

## Annexure II

### SCHEME OF EXAMINATION FOR B.Sc. ZOOLOGY (HONS.) SEMESTER SYSTEM w.e.f. Session 2015-16

Semester I						
S.No.	Paper Code	Nomenclature	Marks	Periods /week <sup>#</sup>	Exam. Duration	
1.	101	Introduction to biology	40+10	4	3 hrs.	
2.	102	Biodiversity-I Non-Chordata	40+10	4	3 hrs.	
3.	103	Biodiversity-II Non-Chordata	40+10	4	3 hrs.	
4.	104	Chemistry I	40+10	3	3 hrs.	
5.	105	Botany I Plant Diversity	40+10	3	3 hrs.	
6.	106	English	40+10	3	3 hrs.	
7.	P-I	Practical (101, 102, & 103)		12		
8.	P-II	Practical (104, 105)		6		
Semester II						
1	201	Biodiversity-III Chordata	40+10	4	3 hrs.	
2	202	Biodiversity-IV Chordata	40+10	4	3 hrs.	
3	203	Animal Physiology & Histology I	40+10	4	3 hrs.	
4	204	Chemistry II	40+10	3	3 hrs.	
5	205	Botany II Plant Physiology and Metabolism	40+10	3	3 hrs.	
6	206	English	40+10	3		
7	P-I	Practical (101, 102, & 103)	50+50+50		6 hrs.	
8	P-II	Practical (104, 105)	50+50		6 hrs.	
9	P-III	Practical (201-203)	50+50+50	12	6 hrs.	
10	P-IV	Practical (204, 205)	50+50	6	6hrs.	
Semester III						
1	301	Cell Biology I	40+10	4	3 hrs.	
2	302	Molecular Biology I	40+10	4	3 hrs.	
3	303	Animal Physiology & Histology II	40+10	4	3 hrs.	
4	304	Chemistry III	40+10	3	3 hrs.	
5	305	Botany III Plant Anatomy, Reproduction & Biotechnology	40+10	3	3 hrs.	
7	P-V	Practical (301-303)		12		
8	P-VI	Practical (304, 305)		6		
Semester IV						
1	401	Cell Biology II	40+10	4	3 hrs.	
2	402	Molecular Biology II	40+10	4	3 hrs.	
3	403	Animal Ecology	40+10	4	3 hrs.	
4	404	Chemistry IV	40+10	3	3 hrs.	
5	405	Environmental Management	40+10	3	3 hrs.	
6	P-V	Practical (301-303)	50+50+50		6hrs.	
7	P-VI	Practical (304, 305)	50+50		6 hrs.	
8	P-VII	Practical (401, 402, & 403)	50+50+50	12	6hrs.	
9	P-VIII	Practical (404,405)	50+50	6	6 hrs.	
Semester V						
1	501	Genetics & Genomics I	40+10	4	3 hrs.	
2	502	Evolutionary Biology	40+10	4	3 hrs.	
3	503	Immunology I	40+10	4	3 hrs.	
4	504	Biochemistry & Metabolism	40+10	4	3 hrs.	
5	505	Computer and Biostatistics	40+10	4	3 hrs.	
6	P-IX	Practical (501, 502, & 503)		12		
7	P-X	Practical (504, 505)		6		
Semester VI						
1	601	Genetics & Genomics II	40+10	4	3 hrs.	
2	602	Applied Zoology	40+10	4	3 hrs.	
3	603	Immunology II	40+10	4	3 hrs.	
4	604	Animal Biotechnology	40+10	4	3 hrs.	
5	605	Developmental Biology	40+10	4	3 hrs.	
6	P-IX	Practical (501, 502, & 503)	50+50+50		6hrs.	

7	P-X	Practical (504, 505)		50+50		6 hrs.
8	P-XI	Practical (601, 602, & 603)		50+50+50	12	6 hrs.
9	P-XII	Practical (604, 605)		50+50	6	6 hrs.

**Grand Total of Semesters = 2150**

Note: -

- There will be an internal assessment, in each theory paper, inclusive of 20% of total marks i.e. 40+10
- #1Period=45 minutes
- Practicals will be held throughout the year and examination will be held annually.

