

54

Zoology

B.Sc.: Elective

Outlines of Tests

Paper	Title of Course	Marks
A		45
B		50
C		45
D	Practical A+B+C	60
Total:		200

PAPER A: PRINCIPLES IN ANIMAL LIFE

1. Place of Zoology in Science:-

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 element: 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 movement across membranes; cytoplasm, organelles, and cellular components; functional account of ribosomes, 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, 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; Medelian inheritance patterns; other inheritance patterns, Environmental effect and Gene Expression.

8. Chromosomes and Gene Linkage:

Eukaryotic Chromosomes Linkage Relationship, 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 biotic environment; populations ; intraspecific 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, Autinopomorphism; Development of Behavior, Learning, Control of Behavior, Communication Behavioral Learning Control of Behavior 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, Nautral Selection, Gene Flow Mutation and Balanced Polymorphism species and speciation Rates of Evolution; Molecular Evolution Mosaic Evolution.

PAPER B: INVERTEBRATES AND CHORDATES DIVERSITY: CLASSIFICATION, PHYLOGENY AND ORGANIZATION

Introduction

Classification of organisms; evolutionary relationships and tree diagrams; patterns of organization.

Animal –Like Protists: The Protozoa .

Evolutionary perspective; life within a single plasma membrane; symbiotic life-style. Protozoan taxonomy; (up to phyla, subphyla and super classes, whenever applicable). Pesudopodia and amoeboid lccomotion; cilia and other pellicular structures: nutrition; genetic control and reproduction; symbiotic ciliates; further phylogenetic considerations.

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 (coelenterata) the body wall and nematocysts; alternation of generations; maintenance functions; reproduction and classification up to class. Phylum tenophora; further phylogenetic considerations.

The Triploblastic, Acoelomate Body Plan

Evolutionary perspective; phylum platyheiminthes; classifications up to class; the free living

flatworms and the tapeworms; phylum nemertea; phylum gastrotricha; further phylogenetic considerations.

The Pseudocoelomate Body Plan; Aschelminths.

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 menatoda. Phylum kinoryncha Some important nematode parasites of humans; further phylogenetic consideration.

Molluscan Success;

Evolutionary perspective; relationships to their animals; origin of the coelom; molluscan 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.

Annelida; 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.

The Arthropods: Blueprint for Success

3

Evolutionary perspective; classification and relationships to other animals; metamerism and tagmatization; the exoskeleton; metamorphosis; classification up to class; and further phylogenetic considerations.

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; insect behavior; insects and humans ; further phylogenetic considerations.

The Echinoderms

Evolutionary Perspective; Relationships to other Animals; Echinoderm Characteristics up to class, Maintenance functions, regeneration, Reproduction and development in Asteroid, Ophiuroidea, Echinodermata, Holothuroidea and Crinoidea further phylogenetic considerations, some Lesser Known invertebrates; The Lophophorates Entoprocts, Cycliophores and Chordates.

Hemichordata invertebrate Chordates:

Evolutionary perspective phylogenetic Relationships; Classification up to subphylum or class where applicable; Further and phylogenetic consideration.

The Fishes: Vertebrate Success in Water

Evolutionary Perspective: Phylogenetic Relationship survey of super class Agnatha and Gnathostomata Evolutionary pressures: Adaptations in locomotion., Functions Excretion and osmoregulation Reproduction and Development further Phylogenetic Considerations

Amphibians: The First Terrestrial Vertebrates.

Evolutionary Perspective: Phylogenetic Relationship survey of order caudate and Anura 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 Phylogenetic Consideration.

Reptiles: The First Amniotes.

Evolutionary Perspective: Cladistic Interpretation of the Amniotic Lineage Survey of order

testudies or chelonian Rhynchocephalia Squamata and crocodile; Evolutionary pressures adaptation 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 Phylogenetic Consideration

Bird: Feathers, Flight, and Endothermy.

Evolutionary Perspective; phylogenetic Relationship, 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 and osmoregulation Reproduction and Development: Migration and Navigations.

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 Regulations Nervous and Sensory Functions Excretion and osmoregulation behavior Reproduction and Development.

PAPER C: ANIMAL FORM AND FUNCTIONS
A COMPARATIVE PERSPECTIVE

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; invertebrates and vertebrates 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. Tactile receptors and thermoreceptors of invertebrates ; lateral line system an 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 , platyhelminthes, nemertean, nematodes, mollusks, annelids , arthropods, and echinoderms invertebrates; an overview of the vertebrates 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's coelomic fluid. Hemolymph, and blood cells; transport systems in vertebrates ; characteristics of vertebrates blood, blood cells and vessels ; the hearts and circulatory systems of bony fishes, amphibians , reptiles, birds, and mammals; the human heart; blood pressure and the lymphatic system; immunity; nonspecific defenses , the immune response; gas exchange ; respiratory surfaces; invertebrates and vertebrates 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 Heterotrophy, Digestion: animal Strategies of 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 sites of Digestion, Large Intestine, role of Pancreas in digestion: and role of the Liver and Gallbladder in digestions

