SHIVAJI UNIVERSITY, KOLHAPUR.



Accredited By NAAC 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) <u>BCH-101</u> Biomolecules-I

Topic		Lectures
No.		45
	Unit- I	11
	Biochemistry an overview:- Origin & definition, historical	
1	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 :	
	1. Hydrocarbon chain amino acids-Glycine, Alanine, Valine,	
	Leucine, Isoleucine.	
	11. Hydroxy amino acids- Serine, Threonine.	
	in. Suitur containing amino acids-Cysteine, Methionine.	
	v. Heterocycelic amino acids – Proline	
	b) Acidic amino acids and their amides: Aspartic acid Glutamic acid	
	Aspargine Glutamine	
	c) Basic aminoacids · 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.	
2	Unit- II	11
	Proteins :	
	Defination, 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.	
	Unit-III	11
n	Carbohydrates	
2	Definition, Classification and brief account of structure and biological	
	I Die OI, A) Managenenhamidag (aldagag and katagag):	
	A) Monosacchanues (aldoses and ketoses). Trioses – Gluceraldebudes Dibudrovyacetone	
	Tetroses – Grycelaidenydes, Dinydroxyacetone	
	Pentoses – Elyunoses, Elyunuose Pentoses – Ribose Xulose Ribulose Xululose	
	Hexoses – Glucose, Galactose, Fructose	
	Reactions of anomeric hydroxyl groun 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.	
	Unit- IV	12

	C) Polysaccharides : Structure and biological role of Starch,	
4	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).	

<u>BCH-102</u> Biochemical Techniques-I

Topic		Lectures
No.		45
	Unit- I	11
	Chromatography:	
1	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.	11
2	Unit- II	11
	Chromatography:	
	Introduction, definition, principle, technique and applications of	
	should include selection of matrix, column packing, sample	
	application mechanism of separation important applications and	
	advantages.	
	∐nit- III	11
	Electrophoresis:	
3	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.	
	Unit- IV	12
	Cell Fractionation: Homogenization methods and fractionation	
4	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 α , 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.	

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

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

Syllabus for B. Sc. Part- I, Semester-II Biochemistry (Optional) <u>BCH-201</u> Biomolecules-II

Topic. No.		Lectures 45
	Unit –I	
	Enzymes :	12
	Definition, Explanation of terms – Holoenzyme, Apoenzyme,	
	Coezyme, Prosthetic group, Cofactor. Classification of enzymes	
1	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.	
	Unit- II	
	Theories of mechanism of enzyme action - Lock and key and	11
	induced fit theory.	
2	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.	
	Unit-III	11
	Vitamins and coenzymes:	11
2	Introduction, Definition, Classification. Sources, requirement,	
5	Deficiency diseases and Biochemical functions of vitamins, viz.	
	I hiamine, Riboflavin, Niacin, Pyridoxine, Pantothenic acid, Lipoic	
	acid, Biotin, Vitamin A and vitamin D	11
	Unit-IV	11
1	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 polynucleolide chain, walson Click model of DINA,	
	Structure and functions of mixing, fixing and txing (yeast).	
	Linids: Definition and classification of linids 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. cenhalin.	
	phosphatidylserine, sphingomyelin, glycolipids (cerebrosides &	
	gangliosides). Ampipathic nature of phospholipids.	
	Derived lipids: steroids (cholesterol).	
	Lipid bilayer and Fluid mosaic model of membrane.	

BCH-102 Biochemical Techniques-I

Topic No.		Lectures 45
	Unit- I	11
	pH and buffers:	
1	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 fole of ATP as the	
2		11
4	Unit- II Absorption spectroscopy:	11
	Absolption specific oscopy. 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 ⁺	
	Unit- III	11
_	Enzyme immobilization:	
3	Introduction, Definition, Types and technique of immobilization,	
	Adsorption on carriers, covalent binding, intermolecular cross	
	linking, gel entrapment, Industrial applications of immobilization.	
	Unit- IV	12
	Electron microscopy:	
4	Principle, construction, working and applications.	
	Centifugation 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.

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

CH 1O3: Biochemistry Practical Course.

BCH 2O3- 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 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	Title of the Course	Theory/	Marks	Lecture/
Code		Practical		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	Title of the Course	Theory/	Marks	Lecture/
Code		Practical		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

Q.No.1	Multiple Choice questions	10Marks
	(1 marks each)	
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.