

**KURUKSHETRA UNIVERSITY,  
KURUKSHETRA**

**Scheme of Examination and Syllabus**

**for**

**B.Sc. Medical  
Subject: Zoology**

**Under**

**Choice Based Credit System (CBCS)**  
**(With effect from 2020-2021 in IIHS and 2021-22 in all affiliated  
colleges in Phased Manner)**

### **Programme Outcomes (POs) for UG courses of Faculty of Life Sciences**

1. To develop skills in graduate students to be able to acquire theoretical and practical knowledge in fundamentals of biology in respective disciplines of plants, animals, microbes and environment.
2. To inculcate ability to critically evaluate problems and apply lateral thinking and analytical skills for professional development.
3. To create awareness on ethical issues, good laboratory practices and biosafety.
4. To develop ability in youth for understanding basic scientific learning and effective communication skills.
5. To prepare youth for career in teaching, industry, government organizations and self reliant entrepreneurship.
6. To make students aware of natural resources and environment and its sustainable utilization.
7. To provide learning experience in students that instills deep interest in biological science for the benefit of society.

### **Programme Specific Outcomes (PSOs) for Zoology subject of B.Sc. Medical**

1. Students will gain knowledge to develop acquaintance of animal species around them and variations in their life cycles/biology and their interaction with the environment.
2. Young students will be also be apprised about likeness between the physiological processes at the cellular and organismic levels.
3. Youth will be capable of using knowledge of subject and analytical methods in identifying and solving various complex situations of living forms and environment taking into consideration ethics and responsibilities.
4. Teaching of this subject will also develop ability in youth to have understanding of basic Zoology with effective communication ability.
5. This PG programme will develop youth who is aware of natural resources and their sustainable utilization.
6. This programme will develop personnel who can be capable of doing Masters in the subject and can develop career as teacher, in industry or as entrepreneur in the realms of the subject.

# KURUKSHETRA UNIVERSITY, KURUSHETRA

## Scheme of Examination for B.Sc. Medical under CBCS pattern w.e.f. session 2020-21 in IIHS, KUK and 2021-22 in all affiliated colleges in phased manner

### Subject: Zoology

Semester	Course	Paper(s)		Credits	Internal marks	External Marks	Total	Exam Duration	Contact Hours per week
I	CC- Zoology	B-ZOO-101		3	15	60	75	3 hrs.	3
		B-ZOO-102		3	15	60	75	3 hrs.	3
		B-ZOO-103		2	10	40	50	4 hrs.	4
II	CC-Zoology	B-ZOO-201		3	15	60	75	3 hrs.	3
		B-ZOO-202		3	15	60	75	3 hrs.	3
		B-ZOO-203		2	10	40	50	4 hrs.	4
III	CC-Zoology	B-ZOO-301		3	15	60	75	3 hrs.	3
		B-ZOO-302		3	15	60	75	3 hrs.	3
		B-ZOO-303		2	10	40	50	4 hrs.	4
IV	CC- Zoology	B-ZOO-401		3	15	60	75	3 hrs.	3
		B-ZOO-402		3	15	60	75	3 hrs.	3
		B-ZOO-403		2	10	40	50	4 hrs.	4
V	DSE* Zoology	B-ZOO-501(i)	B-ZOO-501(ii)	2	10	40	50	3 hrs.	2
		B-ZOO-502 (i)	B-ZOO-502 (ii)	2	10	40	50	3 hrs.	2
		B-ZOO-503(i)	B-ZOO-503(ii)	2	10	40	50	4 hrs.	4
VI	DSE* Zoology	B-ZOO-601(i)	B-ZOO-601(ii)	2	10	40	50	3 hrs.	2
		B-ZOO-602 (i)	B-ZOO-602 (ii)	2	10	40	50	3 hrs.	2
		B-ZOO-603(i)	B-ZOO-603(ii)	2	10	40	50	4 hrs.	4
Semester IV-VI	SEC- Zoology	B-ZOO-S1		2	10	40	50	3 hrs.	2

