SYLLABUS

B.Sc. (Zoology) Part-II (Semester-III and IV)

(Session 2021-22, 2022-23 and 2023-24)

Semester-III

THEORY

	External Marks	**Internal Assessment**
Paper-V : Biochemistry	40	15 (Attendance: 3 + Assignment: 6 + House Test 6)
Paper-VI : Animal Physiology	40	15 (Attendance: 3 + Assignment: 6 + House Test 6)

PRACTICAL

Pertaining to Theory Paper-V and Theory Paper-VI:	40

Total Marks (Semester-III)

Theory		80 Marks
Practical		40 Marks
Internal Assessment pertaining to Theory Paper V & VI		30 Marks
Total	**:**	**150 Marks**

Semester-IV

THEORY

	External Marks	**Internal Assessment**
Paper-VII : Evolutionary Biology	40	15 (Attendance: 3 + Assignment: 6 + House Test 6)
Paper-VIII : Genetics	40	15 (Attendance: 3 + Assignment: 6 + House Test 6)

PRACTICAL

Pertaining to Theory Paper-VII and Theory Paper-VIII :	40

Total Marks (Semester-IV)

Theory		80 Marks
Practical		40 Marks
Internal Assessment pertaining to Theory Paper VII & VIII		30 Marks
Total	**:**	**150 Marks**

Note:

1) The number of teaching hours per week will be three for each theory paper and three for each practical in every semester. In all, there will be 12 teaching hours per week covering both theory and practical requirements. (Six teaching hours for theory and Six teaching hours for practical per week)
2) There will be one Practical paper of 3 hours pertaining to the theory papers in each semester. The timing of practical examination will be 9.00 am to 12.00 noon.

SEMESTER-III

PAPER-V: BIOCHEMISTRY

Max. Marks: 55 ***Time Allowed: 3 hours***
Pass marks: 35% ***Lectures to be delivered: 45***
Theory-40 ***(Each of 45 minutes duration)***
Internal Assessment: 15

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and will carry 6 marks each. Section C will consist of 8 short-answer type questions which will cover the entire syllabus uniformly and will carry 16 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

Section A

1. Biochemistry: its scope and importance, chemical bonds and energy, Biomolecules: configuration and conformation, Properties of water as biological solvent, Introduction to metabolism.

2. Carbohydrates: Structure and Biological importance- Monosaccharides, Disaccharides, Polysaccharides; Derivatives of Monosaccharides; Carbohydrate metabolism: Glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogenesis, Glycogenolysis.

3. Proteins: Amino acids- Structure, Classification, General and Electrochemical properties of α-amino acids; Physiological importance of essential and non-essential amino acids, Peptide Bond stabilizing protein structure; Levels of protein organization; Protein metabolism: Transamination, Deamination, Urea cycle, Fate of C-skeleton of Glucogenic and Ketogenic amino acids

Section B

4. Lipids: Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Triacylglycerols, Phospholipids, Sphingolipid, Glycolipids, Steroids, Eicosanoids and terpenoids. Lipid metabolism: β-oxidation of fatty acids - Palmitic acid, Linoleic acid; Fatty acid biosynthesis, Formation of lipid bi-layer

5. Nucleic Acids: Structure of Purines, Pyrimidines, Nucleosides and Nucleotides; Nucleic Acid Metabolism: Catabolism of Adenosine, Guanosine, cytosine and thymine.

6. Enzymes : Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Derivation of Michaelis-Menton equation, Lineweaver-Burk plot; Factors affecting rate of enzyme-catalyzed reactions; Enzyme inhibition.

PAPER-VI : ANIMAL PHYSIOLOGY

Max. Marks: 55 ***Time Allowed: 3 hours***
Pass marks: 35% ***Lectures to be delivered: 45***
Theory-40 ***(Each of 45 minutes duration)***
Internal Assessment: 15

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and will carry 6 marks each. Section C will consist of 8 short-answer type questions which will cover the entire syllabus uniformly and will carry 16 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Digestion: Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids

2. Respiration: Pulmonary ventilation, Respiratory volumes and capacities, Transport of Oxygen and carbon dioxide in blood, Oxygen dissociation curve of haemoglobin, Bohr effect, chloride shift, Haldane effect and control of breathing.

3. Excretion: Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism, Osmoregulation

4. Cardiovascular system: Composition of blood, molecular structure and function of haemoglobin, blood clotting, blood groups including Rh-factor, haemostasis and haemopoiesis. Origin and conduction of the cardiac impulse, Cardiac cycle, electrocardiogram.