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 Fluctuation: temperature Regulation in Invertebrates fishes amphibian Reptiles Birds and Mammals: Heat Production in Birds and mammals, control of water and solutes (Osmoregulation and Excretion) Invertebrates and Vertebrate Excretory Systems; How vertebrate Achieves osmoregulation: Vertebrate Kidney Variations: Mammals Mechanism in metamorphic kidney Function

8. Reproduction and Development

Asexual Reproduction in Invertebrates: Advantages and disadvantages in asexual Reproduction: Sexual reproduction in Invertebrates: Advantage and disadvantages of sexual reproduction, Sexual reproduction in vertebrate: Reproduction 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 Environment, Avian embryology the Fate of Mesoderm.

PRACTICAL PAPER A: PRINCIPLES IN ANIMAL SCIENCES

1. Tests for different carbohydrates, proteins and lipids.
Note: Emphasis on the concept that tests materials have been ultimately obtained from living organism 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.

6

Note:- 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 tips
6. Study of meiosis in grass Hopper testis
Note: for 5-6 prepared microscopic and projection slides and or CD Rom computer projections must be used
7. Problem Based study of Mendelian ratio in animals.
8. Multiple alleles study in blood groups
9. Survey study of a genetic factor in population and its frequency
10. Study of chromosomal numbers and structural change in Drosophila.
11. Study of Karyotypes in drosophila.
12. Study of cytochemical demonstration in DNA in protozoa and avian blood cell

13. Study of stages in the development of Echinoderm.
14. Study of early stages in the development of a frog, chick and mammal
15. Study to demonstrate nervous or endocrine base behavior (Conditioned reflex or aggression or parental behavior)
16. Study to demonstrate social behavior (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)

PRACTICAL PAPER B: INVERTEBRATES AND CHORDATE DIVERSITY: - PHYLOGENY AND ORGANIZATION

1. Study of Euglena, Amoeba, Entamoeba, Plasmodium, Trypanosoma, Paramecium as representative of animal like protists. (prepared slides)
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 groups of phylum Arthropod.
9. Study of a representative of hemichordate and invertebrate chordate

10. Study of representative groups of class fishes.
11. Study of representative groups of class amphibian
12. Study of representative groups of class reptilia
13. Study of representative groups of class aves
14. Study of representative groups of class mammalian
15. 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

PRACTICAL PAPER C: ANIMAL FORM AND FUNCTIONS A COMPARATIVE PERSPECTIVE

- (1) Study of insect chitin, fish scale, amphibian skin, reptilian scales, feathers and mammalian skin.
- (2) Study and notes of skeleton of *Labeo*, *Rana tigrina*, *Varanus*, Fowl and rabbit.
Note: exercises of notes on the adaptations of skeleton to their function must be done.
- (3) Earthworm or leech; cockroach, freshwater muscles, *Channa* or *Catla catla* or *Labeo* or any other local fish. Frog, pigeon and rat or mouse and rabbits are representative animals for study in dissections.
- (4) Study of models or preserved brains of representative animals and notes on adaptations.
- (5) Study of nervous system of earthworm and a fish.
- (6) Study of endocrine system in an insect and a mammal
- (7) Study of different types of blood cells in blood smear.
- (8) Study of heart, Principal arteries and principal veins in a representative vertebrate.
- (9) Study of respiratory system in an invertebrate and vertebrate representative.
- (10) Study of excretory system in an invertebrate and a vertebrate representative.
- (11) Study of nutritive canal in an invertebrate and a vertebrate representative.
- (12) Study of male reproductive system in an invertebrate and vertebrate representative.
- (13) Study of female reproductive system in an invertebrate and a vertebrate representative.
- (14) Study of hormonal influence of reproductive functions.

- (15) Study of preserved advanced stages of an avian and mammalian development
aminotic membranes and placenta.

Note for 4-6 and 8-13: Notes of comparisons in to adaptation must be written

Recommended Books:

- (b) Miller, S.A. and Harley, J.B. 1999, 2002 and 2005. ZOOLOGY, 4th, 5th & 6th Edition (international). Singapore: McGraw Hill.

ADDITIONAL READINGS:

1. Hickman, C.P., Roberts, L.S. and Larson, A., 2004. INTEGRATED PRINCIPLES OF ZOOLOGY, 11th and 12th Edition (international). Singapore: McGraw Hill.
2. Pechenik, J.A., 2000. BIOLOGY OF INTERVEBRATES, 4TH and 5TH Edition (international). Singapore: McGraw Hill.
3. Kent. G.C. and Miller, S., 2001. COMPARATIVE ANATOMY OF VERTEBRATES, New York: McGraw Hill.
4. Campbell, N.A. , 2002. BIOLOGY, Sixth Edition. Menlo Park, California: Benjamin/Cummings publishing company, Inc.

Books For Practical

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