\*Students have to opt one option/stream of DSE Zoology either (i) or (ii)

**Formula for 20 per cent Internal Assessment (10 Percent on the basis of two hand written assignments, 5 percent on the basis of one class test and 5 percent on the basis of attendance of the student).**

**Nomenclature of Papers B.Sc. (General)**  
**Subject: Zoology**

Semester	Course	Paper(s)	Nomenclature of Paper(s)
I	CC- Zoology	B-ZOO-101	Animal Diversity of Non-Chordates from Protozoa to Helminthes
		B-ZOO-102	Animal Diversity of Non-Chordates from Annelida to Hemichordata
		B-ZOO-103	Zoology Practical Based on B-ZOO-101 & B-ZOO-102
II	CC-Zoology	B-ZOO-201	Animal Diversity of Chordates from Protochordata to Pisces
		B-ZOO-202	Animal Diversity of Chordates from Amphibia to Mammalia
		B-ZOO-203	Zoology Practical Based on B-ZOO-201 & B-ZOO-202
III	CC-Zoology	B-ZOO-301	Animal Biochemistry and Physiology
		B-ZOO-302	Mammalian Physiology and endocrinology
		B-ZOO-303	Zoology Practical Based on B-ZOO-301 & B-ZOO-302
IV	CC- Zoology	B-ZOO-401	Cell Biology
		B-ZOO-402	Animal Genetics
		B-ZOO-403	Zoology Practical Based on B-ZOO-401 & B-ZOO-402
V	DSE* Zoology (i)	B-ZOO-501 (i)	Ecology and Environment
		B-ZOO-502 (i)	Evolution and Developmental Biology
		B-ZOO-503 (i)	Zoology Practical Based on B-ZOO-501(i) & B-ZOO-502(i)
	DSE* Zoology (ii)	B-ZOO-501 (ii)	Applied Zoology
		B-ZOO-502 (ii)	Recent techniques in Zoology
		B-ZOO-503 (ii)	Zoology Practical Based on B-ZOO-501(ii) & B-ZOO-502(ii)
VI	DSE* Zoology (i)	B-ZOO-601 (i)	Aquaculture
		B-ZOO-602 (i)	Pest Management
		B-ZOO-603 (i)	Zoology Practical Based on B-ZOO-601(i) & B-ZOO-602(i)
	DSE* Zoology (ii)	B-ZOO-601 (ii)	Animal Taxonomy
		B-ZOO-602 (ii)	Biodiversity Conservation & Wildlife management
		B-ZOO-603 (ii)	Zoology Practical Based on B-ZOO-601(ii) & B-ZOO-602(ii)
Semester IV-VI	SEC-Zoology	B-ZOO-S1	Economic Zoology

**\*Students have to opt one option/stream of DSE Zoology either (i) or (ii)**

## Scheme of B.Sc. Zoology I & II Semester

<b>Semester</b>	<b>Course</b>	<b>Paper(s)</b>	<b>Credits</b>	<b>Internal marks</b>	<b>External Marks</b>	<b>Total Marks</b>	<b>Exam Duration</b>
I	CC- Zoology	B-ZOO-101	3	15	60	75	3 hrs.
		B-ZOO-102	3	15	60	75	3 hrs.
		B-ZOO-103	2	10	40	50	4 hrs.
II	CC-Zoology	B-ZOO-201	3	15	60	75	3 hrs.
		B-ZOO-202	3	15	60	75	3 hrs.
		B-ZOO-203	2	10	40	50	4 hrs.

**B.Sc. Zoology Semester-I**  
**SYLLABUS**  
**B-ZOO-101**

**Animal Diversity of Non-Chordates from Protozoa to Helminthes**

**Credits: 3**

**External Marks: 60**

**Internal Assessment: 15**

**Time allotted: 3 Hours**

**Objective:** To understand the taxonomic position, general characteristics, body organization and origin and evolutionary relationship of animals belonging to different Phylum of Protozoa to Helminthes.

