



*Rayat Shikshan Sanstha's*

**YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA  
(Autonomous)**

**(Lead College of Karmveer Bhaurao Patil University,  
Satara)**

**Reaccredited by NAAC with 'A+' Grade**

**Syllabus as per NEP Guidelines 2020 For**

**Subject – BIOCHEMISTRY (Minor)**

**B. Sc. II**

**Semester - III and IV**

**Syllabus to be implemented from June, 2024 onwards**

## Structure of the syllabus:

Class	Level	Sem	Subject-1 Majors		Subject-2 Minor		VSC	SEC	AEC	VEC	CC	Total
			T	P	T	P						
B.Sc. II	5.0	III	6 (3 Theory Papers)	2 (3 Theory Papers)	2	2	2	2	4	2	-	22
		IV	6 (3 Theory Papers)	6 (3 Theory Papers)	2	2	2	2	4	-	2	22

## STRUCTURE of B.Sc. II Biochemistry (Minor):

- Semester III (No. of Courses Theory – 01 and Practical – 01)
- Semester IV (No. of Courses Theory – 01 and Practical – 01)
  - Theory - Total credits - 2, Total Hours – 30 per theory course
  - Practical - Total credits - 2, Total Hours – 60 per practical course

## Titles of the course of B.Sc. II for Semester III and IV

Sem	Course	Course Title	Unit
Sem III	<b>Course</b> BBCT 235	Biochemical Techniques and Bioinformatics	I - Chromatography II - Absorption spectroscopy III - Immobilization, Sequencing, PCR IV - Bioinformatics
	Practical BBCP 236	Practical – BBCT 236	
Sem IV	<b>Course</b> BBCT 245	Molecular Biology and Diseases	I - Molecular biology II - Genetic engineering III – Biochemistry of AIDS IV – Insulin and Diabetes Mellitus
	Practical BBCP 246	Practical – BBCP 246	

**SEMESTER – III**  
**Course BBCT 235 - Biochemical Techniques and Bioinformatics**  
**Credit: - 02            (30 Hours)**

**Course objectives:** Student should be able to...

1. learn techniques and experimental systems required in biochemistry .
2. know how to use the instruments.
3. learn techniques used to purify the biomolecules.
4. understand various biochemical methods to study biomolecules.

<b>SEMESTER-III</b>		
<b>BBCT 235 - Biochemical Techniques and Bioinformatics (Total Credits 2)</b>		<b>No. of hours</b>
<b>Unit I</b>	<p><b>Chromatography</b>            Definition and classification, Principle, technique and applications of i) Paper ii) Thin layer iii) Ion exchange chromatography. The discussion should include selection of matrix, preparation of plates, column packing, sample application, mechanism of separation, important applications and advantages of each one of the methods.</p>	7
<b>Unit II</b>	<p><b>Absorption Spectroscopy</b>            Beer Lambert's law, Meaning of the terms transmittance, absorbance. Construction, working and applications of i) Colorimeter ii) UV-visible spectrophotometer. Advantages of spectrophotometer over colorimeter.</p>	7
<b>Unit III</b>	<p><b>Immobilization, Sequencing, PCR</b>            Enzyme and cell immobilization - Definition, classification, Gel Entrapment method, Industrial applications of immobilization.            Amino acid sequencing – a) Significance, Protein sequencing methods with reaction, advantages &amp; disadvantages i) Sanger ii) Edman iii) Enzyme cleavage.            PCR- Principal, working and applications of PCR.</p>	8
<b>Unit IV</b>	<p><b>Bioinformatics</b>            Introduction to bioinformatics, Applications. Databases, Classification of databases (Primary, Secondary, Composite). Sequences &amp; Nomenclature, IUPAC symbols, nomenclature of DNA &amp; protein sequences &amp; directionality of sequences.</p>	8

**Course outcomes:** Students will be able to...

1. recall the structure, role of biomolecules and their physiological significance.
2. illustrate the structure and role of various proteins.
3. explain biocatalyst and their action.
4. analyse mechanism of kinetics about the enzymes.

**REFERENCE BOOK:**

1. Jermy M. Berg, Gregory J. Gatto, Justin K. Hines, John L. Tymoczko, Lubert Stryer; 2023, Biochemistry; Tenth edition, Springer Verlag.
2. Albert L. Lehninger, David L. Nelson and Cox; 2021, Lehninger's Principles of Biochemistry, Eighth edition, WH Freeman.
3. U. Satyanarayan; 2017, Biochemistry, Fifth edition, Elsevier India.
4. Watson, 2017, Molecular biology of the gene; Seventh edition, Pearson education.
5. Voet, Voet and Pratt; 2016, Fundamentals of Biochemistry, Fifth edition, John Wiley and Sons.
6. Lodish et al. 2016, Molecular Cell Biology; Eight edition, WH Freeman.
7. G. M. Cooper and R. E. Hausman; 2015, The Cell: A Molecular Approach; Seventh edition; Oxford University Press.
8. J. Koolman and K. Roehm; 2013, Color Atlas of Biochemistry; Third edition; Thieme.
9. T. Palmer, B. Philip; 2007, Enzymes; Second edition, Horwood Publication.
10. J. Jain, [N. Jain](#) and [S. Jain](#); 2005, Fundamental of Biochemistry; Sixth Edition ; S. Chand Publication,
11. A. C. Deb; 2001, Fundamentals of Biochemistry; Seventh edition; New Central Book Agency.

