

Zoology

B.Sc. Zoology-I

Total Mark: 100

Part-I

(Outlines of Tests)

Paper-A:	Principles in Animal Life (Written)	35 Marks
Paper-B:	Invertebrates Diversity (Written) (Classification, Phylogeny and Organization)	35 Marks
Paper-C:	Principles in Animal Life (Practical)	15 Marks
Paper-D:	Invertebrates Diversity (Classification, Phylogeny and Organization) (Practical)	15 Marks

(Syllabi and Courses of Reading)

Paper-A: Principles in Animal Life 35 Marks

1. Place of Zoology in Science:

A One-World View: Genetic Unity. The Fundamental Unit of Life, Evolutionary Oneness and the Diversity of Life, Environment and World Resources; What is Zoology ? The Classification of Animals; The Scientific Method.

2. The Chemical Bases of Animal Life:

Atoms and Elements: Building Blocks of All Matter, Compounds and Molecules: Aggregates of Atoms, Acids, Bases, and Buffers, The Molecules of Animals; Fractional account of Carbohydrates, Lipids, Proteins, Nucleotides and Nucleic Acids based on their structural aspects.

3. Cells, Tissues, Organs, and Organ System of Animals:

Structure and Functions of Cell Membranes ; Various Movements across Membranes ; Cytoplasm, Organelles, and Cellular Components ; Functional account of Ribosome's, Endoplasmic Reticulum, Golgi Apparatus, Lysosomes, Mitochondria, Cytoskeleton, Cilia and Flagella, Centrioles and Microtubules, and Vacuoles based on their structural aspects. The Nucleus: Nuclear Envelope, Chromosomes and Nucleolus. Tissues; Diversity in Epithelial Tissue, Connective Tissue, A Muscle Tissue and Nervous Tissue to perform various functions. Structural integrations for functions in Organs and Organ Systems.

4. Energy and Enzymes: Life's Driving and Controlling Forces:

Energy and the Laws of Energy Transformation; Activation Energy ; Enzymes; Structure, Function and Factors Affecting their Activity; Cofactors and Coenzymes ; ATP : How Cells Convert Energy? An Overview.

5. How Animals Harvest Energy Stored in Nutrients:

Glycolysis: The First Phase of Nutrient Metabolism, Fermentation: "Life without Oxygen; Aerobic Respiration ; The Major Source of ATP: Metabolism of Fats and Proteins; Control of Metabolism; The Metabolic Pool.

6. Cell Division:

Mitosis, Cytokinesis, and the Cell Cycle: An Overview, Control of the Cell Cycle Meiosis; The Basis of Sexual Reproduction; Gamete Formation

7. Inheritance Patterns:

The Birth of Modern Genetics ;Mendelian Inheritance Patterns ; Other Inheritance Patterns, Environmental Effects and Gene Expression.

8. Chromosomes and Gene Linkage:

Eukaryotic Chromosomes, Linkage Relationships, Changes in Chromosome Number and Structure.

9. Molecular Genetics : Ultimate Cellular Control:

DNA: The Genetic Material; DNA Replication in Eukaryotes, Genes in Action; Control of Gene Expression in Eukaryotes; Mutations ; Applications of Genetic Technologies Recombinant DNA.

10. Ecology I : Individuals and Populations:

Animals and Their Abiotic Environment; Populations; Interspecific Interactions.

11. Ecology II : Communities and Ecosystems:

Community Structure and Diversity; Ecosystems; Ecosystems of the Earth; Ecological Problems, Human Population Growth, Pollution, Resource Depletion and Biodiversity.

12. Animal Behavior:

Four Approaches to Animal Behavior, Proximate and Ultimate Causes; Aotin- opomorphism; Development of Behavior, Learning, Control of Behaviour, Communication; Behavioral Ecology; Social Behavior.

13. Evolution : A Historical Perspective:

Pre-Darwinian Theories of Change; Lamarck: An Early Proponent of Evolution; Early Development of Darwin's Ideas of Evolution and Evidences; The Theory of Evolution by Natural Selection, Evolutionary Thought after Darwin; Biogeography.

14. Evolution and Gene Frequencies:

The Modern Synthesis: A Closer Look; The Hardy - Weinberg Theorem Evolutionary Mechanisms; Population Size, Genetic Drift, Neutral Selection, Gene Flow, Mutation, and Balanced Polymorphism, Species and Speciation : Rates of Evolution; Molecular Evolution Mosaic Evolution.