# SYLLABUS

B.Sc. (Hons) Zoology

SEMESTER - I

PAPER-102

**BIODIVERSITY-I: NON-CHORDATA**

**Max Marks: 40+10 (Internal assessment) Time allotted: 3 Hours**

**Note:** Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question.

2. Question number I is compulsory consisting of 10 parts (1.0 mark each) covering the entire syllabus.

Answer to each part should not exceed 20 words.

2. Out of remaining eight questions, two questions are to be set from each unit (I to IV), possibly splitting them in parts. Candidate is required to attempt four questions, selecting one question from each unit.

## THEORY

### Unit I

General characters and outline classification of different phyla

#### Protozoa

General characters and outline classification

Locomotion and reproduction in Protozoa.

Type study of *Paramecium*, *Plasmodium* Structure and life history

### Unit II

#### Metazoa

Origin of metazoa, metamerism and coelom.

#### Phylum Porifera

General characters and outline classification

Type study of *Sycon*: Structure and life history

Canal System and spicules in sponges

### Unit III

#### Phylum Cnidaria

General characters and outline classification

Polymorphism in Cnidarians; corals and coral reefs

Type study of *Aurelia*: Structure and life history

### Unit IV

#### Phylum Platyhelminthes

General characters and outline classification

Type study of *Taenia*, *Fasciola* : Structure and life history; parasitic adaptations and evolution of parasitism

#### Phylum Aschelminthes

General characters and outline classification

Type study of *Ascaris*: Structure and life history; parasitic adaptations.

## **SEMESTER - I**

### **PAPER-103**

#### **BIODIVERSITY-II: NON-CHORDATA**

**Max Marks: 40+10 (Internal assessment) Time allotted: 3 Hours**

**Note:** Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question.

1. Question number I is compulsory consisting of 10 parts (1.0 mark each) covering the entire syllabus. Answer to each part should not exceed 20 words.
2. Out of remaining eight questions, two questions are to be set from each unit (I to IV), possibly splitting them in parts. Candidate is required to attempt four questions, selecting one question from each unit.

#### **THEORY**

**General characters and outline classification of different phyla:**

##### **Unit I**

##### **Phylum Annelida**

General characters and outline classification

Adaptive radiations in Polychaeta.

Type study of *Leech*: Structure and life history

##### **Unit II**

##### **Phylum Arthropoda**

General characters and outline classification.

Larval forms of crustacea; social life, moulting and metamorphosis in Insecta; vision in Arthropoda.

Type study of Scorpion: Structure and life history

Affinities of **Onychophora**

##### **Unit III**

##### **Phylum Mollusca**

General characters and outline classification

Torsion and detorsion; modifications of shell and foot

Type study of *Pila*: Structure and life history

##### **Unit IV**

##### **Phylum Echinodermata**

General characters and outline classification

Water-vascular system and larval forms

Type study of *Asterias*: Structure and life history

## **SEMESTER - II**

### **PAPER-201**

#### **BIODIVERSITY-III: CHORDATA**

**Max Marks: 40+10 (Internal assessment) Time allotted: 3 Hours**

**Note:** Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question.

1. Question number I is compulsory consisting of 10 parts (1.0 mark each) covering the entire syllabus. Answer to each part should not exceed 20 words.
2. Out of remaining eight questions, two questions are to be set from each unit (I to IV), possibly splitting them in parts. Candidate is required to attempt four questions, selecting one question from each unit.

#### **THEORY**

##### **General account of Chordates:**

##### **Unit I**

##### **Chordates**

Introduction, affinities and origin.

##### **Protochordates**

General features, Phylogeny & classification of Hemichordates, Urochordates & Cephalochordates. Retrogressive metamorphosis.

##### **Agnatha**

General features of living Agnatha and classification upto classes.

Type study of *Pteromyzon*: Structure and life history

##### **Unit II**

##### **Pisces**

General features & Classification of Placodermi upto subclasses, Chondrichthyes up to suborders and Osteichthyes upto orders. Osmoregulation, migration and Parental care.

