

SHIVAJI UNIVERSITY, KOLHAPUR.



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2009**

New Syllabus For

B.Sc. I

Biochemistry Optional

(Sem.- I & II)

Syllabus to be implemented from June 2013 onwards.

UNITISED SYLLABUS

B. Sc. Part –I (Semester-I), Biochemistry (Optional)

Course Code	Title of the Course	Theory/ Practical	Lecture/ Practical (hrs)
BCH- 101	Biomolecules-I	Theory	45
BCH -102	Biochemical Techniques-I	Theory	45
BCH -103	Biochemistry Practical Course	Practical	20

Syllabus for B. Sc. Part –I (Semester-I),
Biochemistry (Optional)
BCH-101
Biomolecules-I

Topic No.		Lectures 45
1	Unit- I Biochemistry an overview:- Origin & definition, historical background, scope & importance of biochemistry. Chemistry of living cell:-Cell & cellular constituents and their functions. Various classes of biological molecules & functions. Amino acids : Definition, Nomenclature, General structure and classification of amino acids : a) Neutral amino acids : i. Hydrocarbon chain amino acids-Glycine, Alanine, Valine, Leucine, Isoleucine. ii. Hydroxy amino acids- Serine, Threonine. iii. Sulfur containing amino acids-Cysteine, Methionine. iv. Aromatic amino acids-Phenylalanine, Tyrosine, Tryptophan. v. Heterocyclic amino acids – Proline. b) Acidic amino acids and their amides: Aspartic acid, Glutamic acid, Asparagine, Glutamine. c) Basic amino acids : Lysine Arginine, Histidine, Behaviour of glycine, aspartic acid and lysine in neutral, acidic and basic solutions, Zwitter ion and isoelectric pH, Ninhydrin reaction and its significance.	11
2	Unit- II Proteins : Definition, Classification (based on function), Peptide bond and its nature. Polypeptides, Determination of end amino acids of polypeptide chain end group analysis by Sanger, Edman and Carboxypeptidase method. Study of structural levels of proteins - Primary structure (oxytocin), Secondary structure (α- helix and β-pleated structure), Tertiary structure(myoglobin),Quaternary structure (hemoglobin) Forces involved in maintaining different structural levels of proteins.	11
2	Unit- III Carbohydrates Definition, Classification and brief account of structure and biological role of, A) Monosaccharides (aldoses and ketoses) : Trioses – Glyceraldehydes, Dihydroxyacetone Tetroses – Erythroses, Erythrulose Pentoses – Ribose, Xylose, Ribulose, Xylulose Hexoses – Glucose, Galactose, Fructose Reactions of anomeric hydroxyl group viz. Fehling test and Phenyl hydrazine test. B) Disaccharides : Glycosidic bond, Maltose, Isomaltose, Lactose, Sucrose, Cellobiose. Emphasis must be on nature of linkage, reducing properties and hydrolysis studies with acid and enzymes.	11
	Unit- IV	12

4	C) Polysaccharides : Structure and biological role of Starch, Glycogen, Cellulose. D) Mucopolysaccharides: Hyaluronic acid, Heparin. E) Derived Monosaccharides : Structure and biological role of, Deoxy sugars (β-D- deoxy ribose), sugar-acids (L-ascorbic acid), Amino sugars (β-D-glucosamine, β-D-galactosamine, N- acetyl glucosamine).	
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BCH-102
Biochemical Techniques-I

