

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM & MARKING SCHEME

B.Sc. PART – I (Old Course) Biochemistry

SESSION : 2022-23



ESTD: 1958

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A⁺, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

Website - www.govtsciencecollegedurg.ac.in, Email – autonomousdurg2013@gmail.com

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
Approved syllabus for B.Sc. BIOCHEMISTRY by the members of Board
of Studies for the Session

2022-23

The syllabus with the paper combinations is as under

B.Sc. I: (OLD COURSE)

| | |
|--------------------|---|
| Paper I: | BIOMOLECULES |
| Paper II: | BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES |
| Practical : | BIOCHEMISTRY |

B.Sc.II :

| | |
|-------------------|--------------------------------|
| Paper I: | ENZYMOLGY |
| Paper II: | INTERMEDIARY METABOLISM |
| Practical: | BIOCHEMISTRY |

B.Sc. III:

| | |
|-------------------|---|
| Paper I: | MOLECULAR BIOLOGY |
| Paper II: | NUTRITIONAL, CLINICAL & ENVIRONMENTAL BIOCHEMISTRY |
| Practical: | BIOCHEMISTRY |

The syllabus for B.Sc. Bio-Chemistry is hereby approved for the session 2022-23. In case any change or modification is prescribed by Central Board of Studies or Higher Education Department, Govt. of Chhattisgarh with respect to content or distribution of marks for undergraduate syllabi, it will be implemented accordingly.

NAME AND SIGNATURE:

| | Departmental members | |
|---|----------------------|---------|
| | 1..... | 8..... |
| Chairperson /H.O.D | 2..... | 9..... |
| Subject Expert (University Nominee) | 3..... | 10..... |
| Subject Expert..... | 4..... | 11..... |
| Representative (Industry) | 5..... | 12..... |
| Representative (Alumni) | 6..... | 13..... |
| Representative (Professor Science Faculty Other Dept.) | 7..... | 14..... |

Student Representative

B.Sc. BIOCHEMISTRY
2022-23

DIRECTIVES FOR STUDENTS OF B.SC. PART-I, II & III

EVALUATION PATTERN

- Theory Paper - I & II : 50 marks
- Practical: 50 marks

Question Paper Format and Distribution of Marks for Under Graduate Examination

1. The question paper will be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. (No Multiple choice questions, No 'Fill in the blank' type Questions)
3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely and the answer should not exceed the limit of 350 words.
5. The scheme of marks should be as follows :

| Question Type | MM 50 (Marks x No. of Questions) |
|-----------------------|-------------------------------------|
| A (Very short Answer) | 1x10 = 10 |
| B (Short Answer) | 3 x 5 = 15 |
| C (Long Answer) | 5 x 5 = 25 |

6. The half yearly internal examinations will be held for Part-I & Part II. 10% out of marks obtained by the students in each paper in internal examinations will be added to 90% of marks obtained in each paper of annual examination.

NAME AND SIGNATURE:

| | |
|--|---------------------------------------|
| Chairperson /H.O.D <i>Asw</i> | Departmental members: |
| Subject Expert <i>MN</i> (University Nominee) | <i>[Signature]</i> <i>[Signature]</i> |
| Subject Expert <i>S2</i> | <i>[Signature]</i> <i>[Signature]</i> |
| Representative..... (Industry) | <i>[Signature]</i> <i>[Signature]</i> |
| Representative..... <i>B. fair</i> (Alumni) | <i>[Signature]</i> <i>[Signature]</i> |
| Representative <i>[Signature]</i> (Professor Science Faculty Other Dept.) | <i>[Signature]</i> <i>[Signature]</i> |
| Student Representative | <i>[Signature]</i> |

Syllabus and Marking Scheme for First Year (OLD COURSE)

