

SHIVAJI UNIVERSITY, KOLHAPUR.



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(2014) with CGPA-3.16

NEW SYLLABUS FOR

**B.Sc. Part III
BIOCHEMISTRY**

CBCS PATTERN

SYLLBUS TO BE IMPLEMENTED FROM JUNE 2020-2021

SHIVAJI UNIVERSITY, KOLHAPUR

REVISED SYLLABUS FOR BACHELOR OF SCIENCE PART - III : BIOCHEMISTRY

1. **TITLE** :Biochemistry

2. **YEAR OF IMPLEMENTATION** :Revised Syllabus will be implemented from June 2020 onwards.

3. **PREAMBLE**:

This syllabus is framed to give sound knowledge with understanding of Biochemistry to undergraduate students of three years of B.Sc. degree course. Students learn biochemistry as a separate subject from B.Sc. I. The goal of the syllabus is to make the study of biochemistry popular, interesting and encouraging to the students for higher studies including research. The new and updated syllabus is based on a basic and applied approach with vigor and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research.

The syllabus is prepared after discussion at length with number of faculty members of the subject and experts

from industries and research fields. The units of the syllabus are well defined, taking into consideration

the level and capacity of students.

4. **GENERAL OBJECTIVES OF THE COURSE** :

- 1) To make the students knowledgeable with respect to the subject and practicable applicability.
- 2) To promote understanding of basic and advanced concepts in biochemistry.
- 3) To expose the students to various emerging areas of biochemistry.
- 4) To prepare students for further studies, helping in their bright career in subject.
- 5) To expose the students to different processes used in industries and research fields.
- 6) To develop their ability to apply the knowledge of Biochemistry In day to day life.
- 7) To prepare the students to accept the challenges in life sciences.
- 8) To develop skills required in various industries, research labs and in the field of human health.

5. **DURATION** : The course shall be a full time course .

6. **PATTERN**: Pattern of Examination will be Semester.

7. **MEDIUM OF INSTRUCTION** :The medium of instruction shall be in English.

8. **STRUCTURE OF COURSE** -

1) B. Sc. III : Total Number of Papers - 8

Sr.No.	Subjects	Marks
	SEMISTER V	
1.	Course – IX	40+10
2.	Course – X	40+10
3.	Course – XI	40+10
4.	Course – XII	40+10
	SEMISTER VI	
5.	Course – XIII	40+10
6.	Course – XIV	40+10
7.	Course – XV	40+10
8.	Course – XVI	40+10
	PRACTICAL	
1.	Practical Course	200
Total		600

2) Structure and Titles of Papers of B.Sc. III Course:

SEMESTER V

Papers

Course - IX (DSE – E57) - Molecular Biology

Course - X (DSE – E58) - Genetic Engineering

Course - XI (DSE – E59) - Biomembrane Transport And Cytoskeleton

Course – XII (DSE – E60) - Biochemical Techniques and Bioinformatics

SEMESTER VI

Papers

Course - XIII (DSE – F57) - Neurochemistry

Course - XIV (DSE – F58) - Cancer Biology

Course - XV (DSE – F59) - Clinical Biochemistry and Immunochemistry

Course - XVI (DSE – F60) - Fermentation Technology

9. SCHEME OF TEACHING AND EXAMINATION:

[The scheme of teaching and examination should be given as applicable to the course/paper concerned.]

Sr. No.	Subject/Paper	Teaching Scheme (Hrs/week)		
		L	P	Total
1	Course – IX and XIII	3		
2	Course – X and XIV	3		
3	Course – XI and XV	3		
4	Course – XII and XVI	3		12
5	Practical		20	20
	Total			32

10. SCHEME OF EXAMINATION:

- The examination shall be conducted at the end of each semester of academic year.
- Each theory paper shall carry 40 marks.
- The evaluation of the performance of the students in theory papers shall be on the basis of each semester examination of 200 marks.
- The evaluation of the performance of the students in practical shall be on the basis of annual examination of 200 marks
- Question Paper will be set in view of the / in accordance with the entire syllabus and preferably covering each unit of syllabi.