**Practical Course, BBCP 236**

**Credit – 02, No. of hours - 60 hours**

**Course objectives:** Student should be able to...

1. analyse techniques and experimental systems required in biochemical research.
2. learn techniques used to purification of biomolecules.
3. know how to use the instruments.
4. update with software analysis used in bioinformatics.

Credits 2	Practical Course, BBCP 236	
Sr. No.	Name of the Practical	No. of hours
1.	Preparation of solvent system (mobile phase) for chromatography.	
2.	Preparation of reagents and detection system for chromatography	
3.	Paper chromatographic separation & identification of amino acids from binary mixture.	
4.	Paper chromatographic separation & identification of sugars from binary mixture.	
5.	Study of column packaging by using gel beads.	
6.	Study of column packaging by using resins – Dowex 50.	
7.	Activation of resins for ion exchange chromatography.	
8.	Study of uptake of sodium ions by ion exchanging resins.	
9.	Verification of Beer Lambert's law and estimation of copper sulphate by graph method.	
10.	Verification of Beer Lambert's law and estimation of copper sulphate by calculation method.	
11.	Immobilization of baker's yeast cells by gel entrapment method.	
12.	Study of invertase activity by using immobilized yeast cells.	
13.	Demonstration of PCR.	
14.	Demonstration of RasMol software.	
15.	Find, download and save the PDB file for protein from protein data bank	
16.	Open PDB file of protein in RasMol software.	
17.	Study of three dimensional structure of proteins by visualizing software – RasMol.	
18.	Study of secondary structure of proteins by visualizing software – RasMol.	
19.	Study of prosthetic group of protein by visualizing software – RasMol.	
20.	Determination of number of peptides in protein by visualizing software – RasMol.	

**Course outcomes:** Student will be able to...

1. analyze biomolecules with techniques used in laboratories.
2. examine various biochemical methods to study biomolecules.
3. apply knowledge of instruments for molecular study.
4. examine biomolecules by using the software.

**Reference Books:**

1. An Introduction to Practical Biochemistry- David Plummer, McGraw Hill Education, Third edition, 2017.
2. Laboratory Manual in Biochemistry – J. Jayraman, New age international publisher, Second edition, 2011.
3. Introductory practical Biochemistry – S.K. Sawhney, Randir Singh, Alpha science international ltd, 2015.
4. Laboratory manual on Biotechnology- P.M. Swamy, Rastogi publications, First edition, 2008.
5. Biotechnology Procedures and Experiments Handbook - S. Harisha, Laxmi publication, First edition, 2008.
6. Practical Biochemistry – Rajgopal & Toora, Ahuja publishing house, Third edition, 2014.
7. Biochemical methods- Sadashivam & Manikam, New age international publisher, Third edition, 2018.
8. Viva and Practical Biochemistry-Dr. A. C. Deb, New central book agency (p) ltd, 2013.
9. Molecular biology of the gene – Watson, Pearson education, Seventh edition, 2017.

**SEMESTER IV****Course BBCT 245 - Molecular Biology and Diseases****Credit: - 02 (30 Hours)****Course objectives:** Student should be able to...

1. learn the mechanism of DNA, RNA & protein synthesis.
2. know about present research in vaccines and antiviral drugs useful for AIDS.
3. know about genetic code and genetic engineering
4. understand the details about diabetes mellitus.

<b>SEMESTER – IV</b>		
<b>BBCT 245 - Molecular Biology and Diseases (Total Credits 2)</b>		<b>No. of hours</b>
<b>Unit I</b>	<b>Molecular biology</b> Prokaryotic replication – Mode of replication, Ori site, Direction of replication, Role of proteins, Mechanism. Prokaryotic transcription- Role of protein, Initiation, Elongation, Termination. Prokaryotic	8

	translation – Activation of amino acid, Role of protein, Initiation, Elongation, Termination. Genetic code- History, Contribution of Scientists, Properties.	
<b>Unit II</b>	<b>Genetic Engineering and Biotechnology</b> Introduction to tools and techniques used in genetic engineering. Enzymes a) Restriction endonucleases - Eco RI b) Reverse transcriptase, Cloning vectors: Plasmid PBR-322. Passenger DNA – cDNA synthesis. Host organism e.g. E. coli. Basic concept of gene cloning technique (r DNA synthesis, Transfer of rDNA into host cell, screening methods). Production of human insulin by rDNA technology. Applications of genetic engineering.	8
<b>Unit III</b>	<b>Biochemistry of AIDS</b> Structure of HIV, Transmission of HIV, Immunological abnormalities in AIDS, Entry and release of HIV, Natural course of AIDS – i) Acute ii) Chronic, iii) Crises phases. Graphical representation. Anti-AIDS drugs – AZT (Zidovudine) structure and mechanism of action. Vaccine treatment.	7
<b>Unit IV</b>	<b>Insulin and Diabetes Mellitus</b> Introduction structure of Insulin, Metabolic effects of insulin, Overview of mechanism of action of insulin. Role of hormones in blood glucose homeostasis. Explanation of term of i) hyper and hypo glycemia ii) renal threshold value. Types of Diabetes Mellitus. Treatment and Management of Diabetes Mellitus 1) Hypoglycemic drugs 2) Diet 3) Exercise 4) Insulin	7