Topic No.		Lectures 45
	Unit- I	11
1	Chromatography: Introduction, definition and classification, principle, technique and applications of Paper and Thin layer chromatography. The discussion should include selection of adsorbent and types of adsorbents, preparation of plates, and column packing, and sample application, mechanism of separation, important applications and advantages.	
2	Unit- II Chromatography: Introduction, definition, principle, technique and applications of Ion exchange and Gel permeation chromatography. The discussion should include selection of matrix, column packing, sample application, mechanism of separation, important applications and advantages.	11
3	Unit- III Electrophoresis: Definition of the terms electrophoresis - electrophoretic mobility, Factors affecting electrophoretic mobility, principle, technique and applications of paper and starch gel electrophoresis. The discussion should include preparation of gel plates, sample application, mechanism of separation, development of plates, important applications and advantages of the method.	11
4	Unit- IV Cell Fractionation: Homogenization methods and fractionation procedures. Illustrated with the rat liver cell fractionation. Radio isotopic Techniques: Types of radioactive decay, Definition and examples of Isotopes, Isobars, Isotones. Rate of radioactive decay, Units of radioactivity, Interaction of radioactivity with matter, α – particles, γ – rays detection and measurement of radioactivity by Geiger- Muller counter, solid and liquid scintillation counting. Advantage and disadvantage of methods. Applications of radioisotopes in biological sciences like tracing metabolic pathways, pharmacological studies, clinical diagnosis.	12

**Unitized Syllabus for B. Sc. Part –I (Semester-II),
Biochemistry (Optional)**

Course Code	Title of the Course	Theory/ Practical	Lecture/ Practical (hrs)
BCH- 201	Biomolecules-II	Theory	45
BCH -202	Biochemical Techniques-II	Theory	45
BCH -203	Biochemistry Practical Course	Practical	20

**Syllabus for B. Sc. Part- I,
Semester-II Biochemistry (Optional)
BCH-201
Biomolecules-II**

Topic. No.		Lectures 45
	Unit –I	
1	Enzymes : Definition, Explanation of terms – Holoenzyme, Apoenzyme, Coenzyme, Prosthetic group, Cofactor. Classification of enzymes into in to six major classes with an examples of each class, Enzyme as catalyst (concept of activation energy in enzyme catalysed reaction),Units of enzyme activity, Specific activity, Turnover number. Active site of enzyme and it's features, Enzyme specificity, Types of specificity.	12
	Unit- II	
2	Theories of mechanism of enzyme action - Lock and key and induced fit theory. Factors affecting enzyme activity - substrate concentration, pH, temperatutre. Enzyme kinetics - derivation of Michaelis-Menten equation, significance of Km and Vmax, their evaluation by Lineweaver Burk plot. Enzyme inhibition - competitive, noncompetitive inhibition. Isoenzymes of LDH and its clinical importance.	11
	Unit- III	
3	Vitamins and coenzymes: Introduction,Definition, Classification. Sources, requirement, Deficiency diseases and Biochemical functions of vitamins, viz. Thiamine, Riboflavin, Niacin, Pyridoxine, Pantothenic acid, Lipoic acid, Biotin, Vitamin A and vitamin D	11
	Unit- IV	
4	Nucleic acids: Introduction, Meaning, Definition, Distinction between DNA and RNA, Components of nucleic acids viz, bases, sugars. Nucleosides and nucleotides, Representation of primary structure of polynucleotide chain, Watson Crick model of DNA, Structure and functions of mRNA, rRNA and tRNA (yeast^{ala}). Lipids: Definition and classification of lipids with two examples of each class. A brief account of structure and functions of... Simple lipids: triglyceride and fatty acids Compound lipids: Phospholipids, viz. lecithin, cephalin, phosphatidylserine, sphingomyelin, glycolipids (cerebrosides & gangliosides).Ampipathic nature of phospholipids. Derived lipids: steroids (cholesterol). Lipid bilayer and Fluid mosaic model of membrane.	11