Paper-B: Invertebrates Diversity (Classification, Phylogeny and Organization) 35 Marks

1. Introduction:

Classification of Organisms; Evolutionary Relationships and Tree Diagrams; Patterns of Organization.

2. Animal-Like Protists : The Protozoa:

Evolutionary Perspective ; Life within a Single Plasma Membrane ; Symbiotic Life-styles. Protozoan Taxonomy; (up to phyla, subphyla and super classes, wherever applicable). Pseudopodia and Amoeboid Locomotion; Cilia and Other Pellicular Structures; Nutrition; Genetic Control and Reproduction; Symbiotic Ciliates; Further Phylogenetic Considerations.

3. Multicellular and Tissue Levels of Organization:

Evolutionary Perspective :Origins of Multicellularity; Animal Origins. Phylum Porifera; Cell Types, Body Wall, and Skeletons; Water Currents and Body Forms; Maintenance Functions, Reproduction. Phylum Cnidaria (Coelenterate). The Body Wall and Nematocysts: Alternation of Generations; Maintenance Functions ; Reproduction and Classification up to class. Phylum Ctenophore; Further Phylogenetic Considerations.

4. The Triploblastic. Acoelomate Body Plan:

Evolutionary Perspective; Phylum Platyhelminthes; Classification up to class; The Free-Living Flatworms and the Tapeworms, Phylum Nematoda; Phylum Gastrotrich; Further Phylogenetic Considerations.

5. The Pseudocoelomate Body Plan : Ascheiminths:

Evolutionary Perspective; General Characteristics; Classification up to phyla with External Features; Feeding and the Digestive System; Other Organ Systems ; Reproduction and Development of phylum Rotifera and phylum Nematoda; Phylum Kinorhyncha. Some important Nematode Parasites of Humans,; Further Phylogenetic Considerations.

6. Mollusean Success:

Evolutionary Perspective; Relationship to other Animals ; Origin of the Coelom ; Mollusean

Characteristics, Classification up to class. The Characteristics of Shell and Associated Structures, Feeding, Digestion, Gas Exchange, Locomotion, Reproduction and Development, other Maintenance Functions and Diversity in Gastropods, Bivalves and Cephalopods: Further Phylogenetic Considerations.

7. Anelida: The Metameric Body Form:

Evolutionary Perspective; Relationship to other Animals, Metamerism and Tagmatization, Classification up to class. External Structure and Locomotion, Feeding and the Digestive System, Gas Exchange and Circulation, Nervous and Sensory Functions, Excretion, Regeneration, Reproduction and Development, in Polychaeta, Oligochaeta and Hirudinea, Further Phylogenetic Considerations.

8. The Arthropods : Blueprint for Success:

Evolutionary Perspective : Classification and Relationships to Other Animals ; Metamerism and Tagmatization; The Exoskeleton; Metamorphosis; Classification up to class; Further Phylogenetic Considerations.

9. The Hexapods and Myriapods : Terrestrial Triumphs:

Evolutionary Perspective: Classification up to class. External Structure and Locomotion, Nutrition and the Digestive System, Gas Exchange, Circulation and Temperature Regulation, Nervous and Sensory Functions, Excretion, Chemical Regulation, Reproduction and Development in Hexapoda, Insects Behavior, Insects and Humans; Further Phylogenetic Considerations.

10. The Echinoderms:

Evolutionary Perspective; Relationships to other Animals; Echinoderm Characteristics; Classification up to class. Maintenance Functions, Regeneration, Reproduction, and Development in Asterozoa, Ophiurozoa, Echinozoa, Holothurozoa and Crinozoa; Further Phylogenetic Considerations; Some Lesser-Known Invertebrates; The Lophophorates, Entoprocts, Cycliophores, and Chaetognaths.

Recommended Books:

Principal Reference Book:

1. Miller, A.S. and Harley, J.B.; 1999 & 2002. ZOOLOGY, 4th & 5th Edition (International). Singapore: McGraw Hill.

Additional Readings:

2. Hickman, C.P., Roberts, L.S., and Larson, A., 2001. INTEGRATED PRINCIPLES OF ZOOLOGY, 11th Edition (International). Singapore: McGraw Hill.

3. Pechenik, J.A., 2000. BIOLOGY OF INTERVEBRATES, 4th Edition (International). Singapore: McGraw Hill.
4. Kent, G. C. and Miller, S., 2001. COMPARATIVE ANATOMY OF VERTEBRATES. New York: McGraw Hill.
5. Campbell, N.A., 2002; BIOLOGY Sixth Edition, Menlo Park, California; Benjamin Cummings Publishing Company, Inc.