**Course outcomes:**

- CO101.1. Student will be able to describe unique characters and recognize life functions of phylum Protozoa, Porifera, Coelenterate and Helminthes
- CO101.2. Will be capable to identify the diversity and ecological role of phylum Protozoa, Porifera, Coelenterate and Helminthes.

**Note:** Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of short answer type 6 parts (2.0 marks each) covering the entire syllabus. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks.

**SECTION - A**

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*.
2. **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

**SECTION - B**

3. **Phylum – Coelentrata:**
  - i) General characters and classification up to order level
  - ii) Biodiversity and economic importance
  - iii) Type Study - *Obelia*
  - iv) Corals and coral reefs
  - v) Polymorphism in Siphonophores
4. **Phylum – Helminthes:**
  - i) General characters and classification up to order level
  - ii) Biodiversity and economic importance
  - iii) Type study – *Fasciola hepatica*
  - iv) Helminthes parasites: Brief account of life history, mode of infection and pathogenicity of *Schistosoma*, *Ancylostoma*, *Trichinella*, *Wuchereria* and *Oxyuris*.

**B.Sc. Zoology Semester-I**  
**SYLLABUS**  
**B-ZOO-102**

**Animal Diversity of Non-Chordates from Annelida to Hemichordata**

**Credits: 3**

**External Marks: 60**

**Internal Assessment: 15**

**Time allotted: 3 Hours**

**Objective:** To make students understand the general characteristics of animals Kingdom, body organization, taxonomic position and origin and evolutionary relationship belonging to Phylum Annelida up to Hemichordata.

**Course Outcomes:**

CO102.1. Student will be able to describe unique characters and recognize life functions of Phylum Annelida up to Hemichordata.

CO102.2. Will be capable to identify the diversity and ecological role of Phylum Annelida up to Hemichordata.

**Note:** Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of short answer type 6 parts (2.0 marks each) covering the entire syllabus. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks.

**SECTION - A**

1. **Phylum – Annelida:**

- i) General characters and classification up to order level
- ii) Biodiversity and economic importance of Annelida
- iii) Type study – *Pheretima* (Earthworm)
- vi) Metamerism in Annelida
- v) Trochophore larva

2. **Phylum – Arthropoda:**

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

**SECTION - B**

3. **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

4. **Phylum – Echinodermata:**

- i) General characters and classification up to order level
- ii) Biodiversity and economic importance
- vii) Type study – *Asterias* (Sea Star)
- viii) Echinoderm larvae
- ix) Aristotle's Lantern

5. **Phylum Hemichordata:** General Characters; Type Study of *Balanoglossus*

**B.Sc. Zoology Semester-I**  
**SYLLABUS**  
**B-ZOO-103**  
**(Zoology Practical Based on B-ZOO-101 & B-ZOO-102)**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours**

**Objective:** To have practical knowledge about identification and understanding of the classification of invertebrates Phylum of Protozoa up to Echinodermata.

**Course Outcome:**

CO103.1. Students will be capable of identifying the characters and classification of invertebrates species.

CO103.2. Students will be able to realize and explain ecological and economic importance of different invertebrate species

