

SCHEME OF EXAMINATION FOR B.Sc. (ZOOLOGY) SEMESTER SYSTEM

w.e.f. Session 2015-16

B.Sc. I (2015-2016)

Semester I						
Sr. No.	Paper code	Nomenclature		Marks+IA	Periods / week	Exam. Duration
1.	1.1	Life and Diversity from Protozoa to Helminthes		40+10	4	3 hrs.
2.	1.2	Cell Biology		40+10	4	3 hrs.
3.		Practical (1.1 &1.2)			6&6 (6 periods per group per week)	
Semester II						
4.	2.1	Life and Diversity from Annelida to Hemichordata		40+10	4	3 hrs.
5.	2.2	Genetics		40+10	4	3 hrs.
6.		Practical (2.1 & 2.2)		-	6&6 (6 periods per group per week)	-
7.	P-101	Practical (1.1 to 2.2)		100		6 Hrs. (In 2 session)
Total Semester I & II				300		

B.Sc. II (2016-2017)

Semester III						
Sr. No.	Paper code	Nomenclature		Marks+IA	Periods / week	Time
1.	3.1	Life and Diversity of Chordates – I		40+10	4	3 hrs.
2.	3.2	Mammalian Physiology – I		40+10	4	3 hrs.
3.		Practical (3.1 & 3.2)			6&6 (6 periods per group per week)	

4.	3.3	Disaster Management		40+10	5	3 hrs.
Semester IV						
5.	4.1	Life and Diversity of Chordates – II		40+10	4	3 hrs.
6.	4.2	Mammalian Physiology – II		40+10	4	3 hrs.
7.		Practical (4.1 & 4.2)		-	6&6 (6 periods per group per week)	
8.	P-201	Practical (3.1 to 4.2)		100	-	12 Hrs. (in 2 session)
Total Semester III & IV				300		

B.Sc. III (2017-2018)

Semester V						
Sr. No.	Paper code	Nomenclature		Marks+IA	Periods / week	Time
1.	5.1	Fish and fisheries		40+10	4	3 hrs.
2.	5.2	Ecology & Evolution		40+10	4	3 hrs.
3.		Practical 5.1&5.2		-	6&6 (6 periods per group per week)	-
Semester VI						
4.	6.1	Entomology		40+10	4	3 hrs.
5.	6.2	Developmental Biology		40+10	4	3 hrs.
6.		Practical (6.1&6.2)		-	6&6 (6 periods per group per week)	-

7.	P-301	Practical (5.1 to 6.2)		100	-	12 Hrs. (in 2 session)
Total Semester V & VI				300		
Grand Total Semester I – VI				900		

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 the examination will be held annually at the end of even semester.

Disaster management paper of 50 lectures of 45 minutes each as per UGC guidelines (syllabus available on UGC website) & shall be qualifying in nature.

SYLLABUS (B.SC.: - ZOOLOGY)
W.E.F. SESSION 2015-16
B. SC. SEMESTER - I (THEORY)
PAPER – 1.1
LIFE AND DIVERSITY FROM PROTOZOA TO HELMINTHES

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 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-1

Phylum- Protozoa

- i) General characters and classification up to order level
- ii) Biodiversity and economic importance
- iii) Type study of *Plasmodium*;
- iv) Parasitic protozoans: Life history, mode of infection and pathogenicity of *Entamoeba*, *Trypanosoma*, *Leishmania* and *Giardia*.

UNIT-II

Phylum- Porifera:

- i) General characters and classification up to order level
- ii) Biodiversity and economic importance
- iii) Type study - *Sycon*.
- iv) Canal system in sponges
- v) Spicules in sponges

UNIT-III

Phylum - Coelentrata:

- i) General characters and classification up to order level
- ii) Biodiversity, economic importance
- iii) Type Study - *Obelia*
- iv) Corals and coral reefs
- v) Polymorphism in Siphonophores

UNIT-IV

Phylum - Helminths:

- i) General characters and classification up to order level
- ii) Biodiversity, economic importance
- iii) Type study - *Fasciola hepatica*
- iv) Helminths parasites: Brief account of life history, mode of infection and pathogenesis of *Schistosoma*, *Ancylostoma*, *Trichinella*, *Wuchereria* and *Oxyuris*.

B. SC. SEMESTER II
PAPER- 1.2
CELL BIOLOGY

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 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

1. Ultrastructure of different cell organelles of animal cell.
2. Plasma Membrane: Fluid mosaic model, various modes of transport across the membrane, mechanism of active and passive transport, endocytosis and exocytosis.
3. Endoplasmic reticulum (ER): types, role of ER in protein synthesis and transportation in animal cell.
4. Goigi complex: Structure, Associated enzymes and role of golgi-complex in animal cell.