Paper-C:

Principles in Animal Life (Practical)

15 Marks

1. Tests for different carbohydrates, proteins and lipids.

Note for 1. Emphasis on the concept that tests materials have been ultimately obtained from living organisms and constituted their body.

2. Study of the prepared slides of squamous, cuboidal, columnar epithelial tissues, adipose, connective, cartilage bone, blood, nervous, skeletal muscle, smooth muscle and cardiac muscle tissues.

Note for 2. Prepared microscopic and or projection slides and or CD ROM computer projections must be used.

3. Plasmolysis and deplasmolysis in blood
4. Protein digestion by pepsin.
5. Study of mitosis in onion root tip.
6. Study of meiosis in grass hopper testis.

Note for 5-6. Prepared microscopic and or projection slides and or CD ROM computer projections must be used.

7. Problem based study of Mendelian ratio in animals.
8. Multiple allels study in blood groups.
9. Survey study of a genetic factor in population and its frequency.
10. Study of chromosomal number and structural change in Drosophila.
11. Study of karyotypes of Drosophila, Mosquito.
12. Study of cytochemical destruction of DNA in protozoa and avian blood cell.
13. Study of stages in the development of an Echinoderm.
14. Study of early stages in the development of a frog, chick and a mammal.

Note for 10-14. Prepared slides and preserved specimen and or projection slides and or CD ROM computer projections may be used.

15. Study to demonstrate nervous or endocrine basis of behaviour (conditioned reflex or aggression or parental behaviour).
16. Study to demonstrate social behaviour (honey bee, monkey group in a zoo).
17. Ecological notes on animals of a few model habitats.

18. Field observation and report writing on animals in their ecosystem (a terrestrial and an aquatic ecosystem study).

Paper-D:

Invertebrates Diversity (Classification, Phylogeny and Organization) (Practical) 15 Marks

1. Study of **Euglena, Amoeba, Entamoeba, Plasmodium, Trypanosoma, Paramecium** as representative of animal like protists.
2. Study of sponges and their various body forms.
3. Study of principal representative classes of phylum Coelentrata.
4. Study of principal representative classes of phylum Platyhelminthes.
5. Study of representative of phylum Rotifera, phylum Nematoda.
6. Study of principal representative classes of phylum Mollusca.
7. Study of principal representative classes of phylum Annelida.
8. Study of principal representative classes of phylum Arthropoda.
9. Study of a representative of classes of phylum Echinodermata

Recommended Books:

1. Miller, S.A., 2002. GENERAL ZOOLOGY LABORATORY MANUAL. 5th Edition (International) Singapore: McGraw Hill.
2. Hickman, C.P. and Kats, H.L., 2000. LABORATORY STUDIES IN INTEGRATED PRINCIPLES OF ZOOLOGY. Singapore: McGraw Hill

Zoology

B.Sc. Zoology-II

Total Mark: 100

Part-II

(Outlines of Tests)

Paper-A:	Chordates Diversity (Classification, Phylogeny and Organization) (Written)	35 Marks
Paper-B:	Animal form and function (A comparative Perspective) (Written)	35 Marks
Paper-C:	Chordates Diversity (Classification, Phylogeny and Organization) (Practical)	15 Marks
Paper-D:	Animal form and function (A comparative Perspective) (Practical)	15 Marks

(Syllabi and Courses of Reading)

Paper-A: Chordates Diversity (Classification, Phylogeny and Organization) 35 Marks

1. Hemichordata and Invertebrate Chordates

Evolutionary Perspective: Phylogenetic Relationships; Classification up to subphylum or class where applicable; Further Phylogenetic Considerations.

2. The Fishes: Vertebrate Success in Water

Evolutionary Perspective: Phylogenetic Relationships; Survey of Superclass Agnatha and Gnathostomata; Evolutionary Pressures: Adaptations in Locomotion, Nutrition and the Digestive System, Circulation, Gas Exchange, Nervous and Sensory Functions, Excretion and Osmoregulation, Reproduction and Development; Further Phylogenetic Considerations.