**A. Classification up to orders with ecological note and economic importance of the following animals:**

1. Protozoa: Lamination of cultures of *Amoeba*, *Euglena* and *Paramecium*; permanent prepared slides: *Amoeba*, *Euglena*, *Trypanosoma*, *Noctiluca*, *Eimeria*, *Paramecium* (binary fission and conjugation), *Opalina*, *Vorticella*, *Balantidium*, *Nyctotherus*, radiolarian and foraminiferan ooze.
2. Parazoa (Porifera): *Sycon*, *Grantia*, *Euplectella*, *Hyalonema*, *Spongilla*, *Euspongia*
3. Coelenterata: *Porpita*, *Varella*, *Physalia*, *Aurelia*, *Rhizostoma*, *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*, *Bougainvillea*, *Aurelia* (sense organs and stages of life history).
4. Platyhelminthes: *Dugesia*, *Fasciola*, *Taenia*, *Echinocoecus*. Permanent prepared slides: *Miracidium*, *Sporocyst*, *Redia*, *Cercaria*, *Scolex* and *Proglottids* of *Taenia* (mature and gravid).
5. Aschelminthes: *Ascaris* (male and female), *Trichinella*, *Ancylostoma*, *Meloidogyne*
6. Annelida: *Pheretima*, *Heteronereis*, *Polynoe*, *Aphrodite*, *Chaetopterus*, *Arenicola*, *Tubifex* and *Pontobdella*
7. Arthropoda: *Peripatus*, *Palaemon* (Prawn), *Lobster*, *Cancer* (crab), *Sacculina*, *Eupagurus* (hermit crab), *Lepas*, *Balanus*, *Cyclops*, *Daphnia*, *Lepisma*, *Periplaneta* (cockroach), *Schistocerca* (locust), *Poeciloceris* (ak-hopper), *Gryllus* (cricket), *Mantis* (praying mantis), *Cicada*, *Forticula* (earwig), Dragon fly, termite queen, bug, moth, beetle, *Polistes* (wasp), *Apis* (honey bee), *Bombyx* (silk moth), *Cimex* (bed bug), *Pediculus* (body louse), *Millipede*, *Scolopendra* (centipede), *Palamnaeus* (scorpion), *Aranea* (spider), *Limulus* (king crab)
8. Mollusca: *Mytilus*, *Ostrea*, *Cardium*, *Pholas*, *Solen* (razor / Fish), *Pecten*, *Holiotis*, *Patella*, *Aplysia*, *Doris*, *Limax*, *Loligo*, *Sepia*, *Octopus*, *Nautilus* (complete and T.S.), *Chiton* and *Dentalium*
9. Echinodermata: *Asterias*, *Echinus*, *Cucumaia*, *Ophiothrix*, *Antedon* and *Asterophyton*
10. Hemichordata: *Balanoglossus*

**(B). Study of the following permanent stained preparations:**

1. L.S. and T.S. *Sycon*; gemmules, spicules and spongin fibres of *Sycon*, canal system of sponges
2. T.S. *Hydra* (testis and ovary region)
3. T.S. *Fasciola* (different regions)
4. T.S. *Ascaris* (male and female)
5. T.S. *Pheretima* (pharyngeal and typhlosolar regions), Setae, septal nephridia and spermathecae of *Pheretima*.
6. Trachea and mouthparts of cockroach.
7. Statocyst of *Palaemon*.
8. Glochidium larva of *Anodonta*; radula and osphradium of *Pila*.
9. T.S. Star fish (arm).
10. T.S. *Balanoglossus* (through various regions).

**(C) Preparation of the following slides:**

1. Temporary preparation of *Volvo*, *Paramecium*, Gemmules and spicules of *Sycon*; mouth parts and trachea of *Periplaneta* (cockroach).
2. Preparation of permanent stained whole mounts of *Hydra*, *Obelia*, *Sertularia*, *Plumularia* and *Bougainvillea*.
3. Preparation of mouth parts of Mosquito, House fly and cockroach.

**(D) Study of Internal Anatomy**

1. Computer, simulated study/ model of:
  - (i) *Earthworm*: Digestive, reproductive and nervous systems
  - (ii) *Pila* : Pallial complex, digestive and nervous system
2. Demonstration of internal anatomy of cockroach: Digestive, reproductive and nervous systems

**GUIDELINES/INSTRUCTIONS FOR PRACTICAL EXAMINATION (SEMESTER-I)**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours (One session)**

**Note : Following exercises will be set in the examination as per marks assigned for each.**

	<b>Exercise</b>	<b>Marks allotted</b>
1.	Internal Anatomy – One (Labelled diagram)	03
2.	Permanent Slide Preparation - one (Staining, identification, sketch)	06
3.	Museum specimens – Seven (Identification and classification)	14 (7x2)
4.	Ecological note – One specimen	03
5.	Permanent slides – Two (Identification with reasons)	04 (2x2)
6.	Practical record and slides	05
7.	Viva-voce	05