BCH-102
Biochemical Techniques-I

Topic No.		Lectures 45
	Unit- I	11
1	pH and buffers: Hydrogen ion concentration, Henderson-Hasselbalch equation, buffers of biological importance such as carbonate-bicarbonate, phosphate, acetate, hemoglobin. Buffering capacity, mechanism of action of buffers. Construction and working of pH meter. Bioenergetics: First law of thermodynamics, Second law of thermodynamics, Meaning of enthalpy, entropy, and Free energy, and their relevance in biochemical reactions. Living organisms as steady state systems, Structure and biological role of ATP as the universal energy transfer molecule.	
2	Unit- II	11
	Absorption spectroscopy: Beer Lambert's law, its mathematical derivation, meaning of the terms-transmittance, absorbance, molar and specific absorbance, Limitations of Beer Lambert's law. Construction, working and applications of colorimeter and spectrophotometer. Advantages of spectrophotometer over colorimeter, Absorption spectra of proteins, nucleic acids, cytochrome and NAD⁺	
3	Unit- III	11
	Enzyme immobilization: Introduction, Definition, Types and technique of immobilization, Adsorption on carriers, covalent binding, intermolecular cross linking, gel entrapment, Industrial applications of immobilization.	
4	Unit- IV	12
	Electron microscopy: Principle, construction, working and applications. Centrifugation Technique: Introduction, Basic principles of sedimentation, sedimentation coefficient, High speed centrifuges and preparative ultra centrifuges. Differential and Density gradient centrifugation. Applications of analytical ultracentrifuges such as determination of molecular mass purity of macromolecules and conformational changes in macromolecules.	

Reference Books:-

- 1) A text book of biological chemistry- M. S.Yadav, Dominant publishers.
- 2) Biophysics- Pattabhi & Gautam Narosa publishing house
- 3) Outline of biochemistry- Conn & Stumph
- 4) Principles of Biochemistry- Jeffory, Zubey
- 5) Biochemistry- Lubert Stryer
- 6) Biochemistry (Concepts and Applications)-BurtonE.tropp Brooks/ Cle publishing company
- 7) Principles of Biochemistry-White, Handler and Smith.

- 8) Biochemistry-O.P.Agrawal.
- 9) Text book of Biochemistry-West, Todd and Manson.
- 10) Text book of Biochemistry and Human Physiology-G.P.Talwar.
- 11) Review of physiological chemistry-H.A.Harper.
- 12) Hawk's physiological chemistry- Oser.
- 13) Introduction to Chromatography theory and practice - Shrivastava.
- 14) Chromatography- B.K.Sharma.
- 15) Biochemistry- S.C. Rastogi.
- 16) Text book of Biochemistry-R.C. Dubey.
- 17) Text book Biochemistry- A.V.S.S.Ramarao.
- 18) Biochemistry-J.H. Weil.
- 19) Fundamentals of Biochemistry-Voet, Voet & Pratt.
- 20) Fundamentals of Biochemistry-J.L.Jain.
- 21) Biochemistry-U.Satyanarayan.
- 22) Theory and Problems in Biochemistry-P.W.Kuchel and Ralston.
- 23) Nutritional Biochemistry-Dr.S.Ramkrishna & dr.S.Vyankatrao.
- 24) Cell and molecular biology-P.K.Gupta.
- 25) Biotechnology-B.D.Singh.
- 26) Biotechnology-M.P.Arora.

CH 103: Biochemistry Practical Course.

Sr. No.	Name of the Practical	Practicals 20 L
1.	Fundamentals of Biochemical analysis. Control and Accuracy.	1
2.	Calibration of glassware's (pipette, burette, volumetric flasks etc.) and its importance.	1
3.	Preparation of standard solutions (% , Molar, Molal and Normal) of acids and alkali, stock and working solutions.	1
4	Preparations of buffer solutions of known pH and molarity using pH meter (Bicarbonate/phosphate/acetate).	1 (Minor expt,)
	VOLUMETRIC EXPERIMENTS	
5	Estimation of glycine by formal titration	1
6	Estimation of Vitamin C from lemon juice/tablet by 2,6, Dichlorophenol indophenols method	1
7	Estimation of lactose in milk by Benedict's method.	1
	ISOLATIONS OF BIOLOGICAL SAMPLES	
8	Isolation and characterization of starch from potatoes.	1
9	Isolation and characterization of albumin from egg.	1
10	Isolation and characterization of casein from milk	1

BCH 203- Biochemistry Practical Course.