UNIT-II

1. Ribosomes: Types, biogenesis and role in protein synthesis.
2. Lysosomes: Structure, enzyme and their role; polymorphism
3. Mitochondria: Mitochondrial DNA; as semiautonomous body, biogenesis, mitochondrial enzymes (only names), role of mitochondria.
4. Cytoskeleton: Microtubules, microfilaments, centriole and basal body.
5 Cilia and Flagella

UNIT-III

1. Ultrastructure and functions of Nucleus: Nuclear· membrane, nuclear lamina, nucleolus, fine structure of chromosomes, nucleosome concept and role of histones,
2. Euchromatin and heterochromatin, lampbrush chromosomes and polytene chromosomes.

UNIT-IV

1. Mitosis and Meiosis (Cell reproduction)
2. Brief account of causes of cancer.
3. An elementary idea of cellular basis of Immunity.

B.SC. SEMESTER - II
PAPER – 2.1
LIFE AND DIVERSITY OF ANNELIDA TO HEMICHORDATA

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 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

Phylum - Annelida:

- i) General characters and classification up to order level
- ii) Biodiversity and economic importance of Annelida
- iii) Type study - *Pheretima* (Earthworm)
- iv) Metamerism in Annelida
- v) Trochophore larva: Affinities, evolutionary significance

UNIT-II

Phylum - Arthropoda:

- i) General characters and classification up to order level
- ii) Biodiversity and economic importance of insects
- iii) Type study – *Periplaneta*

UNIT-III

Phylum - Mollusca:

- i) General characters and classification up to order level
- ii) Biodiversity and economic importance
- iii) Type study - *Pila*
- iv) Torsion and detorsion in gastropoda
- v) Respiration and foot

UNIT-IV

Phylum - Echinodermata:

- i) General characters and classification up to order level
- ii) Biodiversity and economic importance
- iii) Type Study -*Asteries* (Sea Star)
- iv) Echinoderm larvae
- v) Aristotle's Lantern

Phylum – Hemichordata:

Type study: *Balanoglossus*

SEMESTER-II
PAPER – 2.2
GENETICS

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 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

1. Elements of Heredity and variations.
2. The varieties of gene interactions
3. Linkage and recombination: Coupling and repulsion hypothesis, crossing-over and chiasma formation; gene mapping.

UNIT-II

1. Sex determination and its mechanism: male and female heterozygous systems, genetic balance system; role of Y -chromosome, male haploidy, cytoplasmic and environmental factors, role of hormones in sex determination.
2. Sex linked inheritance: Haemophilia and colour blindness in man, eye colour in *Drosophila*, Non-disjunction of sex-chromosome in *Drosophila*; Sex-linked and sex influenced inheritance.
3. Extra chromosomal and cytoplasmic inheritance:
 - i) Kappa particles in Paramecium.
 - ii) Shell coiling in snails.
 - iii) Milk factor in mice.

UNIT-III

1. Multiple allelism: Eye colour in *Drosophila*; A, B, O blood group in man.
2. Human genetics: Human karyotype, Chromosomal abnormalities involving autosomes and sex chromosomes, monozygotic and dizygotic twins.
3. Inborn errors of metabolism (Alcaptonuria, Phenylketonuria, Albinism, sickle-cell anaemia).

UNIT-IV

1. Nature and function of genetic material; Structure and type of nucleic acids; Protein synthesis. spontaneous and induced (chemical and radiations) mutations; gene mutations; chemical basis of mutations; transition, transversion, structural chromosomal aberrations (deletion, duplication, inversion and translocation); Numerical aberrations (autopolyploidy, euploidy and polyploidy in animals)
2. Applied genetics: Eugenics, eugenics and euphenics; genetic counseling, pre-natal diagnostics, DNA-finger printing, transgenic animals

B.Sc.-SEMESTER I PRACTICAL

(A) Classification up to orders with ecological note and economic importance of the following animal:

