enzyme kinetics of single substrate reaction-Derivation Michaelis-Menton equation. Significance of K_m and V_{max} values. Linear transformations of Michaelis-Menton equation.	22%	13
3	UNIT-III Kinetics of bi substrate reactions- Terminology and classification of Bisubstrate with examples of each class. Kinetics of multisubstrate reactions. Rate equations for Ping Pong and ordered Bi-Bi reaction mechanism. Differentiating Bi substrate mechanisms. Enzyme inhibition: reversible inhibition- competitive, noncompetitive, uncompetitive and mixed inhibition – partial	18%	11

	inhibition – substrate inhibition and allosteric inhibition. Irreversible inhibition. Suicide inhibition (DFMO-Di fluoro methoxy ornithine, 5 Fluro dUMP).		
4	UNIT-IV Enzyme catalytic mechanisms: general acid base catalysis, electrostatic catalysis, covalent catalysis, intramolecular catalysis, and enzyme catalysis. Mechanistic role of following coenzymes in enzyme catalyzed reactions – thiamine pyrophosphate, nicotinamide nucleotides, flavin nucleotides, PLP, biotin and tetrahydrofolate. Mechanisms of reaction catalyzed by chymotrypsin, lysozyme, Ribonuclease and Carboxypeptidase A	20%	11
5	UNIT-V Regulation of enzyme activity- covalent modification , zymogen activity and protein protein interaction. Allosteric enzyme action: Cooperativity – the Hill equation. Sigmoidal kinetics the MWC and KNF models – significance of sigmoidal behaviors – study of ATCase as a typical allosteric enzyme. Enzyme Technology: Industrial uses of enzymes-Food and Pharmaceutical industries. Clinical Enzymology- serum enzymes in health and diseases. Immobilized enzymes.	22%	13

Books Recommended:

1. Principles of Biochemistry, 1993A..L.Lehninger, Nelson and Cox (C.B.S., India).
2. Principles of Biochemistry General Aspects 1983 –Smith et al., general.(Mc Graw Hills)
3. Biochemistry, (2 nd edition) –Voet &Voet.
4. Biochemistry (4 th edition) –A.Stryer (Freeman)
5. Text book of biochemistry with clinical correlations. (4 th edition) –Thomas M.Devlin
6. Text book of Biochemistry, (1908) –West and Todd. (Mac Milan)
7. Biochemistry –Zubay.
8. Nucleic acid Biochemistry and Molecular biology –Main Waring, et al. (Blockwell).
9. Understanding enzymes. (1985) –Trevor Palmer (John Wiley)
10. Fundamentals of Enzymology (II ed) by Nicholas C Price and Lewis Stevens, Oxford UnivPress.
11. Principles of Enzymology for Food Science (1972) by J R Whitkar, M Dekker Publishers.
12. Enzymes (3 rd ed 1979) Dixon M and Webb, E C, Longmans, London.
13. The chemical kinetics of enzyme action by K J Laidler and P S Bunting, Oxford University Press, London.
14. Enzyme structure and function by S Blackburn, Marcel Dekker, Inc., NY.

PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE
Department of Biochemistry
SYLLABUS FOR 1st Sem M.Sc. PROGRAMME
LAB-1 BIOCHEMICAL ANALYSIS (11203112)

Type of Course: M.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs/Week)			Credit	Examination Scheme					Total
L	T	P		External		Internal			
				Theory	Practical	Theory	*C.E.	Practical	
-	-	4	2	-	60	-	-	40	100

BIOCHEMICAL ANALYSIS

1. General reactions of carbohydrates. Specific reactions of different sugars: Ribose, Glucose, Fructose, Galactose, Sucrose, Maltose, Lactose, Starch and Glycogen.
2. General reactions of proteins and Aminoacids.
3. General reactions of lipids and Cholesterol.
4. Isolation and estimation of cholesterol from Zak's method.
5. Isolation and estimation of glycogen/starch.
6. Estimation of Fructose in Fruit juice.
7. Estimation of proteins in biological samples: a.)Biuret method
b) Folin-lowry method c.)UV method, d.)Bradford dye binding method.
8. Titration curve of aminoacids and calculation of pk and pi values.
9. Estimation of aminoacids by formal titration.
10. Estimation of aminoacid by ninhydrin method.
11. Estimation of tyrosine by Millions method.
12. Estimation of praline by Colorimetric method.
13. Identification of N-Terminal group of proteins by Sanger's method.
14. Preparation of Casein from milk.
15. Crystallization of egg albumin.

PARUL UNIVERSITY - FACULTY OF APPLIED SCIENCE
Department of Biochemistry
SYLLABUS FOR 1st Sem M.Sc. PROGRAMME
LAB-2 ANALYTICAL METHODS (11203111)

Type of Course: M.Sc.

Prerequisite:

Rationale:

Teaching and Examination Scheme:

Teaching Scheme (Hrs/Week)			Credit	Examination Scheme					Total
L	T	P		External		Internal			
				Theory	Practical	Theory	*C.E.	Practical	
-	-	4	2	-	60	-	-	40	100

ANALYTICAL METHODS

1. Effect of solvent system on the R_f value of two solutes using paper and Thin layer Chromatography.
2. Separation of purines and pyrimidines by paper chromatography.
3. Separation of amino acids by paper chromatography.
4. Separation of sugars by TLC.
5. Separation of lipids by and TLC.
6. Separation of amino acids by Ion exchange chromatography (demonstration)
7. Separation of metalloenzymes by affinity chromatography.
8. Determination of Molecular weight of protein by gel permeation chromatography.
9. Precipitation of serum proteins and desalting by Dilaysis (or) Spin gel permeation chromatography – Lyophilization of desalted protein fractions.
10. Separation of Serum proteins by paper electrophoresis.
11. Determination of subunit composition of protein by SDSPAGE.
12. Absorption spectra of phenol red, Aminoacids and Nucleic acids.
13. Verification of Beer's law and determination of molar extinction coefficient using Bromophenol blue (or) Para nitrophenol.
14. Isolation and spectrophotometric characterization of metalloporphyrins.
15. Measurement of specific rotation of sugars by polarimeter.

PARUL UNIVERSITY
PARUL INSTITUTE OF APPLIED SCIENCES
M.Sc. (BIOCHEMISTRY)
SYLLABUS FOR 1st SEMESTER
SUBJECT NAME-SEMINAR (11203114)

Teaching Scheme (Hrs/Week)			Credit	Examination Scheme					Total
L	T	P		External		Internal			
				Theory	Practical	Theory	*C.E.	Practical	
-	2	-	2	-	60	-	40	-	100