2022-23

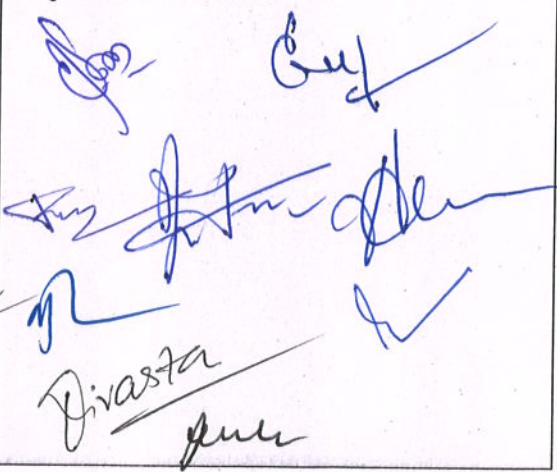
| Paper No. | Title of the Paper | Marks Allotted in Theory |
|-----------|---|--------------------------|
| | | Max |
| I | BIOMOLECULES | 50 |
| II | BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES | 50 |
| III | Practical | 50 |
| | Total | 150 |

| Lab Course | | |
|-----------------|-----------------|----|
| Duration: 5 Hrs | TWO EXPERIMENTS | 30 |
| Total Marks: 50 | VIVA/PROJECT | 10 |
| | SESSIONAL | 10 |

| | | | |
|----|--------------------|---|------------|
| 02 | Theory papers | - | 100 |
| 01 | Practical | - | 50 |
| | Total Marks | - | 150 |

Note: The half yearly internal examinations will be held. 10% out of marks obtained by the students in each paper in internal examinations will be added to 90% of marks obtained in each paper of annual examination.

NAME AND SIGNATURE:

| | |
|---|---|
| Chairperson /H.O.D <i>ASu</i> Subject Expert <i>M.A.</i> (University Nominee) Subject Expert..... <i>S.L.</i> Representative..... (Industry) Representative..... <i>B. Jey</i> (Alumni) Representative <i>S. S. S.</i> (Professor Science Faculty Other Dept.) Student Representative | Departmental members:  |
|---|---|

B.Sc. Part - I (BIOCHEMISTRY) (OLD COURSE)
2022-23
PAPER- I
BIOMOLECULES

Course Outcome (CO):

After completion of the course, the students would be able:

CO1. Carbohydrates:

- a. To identify their chemical elements and the difference between simple sugars and complex carbohydrates. On the food labels, what do sugar or sugar alcohol, and fiber refer to?
- b. To compare and contrast the structure and function of the following carbohydrates and where they are found: glucose, glycogen, starch, cellulose, chitin.

CO2. Proteins:

- a. To identify their chemical elements and functional groups .Recognize the structure of an amino acid and the peptide bond that connects di-, tri, and polypeptides. Recognize the presence of 20 amino acids and that not all are essential amino acids.
- b. To summarize the function of proteins and recognize the importance of the three dimensional shape of a protein on its function and the role of non-covalent bonds in maintaining the shape of a protein.
- c. To explain protein denaturation and the effect of heat on protein structure and function.

CO3. Lipids:

- a. To identify their chemical elements and learn their property of insolubility in water.
- b. To identify the three groups of lipids.
- c. To compare and contrast saturated, mono-unsaturated, and poly-unsaturated fatty acids. Explain the importance of poly-unsaturated fatty acids and why omega-3 and omega-6 fatty acids are considered essential. List sources of polyunsaturated fatty acids.

CO4. Nucleic Acids:

- a. To identify their chemical elements and components of a nucleotide.
- b. To describe the function of DNA
- c. To compare and contrast the 2 types of nucleic acids: DNA and RNA.

NAME AND SIGNATURE:

| | |
|--|---|
| Chairperson /H.O,D <i>Ashe</i> Subject Expert <i>M.A.</i> (University Nominee) Subject Expert <i>S.2</i> Representative (Industry) Representative <i>B. J.</i> (Alumni) Representative <i>Prakash</i> (Professor Science Faculty Other Dept.) Student Representative | Departmental members:  |
|--|---|

B.Sc. Part - I (BIOCHEMISTRY) (OLD COURSE)

2022-23

PAPER- I

BIOMOLECULES

Max. Marks – 50

UNIT –I

Introduction

Introduction to Biochemistry, water as a biological solvent, weak acids and bases, pH, buffers, Henderson-Hasselbalch equation, physiological buffers, fitness of the aqueous environment for living organisms.