Sr. No.	Name of the Practical	Practicals 20 L
	SEPARATION METHODS	
1	Paper chromatographic separation & identification of amino acids from binary mixture.	1
2	Paper chromatographic separation & identification of carbohydrates from binary mixture.	1
3	Uptake of Na ions by cation exchange resin	1
	COLOURIMETRIC ESTIMATIONS	
4	Verification of Beer Lambert's law and estimation of copper sulphate.	1
5	Estimation of protein by biuret method	1
6	Estimation of creatinine in urine	1
7	Estimation of DNA by diphenylamine method	1
	QUALITATIVE TESTS AND DETECTIONS(Minor expts)	
8	Detection of Carbohydrates – Xylose, Glucose, Fructose, Sucrose, Maltose, Starch.	3
9	Detection of amino acids – Ninhydrin, xanthoproteic, sodium nitro preside , Pauly's diazo test.	1
10	Qualitative test of enzyme (amylase/invertase/urease)	1

Recommended Books:-

1. An introduction to Practical biochemistry- David Plummer,
2. Laboratory manual in biochemistry- Jayraman, Wiley Estern Ltd.New Dilli.
3. Modern Experimental Biochemistry-Rodny Boyer, Addison Wesley –Longman Pte Ltd.
4. Biochemical methods- Sadashivam and Manikam
5. Introductory Practical Biochemistry-Sawhney S.K. and Randhir Singh (Narosa publication).
6. Hawk's Physiological Chemistry-Oser
7. Viva and Practical Biochemistry-Dr. A. C. Deb (New central book Limited).

Objectives

Introduction : Biochemistry deals with chemistry of life and living processes. The scope of Biochemistry is large as life itself. Every aspect of life such as birth, growth, reproduction, aging and death involve biochemistry. Biochemistry is rapidly developing and innovative subject.

Advantages: Biochemistry has wide applications to the disciplines of Medicine, Veterinary, Agriculture, Genetic engineering and Biotechnology. Biochemistry serves as a torch of light to trace the intricate complexities and chemical mysteries of life.

Objectives: The students should get the basic knowledge of the subject which will be useful for them to study various other branches of life sciences at U.G. and P.G. levels as well as other courses such as Bioinformatics, D.M.L.T. etc.

Number of the students: Each batch will contain maximum 20 students.

Teacher's qualification : M.Sc. Biochemistry with 55% marks and SET or NET or Ph.D(as per UGC and state govt. rules and regulations.)

A) Distribution of marks of Theory and Practical.

Sem-I

Course Code	Title of the Course	Theory/ Practical	Marks	Lecture/ Practical (hrs)
BCH- 101	Biomolecules-I	Theory	50	45
BCH -102	Biochemical Techniques-I	Theory	50	45
BCH -103	Biochemistry Practical Course	Practical	-----	20

Sem-II

Course Code	Title of the Course	Theory/ Practical	Marks	Lecture/ Practical (hrs)
BCH- 201	Biomolecules-II	Theory	50	45
BCH -202	Biochemical Techniques-II	Theory	50	45
BCH -203	Biochemistry Practical Course	Practical	50	20

Nature of question paper:

Q.No.1	Multiple Choice questions (1 marks each)	10Marks
Q.No. 2	Long answer questions (solve any 2 out of 3) (10 marks each)	20 Marks
Q.No. 3	Shot answer questions (4 out of 6) (5 marks each)	20 Marks
	Total	50 marks

**Common Nature of Question Paper for B.Sc. Part-I , BCS
Part-I & BFTM Part-I theory paper to be implemented
from academic year 2012 (Except Chemistry)**

Distribution of Marks for Practical Exam:-

1. BCH 103:	
One major experiment	15 marks
One minor experiment	05 marks
2. BCH 203:	
One major experiment	15 marks
One minor experiment	05 marks
3. Oral on Practicals	05 marks
4. Journal	05 marks
Total Marks	50 marks.

Practical Examination

- A) Every candidate must produce a certificate from the Head of the Department in his college, stating that he has completed in a satisfactory manner a practical course on the lines laid down from time to time by the Academic Council on the recommendations of the Board of Studies and that the laboratory Journal has been properly maintained. Every candidate must have recorded his/her observations in the Laboratory journal and written a report on each exercise performed. Every journal is to be signed periodically by a member of the teaching staff and certified by the Head of the Department at the end of the year. Candidates are to produce their journals at the practical examination and such journals will be taken into account by the examiners in assigning marks.
- B) The practical examination will be of 6 hours duration and will be conducted on one day.