

SEMESTER III (Session 2023-24)

B.Sc. ZOOLOGY

Paper- I 3Hrs Duration	Min. Pass Marks 29	Max. Marks 80
Practical 4 Hrs Duration	Min. Pass Marks 15	Max. Marks 40
Internal Assessment	Min. Pass Marks 11	Max. Marks 30
Based on Paper I and Practical 20+10=30		

PAPER CHORDATA AND EVOLUTION

NOTE: The course will contain 5 units. The question paper shall contain three sections. **Section A (10 marks)** shall contain 10 questions two from each Unit. Each question shall be of 1 mark. All the questions are compulsory. Section A will be prepared such that questions i to v are multiple choice questions, while question vi to x will be fill in the blank questions. **Section B (25 marks)** shall contain 5 questions (two from each unit with internal choice). Each question shall be of 5 marks. The candidate is required to answer all 5 questions. The answers should not exceed 150 words. **Section C (45 marks)** shall contain 5 questions, one from each Unit. Each question shall be of 15 marks. The candidate is required to answer any three questions by selecting these three questions from different units. The answers should not exceed 400 words.

UNIT-I

Classification of Chordata : Protochordata, Hemichordata and cyclostomes. Habit, Habitat, External features and Anatomy of Herdmania and Branchiostoma (Excluding development) Ascidian larva and retrogressive metamorphosis, Affinities of Urochordata and Cephalochordata. Habit, habitat and External features of Petromyzon and Myxine. Ammocoete larva and its affinities.

UNIT-II

Classification of vertebrat (excluding extinct forms) upto orders(Subclass in case of mammals). Poisonous and non-poisonous snakes and biting mechanism. Basic plan of skull, skull types in reptiles, jaw suspension, axial and appendicular skeleton

UNIT-III

Comparison of the following organ systems of vertebrates with special reference to evolutionary aspects Scoliodon, Rana, Uromastix(or any lizard), Columba livia, Oryctolagus (or any Mammals)

1. Integument including structure and development of placoid scales, feathers, hair, nails and claws.
2. Alimentary canal
3. Heart and evolution of aortic arches.
4. Respiratory system
5. Urinogenital system

UNIT-IV

Evolutionary thought: Lamarckism, Darwinism, origin of life, evidences of organic evolution, genetic basis of evolution, Hardy - Weinberg's law, natural selection,

isolation and isolating mechanism, speciation, variation, adaptation with special reference to flight adaptation, aquatic adaptation and desert adaptations

UNIT-V

Geological time scale, fossils, dating of fossils and imperfection of the geological records. Principle zoogeographical regions of the earth and their mammalian fauna, Extinct forms: Archaeopteryx, Dinosaurs, Evolution of horse.

PRCATICALS

- (1) **Study of Chordates:** Balanoglossus, Herdmania, Ciona, Botryllus, Salpa, Doliolum, Pyrosoma, Amphioxus, Ammocoete larva, Petromyzon, Myxine, Zygaena, Torpedo, Chamaera, Acipenser, Amia, lepidosteus, Labeo, Clarias, Anguilla, Hippocampus, Exocoetus, Echeuis, Pleuronectes, Protopterus, Ichthyophis, , Proteus, Ambystoma, larva (Axolotl), Siren, Alytes, Hyla, Testudo, Chelone, Tortoise,, Sphenodon, Hemidactylus, Phrynosoma, Draco, Chameleon, Eryx, Hydrophis, Naja, Viper, Bungarus, Crocodilus, Alligator, Archaeopteryx,(Model), Pavo cristatus, Ornithorhynchus, Macropus, , Bat, Loris, Scaly ant eater (Model)
- (2) **Permanent Slides:** Mammalian histology, V.S. of Skin, T.S. of Spinal cord, T.S. of Pituitary gland, T.S. of Testis,, T.S. of Ovary, T.S. of Placenta, Bone, Oral hood, Velum, pharyngeal wall, T.S. of Amphioxus through various regions. T.S. of Balanoglossus, Whole mount of Amphioxus, Tadpole larva of Ascidia.
- (3) **Dissection/demonstration(Models, charts, computer simulation:** carp or any other commercial fish/Scoliodon/Labeo- general anatomy, afferent and efferent branchial vessels, Cranial nerves, Internal ear, digestive system, Eye ball and its muscles, Urinogenital system.
- (4) **Permanent mounting,** Spicules and pharyngeal wall of Herdmania, Ampulla of lorenzini, placoid scale
- (5) **Osteology:** Comparative study of articulated and disarticulated bones of Frog, Varanaus, Fowl and Rabbit.
- (6) Exercise in evolution-serial homology in appendages of Prawn, Analogy and homology(wings of birds and insects, forelimb of bat and rabbit.