<b>Semester-I</b>													
<b>Core Course-Zoology</b>													
<b>B-ZOO-101</b>				<b>Animal Diversity of Non-Chordates from Protozoa to Helminthes</b>									
<b>B-ZOO-102</b>				<b>Animal Diversity of Non-Chordates from Annelida to Hemichordata</b>									
<b>B-ZOO-103</b>				<b>Zoology Practical Based on B-ZOO-101 &amp; B-ZOO-102</b>									
<b>CO#</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO101.1.</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO101.2.</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO102.1.</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO102.2.</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO103.1.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO103.2.</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>
<b>Average</b>	<b>2.16</b>	<b>6</b>	<b>1.66</b>	<b>1.66</b>	<b>2.5</b>	<b>2.16</b>	<b>1.83</b>	<b>2.66</b>	<b>2.66</b>	<b>2.66</b>	<b>2.5</b>	<b>2.66</b>	<b>2.83</b>

**B.Sc. Zoology Semester-II**  
**SYLLABUS**  
**B-ZOO-201**

**Animal Diversity of Chordates from Protochordata to Pisces**

**Credits: 3**

**External Marks: 60**

**Internal Assessment: 15**

**Time allotted: 3 Hours**

**Objective:** To make students understand the basic characters of Chordates, origin and ancestry of chordates from protochordates and about the general characters, scale and fin pattern in class Pisces.

**Course Outcomes:**

- CO201.1. Through this core course the students will be capable of identifying different protochordate and will be capable of Imparting conceptual knowledge of protochordates, their adaptations and associations in relation to their environment.
- CO201.2. Will be able to understand the basic concepts of evolutionary relationship among protochordates and fishes.

**Note:** Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of short answer type 6 parts (2.0 marks each) covering the entire syllabus. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks.

**SECTION - A**

Functional morphology of the types included with special emphasis on the adaptations to their modes of life and environment. General characters and classification of all phyla upto orders with examples emphasizing their biodiversity, economic importance and conservation measures where required.

1. **Chordates:** Salient features of chordates; Principles of classification; Origin and Evolutionary tree.
2. **Protochordates:** Systematic position, distribution, ecology, morphology and affinities of protochordates  
Urochordata: *Herdmania* – type Study  
Cephalochordata: *Amphioxus* – type study

**SECTION - B**

3. Agnatha: Classification upto orders

Cyclostomata: General characters and classification upto order level. Affinities and ecological significance

Petromyzon: Structural & functional morphology

4. **Pisces:** General characters and classification up to orders with examples emphasizing their biodiversity  
Scales & Fins, Parental care in fishes, fish migration.

Type study of Labeo

**Note:** Type study includes detailed study of various systems of the animal.

**B.Sc. Zoology Semester-II**  
**SYLLABUS**  
**B-ZOO-202**

**Animal Diversity of Chordates from Amphibia to Mammalia**

**Credits: 3**

**External Marks: 60**

**Internal Assessment: 15**

**Time allotted: 3 Hours**

**Objective:** To make students capable of Identifying (using key features) and differentiate between vertebrate groups including amphibians, reptiles, birds, and mammals.

**Course Outcomes:**

CO202.1. Students will be able to understand evolutionary lines of vertebrate class including amphibians, reptiles, birds, and mammals.

CO202.2. Students will be able to identify (based on morphological characters) and understand adaptations in vertebrate class including amphibians, reptiles, birds, and mammals.

**Note:** Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of short answer type 6 parts (2.0 marks each) covering the entire syllabus. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks.

**SECTION - A**

1. **Amphibia:** General Characters and Classification upto orders; Origin, Evolutionary tree. Type study of frog (*Rana tigrina*), Parental Care and Neoteny in Amphibia
2. **Reptilia:** General Characters and Classification upto orders, Type study of Lizard (*Hemidactylus*): Structural & Functional morphology, Origin, Evolutionary tree. Extinct reptiles; Poisonous and non-poisonous snakes; Poison apparatus in snakes.