Type study of *Scoliodon*.

##### **Amphibia**

General features & Classification upto orders

Type study of *Rana*.

Origin and evolution of terrestrial ectotherms/tetrapods, Parental care & pedomorphosis.

##### **Unit III**

##### **Reptiles**

General features & Classification upto orders. Origin of reptiles skull types, Poisonous and non-poisonous snakes in

India, Biting mechanism in snakes, Status of *Sphenodon* and Crocodiles.

##### **Aves**

General features & Classification upto orders.

Origin of birds, Flight adaptations, Mechanism of flight and Migration.

##### **Unit IV**

##### **Mammals**

Type study of Rat

General features & Classification upto orders.

Origin of mammals, dentition.

## **PAPER -202**

### **BIODIVERSITY-IV: CHORDATA**

**Max Marks: 40+10 (Internal assessment) Time allotted: 3 Hours**

**Note:** Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question.

1. Question number I is compulsory consisting of 10 parts (1.0 mark each) covering the entire syllabus. Answer to each part should not exceed 20 words.
2. Out of remaining eight questions, two questions are to be set from each unit (I to IV), possibly splitting them in parts. Candidate is required to attempt four questions, selecting one question from each unit.

## **THEORY**

### **Unit I**

#### **Comparative Anatomy of Chordates:**

**Integument** Structure and derivatives of integument

#### **Bone**

Structure and types, Ossification, bone growth.

### **Unit II**

**Digestive System** Alimentary canal and associated glands

#### **Respiratory system**

Skin, Gills, Lungs, Air sacs and voice apparatus, Air bladder and accessory breathing organs in fishes.

### **Unit III**

#### **Circulatory System**

Evolution of heart and aortic arches, Venous system and lymphatic system.

#### **Skeleton System**

Axial and appendicular skeleton, Jaw suspensorium and Visceral arches.

### **Unit IV**

#### **Nervous System**

Central & Autonomic Nervous System, Cranial nerves.

#### **Sense Organs**

Classification of receptors, structure and working of Mammalian eye and ear.

#### **Urinogenital System**

Succession of kidney, Evolution of Urinogenital ducts.

## **BSc I Hons PRACTICALS Paper 102**

### **Protozoa:**

1. Study of permanent slides; *Amoeba*, *Euglena*, *Paramecium*, *Ceratium*, *Noctiluca*, and *Vorticell*, *Eimeria*, *Opalina*, *Balantidium*, *Nyctotherus*, *Radiolarian* & *Foraminiferans* ooze.
2. Culture & stained lamination of *Euglena*, *Amoeba*, *Paramoecium*
3. Study of slides of Malarial parasites positive & negative smears and different stages of malarial parasite life cycle.

### **Porifera:**

1. Study of *Sycon*, *Grantia*, *Leucosolenia*, *Hyalonema*, *Euplectella*, *Spongilla*, *Cliona* and *Euspongia*;
2. Permanent slides of T.S. *Sycon*, Canal system, gemmules, spicules and sponging fibres
3. Temporary mounts of spicules, gemmules and spongin fibres.

### **Cnidaria:**

1. Study of *Porpita*, *Vellela*, *Physalia*, *Millepora*, *Aurelia*, *Rhizostoma*, *Metridium*, *Zoanthus*, *Alcyonium*, *Tubipora*, *Madrepora*, *Favia*, *Fungia*, *Astrea*.
2. Study of permanent slides *Obelia*, *Hydra* (W.M. & sections), *Sertularia*, *Plumularia*, *Bougainvillea*, *Aurelia* (Sense organs & stages of life history) *Scyphistoma* and *Ephyra* larvae.
3. Preparation of permanent stained mount of *Obelia*, *Hydra*, *Sertularia*, *Plumularia*, *Bougainvillea*.