SECTION-B

6. Structure and physiology of endocrine glands- thyroid; Parathyroid, adrenal, hypothalamus, pituitary, pancreas and gonads.

7. Nerve: Structure of a neuron, Resting membrane potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, synapse and myoneural junction.

8. Muscle: Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction.

Books recommended:

- A.L., Lehninger (1982). *Principles of Biochemistry*, Worth Publishers, Inc. New York.
- E.E. Conn and P.K. Stumpf. (1976) *Outlines of Biochemistry,* Wiley Eastern, New Delhi.
- L. Stryer (1995) *Biochemistry*, W.H. Freeman Press, San Francisco, USA.
- Voet, D. and Voet, J.G. (2004). *Biochemistry*, 3rd Edition, John Wiley & Sons, Inc. USA.
- Guyton, A.C. and Hall, J.E. (2011). T*extbook of Medical Physiology*, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
- Tortora, G.J. and Derrickson, B.H. (2009). *Principles of Anatomy and Physiology*, XII Edition, John Wiley & Sons, Inc.

LIST OF PRACTICALS

1. Identification of food stuffs: starch, glucose, proteins and fats in a given solution.
2. Demonstration of osmosis and diffusion.
3. Demonstration of presence of amylase in saliva, denaturation with change of pH and temperature.
4. Analysis of urine for urea and glucose.
5. Determination of coagulation and bleeding time of blood in man.
6. Determination of blood groups of human blood sample.
7. Recording of blood pressure of man.
8. Estimation of haemoglobin content.
9. Preparation of slide to study TLC and DLC.
10. Preparation and study of human blood smear.
11. Study of permanent mount of striated muscles.
12. Study of permanent mount of myelinated nerve fibre.

13. Identification of permanent histological sections of mammalian thyroid; Parathyroid, adrenal, hypothalamus, pituitary, pancreas and gonads.
14. Field study: Visit to a clinical lab.

INSTRUCTIONS FOR PRACTICAL PAPER

Max. Marks: 40 *Time Allowed: 3 hours*
Pass Marks: 35%

1.	Biochemistry Experiment out of Experiment No. 1-4	8
2.	Physiology Experiment out of Exp. No. 5-8	8
3.	Preparation, Study & Sketch of slide out 9-10	8
4.	Identification of 2 slides out of 11-13.	6
5.	Lab Visit report	4
6.	Viva-voce	3
7.	Note Book	3

SEMESTER-IV
PAPER-VII : EVOLUTIONARY BIOLOGY

Max. Marks: 55 ***Time Allowed: 3 hours***
Pass marks: 35% ***Lectures to be delivered: 45***
Theory-40 ***(Each of 45 minutes duration)***
Internal Assessment: 15

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and will carry 6 marks each. Section C will consist of 8 short-answer type questions which will cover the entire syllabus uniformly and will carry 16 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION A

1. Life's Beginnings: Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes
2. Historical review of evolutionary concept: Lamarckism, Darwinism, Neo-Darwinism
3. Sources of variations: Heritable variations and their role in evolution
4. Evidences of Evolution: Fossil record (types of fossils, transitional forms, geological time scale, evolution of horse and man, Molecular evolution (three domains of life, neutral theory of molecular evolution, molecular clock

SECTION B

5. Hardy-Weinberg Law (its assumptions and applications)
6. Natural selection and other forms of selection. Genetic Drift (mechanism, founder's effect, bottleneck phenomenon; Role of Migration and Mutation in changing allele frequencies)
7. Product of evolution: Micro and Macro evolution and isolating mechanisms, Micro evolutionary changes (inter-population variations), Modes of speciation
8. Extinctions, Back ground and mass extinctions (causes and effects), detailed example of K-T extinction
9. Origin and evolution of man, Unique hominid characteristics contrasted with primate characteristics, primate phylogeny from Dryopithecus leading to *Homo sapiens*, molecular analysis of human origin

Books Recommended

1. Ridley,M (2004) Evolution III Edition Blackwell publishing
2. Hall, B.K. and Hallgrimson, B (2008). Evolution IV Edition. Jones and Barlett Publishers.
3. Campbell, N.A. and Reece J.B (2011). Biology. IX Edition. Pearson, Benjamin, Cummings.
4. Douglas, J. Futuyuma (1997).Evolutionary Biology. Sinauer Associates.
5. Snustad. S Principles of Genetics.
6. Pevsner, J (2009). Bioinformatics and Functional Genomics. II Edition WileyBlackwell
7. Minkoff, E. (1983). Evolutionary Biology. Addison-Wesley