Carbohydrates

Structure of monosaccharides. Stereoisomerism and optical isomerism of sugars. Reactions of aldehyde and ketone groups. Ring structure and anomeric forms, mutarotation. Reactions of sugar due to hydroxyl groups. Important derivatives of monosaccharides, disaccharides and trisaccharides (structure, occurrence and functions of important ones). Structure, occurrence and biological importance of monosaccharides, oligosaccharides and polysaccharides e.g. cellulose, chitin, agar, algalic acids, pectins, proteoglycans, sialic acids, blood group polysaccharides, glycogen and starch. Bacterial cell wall polysaccharides etc. Glycoproteins.

UNIT-II

Lipids

Definition and classification. Fatty acids: Introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids, prostaglandins. Triacylglycerols: nomenclature, physical properties, chemical properties and characterization of fats – hydrolysis, saponification value, rancidity of fats, Reichert – Meissel number and reaction of glycerol. Biological significance of fats. Glycerophospholipids (lecithins, lysolecithins, cephalins, phosphatidyl serine, phosphatidyl inositol, plasmalogens), sphingomyelins, glycolipids – cerebrosides, gangliosides. Properties and functions of phospholipids, isoprenoids and sterols.

UNIT-III

Proteins

Introduction, classification based on solubility, shape, composition and functions. Amino acids: common structural features, stereo-isomerism and RS system of designating optical isomers, classification and chemical properties, titration of amino acids, separation of amino acids. Essential amino acids.

Peptides: structure of peptide bond, chemical synthesis of polypeptides – protection and deprotection of N-terminal, C-terminal ends and functional groups in the side-chains, formation of peptide bonds, condensing agents, strategy of chemical synthesis, Merrifield solid-phase peptide synthesis. Determination of the amino acid sequence of a polypeptide chain, specific chemical and enzymatic cleavage of a polypeptide chains and separation of peptides. Protein structure: levels of structure in protein architecture, primary structure of proteins, secondary structure of proteins – helix and pleated sheets, tertiary structure of proteins, forces stabilizing the tertiary structure and quaternary structure of proteins. Denaturation and renaturation of proteins. Behaviour of proteins in solutions, salting in and salting out of proteins. Structure and biological functions of fibrous proteins (keratins, collagen and elastin), globular proteins (hemoglobin, myoglobin), lipoproteins, metalloproteins, glycoproteins and nucleoproteins.

UNIT-IV

Nucleic acids

Nature of genetic material; evidence that DNA is the genetic material, Composition of RNA and DNA, generalized structural plan of nucleic acids, nomenclature used in writing structure of nucleic acids, features of DNA double helix. Denaturation and annealing of DNA, structure and roles of different types of RNA. Size of DNA in prokaryotic and eukaryotic cells, central dogma of molecular biology. Gene, genome, chromosome.

UNIT-V

Porphyryns

Porphyryns: Porphyrin nucleus and classification of porphyryns. Important Metalloporphyryns occurring in nature. Detection of porphyryns spectrophotometrically and by fluorescence. Bile pigments – chemical nature and their physiological significance

LIST OF REFERENCE BOOKS:

1. Lehninger's Principles of biochemistry by Nelson , David L and Cox M.M. Macmillan, NY.
2. Fundamental of biochemistry by Donald Voet, Judith G Voet and Charlotte W Pratt, John Willey & sons, NY.
3. Biochemistry III ed by Lubert Stryer, WH Freeman and Co , San Francisco.

Question Paper Format and Distribution of Marks for Under Graduate Examination

1. The question paper will be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. (No Multiple choice questions, No 'Fill in the blank' type Questions)
3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely and the answer should not exceed the limit of 350 words.
5. The scheme of marks should be as follows :

| Question Type | MM 50 (Marks X No. of Q.) |
|---------------------|------------------------------|
| A (Very short Ans.) | 1X10 = 10 |
| B (Short Ans.) | 3X5 = 15 |
| C (Long Ans.) | 5X5 = 25 |

