

**Gondwana University, Gadchiroli**

**Faculty of Science**

*Syllabus*

**B. Sc. II**

**BIOCHEMISTRY**

**(SEMESTER III & IV)**

**(with effect from academic session 2013-14)**

**Gondwana University, Gadchiroli**  
**Syllabus**  
**Semester Pattern**  
**B.Sc. Part II**  
**(Semester III and IV)**  
**BIOCHEMISTRY**  
**(with effect from academic session 2013-14)**

- 1) There shall be two semesters in B.Sc. Part II Biochemistry.
- 2) Each semester comprise of two theory papers, internal assessment and practical.
- 3) Each theory paper divided into four units.
- 4) The syllabus is based on six theory periods and six practical periods per batch per week.
- 5) Students are expected to perform all the practicals mentioned in the syllabus. However a minimum of seven experiments in each semester is mandatory.
- 6) Each theory paper examination shall be of three hours duration, comprise 5 questions and carry 50 marks. The practical examination shall be of 6 hours duration and carry 30 marks.
- 7) The B.Sc. students of Biochemistry shall pay at least one visit to any Biochemical/Research Institute as a study tour during three year (six semester) degree course.

Sr No	Semester	Paper No.	Title of Paper	Total periods/Week	Max.Marks		Total Marks
					Th	Int.	
1	III	I	Macromolecules	03	50	10	60
		II	Biophysical and Biochemical Techniques I	03	50	10	60
			Practical	6	30		30
2	IV	I	Enzymology	03	50	10	60
		II	Biophysical and Biochemical Techniques II	03	50	10	60
			Practical	6	30		30

**Marks Distribution:**

1. Theory Exam : 50 Marks ( for each paper)
2. Internal Assessment : 10 Marks ( for each paper)
3. Practical : 30 Marks

**Distribution of Marks in practical Examination:**

1. Experimental work - 20 marks
2. Practical record - 05 marks
3. Viva - 05 marks

**Study tour:**

The B.Sc. students of Biochemistry shall pay at least one visit to any Biochemical/Research Institute as a study tour during three year (six semester) degree course.

**B. Sc. Part II**  
**Semester III**  
**PAPER – I**  
**(MACROMOLECULES)**

**UNIT I:**

**Proteins: -**

- a) Classification based on solubility, shape and functions
- b) Determination of primary structure of proteins
- c) Peptide, peptide mapping, Merrifield-Gutt synthesis.
- d) Secondary structure of proteins: - The  $\alpha$  helix,  $\beta$ -pleated sheet structures.

**UNIT II:**

**Proteins: -**

- a) Tertiary structure of proteins: Forces that stabilize the structure, Concept of domains, Protein denaturation.
- b) Quaternary structure of proteins: Subunit interaction
- c) Structure and biological functions of Collagen

**UNIT-III:**

**Nucleic acids: -**

- a) Chemical structure & base composition of nucleic acids, Chargaff's rules.
- b) Double helical structures, Watson - Crick Model (B-DNA), Deviations from Watson - Crick Model, Other DNA helices (A- & Z- DNA).
- c) Forces stabilizing nucleic acid structures, Base pairing, Base stacking, Hydrophobic and ionic interactions, Denaturation & renaturation

**UNIT-IV:**

**Nucleic acids: -**

- a)  $T_m$  & buoyant density and their relationship with G-C content in DNA, Satellite DNA.
- b) DNA sequencing: Maxam-Gilbert & Sanger's dideoxynucleotide sequencing.
- c) Structure of m-RNA, r-RNA & t-RNA.

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**B. Sc. Part II**  
**Semester III**  
**PAPER – II**  
**( BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES I )**

**UNIT I :**

**Buffers and pH:-**

- a) Buffer capacity, Mechanism of buffer action, Henderson-Hasselbalch equation, Isoelectric pH.
- b) Biochemically & Physiologically important buffers.
- c) Titration curve of weak acids, Titration curve of amino acids.
- d) Electrometric determination of pH (Hydrogen, Calomel and combined glass electrode).