**SECTION - B**

3. **Aves:** General Characters and Classifications upto orders. Type study of Pigeon (*Columba livia*); Structural & Functional morphology  
Aerial adaptation, Principles of aerodynamics in Bird flight, migration in birds.
4. **Mammals:** General Characters and classification up to orders;  
type study of Rat; Adaptive radiations of mammals, dentition.  
Affinities of Prototheria, metatheria & eutheria

**Note:** Type study includes detailed study of various systems of the animal.

**B.Sc. Zoology Semester-II**  
**SYLLABUS**  
**B-ZOO-203**  
**(Zoology Practical Based on B-ZOO-201 & B-ZOO-202)**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours**

**Objective:** To make students understand the classification of vertebrates Phylum and ways of identifying respective species

**Course Outcomes:**

CO203.1. Students will be able to classify and identify vertebrates' species and their skeleton

CO203.2. Learners will also realize and understand economic importance of the vertebrate species and will be aware about their conservation.

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, Ostracion, Tetradon, Echinus, Lophius, Solea* and *Polypterus*. Any of the Lung Fishes.
- Amphibia: *Necturus, Proteus, Amphiuma, Salamandra, Amblystoma, Axolotl larva, Alytes, Bufo, Rana*.
- Reptilia: *Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhlops, Python, Eryx, Ptyas, Bungarus, Naja, Hydrus, Viper, Crocodilus, Gavialis, Chelone* (Turtle) and *Testudo* (Tortoise).
- Aves: *Casuarus, Arden, Anas, Milvus, Pavo, Eudynamis, Tyto, Alcedo, Halcyon*
- Mammalia: *Ornithorhynchus, Echidna, Didelphis, Macropus, Loris, Macaque, Hystrix, Funambulus, Felix, Panthera, Canis, Herpestes, Capra, Pteropus*.

2. Internal anatomy of the following animals:

(i) Computer simulated model/study of :

(a) *Herdmania*: General anatomy

(b) *Rat*: Digestive, arterial, venous and urinogenital systems.

(c) *Hemidactylus*: Digestive, arterial, venous and urinogenital systems

(ii) Demonstration & Study of Internal Anatomy of locally available fish (*Labeo*). Digestive and reproductive systems, cranial nerves, Ear ossicle

3. Study of the skeleton of *Scoliodon*, *Labeo*, *Rana* (Frog), *Varanus*, Pigeon or Gallus and *Oryctolagus*/rat, Palates of birds, skulls of dog & rabbit.
4. Study of the following prepared slides:  
Tornaria larva, T.S. *Amphioxus* (through different regions). Oikopleura, Histology of rat (compound tissues), different types of scales.
5. Make permanent stained preparations of the following:  
*Salpa*, Spicules, and Pharynx of *Herdmania*, *Amphioxus*, Cycloid scales
6. Field Visit to National Park or Zoo.

### **GUIDELINES/INSTRUCTIONS FOR PRACTICAL EXAMINATION (SEMESTER-II)**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours (One session)**

**Note : Following exercises will be set in the examination as per marks assigned for each.**

<b>Exercise</b>	<b>Marks allotted</b>
1. Internal Anatomy – One (Labelled diagram)	03
2. Permanent Slide Preparation - one (Staining, identification, sketch)	06
3. Museum specimens – Six (Identification and classification)	12 (6x2)
4. Bone – Two pieces (Identification with reasons)	05
5. Permanent slides – Two (Identification with reasons)	04 (2x2)
6. Practical record, Field report and slides	05
7. Viva-voce	05