NAME AND SIGNATURE:

| | |
|---|--|
| Chairperson /H.O.D <i>A. Sene</i> | Departmental members: <i>[Signatures]</i> |
| Subject Expert <i>M. A.</i> (University Nominee) | |
| Subject Expert <i>S. S. 2</i> | |
| Representative..... (Industry) | |
| Representative... <i>B. fai</i> (Alumni) | |
| Representative (Professor Science Faculty Other Dept.) | |
| <i>Student Representative</i> | |

B. Sc. Part - I (BIOCHEMISTRY) (OLD COURSE)
2022-23
PAPER- II
BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES

Course Outcome (CO):

After completion of the course, the students would be able:

- CO1. To develop competence in handling various chromatographic techniques and apply them in isolating and characterizing different biological molecules.
- CO2. To understanding the applications of centrifugation and chromatography in biological investigations.
- CO3. To Purify proteins by affinity chromatography using epitope tags such as histidine tag, GST tag, Flag tag etc.
- CO4. To understanding the principles of Electrophoresis, Spectrophotometry and ELISA and their applications in biological investigations/experiments.

NAME AND SIGNATURE:

| | | Departmental members | |
|---|--------------------|------------------------------|-------------------------------|
| Chairperson /H.O.D | <i>[Signature]</i> | | |
| Subject Expert (University Nominee) | <i>[Signature]</i> | 1..... <i>[Signature]</i> | 8..... <i>[Signature]</i> |
| Subject Expert..... | <i>[Signature]</i> | 2..... <i>[Signature]</i> | 9..... <i>[Signature]</i> |
| Representative (Industry) | | 3..... <i>[Signature]</i> | 10..... <i>[Signature]</i> |
| Representative (Alumni) | <i>[Signature]</i> | 4..... | 11..... <i>[Signature]</i> |
| Representative (Professor Science Faculty Other Dept.) | <i>[Signature]</i> | 5..... | 12..... <i>[Signature]</i> |
| Student Representative | | 6..... <i>[Signature]</i> | 13..... |
| | | 7..... | 14..... |

[Signature]

B. Sc. Part - I (BIOCHEMISTRY) (OLD COURSE)
2022-23
PAPER- II
BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES

Max. Marks – 50

UNIT-I

Concepts of Bioenergetics

Principles of thermodynamics and their applications in biochemistry-introduction, thermodynamic system, thermodynamic state functions, first and second laws of thermodynamics, concept of free energy, standard free energy, determination of ΔG for a reaction, relation between equilibrium constant and standard free energy change, biological standard state and standard free energy change in coupled reactions. Biological oxidation-reduction reactions – introduction, redox potentials, relation between standard reduction potentials and free energy change (derivations and numericals included). High-energy phosphate compounds-introduction, phosphate group transfer-free energy of hydrolysis of ATP and sugar phosphates along with reasons for high ΔG .

UNIT-II

Hydrodynamic Methods

Sedimentation: sedimentation velocity, preparative and analytical ultracentrifugation techniques, determination of molecular weight by hydrodynamic methods (derivations excluded and numericals included).

Measurement of pH

Principles of glass and reference electrodes, types of electrodes, complications of pH measurement (dependence of pH on ionic strength electrode contamination and sodium error) and use of pH paper.

UNIT-III

Radio Isotopic Techniques

Types of radioisotopes used in Biochemistry, units of radioactivity measurements, techniques used to measure radioactivity (gas ionization and liquid scintillation counting), nuclear emulsions used in biological studies (pre-mounted, liquid and stripping), isotopes commonly used in biochemical studies – ^{32}P , ^{35}S , ^{14}C and ^3H , Autoradiography. Biological hazards of radiation and safety measures in handling radioisotopes. Biological applications.

UNIT-IV

Chromatography

General principles and application of:

- | | |
|-------------------------------|-----------------------------------|
| 1. Adsorption chromatography | 2. Ion-exchange chromatography |
| 3. Thin-layer chromatography | 4. Molecular-sieve chromatography |
| 5. Hydrophobic chromatography | 6. Gas-liquid chromatography |
| 7. HPLC | 8. Affinity chromatography |
| 9. Paper chromatography | |

Electrophoresis

Basic principles of agarose electrophoresis, PAGE and SDS-PAGE, Two-dimensional electrophoresis, its importance. Isoelectrofocussing.