#### **Platyhelminthes:**

1. Study of *Dugesia*, *Fasciola*, *Taenia*, *Echinococcus*;
2. Life history and sections of *Fasciola* and *Taenia*
3. Permanent slides of Miracidium, Sporocyst, Radia, Cercaria, Metacercaria; Scolex & proglottids of *Taenia*

#### **Aschelminthes:**

1. Study of male and female *Ascaris*, *Ancylostoma*, *Trichinella*, *Meloidogyne*, *C. elegans*
2. Study of permanent slides including T.S. Male & Female *Ascaris*
3. Prepare a report on Parasitic adaptations in Helminthes

### **BSc I Hons PRACTICALS Paper 103**

#### **Annelida:**

1. **Demonstrations, models, CD's etc:** digestive, nervous and reproductive systems of earthworm.
2. **Temporary mounts:** Ovary, spermathecae, pharyngeal and septal nephridia of earthworm.
3. **Slides:** T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm.
4. **Specimens:** *Aphrodite*, *Heteronereis*, *Arenicola*, *Polynoe*, *Eunice*, *Chaetopterus*, *Pheretima*, *Tubifex*, *Hirudinaria*, *Pontobdella*.

#### **Arthropoda:**

5. **Demonstrations, models, CD's etc:** digestive, nervous and reproductive systems of cockroach.
6. **Temporary mounts:** salivary glands and mouth parts of cockroach, Honey Bee, Housefly; *Pediculus* & Ticks W.M.; Statocyst of Prawn.
7. **Specimens/slides:** *Peripatus*, *Palaeomon*, *Palinurus*, *Cancer*, *Sacculina*, *Eupagurus*, *Iepas*, *Balanus*, *Cyclops*, *Daphnia*, *Crustacean larvae*, *Scolopendra*, *Julus*, *Lepisma*, *Periplanata*, *Schistocerca*, *Poeciloceris*, *Gryllus*, *Grylotalpa*, *Mantis*, *Cicada*, *Forficula*, *Dragon Fly*, *Microtreme*, *Belostoma*, *Polistes*, *Bombyx*, *Apis*, *Cimex*, *Pediculus*, *Limulus*, *Araneae*, *Palamneus*.
8. Collection of insects from 10 different orders.

#### **Mollusca:**

8. **Demonstrations, models, CD's etc:** digestive & nervous system of *Pila*;
9. **Temporary mounts-** radula & osphradium of *Pila*.
9. **Specimens:** *Neopalina*, *Chiton*, *Dentalium*, *Pila*, *Aplysia*, *Doris*, *Limax*, *Unio*, *Ostrea*, *Teredo*, *Mytilus*, *Cardium*, *Pholas*, *Solen*, *Pecten*, *Heliotis*, *Patella*, *Cypraea*, *Loligo*, *Sepia*, *Octopus* and *Nautilus*.

### **Echinodermata:**

10. **Slides:** T. S. arm of *Asterias*, Echinoderm larvae.

11. **Specimens:** *Antedon, Holothuria, Cucumaria, Echinus, Echinocardium, Clypeaster, Pentaceros, Astropecten, Astrophyton, Ophiothrix.*

### **Hemichordata**

12. *Balanoglossus*

## **Bsc I Hons.PRACTICAL Paper 201**

### **1. Protochordata:**

Study of *Herdmania, Molgula, Botryllus, Ciona, Salpa, Doliolum, Oikopleura, Branchiostoma.*

*Amphioxus* - oral hood, Whole Mount sections through pharyngeal, intestinal & caudal regions.

Mounting of spicules and pharynx of *Herdmania*; Oral Hood & velum *Branchiostoma.*

Demonstration through CD's/ Models of Digestive system and general anatomy of *Herdmania*

### **2. Cyclostomes & Pisces:**

Study of *Petromyzon, Ammocoet Larva, Myxine, Scoliodon, Zygonea, Pristis, Trygon, Torpedo, Raja, Rhinobatus, Chimaera, Polypterus, Acipenser, Lepidosteus, Muraena, Notopterus, Labeo, Catla, Cirrihina, Heteropneustes, Mystus, Exocoetus, Anabas, Diodon, Tetrodon, Ostracion, Lophius, Solea, Protopterus.*

Demonstrations, models, CD's etc: Afferent & Efferent branchial arteries and Cranial Nerves of *Scoliodon.*

Weberian ossicles of *Mystus.*

Temporary unstained preparation of Placoid, Cycloid and Ctenoid scales.

