

SYLLABUS

B.SC. PART I

(WITH EFFECTIVE FROM 2018-19)

4. ZOOLOGY

Scheme:

Paper	Duration	Max. Marks	Min. Pass Marks
Paper I	3 hrs.	50	18
Paper II	3 hrs.	50	18
Paper III	3 hrs.	50	18
Practical	5 hrs.	75	27
Total Marks		225	81

Note: Each theory paper is divided into three independent units. The question paper is divided into three parts Part -A, Part -B and Part -C. Part A (10 marks) is compulsory and contains 10 questions (20 words) at least three questions from each unit, each question is of one mark. Part -B (10 marks) is compulsory and contains five questions at least one from each unit. Candidate is required to attempt all five questions. Each question is of two marks (50 words). Part -C (30 marks) contains six questions two from each unit. Candidate is required to attempt three questions one from each Unit. Each question is of ten marks (400 words).

PAPER-I

DIVERSITY OF ANIMALS AND EVOLUTION

UNIT I

- 1 General principles of taxonomy - concept of the five kingdom scheme.
- 2 Concept of protozoa, parazoa, metazoa, eumetazoa and levels of organisation
- 3 Basis of classification of non-chordata: Symmetry, coelom, segmentation and embryogeny.
4. Classification of various phyla up to class –
General characters and classification of Phylum – Protozoa
General characters and classification of Phylum – Porifera
General characters and classification of Phylum – Coelenterate
General characters and classification of Phylum – Platyhelminthes
General characters and classification of Phylum – Nematoda
General characters and classification of Phylum – Annelida

UNIT III

5. Classification of various phyla up to class –
General characters and classification of Phylum – Arthropod
General characters and classification of Phylum – Mollusca
General characters and classification of Phylum - Echinodermata
6. Salient features and classification of Hemichordata
7. Economic importance of Protozoa, Porifera,, Helminthes, Arthropod and Mollusca

UNIT III

- 1 History of evolutionary thought –Lamarckism, Neo-Lamarckism, Darwinism and Neo- Darwinism.
- 2 Natural selection (differential reproduction), genetic basis of evolution, speciation.
- 3 Variations, Isolation and Adaptations and their role in evolution.
- 4 Palaeontology: Fossils, geological divisions of the earth's crust, imperfection of the geological record.
- 5 Zoogeographical distribution, principle zoogeographical regions of the world with special reference to their mammalian fauna, continental drift.
- 6 Study of extinct types: Dinosaurs and Archaeopteryx

PAPER- II : CELL BIOLOGY AND GENETICS

UNIT - I

- 1 Introduction to Cell: Cell theory; Morphology, size, shape and characteristics of Prokaryotic, Mycoplasma, Virus and Eukaryotic Cell (animal cell).
- 2 Physical and biochemical makeup of Protoplasm.
3. Cytoplasmic organelles:
 - (i) Plasma-membrane: Characteristics of cell membrane molecules, Fluid-mosaic model of Singer and Nicolson, Concept of unit membrane. Specialised structure of Plasma membrane. Functions. Cell-membrane transport: Passive (diffusion and osmosis) and active transport.
 - (ii) Structure and functions of endoplasmic reticulum, Golgi complex, Lysosomes and Microbodies.
 - (iii) Structure and biogenesis of mitochondria: electron transport chain and generation of ATP molecules.
 - iii) Structure and functions of Ribosomes, Centrosomes, Microtubules, Flagella, Cilia and Nucleus.
4. Chromosomes: Morphology, chromonema, chromomeres, telomeres, primary and secondary constrictions, chromatids, prokaryotic chromosome; Giant Chromosomes: Lampbrush and Polytene chromosome

UNIT II

1. Nucleic Acid: DNA and RNA
 - i) DNA Structure, polymorphism (A, B and Z type) and replication (semi-conservative mechanism), elementary idea about polymerases, topoisomerases, single strand binding protein, replication forks (both unidirectional and bidirectional), leading and lagging strands, RNA primers and Okazaki fragments, elementary idea about DNA repairs.
 - ii) RNA structure and types (mRNA, rRNA and tRNA) and transcription (elementary idea about polymerases, capping, poly A tail, exon and introns).
2. Transcription and Translation, (Protein synthesis): Mechanism of transcription, Genetic code and its characteristics, Translation.
3. Cell reproduction:
 - i) Interphase nucleus and cell cycle S, G₁, G₂ M-phase.
 - ii) Mitosis: Phases and process of mitosis, structure and function of spindle apparatus, anaphasic movement.
 - iii) Meiosis: Phases and process of meiosis, synapses and synaptonemal complex, formation and fate of chiasmata and significance of crossing over.