- I. Protozoa Lamination of cultures of *Amoeba*, *Euglena* and *Paramecium*; permanent prepared slides: *Amoeba*, *Euglena*, *Trypanosoma*, *Noctiluca*, *Eimeria*, *Paramecium* (binary fission and conjugation), *Opalina*, *Verticella*, *Balantidium*, *Nyctotherus*, radiolarian and foraminiferan ooze.
2. Parazoa (Porifera) Specimens: *Sycon*, *Grantia*, *Euplectella*, *Hyalonema*, *Spongilla*, *Euspongia*
3. Coelenterata. Specimens: *Porpita*, *Varella*, *Physalia*, *Aurelia*, *Rhyzostoma*, *Metridium*, *Millipora*, *Alcyonium*, *Tubipora*, *Zoanthus*, *Madrepora*, *Favia*, *Fungia*, and *Astrea*,
Permanent prepared slides: *Hydra* (W.M.), *Hydra* with buds, *Obelia* (colony and medusa), *Sertularia*, *Plumularia*, *Tubularia*, and *Bougainvillea*, *Aurelia* (sense organs and stages of life history).
4. Platyhelminthes Specimens: *Dugesia*, *Fasciola*, *Taenia*, *Echinococcus*,
Permanent prepared slides: *Miracidium*, *sporocyst*, *redia*, *cercaria*, *scolex* and *proglottids*; *Taenia* (mature and gravid).
5. Aschelminthes *Ascaris* (male & female), *Trichinella*, *Ancylostoma*, *Meloidogyne*.

(B) Study of the following permanent stained preparations:

- I. L.S. and TS. *Sycon*; gemmules, spicules and sponging fibres of *Sycon*, canal system of sponges.
2. TS. *Hydra* (testis and ovary region).
3. T.S. *Fasciola* (different regions).
4. T.S. *Ascaris* (male and female).

(C) Preparation of the following slides:

1. Temporary preparation of *Volvox*, *Paramecium*, Gemmules and spicules of *Sycon*
2. Preparation of permanent stained whole mounts of *Hydra*, *Obelia*, *Sertularia*, *Plumularia* and *Bougainvillea*.
3. Pathogenic protozoans: Plasmodium, Giardia or as available
4. Pathogenic Helminthes: Ancylostoma; Wuchereria or as available

(D) Cell biology and Genetics:

- I. Cell division: Prepared slides of stages of mitosis and meiosis.
2. Temporary squash preparations of onion root tip / grasshopper testis for the study of mitosis using acetocarmine stain.

(E) Project:

1. Parasitic adaptations (Protozoa to helminthes)
2. DNA: types, structure and its model preparation
3. Survey- Diversity of particular family/taxa in your surrounding area
4. Microscopy: principles and its significance
5. Staining techniques and their significance

(F) Disaster Management Project Work: (Field Work, Case Studies)

for details see the UGC Website

B.Sc.-Semester II

PRACTICAL

(A) Classification up to orders with ecological note and economic importance of the following group of animals:

1. Annelida Specimens: Pheretima, Heteronereis, Polynoe, Aphrodite, Chaetopterus, Arenicola, Tubifex and Pontobdella.
2. Arthropoda Specimens: Peripatus, Palaemon (Prawn), Lobster, Cancer (crab), Sacculina, Eupagurus (hermit crab), Lepas, Balanus, Cyclops, Daphnia, Lepisma, Periplaneta (cockroach), Schistocerca (locust), Poecilocerous (ak-hopper), Gryllus (cricket), Mantis (praying mantis), Cicada, Forficula (earwig), Dragon fly, termite queen, bug, moth, beetle, Polistes (wasp), Apis (honey bee), Bombyx (silk moth), Cimex (bedbug), Pediculus (body louse). Millipedes, Scolopendra (centipedes), Palamnaeus (scorpion), Aranea (spider), Limulus (king crab).
3. Mollusca Specimens: Mytilus, Ostrea, Cardium, Pholas, Solen
(razor fish), Pecten, Haliotis, Patella, Aplysia, Doris, Limax, Loligo, Sepia, Octopus, Nautilus (complete and T.S.), Chiton and Dentalium.
4. Echinodermata Specimens: Asterias, Echinus, Cucumara, Ophiothrix, Antedon and Asterothyton.
5. Hemichordata Balanoglossus

(B) Study of the following permanent stained preparations:

1. T.S. Pheretima (pharyngeal and typhlosolar regions), Setae, septal nephridia and spermathecae of Pheretima.
2. Trachea and mouthparts of cockroach.
3. Statocyst of Palaemon.
4. Glochidium larva of Anodonta; radula and osphradium of Pila.
5. T.S. Star fish (arm)
6. T.S. Balanoglossus (through various regions).

(C) Demonstration by C. D.:

1. Mouth parts and trachea of Periplaneta (cockroach), radula of Pila; pedicellariae of Asterias.

2. setae of earthworm, and mouth parts of Honey bee, House fly and cockroach.