DISTRIBUTION OF MARKS

S.No	Permanent exercise	Regular
1	Dissection/ demonstration	8
2	Permanent Preparation	6
3	Exercise in evolution	6
4	Spot(5)	10
5	Record	5
6	Viva-voce	5
	Grand Total	40

SEMESTER IV
B.Sc. ZOOLOGY

Paper- I 3Hrs Duration	Min. Pass Marks 29	Max. Marks 80
Practical 4 Hrs Duration	Min. Pass Marks 15	Max. Marks 40
Internal Assessment	Min. Pass Marks 11	Max. Marks 30
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PAPER BIOTECHNOLOGY AND BIOSTATISTICS

NOTE: A course will contain 5 units. The question paper shall contain three sections. **Section A (10 marks)** shall contain 10 questions two from each Unit. Each question shall be of 1 marks. All the questions are compulsory. Section A will be prepared such that questions i through v are multiple choice questions, while question vi through x will be fill in the blank questions. **Section B (25 marks)** shall contain 5 questions (two from each unit with internal choice). Each question shall be of 5 marks. The candidate is required to answer all 5 questions. The answers should not exceed 150 words. **Section C (45 marks)** shall contain 5 questions, one from each Unit. Each question shall be of 15 marks. The candidate is required to answer any three questions by selecting these three questions from different units. The answers should not exceed 400 words.

UNIT-I

Molecular genetics: Gene structure (Recon, Muton, Cistron) and regulation of gene (Lac operon: inducible and repressible system). Bacterial genetic transformation, transduction and conjugation. Lytic and lysogeny cycle. Elementary idea about eugenics.

UNIT-II

Elementary idea about genetic engineering, gene cloning and recombinant DNA technology (vectors for gene transfers, plasmids and phages). Restriction enzymes. Introduction, historical perspective, animal cell hybridoma, major areas and future prospects of biotechnology. Medicines and Biotechnology, Microbes in medicine. Antibiotics, Vaccine, Antibodies, Antigens,

UNIT-III

Environmental biotechnology: Use of microorganisms in metal and petroleum recovery, pest control, waste treatment, processing of industrial waste.

Degradation of xenobiotic compounds including pesticides and surfactants. Surfactants and oil pollutants. Food and drink biotechnology, ferment food, dairy products, food preservation, microbial spoilage, alcoholic beverages. Vinegar, Monoclonal antibodies and their applications.

UNIT-IV

Introduction and understanding of concepts of descriptive and inferential statistics, frequency distribution, graphical presentation, mean, mode, median, standard deviation, standard error of mean.

UNIT-V

Productivity distribution, correlation and regression. Test of significance, Chi square and t-test. Biostatistical analysis of gene distribution in population.

PRACTICALS

Exercise in biotechnology

- (1) Food preservations and Study of Dairy Products
- (2) Culture and maintenance of E. Coli Bacteria
- (3) Agarose gel Electrophoresis
- (4) Genomic DNA Extraction
- (5) Sterilization of Glasswares
- (6) Tour Report on Research Institutes on biotechnological tools

Biostatistics

- (1) Construction of frequency tables, Histogram, polygons, pie charts.
- (2) Exercise on Mean, Median and Mode.
- (3) Test of significance: t- test and Chi square test

S.No.	Permanent Exercise	Regular
1	Biotechnology 1	7
2	Biotechnology 2	6
3	Biostatistics	7
4	Tour Report	10
5	Record	5
6	Viva voce	5
	Grand Total	40

SEMESTER V
B.Sc. ZOOLOGY

Paper- I 3Hrs Duration	Min. Pass Marks 29	Max. Marks 80
Practical 4 Hrs Duration	Min. Pass Marks 15	Max. Marks 40
Internal Assessment	Min. Pass Marks 11	Max. Marks 30
Based on Paper I and Practical 20+10=30		

PAPER : DEVELOPMENTAL BIOLOGY AND GENETICS

NOTE: A course will contain 5 units. The question paper shall contain three sections. **Section A (10 marks)** shall contain 10 questions two from each Unit. Each question shall be of 1 marks. All the questions are compulsory. Section A will be prepared such that questions 1 to 5 are multiple choice questions, while question vi through x will be fill in the blank questions. **Section B (25 marks)** shall contain 5 questions (two from each unit with internal choice). Each question shall be of 5 marks. The candidate is required to answer all 5 questions. The answers should not exceed 150 words. **Section C (45 marks)** shall contain 5 questions, one from each Unit. Each question shall be of 15 marks. The candidate is required to answer any three questions by selecting these three questions from different units. The answers should not exceed 400 words.