UNIT-V**Spectroscopic Techniques**

Beer-Lambert law, light absorption and its transmittance, determination and application of extinction coefficient, application of visible and UV spectroscopic techniques (structure elucidation and numericals excluded). Principle and application of NMR, ESR, Mass spectroscopy. Fluorescent and emission spectroscopy.

Immunological Techniques

Immunodiffusion, immunoelectrophoresis, radioimmunoassay, ELISA, immunofluorescence.

List of Reference Books:

1. Physical Biochemistry by van Holde KE, Prentice hall Inc., New jersey.
2. Physical biochemistry by D Friefelder , WH Freeman & Co., USA..
3. Outlines of biochemistry by Eric E Conn, PK Stumpf, G Bruening and Ray H Doi , John Wiley & sons NY
4. Chromatography : A laboratory handbook of chromatography and electrophoretic methods by Erich Heftman, van Nostrand Reinhold, NY.

Question Paper Format and Distribution of Marks for Under Graduate Examination

1. The question paper will be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. (No Multiple choice questions, No 'Fill in the blank' type Questions)
3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely and the answer should not exceed the limit of 350 words.
5. The scheme of marks should be as follows :

| Question Type | MM 50 (Marks X No. of Q.) |
|---------------------|------------------------------|
| A (Very short Ans.) | 1X10 = 10 |
| B (Short Ans.) | 3 X 5 = 15 |
| C (Long Ans.) | 5 X 5 = 25 |

NAME AND SIGNATURE:

| | |
|--|---------------------------------------|
| Chairperson /H.O.D <i>[Signature]</i> | Departmental members: |
| Subject Expert <i>[Signature]</i> (University Nominee) | <i>[Signature]</i> <i>[Signature]</i> |
| Subject Expert <i>[Signature]</i> | <i>[Signature]</i> <i>[Signature]</i> |
| Representative..... (Industry) | <i>[Signature]</i> <i>[Signature]</i> |
| Representative..... <i>[Signature]</i> (Alumni) | <i>[Signature]</i> <i>[Signature]</i> |
| Representative <i>[Signature]</i> (Professor Science Faculty Other Dept.) | <i>[Signature]</i> <i>[Signature]</i> |
| Student Representative | <i>[Signature]</i> |

B.Sc. Part – I


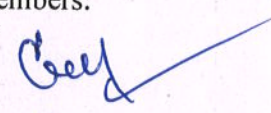


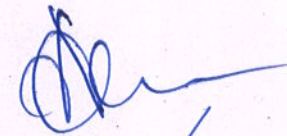


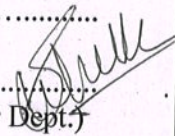

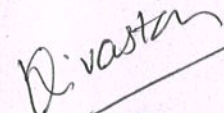
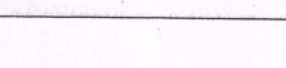

BIOCHEMISTRY PRACTICAL(OLD COURSE)

Max.Marks – 50

Min.Marks - 17

1. Preparation of standard buffers and determination of pH of a solution.
2. Qualitative test for :
 - a. Carbohydrates
 - b. Proteins and amino acids
 - c. Lipids
3. Determination of saponification value and iodine number of fats.
4. Estimation of ascorbic acid.
5. Titration curve for amino acids and determination of pK value.
6. Verification of Beer-Lambert's law.
7. Estimation of
 - i) Carbohydrate by anthrone method.
 - ii) Blood glucose by the methods
 - (a) Folin-Wu,
 - (b) Nelson-Somogyi
8. Estimation of amino acids by ninhydrin method.
9. Isolation and assay of glycogen from rat liver.
10. i) Extraction of total lipids by Folch method
ii) Estimation of food adulterant.
11. Estimation of DNA and RNA.
12. Separation of sugars using paper chromatography.

NAME AND SIGNATURE:

| | | |
|--|---|---|
| Chairperson /H.O.D | Departmental members: | |
| Subject Expert (University Nominee) |  |  |
| Subject Expert.....  |  |  |
| Representative..... (Industry) |  |  |
| Representative..... (Alumni) |  |  |
| Representative (Professor Science Faculty Other Dept.) |  |  |
| Student Representative |  | |