11. EQUIVALENCE IN ACCORDANCE WITH TITLES AND CONTENT OF PAPERS FOR REVISED SYLLABUS

Sr. No.	TITLE OF OLD PAPER	TITLE & CODE OF NEW PAPER
1	Paper IX – Molecular Biology	Course - IX (DSE – E57) - Molecular Biology
2	Paper X – Cell Biology	Course - XI (DSE – E58) - Genetic Engineering
3	Paper XI- Biomembrane Transport And Cytoskeleton	Course - XI (DSE – E59) - Biomembrane Transport And Cytoskeleton
4	Paper XII- Biochemical Techniques	Course – XII (DSE – E60) - Biochemical Techniques and Bioinformatics
5	Paper XIII – Neurochemistry	Course - XIII (DSE – F57) – Neurochemistry
6	Paper XIV – Cancer Biology	Course - XIV (DSE – F58) - Cancer Biology

7	Paper XV – Clinical Biochemistry	Course - XV (DSE – F59) – Clinical Biochemistry and Immunochemistry
8	Paper XVI – Fermentation Technology	Course - XVI (DSE – F60) - Fermentation Technology
9	Practical	Practical

12. OTHER FEATURES :

- (A) **LIBRARY** : Reference and Text Books, Journals and Periodicals, Reference book list is mentioned below the course syllabus.
- (B) **SPECIFIC EQUIPMENTS** : Necessary to run the Course –
OHP, Computer, L.C.D., Projector
- (C) **LABORATORY SAFETY EQUIPMENTS** :
- 1) Fire extinguisher
 - 2) First aid kit
 - 3) Fumigation chamber
 - 4) Stabilized power supply
 - 5) Insulated wiring for electric supply.
 - 6) Good valves, distribution pipes & regulators for gas supply.
 - 7) Operational manuals for instruments.
 - 8) Emergency exits

SHIVAJI UNIVERSITY, KOLHAPUR

B. Sc. III Biochemistry

Semester V

COURSE - IX (DSE – E57) MOLECULAR BIOLOGY

(Credits 2, Total lectures - 45)

Unit I

[23]

Introduction to Transcription and Translation

1. Eucaryotic transcription and regulation: (all point at introductory level)
 - a. RNA polymerase structure and assembly,
 - b. RNA polymerase I, II, III,
 - c. Transcription initiation, elongation and termination, activation and r
2. Splicing, RNA editing, Nuclear export of mRNA, mRNA stability, catalytic RNA
3. The translation machinery, ribosomes, composition and assembly,
4. Mechanism of eukaryotic translation
 - a. Initiation
 - b. Elongation
 - c. Termination

Unit II

[22]

DNA repair and mutation

1. DNA repair
2. Photoreactivation,
3. Mismatch correction
4. SOS repair.

Types of Mutation

- a. Point mutations:-Nonsense and Missense
- b. Intragenic and intergenic suppression,
- c. Frameshift mutations,
- d. Physical, chemical and biological mutagens.

Recommended books:

1. Stryer L (1995) Biochemistry, 4 th edition, W. H. Freeman & company, New York.
2. Nelson and Cox, (2010), Lehninger's Principals of biochemistry.
3. Watson J. D., Hopkins, N. H., Roberts, J. W., Steitz, J. A. and Weiner, A. M. (1988) Molecular biology of the gene, 4 th edition, The Benjamin/Cummings publishing companies, inc, California.
4. Benjamin Lewin (1999) Genes (all volumes), oxford University Press, Oxford.
5. Weaver R. F. (1999) Molecular biology, WCB McGraw-Hill companies, Inc, New York.
6. Brown T A (1995) Essential molecular biology, vol. I, A practical approach, IRL press, Oxford.
7. Genes and Genomes Maxine Singer and Paul Berg

COURSE - X (DSE – E58) GENETIC ENGINEERING

(Credits 2, Total lectures - 45)

Unit I

Introduction and tools of Genetic Engineering

[22]

1. Enzymes :- Restriction Endonuclease – introduction to class I, II, and III , eg EcoR1 BamH1 b. Reverse transcriptase c) S1 Nuclease d) DNA ligases c) Alkaline Phosphatase
2. Cloning vectors :- properties and construction of Plasmid pBR- 322, Cosmids, lamda phage
3. Passenger DNA - cDNA synthesis
4. Host e.g E. coli

Unit II

Techniques and Application of Genetic engineering

[23]

1. Gene cloning Techniques – hybridisation, r DNA synthesis, gene transfer methods, screening
2. Production of human insulin by r DNA technology
3. Principle, Working and application of PCR
4. Blotting techniques- southern and western blotting and their application
5. Application of genetic engineering.