PAPER-VIII : GENETICS

Max. Marks: 55 ***Time Allowed: 3 hours***
Pass marks: 35% ***Lectures to be delivered: 45***
Theory-40 ***(Each of 45 minutes duration)***
Internal Assessment: 15

INSTRUCTIONS FOR PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and will carry 6 marks each. Section C will consist of 8 short-answer type questions which will cover the entire syllabus uniformly and will carry 16 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

Section-A

1. Chromatin and the Nucleosome: Structure of Nucleosome. Chromatin structure-Euchromatin, Heterochromatin-Constitutive and Facultative heterochromatin. Organization of Chromosomes.

2. Mendelism, Non- Mendelian Gene Interactions: Complementary factor, Epistatic gene, Duplicate genes, Supplementary factor, Lethal genes, Pleiotropism. Incomplete Dominance

3. Multiple Alleles: Inheritance of ABO Blood groups in Man, Rh factor and Erythroblastosis foetalis in Man, Polygenic inheritance- Skin pigmentation in Man, Eye colour in *Drosophila*.

4. Linkage –Types, theories and significance

5. Crossing over-Mechanism of crossing over, Factors affecting crossing over, Significance and consequences of crossing over.

6. Cytoplasmic Inheritance: Definition, characteristics, and examples: Shell coiling in *Pila* and Kappa particles in *Paramecium*.

Section B

7. Mutation: Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations, Molecular basis of Mutations in relation to UV light and chemical mutagens, Detection of mutations.

8. Sex determination: Autosomes and allosomes (sex chromosomes), Chromosomal methods of sex determination – XO, XY (Man and Drosophila), ZZ,ZW .
Sex linked inheritance: Sex linked inheritance in *Drosophila*, Sex linked inheritance in man –colourblindness, Haemophilia, Hypertrichosis and Baldness

9. Transposable genetic elements: Prokaryotic transposable elements- IS elements, Eukaryotic transposable elements- P elements in Drosophila; Uses of transposons

10. Human Genetics: Syndromes – Turner's, Klinefelter's, Down's and Cri-du-chat, In Born errors of metabolism –Phenylketonuria (PKU), Alkaptonuria, Albinism, Human pedigree analysis.

11. Genetic Analysis in Bacteria: Conjugation, Transformation, Transduction

Books Recommended

1. Karp, G. 2010 Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006 Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., 2008 Molecular Biology of the Gene (6th edition.). Cold Spring Harbour Lab. Press, Pearson Pub.

LIST OF PRACTICALS

1. Study of fossils from models/ pictures
2. Study of homology and analogy from suitable specimens
3. Study and verification of Hardy-Weinberg Law by chi square analysis
4. Graphical representation and interpretation of data of height/ weight of a sample population in relation to their age and sex.
5. Phylogeny of horse with diagrams of limbs and teeth of horse ancestors
6. Study of evolution of Darwin's Finches with diagrams of beaks of different species
7. Study of Evolution of man from charts
8. Visit to natural history museum (Excursion file)
9. Demonstration of Mendelian laws and gene interaction (use of colored beads).
10. Study of Human Karyotype (normal and abnormal) From Charts.
11. Problems based on gene interaction and sex-liked inheritance.
12. Preparation of temporary squash preparations of salivary glands for studying polytene chromosomes of *Chironomus*/ *Drosophila.*
13. Study of Gene frequencies (using colored beads)
14. Dermatographics: palm print taking and finger tip patterns and relation to genetic diseases
15. Survey of human subjects for the demonstration of the frequency of dominant and recessive traits such as free and attached pinna, rolling of tongue, eye colour, hair colour etc.

INSTRUCTIONS FOR PRACTICAL PAPER

Max. Marks: 40 *Time Allowed: 3 hours*

Pass Marks: 35%

1.	Evolutionary biology experiment out of 1-3	7
2.	Evolutionary experiment out of Exp. No. 4-7	7
3.	Genetics experiment out of 9-12	7
4.	Genetics experiment out of 13-15	7
5.	Excursion Report or Project regarding Inheritance of human characteristics or Dermatographics	4
5.	Viva-voce	4
6.	Note Book	4