UNIT-I

1. Historical perspective, aim and scope of developmental biology.
2. Gametogenesis :
 - A. Spermatogenesis with emphasis on spermeiogenesis, structure of spermatozoa.
 - B. Oogenesis with special reference to vitellogenesis.
3. Fertilization-definition, external and internal fertilization, mechanism of fertilization, significance of fertilization.
4. Parthenogenesis: Natural and artificial parthenogenesis, significance of parthenogenesis.
5. Cleavage:
 - A. Type, patterns and planes of cleavage.
 - B. Significance of cleavage, Blastulation.

UNIT-II

1. Gastrulation, Morphogenetic movements (epiboly and emboly). Fate Map, significance of gastrulation.

2. Elementary idea of the following developmental processes: Embryonic induction, differentiation, organogenesis of limb, Malignancy, teratogenesis, aging, Regeneration in vertebrates and invertebrates (epimorphic and morphalactic).
3. Embryogenesis of frog: Structure of tadpole larva and its metamorphosis with special reference to endocrine control.
4. Development of chick up to 96 hrs. stage.

UNIT-III

1. Embryonic adaptations:
 - A. Development, structure and functions of extra- embryonic membranes in chick.
 - B. Placentation in mammals-Definitions, types, structure (morphology and histology) and functions of placenta.

UNIT-IV

1. Mendel's laws of inheritance-- Monohybrid and dihybrid cross, incomplete dominance. Current status of Mendelism.
2. Genetic variations.
 - A. Variations in chromosome number (Euploidy and Aneuploidy), genetic disorders in Human beings (Down's syndrome, Turner's syndrome, Klinefelter syndrome).
 - B. Chromosomal aberration-Deletion, Duplication, Translocation and Inversion.
 - C. Gene mutations-Detection, Molecular basis of gene mutations and Mutagens.

UNIT-V

1. Crossing over and linkage.
2. Sex determination-XO, XY and WZ-mechanism.
3. Sex linked inheritance-Haemophilia, colour blindness.
4. Genetic inter-actions: supplementary, complementary, duplicate, inhibitory and polymorphic genes.
5. Multiple alleles, ABO, Rh and MN-blood groups and their inheritance.
6. Elementary idea about Eugenics.

Practical

Developmental biology

1. Study of spermatogenesis (frog/rat) through slides/ models/charts.
2. Study of oogenesis (frog/rat) through slides/model/ charts.
3. Study of fertilization, external and internal (through charts).
4. Study of development of frog/toad through preserved materials (whole embryo or sections), egg, early cleavage, blastula, gastrula, neurula, tail bud, external gill, mature tadpole larva.
5. Study of metamorphosis (frog/toad) through preserved material/chart/model.
6. Study of foetal membrane (amnion, chorion, allantois and yolk-sac) of any amniote (chick) after 10-12 days of incubation.
7. Study of development of chick with the help of whole mounts: 18 hours; 21 hrs; 33 hrs; 72 hrs; and 96 hrs. stage.

Genetics

8. Drosophila culture (wild and mutants) and study of phenotypic characters.
9. Simple problem based on monohybrid/dihybrid cross.
10. Preparation of slide of Giant chromosome.