Study of Endoskeleton of *Scoliodon & Labeo*

### **3. Amphibia:**

Study of *Uraeotyphlus, Necturus, Proteus, Siren, Amblystoma, Salamandra, Axolotl larva, Alytes, Bufo, Hyla, Rana, Rhacophorus.*

Demonstration through Models/CD's Digestive, Arterial, Venous and urinogenital systems of *Rana.*

Study of Endoskeleton of *Rana.*

**4. Project Report-** Pisciculture/ local inland edible fish, their culturing, rearing, harvesting, and marketing.

## **Bsc II Hons.PRACTICAL Paper 202**

### **1. Reptiles:**

Study of *Chelone, Testuda, Kachuga, Hemidactylus, Varanus, Uromastix, Ophiosaurus, Chameoleon, Draco, Calotes, Phrynosoma, Typhlops, Eryx, Hydrophis, Bungarus, Viper, Krait, Coral snakes, Naja, Crotalus, Python, Crocodiles*



Demonstration through models/ CD's of Digestive, Arterial, Venous and Urinogenital systems of Hemidactylus.

Disarticulated skeleton of *Varanus*, Carapace & plastron of tortoise.

**5. Aves:** Report on dozen Birds of your District/State

Study of *Casuaris*, *Anas*, *Milvus*, *Pavo*, *Eudynamis*, *Tito*, *Ardea*, *Corvus*, *Psitaculla*, *Passer*, *Alcedo*, *Penguin*, *Emu*, *Struthio*, *Kiwi*, *Columbo*.

Study of Quill, Countour, Filoplule and down feathers.

Demonstration through Models/ CD's of Digestive, Arterial, venous and urinogenital system of pigeon

Disarticulated skeleton of Fowl.

**6. Mammals:**

Study of *Ornithorynchus*, *Echidna*, *Didelphys*, *Dasypos*, *Maropus*, *Histrix*, *Herpestes*, *Sorex*, *Shrew*, *Hedgehog*, *Pteropus*, *Funambulus*, *Felisdomesticus*, *Canisdomesticus*, *Capra*.

Disarticulated skeleton of Rabbit

Demonstration through models/ CD's of Digestive, Arterial, Venous, Urinogenital system, Neck region of Rat.

**7. Report on common diseases in cattle and buffalo.**

Demonstration through models/ CD's of Digestive, Arterial, Venous, Urinogenital system, Neck region of Rat.

**B.Sc. (Zoology Hons.)**  
**SEMESTER –IV (w.e.f. 2014-15)**  
**PAPER-403**  
**ANIMAL ECOLOGY**

**Max Marks: 40+10 (Internal assessment)**  
**Hours**

**Time allotted: 3**

**Note:** Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question.

1. Question number I is compulsory consisting of 8 parts (1.0 mark each) covering the entire syllabus. Answer to each part should not exceed 20 words.
2. Out of remaining eight questions, two questions are to be set from each unit (I to IV), possibly splitting them in parts. Candidate is required to attempt four questions, selecting one question from each unit.

**UNIT I**

**Introduction to Ecology**

Relevance of studying ecology, its history, autecology, synecology. Species- Sympatric, parapatric and Allopatric, Population, Community.

**Ecosystem, Biome, Biosphere and Ecosphere**

Abiotic Factors: Laws of limiting factors- Liebig's law of minimum and Shelford's law of tolerance. A brief account of light and temperature as limiting factors, soil types and soil erosion.

## UNIT II

### **Population**

Unitary and modular populations, its unique and group attributes- population density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio. Population dispersal and distribution patterns.

### **Population growth**

Exponential/Malthusian and Sigmoid growth patterns, Verhulst-Pearl growth equation, 'r' and 'k' strategies.

## UNIT III

### **Population Growth regulation**

Intrinsic mechanism- Density dependant fluctuations and oscillations, Extrinsic mechanism- Density independent, environmental and climatic factors, population interactions- types in a tabular form with examples.