<b>Semester-II Core Course-Zoology</b>													
<b>B-ZOO-201</b>				<b>Animal Diversity of Chordates from Protochordata to Pisces</b>									
<b>B-ZOO-202</b>				<b>Animal Diversity of Chordates from Amphibia to Mammalia</b>									
<b>B-ZOO-203</b>				<b>Zoology Practical Based on B-ZOO-201 &amp; B-ZOO-202</b>									
<b>CO#</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO201.1.</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO201.2.</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO202.1.</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>
<b>CO202.2.</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO203.1.</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>
<b>CO203.2.</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Average</b>	<b>2.00</b>	<b>1.66</b>	<b>2.00</b>	<b>1.66</b>	<b>1.66</b>	<b>2.33</b>	<b>1.83</b>	<b>2.83</b>	<b>2.5</b>	<b>2.5</b>	<b>2.83</b>	<b>2.83</b>	<b>2.5</b>

## Scheme of B.Sc. Zoology III & IV Semester

<b>Semester</b>	<b>Course</b>	<b>Paper(s)</b>	<b>Credits</b>	<b>Internal marks</b>	<b>External Marks</b>	<b>Total</b>	<b>Exam Duration</b>
III	CC-Zoology	B-ZOO-301	3	15	60	75	3 hrs.
		B-ZOO-302	3	15	60	75	3 hrs.
		B-ZOO-303	2	10	40	50	4 hrs.
IV	CC- Zoology	B-ZOO-401	3	15	60	75	3 hrs.
		B-ZOO-402	3	15	60	75	3 hrs.
		B-ZOO-403	2	10	40	50	4 hrs.

**B.Sc. Zoology Semester-III**  
**SYLLABUS**  
**B-ZOO-301**  
**Animal Biochemistry and Physiology**

**Credits: 3**

**External Marks: 60**

**Internal Assessment: 15**

**Time allotted: 3 Hours**

**Objective:** To make students understand the structure and classification of bio-molecules, dynamics of enzymes and concept of physiology of bones and muscles.

**Course Outcomes:**

CO301.1. Students will be able to understand and explain the mechanism that works to keep the human body functioning.

CO301.2. Students will be able to explain the interaction and interdependence of physiological and biochemical processes.

**Note:** Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of short answer type 6 parts (2.0 marks each) covering the entire syllabus. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks.

**SECTION - A**

1. Introduction, Classification, Structure, function and general properties of proteins, carbohydrates and lipids.
2. Nomenclature, Classification and mechanisms of enzyme action; **Energy Kinetics of enzymes, factors affecting enzyme activity, inhibition of enzymes**
3. Transport through biomembranes (Active and Passive), **osmotic pressure, hydrogen ion concentration and buffers**

**SECTION - B**

4. **Nutrition:** Nutritional components: Carbohydrates, fats, lipids, Vitamins and Minerals; Types of nutrition & feeding, Digestion of dietary constituents, viz. lipids, proteins, carbohydrates & nucleic acids; symbiotic digestion, **lactose intolerance, Physico- chemical mechanism of Absorption** of nutrients & assimilation; **control of secretion of digestive juices.**
5. **Muscles:** Types of muscles, ultra-structure of skeletal muscle, **neuromuscular junction.** Bio-chemical and physical events during muscle contraction, single muscle twitch, tetanus, muscle fatigue, muscle tone, oxygen debt., Cori's cycle, single unit smooth muscles, their physical and functional properties.
6. **Bones:** Structure and types, classification, bone growth and resorption, effect of ageing on Skeletal system and bone disorders

## B.Sc. Zoology Semester-III

### SYLLABUS

#### B-ZOO-302

#### Mammalian Physiology and endocrinology

**Credits: 3**

**External Marks: 60**

**Internal Assessment: 15**

**Time allotted: 3 Hours**

**Objective:** To impart the fundamental knowledge of physiology and endocrine system of animals

**Course Outcomes:**

CO302.1. It will make the students understand the appropriate functioning of each body system in animals and mechanism of working.

CO302.2. Students will be able to explain the mechanism of action of hormones and related molecules involved in various physiological processes

**Note:** Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of short answer type 6 parts (2.0 marks each) covering the entire syllabus. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks.