S.No	Permanent exercise	Regular
1	Developmental Biology	10
2	Exercise on Genetics	10
3	Spot(5)	10
4	Record	5
5	Viva-voce	5
6	Grand Total	40

SEMESTER VI
B.Sc. ZOOLOGY

Paper- I 3Hrs Duration	Min. Pass Marks 29	Max. Marks 80
Practical 4 Hrs Duration	Min. Pass Marks 15	Max. Marks 40
Internal Assessment	Min. Pass Marks 11	Max. Marks 30
Based on Paper I and Practical 20+10=30		

PAPER : ENVIRONMENTAL BIOLOGY AND ANIMAL BEHAVIOUR

NOTE: A course will contain 5 units. The question paper shall contain three sections. **Section A (10 marks)** shall contain 10 questions two from each Unit. Each question shall be of 1 marks. All the questions are compulsory. Section A will be prepared such that questions i through v are multiple choice questions, while question vi through x will be fill in the blank questions. **Section B (25 marks)** shall contain 5 questions (two from each unit with internal choice). Each question shall be of 5 marks. The candidate is required to answer all 5 questions. The answers should not exceed 150 words. **Section C (45 marks)** shall contain 5 questions, one from each Unit. Each question shall be of 15 marks. The candidate is required to answer any three questions by selecting these three questions from different units. The answers should not exceed 400 words.

UNIT-I

1. Introduction to Ecology, definition, history, sub-divisions and scope of ecology.
2. The Environmental factors-
 - (a) Physical (abiotic) factors-soil, water, air, temperature.
 - (b) Biotic factors, Interspecific and intraspecific relations (Neutralism, Mutualism, commensalism, antibiosis, parasitism, predation, competition).
3. Concept of limiting factors: Liebig's Law of minimum, Shelford's law of tolerance and combined concept of limiting factors.
4. Population ecology:
 - (i) Definition
 - (ii) Characteristics of community
 - (iii) Ecotone
 - (iv) Habitat and ecological niche.
 - (v) Ecological succession-definition kinds of succession, (Primary and secondary succession, autotrophic and heterotrophic succession), xerosere, mesosere and hydrosere. Climax community concept.

UNIT-II

1. Ecosystem:

- (i) Concept of ecosystem.
- (ii) Components of ecosystem.
- (iii) Ponds as an ecosystem.
- (iv) Trophic levels, food chain and food web.
- (v) Ecological pyramids.
- (vi) Energy flow in ecosystem.
- (vii) Bio-geochemical cycles: CO₂, N₂, O₂, S and P.

2. Fresh water ecology:

- (i) Physico-chemical nature of fresh water habitat.
- (ii) Lentic habitat (lake and pond)
- (iii) Lotic habitat (stream and river)
- (iv) Fresh water fauna and their adaptations.

UNIT-III

1. Marine ecology:

- (i) Characteristic features of Marine habitat.
- (ii) Zonation of Marine environment.
- (ii) Marine water fauna and their adaptations.
- (iv) Deep sea fauna and their adaptations.
- (v) Estuarine habitat-their fauna and adaptations.

2. Terrestrial ecology:

- (i) Characteristic features of terrestrial habitat.
- (ii) Forest ecosystem (forest types).
- (iii) Desert ecosystem; characteristics of desert environment, desert fauna and their adaptations, with special reference to Rajasthan.

UNIT-IV

1. Applied ecology:

- (i) Pollution (water, air and sound).
- (ii) Radiations, nuclear fall out and biological effects of radiations.

(iii) Food, food production on land, food production in sea and synthesis of food.

(iv) Fuels: coal, petroleum and nuclear fuels.

(v) Management of environment.

UNIT-V

1. Ethology:

(i) History and concept of ethology.

(ii) Methods of studying behaviour.

(iii) Social behaviour and Social Organisation among mammals eg. Rhesus and Black buck.

(iv) Orientation; taxes and kinesis, fish and bird migration.

(v) Communication among animals-acoustic tactile, olfactory, language of bees.

(vi) Conservation and management of wild life of India with special reference to Rajasthan.

Practical

1. Examination of physical characteristics of soil/water sample : Temperature, Relative humidity, Texture
2. Examination of physical and chemical characteristics of soil/water sample : pH, turbidity, salinity, chloride content, dissolved O₂, alkalinity, Free CO₂ .
3. Study of local habitat (Pond and Terrestrial Ecosystem): Collection and examination of microscopic fauna(Zooplanktons/Phytoplanktons/Benthos)
4. Paramecium culture and study of behaviour of Paramecium to different stimuli; Contact, chemicals, light.
5. Study of phototactic response of Tribolium/house fly.
6. Field Trip/ Zoo Report

S.No.	Permanent exercise	Regular
1	Ecology	10
2	Exercise on Ethology	10
3	Tour report	10
4	Record	5
5	Viva-voce	5
6	Grand Total	40