Niche concept, Gause's principle of competitive exclusion with laboratory and field examples, Lotka Volterra Equation for prey predator interaction, functional and numerical responses of prey and predator

## UNIT IV

### **Ecosystem and Community**

Ecosystems- terrestrial (grassland), marine, and aquatic (pond).

### **Community**

Characteristics of community diversity, diversity index, types of biodiversity species richness, abundance, species area relationship, community stratification, ecotone/edge effect, succession, stages of primary succession, climax community. Energy flow through an ecosystem- food chains, food web, trophic levels, grazing and detritus type of food chain, Y- shaped food chain in forest, one example of food web- Terrestrial or Aquatic, Nutrient cycle, Nitrogen cycle.

## PRACTICALS

1. Study of all the biotic and abiotic components of any simple ecosystem- natural pond or terrestrial ecosystem or human modified ecosystem.
2. Determination of population density in a terrestrial community or hypothetical community by quadrat method and calculation of the Simpson's and Shannon- Weiner diversity index for the same community.
3. **Biochemical analysis of pond or river water for dissolved O<sub>2</sub>/CO<sub>2</sub>/Chloride/Nitrate and sulphate**
4. Study of the life table and fecundity table, plotting of the three types of survivorship curves from the hypothetical data.
5. Study of the types of soil, their texture by sieve method and rapid tests for -pH, chlorides,

- nitrates, carbonates and organic carbon
6. Study any five endangered/ threatened species- one from each class.

### SUGGESTED BOOKS

1. Colinvaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
2. Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
3. Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
4. Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Press

### SEMESTER - V PAPER-502 Organic Evolution

**Marks: 40+10 (Internal assessment)**

**Time allotted: 3 Hours**

**Note:** Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question.

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2. Out of remaining eight questions, two questions are to be set from each unit (I to IV), possibly splitting them in parts. Candidate is required to attempt four questions, selecting one question from each unit.

### THEORY

#### Unit I – Theories of Evolution

Concept of Evolution; Origin of Life; Evidences in favour of Evolution; Theories of Evolution viz, Lamarckism, Wiesman's theory of continuity of Germ Plasam, Neo-Lamarckism, Darwinism and Modern Synthetic Theory of Evolution

#### Unit II – Mechanism of Evolution

Sources of variability amongst populations; Mutations; Isolation; Natural Selection; Hardy – Weinberg Principle; Speciation and its types; Micro and Macro Evolution

#### Unit III – Results of Evolution

Structural and Functional Adaptations; Mimicry and protective coloration; Zoo-Geographical Distribution of animal species (Realms).

#### Unit IV – Paleontology

Fossils – Formation, Kinds, Interpretation, Age and significance; Evolution of Man.

### PRACTICALS

1. Study of Homologous organs through forelimbs of *Talpa*, **Bat**, **Monkey**, **Gibbon**, **Whale** and **horse**.
2. Study of adaptive modifications of feet and claws in birds.
3. Study of adaptive modifications in mouth parts of insects viz *Anopheles*, *Musca*, *Apis* and **butterfly**.
4. Study of evolution of Man and horse through charts, models and CD's. The questions will be asked to explain the peculiar evolutionary characteristics of two specific stages from these models/ charts/ CD's.
5. Study of evolutionary significance of *Peripatus*, *Neopalina*, *Balanoglossus*, *Amphioxus*, *Chimaera*, *Protopterus*, *Ichthyophes*, *Ureotyphlus*, *Amblyostoma*, *Sphenodon*, *Crocodylus*, *Archaeopterus*, *Echidna*, *Ornithorhynchus*.
6. Preparation of an anthropological survey report on the basis of morphometric trait analysis of atleast 50 students of a specific social group from your college.

## **SUGGESTED BOOKS**

1. Ridley, M. (2004) Evolution. III Edition. Blackwell Publishing
2. Barton, N. H., Briggs, D.E.G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring Harbour Laboratory Press.
3. Hall, B.K. and Hallgrímsson, B. (2008) Evolution. IV Edition. Jones and Bartlett Publishers
4. Pevsner, J. (2009) Bioinformatics and functional genomics. II Edition. Wiley-Blackwell