3. Amphibians: The First Terrestrial Vertebrates

Evolutionary Perspective: Phylogenetic Relationships; Survey of Order Caudata, Gymnophiona, and Anura. Evolutionary Pressures: Adaptations in External Structure and Locomotion, Nutrition and the Digestive System, Circulation, Gas Exchange, Temperature Regulation, Nervous and Sensory Functions, Excretion and Osmoregulation, Reproduction, Development, and Metamorphosis; Further Phylogenetic Considerations.

4. Reptiles: The First Amniotes

Evolutionary Perspective: Cladistic Interpretation of the Amniotic Lineage; Survey of Order Testudines or Chelonia, Rhynchocephalia, Squamata, and Crocodilia; Evolutionary Pressures: Adaptations in External Structure and Locomotion, Nutrition and the Digestive System, Circulation, Gas Exchange, and Temperature Regulation, Nervous and Sensory Functions, Excretion and Osmoregulation, Reproduction and Development; Further Phylogenetic Considerations.

5. Birds: Feathers, Flight, and Endothermy

Evolutionary Perspective: Phylogenetic Relationships; Ancient Birds and the Evolution of Flight; Diversity of Modern Birds; Evolutionary Pressures: Adaptation in External Structure and Locomotion, Nutrition and the Digestive System, Circulation, Gas Exchange, and Temperature Regulation, Nervous and Sensory Systems, Excretion and Osmoregulation, Reproduction and Development; Migration and Navigation.

6. Mammals: Specialized Teeth, Endothermy, Hair, and Viviparity

Evolutionary Perspective: Diversity of Mammals; Evolutionary Pressures: Adaptations in External Structure and Locomotion, Nutrition and the Digestive System, Circulation, Gas Exchange, and Temperature Regulation, Nervous and Sensory Functions, Excretion and Osmoregulation, Behavior, Reproduction and Development.

Paper-B: Animal form and function (A comparative Perspective) 35 Marks

1. Protection, Support, and Movement

Protection: The Integumentary System of Invertebrates and Vertebrates; Movement and Support: The Skeletal System of Invertebrates and Vertebrates; Movement: Non-muscular Movement; An Introduction to Animal Muscles; The Muscular System of Invertebrates and Vertebrates.

2. Communication I: Nerves

Neurons: Structure and Function; Neuron Communication: Introductory accounts of Resting Membrane Potential, Action Potential (Nerve Impulse) and Transmission of the Action Potential between Cells; Invertebrate and Vertebrate Nervous Systems: The Spinal Cord, Spinal Nerves, The Brain, Cranial Nerves and The Autonomic Nervous System.

3. Communication II: Senses

Sensory Reception: Baroreceptors, Chemoreceptors, Georeceptors, Hygroreceptors, Phonoreceptors, Photoreceptors, Proprioceptors, Tactile Receptors, and Thermoreceptors of invertebrates; Lateral-Line System and Electrical Sensing, Lateral-Line System and Mechanoreception, Hearing and Equilibrium in Air, Hearing and Equilibrium in Water, Skin Sensors of Damaging Stimuli, Skin Sensors of Heat and Cold, Skin Sensors of Mechanical Stimuli, Sonar, Smell, Taste and Vision in Vertebrates.

4. Communication III: The Endocrine System and Chemical Messengers

Chemical Messengers: Hormones Chemistry; and Their Feedback Systems; Mechanisms of Hormone Action; Some Hormones of Porifera, Cnidarians, Platyhelminths, Nemertean, Nematodes, Molluscs, Annelids, Arthropods, and Echinoderms Invertebrates; An Overview of the Vertebrate Endocrine System; Endocrine Systems of Vertebrates other Than Birds or Mammals; Endocrine Systems of Birds and Mammals.

5. Circulation, Immunity, and Gas Exchange

Internal Transport and Circulatory Systems in Invertebrates: Characteristics of Invertebrate Coelomic Fluid, Hemolymph, and Blood Cells; Transport Systems in Vertebrates; Characteristics of Vertebrate Blood, Blood Cells and Vessels; The Hearts and Circulatory Systems of Bony Fishes, Amphibians, and Reptiles, Birds and Mammals; The Human Heart: Blood Pressure and the Lymphatic System; Immunity: Nonspecific Defenses, The Immune Response; Gas Exchange: Respiratory Surfaces; Invertebrate and Vertebrate Respiratory Systems: Cutaneous Exchange, Gills, Lungs, and Lung Ventilation; Human Respiratory System: Gas Transport.