Recommended books:

1. Genetic engineering by vermap.s
2. Principles of Gene Manipulation: An Introduction To Genetic Engineering” by Old RW and Primrose SB
3. Genetic Engineering (Oxford Higher Education)” by SmitaRastogi and Neelam Pathak
4. Genetic Engineering” by L M Narayanan and A Mani
5. Genetic Engineering” by Verma P S and Agarwal V K

**COURSE - XI (DSE – E59) BIOMEMBRANE TRANSPORT AND CYTOSKELETON
(Credits 2, Total lectures - 45)**

Unit I

[22]

Transport across biomembranes

Structure and function of plasma membrane (Sanger and Nicholson model)

1. Active , passive and facultative transport
2. Ion channels.
3. Symport and antiport system.
4. Organisation and significance of
 - a. Na^+ - K^+ ATPase,
 - b. Na^+ - H^+ ATPase,
 - c. Ca^{++} -ATPase pumps.
5. Endocytosis,
6. Pinocytosis and
7. Phagocytosis,
8. Receptor mediated endocytosis, transcytosis.

Unit III

[23]

Specialized transport systems and Cytoskeleton

1. Gap junctions transport,
2. Nuclear pores transport,
3. Transport of water – Aquaporins
4. Elements of cytoskeleton
 - a. Microtubules,
 - b. Microfilaments and
 - c. Intermediary filaments.

Recommended books:

1. Molecular Cell Biology by H. Lodish, David Baltimore, et al W. H. Freeman Publication, 1996
2. Biological Membranes Findlay and Evans
3. Biochemistry of Tissues by Banks
4. Cell by Cooper
5. Stryer L (1995) Biochemistry, 4 th edition, W. H. Freeman & company, New York.
6. Nelson and Cox, (2010), Lehninger's Principals of biochemistry.

**COURSE - XII (DSE – E60) BIOCHEMICAL TECHNIQUE AND BIONIFORMATICS
(Credits 2, Total lectures - 45)**

Unit I

[22]

Basic of bioinformatics

1. Introduction to bioinformatics
2. Database
3. Information source (NCBI, GDB, MGD)
3. Information source (NCBI, GDB, MGD)
4. Database retrieval tool (ENTREZ, OMIM, PubMed)
5. Database similarity searching (BLAST)
6. Applications

Unit II

[23]

Chromatography

1. Principle, technique and applications of
(Discussion should include selection of matrix, column packing sample application mechanical of separation important application and advantages)
 - a. Affinity chromatography,
 - b. HPLC
 - c. Reverse phase chromatography,
 - d. Gas chromatography
2. Electrophoresis
 1. Isoelectric focusing,
 2. Capillary electrophoresis
 3. Pulse field gel electrophoresis
 4. 2D electrophoresis

Recommended books:

- 1) Protein Purification by Robert Scopes, Springer Verlag Publication, 1982
- 2) Tools in Biochemistry David Cooper
- 3) Methods of Protein and Nucleic acid Research, Osterman Vol I – III
- 4) Centrifugation D. Rickwood
- 5) Practical Biochemistry, V th edition, Keth, Wilson and Walker.
- 6) Bioinformatics by rastogi

Semester VI

COURSE - XIII (DSE – F57) NEUROCHEMISTRY (Credits 2, Total lectures - 45)

Unit I

[22]

Nervous system

An overview of

1. Central Nervous System,
2. Peripheral and Autonomic Nervous system.
3. Cells of Nervous System – Neurons, Astrocytes, Glial cells, Oligodendrocytes and Schwann cells.

Neurotransmission

1. Membrane potentials,
2. Action potential –
 - a. Depolarization,
 - b. Repolarization and
 - c. Hyperpolarization,
3. Resting potential
4. Axonal Neurotransmission

Unit II

[23]

Neurotransmission and Disease of nervous system

1. Action of neurotransmitters
 - a. Acetyl choline,
 - b. GABA,
2. Agonists and Antagonists – their mode of action and effects
3. Disease of nervous system
 1. Parkinson's disease,
 2. Alzheimer's disease,
 3. Schizophrenia, and
 4. Multiple sclerosis.

Recommended books:

1. Neurochemistry by Ferdinand Hucho, VCH Publication, 1986
2. Molecular cell Biology, by Lodish, Baltimore, et al W.H. Freeman & Co. 1996
3. Basic Neurochemistry by M. P. Spiegel

COURSE - XIV (DSE – F58) CANCER BIOLOGY

(Credits 2, Total lectures - 45)

Unit I

[22]

Cancer cell

1. Characteristics of cancer cell
2. Types of cancer
 - a. Benign
 - b. Malignant
3. Metastasis
4. Tumor markers (CEA, AFP)

Carcinogen

1. Chemical: - Base analogues, Alkylating agents and intercalating agents
Physical: - Radiation energy
Biological mutagens: - RNA and DNA Tumor viruses and Retrovirus viral oncogene

Unit II

[23]