**Course outcomes:** Student will be able to...

1. recall the mechanism of DNA, RNA & protein synthesis.
2. elaborate the genetics, molecular biology, genetic engineering
3. explain the vaccines and antiviral drugs strategies.
4. analyse details about diabetes mellitus.

**Reference Books:**

1. Jermy M. Berg, Gregory J. Gatto, Justin K. Hines, John L. Tymoczko, Lubert Stryer; 2023, Biochemistry; Tenth edition, Springer Verlag.
2. Albert L. Lehninger, David L. Nelson and Cox; 2021, Lehninger's Principles of Biochemistry, Eighth edition, WH Freeman.
3. U. Satyanarayan; 2017, Biochemistry, Fifth edition, Elsevier India.

4. Watson, 2017, Molecular biology of the gene; Seventh edition, Pearson education.
5. Voet, Voet and Pratt; 2016, Fundamentals of Biochemistry, Fifth edition, John Wiley and Sons.
6. Lodish et al. 2016, Molecular Cell Biology; Eight edition, WH Freeman.
7. G. M. Cooper and R. E. Hausman; 2015, The Cell: A Molecular Approach; Seventh edition; Oxford University Press.
8. J. Koolman and K. Roehm; 2013, Color Atlas of Biochemistry; Third edition; Thieme.
9. T. Palmer, B. Philip; 2007, Enzymes; Second edition, Horwood Publication.
10. J. Jain, [N. Jain](#) and [S. Jain](#); 2005, Fundamental of Biochemistry; Sixth Edition ; S. Chand Publication,
11. A. C. Deb; 2001, Fundamentals of Biochemistry; Seventh edition; New Central Book Agency.

### **Practical Course, BBCP 246**

**Credit: - 02**

**Course objectives:** Student should be able to...

1. learn techniques and experimental systems required in biochemical study.
2. know techniques used to biomolecules study.
3. recall various biochemical methods to study biomolecules.
4. know how to use software analysis in bioinformatics.

Credits 2	Practical Course, BBCP 246	
Sr. No.	Name of the Practical	No. of hours
1.	Colorimetric estimation of DNA by diphenylamine method.	
2.	Colorimetric estimation of RNA by Bial's orcinol method.	
3.	Preparation of buffer.	
4.	Study and use of pH meter.	
5.	Study of absorption property of protein.	
6.	Spectroscopic study of protein ligand interaction.	
7.	Preparation of liquid culture media – Nutrient broth.	
8.	Preparation of solid culture media – MacConkey's agar.	
9.	Cultivation of <i>E. coli</i> using suitable method.	



10.	Study of bacterial growth by measuring the change in optical density.
11.	Problems on DNA - RNA sequence.
12.	Problems on Genetic code
13.	Problems on peptide sequence.
14.	Find, download and save the PDB file for protein from protein data bank.
15.	Open PDB file of protein in RasMol software.
16.	Study of three dimensional structure of DNA by visualizing software – RasMol.
17.	Preparation of protein free extract of blood.
18.	Study and detection of blood group antigens.
19.	Colorimetric estimation of glucose from blood.
20.	Demonstration of glucometer.

**Course outcomes:** Student will be able to...

1. identify biomolecules from samples.
2. download and visualize the PDB files from databases.
3. apply knowledge of instruments in biochemical study.
4. examine biomolecules by using the software.

**Reference Books:**

1. Sadashivam and Manikam, 2018, Biochemical methods; Third edition, New age international publisher.
2. David Plummer; 2017, An Introduction to Practical Biochemistry; Third edition, McGraw Hill Education.
3. S. Sawhney, R. Singh; 2015, Introductory practical Biochemistry; First edition, Alpha science international ltd.
4. Rajgopal and Toora; 2014, Practical Biochemistry, Third edition, Ahuja publishing house.
5. Dr. A. C. Deb, 2013, Viva and Practical Biochemistry; First edition, New central book agency (p) ltd,
6. J. Jayraman, 2011, Laboratory Manual in Biochemistry; Second edition, New age international publisher.
7. P.M. Swamy, 2008, Laboratory manual on Biotechnology; First edition, Rastogi publications.
8. S. Harisha; 2008, Biotechnology Procedures and Experiments Handbook; First

edition, Laxmi publication.

9. Gyorgy Hegyi et al.; 2014, Introduction to Practical Biochemistry; Second edition, Eotvos Lorand University.
10. G. Sattanathan, S. Padmapriya, B. Balamuralikrishnan; 2020, Practical Manual of Biochemistry; First edition, Skyfox Publishing Group.

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