**UNIT II:**

**Spectrophotometry:-**

- a) Concepts of electromagnetic radiation's, Spectrum, Absorption of electromagnetic radiation's.
- b) Orbital theory, Concept of orbitals & their involvement in absorption of electromagnetic radiations.
- c) Concept of chromophores, Beer's law – derivation & deviations, Extinction coefficient.
- d) Instrumentation & applications of UV & Visible spectrophotometry.
- e) Spectrofluorometry, Absorption & emission flame photometry.

**UNIT III:**

**Chromatography:-**

- a) Partition principle, partition coefficient, Nature of partition forces.
- b) Detailed account of Paper, Thin layer & Column chromatography (Column efficiency and concept of plates).
- c) Gel filtration: - Concept of distribution coefficient, Types of gels & glass beads, Applications.

**UNIT IV:**

**Chromatography:-**

- a) Ion-Exchange chromatography: - Principle, Types of resins, Choice of buffers, Applications.
- b) Affinity chromatography: - Principle, Selection of ligand, Ligand attachment, Specific & non-specific elution, Applications.
- c) Elements of High Pressure Liquid Chromatography & Gas Chromatography.

**B. Sc. Part II Semester III**  
**PRACTICALS**

- 1) Quantitative estimation of amino acids using Ninhydrin reaction.
- 2) Estimation of DNA by diphenylamine reaction.
- 3) Estimation of RNA by orcinol reaction.
- 4) Determination of albumin and A / G ratio in serum.
- 5) The validity of Beer's law for colorimetric estimation of creatinine.
- 6) Estimation of blood glucose by Nelson-Somogyi method.
- 7) Estimation of blood sugar by Orthotoluidine method.
- 8) Determination of absorption maxima of hemoglobin.
- 9) Absorption spectrum of NAD and NADH
- 10) Separation of amino acids by two-dimensional TLC.
- 11) Separation of amino acids by descending\ascending paper chromatography.
- 12) Estimation of glycine by Sorenson's formol titration.
- 13) Preparation of standard buffers and determination of a pH of a solution.
- 14) Determination of pKa of weak acid by pH meter.
- 15) Determination of isoelectric pH of casein, egg albumin & BSA.
- 16) Titration of mixture of strong acid and weak acid.
- 17) Titration curves of amino acid/weak acids and determination of pK value.
- 18) Colorimetric estimation of calcium in serum.

**(Mandatory to perform at least 7 practical)**

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**Semester III**  
**BOOKS FOR REFERENCE**

- 1) Harper's Biochemistry – Murray, Granner, Mayes, Rodwell- Prentice Hall International Inc.
- 2) Biochemistry – Lehninger – CBS publishers.
- 3) Biochemistry – Stryer – W. H. Freeman & Co. – New York.
- 4) Textbook of Biochemistry – West, Todd, Bruggen, Mason – Amerind publishing Co. Pvt. Ltd.
- 5) Biophysical Chemistry, Principles & Techniques – Upadhyay, Upadhyay & Nath – Himalaya Publ. House.
- 6) A Biologists Guide to Principle & Techniques of Practical Biochemistry – Williams & Wilson – Edward Erhold Publ.
- 7) The Tools of Biochemistry – T. G. Cooper.
- 8) Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ. Press.
- 9) Principles of Biochemistry – White, Handler, Smith – McGrew Hill Publ.
- 10) Biologist's Physical Chemistry – T. G. Morris.
- 11) Chromatography – G. Abbott.
- 12) Methods in Experimental Biology – R. Ralph.
- 13) Physical biochemistry – vanHolde – Prentice Hall Inc.
- 14) Physical Biochemistry – D. Friefelder – W. H. Freeman & Co.
- 15) Chromatography: A Lab Handbook of chromatographic and electrophoretic methods – Erich Heftman – Van Nostrand Reinhold, NY.
- 16) Immunology – Riott, Brastoff, Male – Mosby
- 17) Introduction to Immunology – Nandini Shetty.
- 18) Immunology – Janis Kuby. – W. H. Freeman and Co
- 19) Textbook of Biochemistry – J. L. Jain