UNIT III

1. Mendelism : Brief history of genetics and Mendel's work, Mendel's laws of inheritance, Monohybrid and dihybrid cross, their significance and current status
2. Variation in chromosomal number; haploidy, diploidy, polyploidy, aneuploidy.
3. Genetic disorder in Human beings (Down's, Turner's, Klinefelter's)
4. Chromosomal mutations: Classifications of chromosomal mutations: deletion, duplication, translocation and inversion
5. Molecular basis of Gene interaction
6. Linkage and crossing over.
7. Sex determination- types and Sex linked inheritance.
8. Genetic interaction: Allelic gene interaction- incomplete dominance, co dominance and Lethal genes ; Non allelic interactions- Supplementary genes, complementary genes, duplicate genes, epistasis, inhibitory and polymorphic genes; Multiple gene inheritance- ABO blood groups and Rh factor and their significance.

PAPER- III : DEVELOPMENTAL BIOLOGY

UNIT I

1. Basics of embryology: Historical review and types of embryology. General idea of asexual and sexual reproduction. An introduction to animal development in sexually reproducing animals (Reproductive system). Neuroendocrine regulation of reproductive organs: estrous and menstrual cycles.
2. Gametogenesis :
 - i) Formation of egg and sperm
 - ii) Vitellogenesis
3. Fertilization: Activation of ovum, essence of activation, changes in the organization of the egg cytoplasm.
4. Parthenogenesis, evolution of viviparity
5. Cleavage: Definition, types of cleavage, planes and patterns Significance of cleavage, morulation and blastulation.
6. Gastrulation: definition, fate maps, morphogenetic cell movements, significance of gastrulation.

UNIT II

1. Embryonic induction; primary organizer, differentiation, competence
2. Organogenesis and Growth
3. Regeneration, Teraogenesis, Senescence and Ageing
4. Extraembryonic membranes of chick.
5. Development of chick embryo up to 96 hours.
6. Placentation in Mammals : Definition, types, classification on the basis of morphology and histology, functions of placenta

UNIT III

1. Embryogenesis of Frog and Metamorphosis
2. Mechanism of cellular differentiation in sex determination and sex differentiation
3. Government rules against sex determination during pregnancy
4. Physiological transition of the Foetus at Birth
5. Basic concept of animal cell and tissue culture
6. In vitro fertilisation and Embryo Transfer
7. Embryonic stem cell

PRACTICAL ZOOLOGY

Duration 5 hrs.

Max. Marks 75

Min. Marks 27

Practical work based on Papers I, II and III

Notes :

1. With reference to whole mounts and museum specimens, in case of unavailability of certain animal types, diagrams, photographs, models and digital techniques etc. should be substituted. Study will include classification (up to orders) with diagnostic characters and comments.
2. Candidates will keep a record of all work done in the practical class.

I. Microscopic Techniques

1. Organisation and working of optical microscopes: dissecting and compound microscope.
2. General methods of microscopical permanent preparations. Fixatives: Formalin, Bouin's fluid. Stains: Borax carmine, acetocarmine, acetorcein, haematoxyline, eosin. Common reagents: Normal saline, Ringer's solution, acid water, acid alcohol, Mayer's egg albumin.

II. Culture Techniques

Culture of *Paramecium*, *Euglena*, *amoeba*, *Planaria*, *Earthworm*, *daphnia*, *Cylops* etc. in the laboratory and study of its Structure, life processes and behaviour in the living state.

III. Mounting – Permanent

Permanent preparations of
Protozoa-*Paramecium*, *Euglena*, and other zooplanktons.
Porifera- sponge spicules, fibers and gemmules.
Coelenterata- *Obelia* colony and medusa.
Platyhelminthes- *Taenia* Proglottids
Annelida- Neriesparapodia

IV. Study of invertebrate types

Protozoa: *Trypanosoma*, *Giardia*, *Entamoeba*, *Elphidium* (*Polystomella*), Foraminiferous shell, *Monocystis*, *Plasmodium*, *Paramecium*, *Paramecium* showing binary fission and conjugation, *opalina*, *Nyctotherus*, *Balantidium*, *Vorticella*.

Porifera : *Leucosolenia*, *Euplectella*, L.S. of *Spongila* and T.S. of *Sycon*, spicules, spongin fibres, gemmules.

Coelenterate: Millepora, *Physalia*, *Vellela*, *Aurelia*, *Alcyonium*, *Gorgonia*, *Pennatulata*, Sea anemone, Stone corals. *Obelia* colony and medusa.

Ctenophora : Any Ctenophore

Platyhelminthes: Dugesia, Fasciola, Schistosoma, Taenia.

Nematoda : Dracunculus, Filaria, Ancylostoma, Enterobius.