Chemical Carcinogenesis and therapies

1. Genetic and epigenetic carcinogens :- Src and Ras gene
2. Procarcinogens and cocarcinogens,
3. Mutagenic agents (Nicotine),
4. Testing for carcinogenicity- Ames test.
5. Physical, chemical and other therapies

Recommended books:

1. Klaassen C D, Amdur M O & Doull J (1986) Casarett and Doull's Toxicology, III rd edition, Macmillan publishing company, New York. 26
2. Williams P L & Burson J L (1985) Industrial Toxicology, Van- Nostrand Reinhold, New York.
3. Hayes A W (1988) Principles and methods of toxicology, II nd edition, Raven press New York.
4. Stewart C P & Stolman A (1960) Toxicology, vol I, Academic press, New York.

**COURSE - XV (DSE – F59) CLINICAL BIOCHEMISTRY AND IMMUNOCHEMISTRY
(Credits 2, Total lectures - 45)**

Unit I

[22]

Laboratory setup and safety and enzymes in diagnosis and monitoring of disorders
Requirements of setting up of clinical laboratory, SI units in clinical laboratory, collection preparation, preservation, and handling of clinical samples, quality control,

1. Use of enzyme in clinical biochemistry
 - a. LDH,
 - b. SGPT,
 - c. SGOT,
 - d. Acid and alkaline phosphatase,
 - e. amylase,

In diagnosis and monitoring of disorders

Unit II

[23]

Liver

1. Bilirubin metabolism,
2. Types of jaundice and clinical assesment,
3. Kidney and heart
 - a. Glomerular filtration rate
 - b. Renal threshold and clearance value
 - c. Role of enzyme in assessment of myocardial infraction
4. Immunochemistry (introductory level)
 - a. Natural and acquired immunology
 - b. Nature of immune response
 - c. T cell and B cell
 - d. Structure of IgG
 - e. Antigen – antibody interaction
 - f. Phagocytosis by microphages
 - g. Radial, single, and double diffusion method

Recommended books:

1. Clinical Chemistry by Kaplan L.A. and Pesce A. J. C. V. Mosby, 1989
2. Clinical Biochemistry by W. J. Marshall and S. K. Bangert, Churchill Livinston N.Y. 1995
3. Practical Clinical Biochemistry (Varley) by Gowenlock
4. Biochemical Aspects of Human Diseases by Elkeles and Tavill
5. Textbook of Medical Physiology by A.C. Guyton and J. E. Hall, W.B. Saunders Publication, 9th Edition , 1996

**COURSE - XVI (DSE – F60) FERMENTATION TECHNOLOGY
(Credits 2, Total lectures - 45)**

Unit I

[22]

Upstream Processing

1. Microbial cell growth and kinetics
2. Growth Medium – micro and macronutrients
3. Design and parts of fermenter
4. Construction materials,

Various sterilization techniques for

- a. Solid,
- b. Liquid
- c. Gases,
- d. Aeration and agitation, foam, auxillary equipments

Unit II

[23]

Fermentation and downstream processing

1. Batch,
2. Fed-batch and
3. Continuous fermentation
4. Principle of techniques- cell homogenization, liquid-liquid extraction, filtration, distillation, ultrafiltration
5. Industrial production of alcohol

Recommended books:

- 1) Moo-Young M. ed. (1985) Comprehensive Biotechnology vol: I & II, Pergamon Press N.Y.
- 2) Ratledge C and Kristiansen B. eds. (2001) Basic Biotechnology 2nd ed. Cambridge Univ Press Cambridge.
- 3) Old R.W and Primose S.D (1995) Principles of Gene Manipulation 5th ed. Blackwell Scientific Pub. Oxford.
- 4) Bailey J.E and Ollis D.F. (1986) Biochemical Engineering Fundamentals 2nd ed. McGraw Hill Book Company, N. Delhi.
- 5) Aiba S, Humphrey A. E. and N. F. Millis (1973) Biochemical Engineering, 2nd Edition University of Tokyo Press, Tokyo, Japan.

- 6) Stanbury P.F., Whitaker A, and Hall S.J. (1997) Principles of Fermentation Technology 2nd ed. Aditya Books Pvt. Ltd, N.Delhi.
- 7) Mukhopadhaya S.N. (2001) Process Biotechnology Fundamentals. Viva Books Pvt. Ltd. N.Delhi.
- 8) Rehm H.J and Reed G. (1985) Biotechnology vol. I & II. VCH, Basel.
- 9) Stainer R. Y. Ingrahm J. L., Wheelis M. L. and Painter P. R. (1987) General Microbiology 5th Edition, Macmillan Press Ltd. London

Practical Course

Figures shown to the right indicate number of practical/s required.