(D) Preparation of models of the different systems of the following animals:

1. Earthworm: Digestive, reproductive and nervous systems.
2. Grasshopper/ cockroach: Digestive, reproductive and nervous systems.
3. Pila: Pallial complex, digestive and nervous systems

(E) Cell biology and Genetics:

1. Salivary gland and polytene chromosomes of *Drosophila*/*Chironomus*.
2. Numericals based on three point test cross

(F) Project:

1. Survey- Diversity of particular family/taxa in your surrounding area
2. Vermicomposting: Earthworm rearing and economics of the project
3. Evolutionary significance of larvae belonging to different group of invertebrates

B.Sc. PART- I (Zoology Practical)
(Semester I & II)
Guidelines/Instructions for Practical Examination
P-101(1.1 to 2.2)

Max Marks: 100

Time allowed: 6Hrs

Note: Following exercises will be set in the examination as per marks assigned

S. No.	Exercise	Marks	
		P-I	P-II
1.	Dissection (Exposition, labelled diagram)	x	3
2.	Temporary mounting –one (Staining, identification, sketch)	3	3
3.	Museum specimens - four (identification and classification)	12	12
4.	Ecological note –one specimen	3	3
5.	Permanent slides - two (Identification with reasons)	4	4
6.	Preparation of chromosome slide (root tip/grasshopper testis)	4	4
7.	Invertebrate collection and report	4 (2+2)	4 (2+2)
8.	Practical record and slides	7 (5+2)	7 (5+2)
9.	Viva	5	5
10	Project report	8	5

B.Sc. PART- II (Zoology Practical)

(Semester 3 & 4)

Guidelines/Instructions for Practical Examination

P-201(3.1 to 4.2)

Max Marks: 100

Time allowed: 6Hrs

Note: Following exercises will be set in the examination as per marks assigned

S. No.	Exercise	Max Marks P-III	Max Marks P-IV
1.	Model Preparation	5	5
2.	Temporary mounting –one (Staining, identification, sketch)	2	Not applicable
3.	Museum specimens - four (identification and classification)	6	6
4.	Ecological note –one specimen	2	2
5.	Permanent slides - two (Identification with reasons)	3	3
6.	Bone – identification & sketch	4	4
7.	Physiology (two exercise)	5	5
8.	Zoological excursion and its report	6	
9.	Collection and a brief note on feathers		4+4
10.	Practical record and slides	5	5
11.	Viva	4	4
12.	Project report	8	8

B.Sc.-Semester III PRACTICAL

Max. Marks:50

Time allowed: 3Hrs

1. Classification upto orders, habit, habitats, external characters and economic importance (if any) of the following animals:-

Protochordata : *Molgula, Hetryllus, Pyrosoma, Doliolum, Olikopleura, and Amphioxus.*

Cyclostomata : *Myxine, Petromyzon and Ammocoetus larva.*

Chondrichthyes: *Zygaena, Pristis, Narcine (electric ray), Trygon, Rhinobatus, Raja and Chimaera.*

Osteichthyes : *Acipenser, Lepidosteus, Muraena, Mystus, Catla, Hippocampus, Syngnathus, Exocoetus, Anabas, Diodon, Ostraczion, Tetradon, Echinus, Lophius, Solea and Polypterus. Any of the Lung Fishes.*

2. Preparation of models of the different systems of the following animals:

Herdmania: General anatomy

Labeo (locally available fish): Digestive and reproductive systems: cranial nerves

3. Study of the skeleton of *Scoliodon, Labeo*

4. Study of the following prepared slides: Tornaria larva, T.S. *Amphioxus* (through different regions). *Oikopleura*, different types of scales.

5. Make permanent stained preparations of the following: *Salpa*, Spicules, and Cycloid scales

6. Zoological excursion and its report

PHYSIOLOGY PRACTICALS:

1. Qualitative tests for identification of simple sugars, disaccharides and polysaccharides.

2. Study of human salivary amylase activity: Effect of temperature, pH, Concentration.

Project Report:

1. Migration in fishes
2. Ornamental fishes

7. Disaster Management Project Work: (Field Work, Case Studies. for details see the UGC Website

B.Sc.-Semester IV PRACTICAL

**Max. Marks: 50
3Hrs**

Time allowed:

- 1. Classification up to orders, habit, habitats, external characters and economic importance (if any) of the following animals:-**

Amphibia : *Necturus, Proteus, Amphiuma, Salamandra, Amblystoma, Axolotie larva, Alytes, Bufo, Rana.*

Reptilia : *Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhops, Python, Eryx, Ptyas, Bungarus, Naja, Hydrus, Viper, Crocodilus, Gavialis, Chelone (Turtle) and Testudo (Tortoise).*

Aves : *Casuarius, Arden, Anas, Milvus, Pavo, Eudynamis, Tyto and Alcedo, Halcyon*

Mammalia : *Ornithorhynchus, Echidna, Didelphis, Macropus, Loris, Macaque, Hystrix, Funambulus, Telix, Panthera, Canis, Herpestes, Capra, Pteropus*

- 2. Preparation of models of the different systems of the following animals:**

Hemidactylus : Digestive, arterial, venous and urinogenital systems.