Annelida: Neries (Heteroneries with parapodia), Aphrodite, Arenicola, Pontobdella, Hirudinaria, Peripatus.

Arthropoda: *Limulus*, Spiders, *Lepas*, *Cancer*, *Lobster*, *Balanus*, *Sacculina*, *Lepusma*, *Papilio*, *Sitophilus*, *julus*, *Schistocera*, *Cyclops*

Mollusca: *Chiton*, *Turbinella*, *Patella*, *Aplysia*, *Dentalium*, *Ostrea*, *Teredo*, *Sepia*, *Loligo*, *Octopus*, *Nautilus*

Echinodermata: Sea star, *Ophiothrix*, *Echinus*, *Holothuria*, *Antedon*

V. Exercises in Cell Biology:

- 1 Squash preparation of onion root tip for the study of mitosis.
- 2 Squash preparation for the study of meiosis in grasshopper or cockroach testes. (students can use Onion buds in case of non-availability of Grasshopper or Cockroach)
- 3 Study of giant chromosomes in salivary glands of Chironomous or *Drosophila* larva.
- 4 Study of DNA by separation using any detergent followed by staining.
- 5 Study of Cell permeability.

VI. Exercises in Genetics

- 1 Study of *Drosophila*: Culture of *Drosophila*, Life - cycle
- 2 Identification of male and female *Drosophila*.
- 3 Identification of wild and mutant (yellow body, ebony body, vestigial wings, white eye and vestigial ebony mutants) of *Drosophila*.
- 4 Study of permanent prepared slides: *Drosophila*: sex comb, salivary gland chromosomes, Barr bodies and human chromosomes.
- 5 Identification of blood groups (A, B, O and Rh factor)
6. Numerical problems related to genetics.

VII. Developmental Biology

- 1 Study of development of frog/toad with the help of:
 - i) Observation in Nature/ charts/ models/ digital techniques: Eggs, cleavage, blastula, gastrula, neurula, tail-bud, hatching, mature tadpole larvae, metamorphic stages, toadlet /froglet.
 - ii) Histological slides: Cleavage, blastula, gastrula, neurula and tail bud stage. Study of limb/tail regeneration with the help of histological slides.
- 2 Study of development of chick with the help of
 - i) Whole mounts: 18 hrs, 21 hrs, 24 hrs, 33 hrs, 72 hrs and 96 hrs. of incubation period embryos.
 - ii) Study of primitive streak stage in living embryo after removal of the blastoderm from the egg, may be demonstrated.
 - (iii) Study of the embryo at various stages of incubation *in vivo* by making a window in the egg shell.
 - (iv) Study of various foetal envelopes in a 10-12 day old chick embryo (amnion, chorion, allantois and yolk sac).

VIII. Live Zoology:

Study of animals from their natural habitat e.g. *Amoeba*, *Paramecium*, *Euglena*, *Hydra*, fresh water sponge, *Daphnia*, *Cyclops*, etc. or any other invertebrate from the nearby area. Student is required to prepare a report of these observations and submit along with the practical record.

Note:(i) Use of animals for dissection is subject to the conditions that these are not banned under the Wild Life(Protection) Act .

(ii) Those Institutions which are already having Zoology Museums should not procure Museum Specimens now onwards and should use charts / slides / models / photographs and digital alternatives in case of need. Those new institutions which are not having Zoology Museum in their Department should provide learning related to zoological specimens with the help of charts / slides / models / photographs and digital alternatives / and arrange visit of students to already established museums.

**Scheme of Practical Examination and Distribution of Marks
(along with skeleton paper)**

Time : 5 hrs.

Min. Pass Marks : 27

Max. Marks : 75
Regular/Ex-students/Non-Collegiate

1	Submission of Animal Culture and its report (Paramecium/ Euglena/ Drosophila)	05
2	Organization of Microscope (Write detail note on the microscope provided along Labelled diagram)	04
3	Permanent Preparation (Prepare slide , Identify the material provided and draw labelled Diagram of the same)	06
4	Exercise in Cell biology	
	a) Exercise based on cell division (Prepare smear, identify stage of cell division And draw labelled diagram of the same)	04
	b) Perform exercise in cell biology, give detail note along with observation and result. Draw diagram if required)	03
5	Exercise in Genetics	
	a) Exercise based on genetics : Give detail note along Method, Procedure, Observation and result)	03
	b) Numerical based on Mendelian Inheritance	04
6	Exercise in Developmental Biology (Give detail note along with diagram)	05
7	Identification and Comments on Spots (1 to 8)	16
8	Live Zoology- Study report of animals in Nature (specified in syllabus)	05
9	Viva Voce	10
10	Class Record	10
Total		75