6. Nutrition and Digestion

Evolution of Nutrition; The Metabolic Fates of Nutrients in Heterotrophs; Digestion; Animal Strategies for Getting and Using Food Diversity in Digestive Structures of Invertebrates and Vertebrates; The Mammalian Digestive System: Gastrointestinal Motility and its Control, Oral Cavity, Pharynx and Esophagus, Stomach, Small Intestine: Main Site of Digestion; Large Intestine; Role of the Pancreas in Digestion; and Role of the Liver and Gallbladder in Digestion.

7. Temperature and Body Fluid Regulation

Homeostasis and Temperature Regulation; The Impact of Temperature on Animal Life; Heat Gains and Losses; Some Solutions to Temperature Fluctuations; Temperature Regulation in

Invertebrates, Fishes, Amphibians, Reptiles, Birds and Mammals; Heat Production in Birds and Mammals; Control of Water and Solutes (Osmoregulation and Excretion); Invertebrate and Vertebrate Excretory Systems; How Vertebrates Achieve Osmoregulation; Vertebrate Kidney Variations; Mechanism in Metanephric Kidney Functions.

8. Reproduction and Development

A sexual Reproduction in Invertebrates; Advantages and Disadvantages of Asexual Reproduction; Sexual Reproduction in Invertebrates; Advantages and Disadvantages of Sexual Reproduction; Sexual Reproduction in Vertebrates; Reproductive Strategies; Examples of Reproduction among Various Vertebrate Classes; The Human Male Reproductive System: Spermatogenesis, transport and Hormonal Control, Reproductive Function; The Human Female Reproductive System: Folliculogenesis, transport and Hormonal Control, Reproductive Function; Hormonal Regulation in gestation; Prenatal Development and Birth Events of Prenatal Development: The Placenta; Birth; Milk Production and Lactation.

9. Descriptive Embryology

Fertilization; Embryonic Development: Cleavage, and Egg Types; The Primary Germ Layers and their Derivatives; Echinoderm Embryology; Vertebrate Embryology: The Chordate Body Plan, Amphibian Embryology, Development in Terrestrial Environments, Avian Embryology, The Fate of Mesoderm.

Paper-C: Practical-I

15 Marks

1. Study of a representative of hemichordate and invertebrate chordate.
2. Study of representative groups of class fishes.
3. Study of representative groups of class Amphibia.
4. Study of representative groups of class Reptelia.
5. Study of representative groups of class Aves.
6. Study of representative groups of class Mammalia.
7. Field trips to study animal diversity in an ecosystem.

Note : Preserved specimen and or colored projection slide and or CD ROM projection of computer must be used.

Paper-D: Practical-II

15 Marks

1. Study and notes on skeleton of *Labeo*, *Rana tigrina*, *Varanus*, fowl and Rabbit,
Note for 1: Exercises of notes on the adaptations of skeletons to their function must be done.
2. Earthworm or leech; cockroach, freshwater mussel, *Channa* or *Catla catla* or *Labeo* or any other local fish, frog, pigeon and rat or mouse or rabbits are representative animals for study in dissections.
3. Study of models or preserved brains of representative animals and notes on adaptations.
4. Study of nervous system of earthworm and a fish.
5. Study of endocrine system in an insect and a mammal.
6. Study of different types of blood cells in blood smear.
7. Study of heart, principal arteries and principle veins in a representative vertebrate.
8. Study of respirator system in cockroach or locust and a vertebrate representative
9. Study of excretory system in an invertebrate and a vertebrate representative
10. Study of nutritive canal in an invertebrate and a vertebrate representative
11. Study of male reproductive system in an invertebrate and a vertebrate representative
12. Study of female reproductive system in an invertebrate and a vertebrate representative.
13. Study of hormonal influence of a reproductive function
14. Study of preserved advanced stages of avian and mammalian development for amniotic membranes and placenta

Recommended Books:

1. Miller, A.S. and Harley, J.B., 1999 & 2002. ZOOLOGY, 4th & 5th Edition (International). Singapore: McGraw Hill.
2. Hickman, C.P., Roberts, L.S. and Larson, A., 2001. INTEGRATED PRINCIPLES OF ZOOLOGY, 11th Edition (International). Singapore: McGraw Hill.
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5. Campbell, N.A., 2002. BIOLOGY, 6th Edition. Menlo Park, California: The Benjamin/Cummings Publishing Company, Inc.

Recommended Books for Practical:

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2. Hickman, C.P. and Kats, H.L., 2000. LABORATORY STUDIES IN INTEGRATED PRINCIPLES OF ZOOLOGY. Singapore: McGraw Hill.