Rat : Digestive, arterial, venous and urinogenital systems.

- 3. Study of the skeleton** of *Rana* (Frog), *Varanus*, Pigeon or Gallus and *Orcyctolagus*/rat

- 4. Study of the following prepared slides:** Histology of rat (compound tissues).

- 5. Study and collection of Quill, Contour, Filoplume and Down feathers**

PHYSIOLOGY PRACTICALS:

1. Estimation of abnormal constituents of urine (Albumin, sugar, ketone bodies).
2. Use of respirometer.
3. Haematein crystal preparation.
4. Estimation of Hb.
5. DLC of Man/RBC count/WBC count.

Project Report:

1. Survey of diversity
2. Parental care
3. Dentition in mammals
4. Migration in birds

B.Sc. PART- III

Semester V & VI

Guidelines/Instructions for Practical Examination

P-301(5.1 to 6.2)

Max. Marks: 100

Time allowed: 6 Hrs

SNo	Title of experiment	MM	MM
		P-V	P-VI
1.	Chemical analysis of water/soil	5	-
2.	Identification and Classification of specimens (Four)	8	-
3.	Ecological note on economically important specimen (two+two)	6	6
4.	Evolutionary evidences	3	-
5.	Slides/nets etc	3	-
6.	Field report	8	-
7.	Identification and Classification of specimens (Four)	-	8
8.	Comment on the Life cycle of a given pest	-	5
9.	Identification of embryological slides with reasons of identification (Two)	-	6
10.	Preparation of window in the egg	-	4
11.	Preparation of the permanent/temporary slides of the various development stages of frog/mosquito.	-	4
12.	Project report	7	7
13.	Practical note book	5	5
14.	Viva-voce	5	5

Note: Field report/collection to be submitted during exam

B.Sc. Part-III

Semester V

PRACTICAL

1. Identification of *Catle*, *Labeo rohita*, *L. calbasu*, *Cirrhius*, *mrigala* *Puntius sarana*, *Channa punctatus*, *C. marulius*. *C. stariatus*, *Trichogaster fasciata*, *Mystus seenghala*, *M. cavasius*, *M. tengra*, *Callichrous pabola*, *C. bimaculatus*, *Wallago attu*, *Prawns*, *Crabs*, *Lobsters*, *Calms*, *Mussels & Oysters*.
2. Chemical analysis of pond water and soil for pH, dissolved oxygen, free CO₂ nitrates, phosphates and chlorides.
3. A study of the slides of fish parasites.
4. A study of the different types of nets, e.g., cast net, gill net, drift net and drags net.
5. A visit to lake/reservoir/fish breeding centre.
6. Evolutionary evidences and/or its demonstration through models/video/CD etc and preparation of working models of the different systems of the following animals:
 - Adaptive modifications in feet and beaks of birds
 - Evolutionary evidences of man and horse.
7. Project report :
 - i) Pearl culture
 - ii) Prawn culture

B.Sc. Part-III

Semester VI

PRACTICAL

1. External morphology, identification marks, nature of damage and host of the following pests:
 - i. **Sugarcane:** Sugarcane leaf-hopper, Sugarcane whitefly, Sugarcane top borer, Sugarcane root borer, Gurdaspur borer (any two).
 - ii. **Cotton :** Red Cotton bug
 - iii. **Wheat:** Wheat stem borer
 - iv. **Paddy:** Gundhi bug, Rice grasshopper, Rice stem borer, Rice hispa (any one).
 - v. **Vegetables:** *Aulocophora faveicollis*, *Dacus cucurbitas*, *Tetranychus tecarius*, *Epilachna* (any three).
 - vi. **Pests of stored grains:** Pulse beetle, Rice weevil, Grain & Flour moth, Rust-red flour beetle, lessergrain borer (any three).
2. Preparation of permanent/temporary slides of developmental stages of frog/mosquito
3. Study of permanent slides of WM of chick embryo (13-18h, 24-36h, 36-48h, 48-72h).
4. Window preparation and identification of stages of development in chick egg.
5. Project report:
 1. Apiculture
 2. Sericulture