A] Colorimetric estimations:-

1. Estimation of bacterial protein by Folin cio-calteu method. (1)
2. Quantitative estimation of amino acids by using ninhydrin method. (1)
3. Estimation of alcohol by $K_2Cr_2O_7$. (1)
4. Estimation of total carbohydrate by Phenol- H_2SO_4 method. (1)
5. Estimation of reducing sugar by DNSA method. (1)

B] Enzyme study:-

6. Study of amylase enzyme assay . (2)
7. Study of optimum pH of Amylase. (1)
8. Study of optimum temperature of Amylase. (1)
9. Study of substrate concentration on Amylase. (1)
10. Study of effect of activator on amylase activity. (1)
11. Study of effect of inhibitor on amylase activity. (1)
12. Production of Alcohol from Beker's yeast. (2)

C] Isolations:-

12. Isolation of Chromosomal DNA from liver. (2)
13. Isolation & characterization of photosynthetic pigment chlorophyll a & b from plant. (2)
14. Isolation and characterization of Glycogen from rat liver. (1)

D] Chromatography:-

15. Preparation and activation of TLC plates. (1)
16. Separation of amino acids or sugars by using TLC. (1)
17. Separation and identification of amino acid mixture by 2D paper chromatography. (1)
18. Determination of capacity of ion exchange resin [Dowex 50]. (1)

E] Electrophoresis & Other Instrument based practicals:-

19. Preparation of gel and its casting in tray/tube. (1)
20. Separation of protein by gel electrophoresis . (1)
21. Separation of DNA by agarose gel electrophoresis. (1)
22. Titration curve of glycine by using pH meter. (1)
23. Detection of changes in confirmation of Protein by viscosity measurement. (1)
24. Study of cell lysis by homogenization or sonication method. (1)
25. Study of U.V. absorption spectra of biomolecules (Protein, nucleic acid, pigments). (1)
26. Detection of blood glucose by using Glucometer. (1)

F] Demonstration:-

27. Demonstration of Western blotting technique. (2)
28. Demonstration of PCR(1)
29. Demonstration of HPLC(1)
30. Demonstration of Fermenter(1)
31. Demonstration of transport of amino acids across the intestine. (1)
32. Separation of proteins by using molecular sieve chromatography.(1)

Recommended Books:-

1. An introduction to Practical biochemistry- David Plummer,
2. Laboratory manual in biochemistry- Jayraman, Wiley Eastern 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).

Practical Examination

A) The practical examination will be conducted on four (4) consecutive days for not less than 5 hours on each day of the practical examination.

B) Each candidate must produce a certificate from the Head of the Department in his/her college stating that he/she has completed in a satisfactory manner the practical course on the guidelines laid down from time to time by Academic Council on the recommendation of Board of studies and has been recorded his/her observations in the laboratory journal and written a report on each exercise performed. Every journal is to be checked and signed periodically by a member teaching staff and certified by the Head of the Department at the end of staff and certified by the Head of the Department at the end of the year. Candidates are to produce their journal at the time of practical examination. Candidates have to visit the least Two (2) places of biochemical interest (Pharmaceutical industry, Dairy, Food, Research institutes etc.) and submit the report of their visit at the time of examination. The report should be duly certified by the Head of the Department.

List of the minimum equipments and related requirements for B. Sc. III

1) Rotary shaker	: One
3) Centrifuge (High Speed)	: One
4) Hot plate	: One
5) Hot air oven	: One
6) Incubator	: One
7) Spectrophotometer	: One
8) Water bath	: One
9) Separate room for fine instruments of size 10'x15' feet dimension	: One
10) Electrophoresis assembly	: one
11) Distillation assembly	: One (Glass)
12) Reflux assembly	: Four

13) Refrigerator	: One
14) Colorimeter	: One
15) Chromatography assembly	: Four
16) Chromatography column	: Four
17) pH meter [digital]	: Two
18) Viscometer	: Four
19) Homogenization	: One
20) Sonicator	: One
21) Spectrophotometer	: One
22) Glucometer.	: One
23) Western blotting assembly	
24) PCR	
25) HPLC	
26) Fermentor	

NATURE OF QUESTION PAPER FOR THEORY IS SAME AND COMMON AS PER UNIVERSITY PATTERN

THE NATURE OF QUESTION PAPER FOR B.SC. PART III BIOCHEMISTRY PRACTICAL EXAMINATION WILL INCLUDE:

- Q. Major Experiment
- Q. Minor Experiment
- Q. Journal
- Q. Project Report:
- Q. Study Tour Report