#### SECTION - A

1. **Circulation:** Origin, conduction and regulation of heart beat; cardiac cycle, electrocardiogram, cardiac output, fluid pressure and flow pressure in closed and open circulatory system; Composition and functions of blood & lymph; Mechanism of coagulation of blood, coagulation factors; anticoagulants, haemopoiesis.
2. **Respiration:** Exchange of respiratory gases, transport of gases, lung air volumes, oxygen dissociation curve of haemoglobin, Bohr's effect, Hamburger's phenomenon (Chloride shift), control / regulation of respiration (**peripheral reflexes, chemical control and Higher centres**), **Myoglobin**.
3. **Excretion:** Patterns of excretory products viz. Amonotelic, ureotelic uricotelic, ornithine cycle (Kreb's – Henseleit cycle) for urea formation in liver; Urine formation, **composition of Urine**, counter-current mechanism of urine formation, osmoregulation, micturition.

#### SECTION - B

4. **Neural Integration:** Nature, origin and propagation of nerve impulse alongwith medullated & non-medullated nerve fibre, conduction of nerve impulse across synapse, **synaptic delay and synaptic fatigue, Neurotransmitter**.
5. **Chemical integration of Endocrinology:** **Structure, chemical nature** and mechanism of **peptide and steroid hormone** action; physiology of hypothalamus, pituitary, thyroid, parathyroid, adrenal, pancreas and gonads, **Hormonal disorders**.
6. **Reproduction:** Spermatogenesis, Capacitation of spermatozoa, ovulation, formation of corpus luteum, oestrous-anoestrous cycle, Menstrual cycle in human, fertilization, implantation and gestation, **parturition**

**B.Sc. Zoology Semester-III**  
**SYLLABUS**  
**B-ZOO-303**  
**(Zoology Practical Based on B-ZOO-301 & B-ZOO-302)**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours**

**Objective:** To develop practical knowledge of various physiological experiments and their role in various biological processes

**Course Outcomes:**

CO303.1. Students will be able to understand and perform biological and analytical techniques in labs to explain biological activities

CO303.2. Will be able to perform experiments of haematology like DLC, Blood group testing etc.

1. Qualitative tests for identification of simple sugars, disaccharides and polysaccharides.
2. Study of human salivary amylase activity: Effect of temperature, pH, Concentration.
3. Estimation of abnormal constituents of urine (Albumin, sugar, ketone bodies).
4. Use of Kymograph unit & respirometer.
5. Haematin crystal preparation.
6. Estimation of Hb.
7. DLC of Man/RBC count/WBC count.
8. Study of permanent slides of endocrine glands
9. Blood antigens and antibodies: Blood group testing

**GUIDELINES/INSTRUCTIONS FOR PRACTICAL EXAMINATION (SEMESTER-III)**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours (One session)**

**Note : Following exercises will be set in the examination as per marks assigned for each.**

	<b>Exercise</b>	<b>Marks allotted</b>
1.	Qualitative tests for (Sugars, disaccharides and polysaccharides)	04
2.	Biochemical exercise	06
3.	Haematin crystal Exercise	08
4.	Blood exercise	08
5.	Permanent slides – Two (Identification with reasons)	04 (2x2)
6.	Practical record and slides	05
7.	Viva-voce	05

<b>Semester-III</b>													
<b>Core Course-Zoology</b>													
<b>B-ZOO-301</b>				<b>Animal Biochemistry and Physiology</b>									
<b>B-ZOO-302</b>				<b>Mammalian Physiology and endocrinology</b>									
<b>B-ZOO-303</b>				<b>Zoology Practical Based on B-ZOO-301 &amp; B-ZOO-302</b>									
<b>CO#</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO301.1.</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>0.5</b>	<b>3</b>
<b>CO301.2.</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>0.5</b>	<b>3</b>
<b>CO302.1.</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>0.5</b>	<b>3</b>
<b>CO302.2.</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>0.5</b>	<b>3</b>
<b>CO303.1.</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>3</b>
<b>CO303.2.</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>
<b>Average</b>	<b>2.33</b>	<b>1.16</b>	<b>1.66</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2.66</b>	<b>2.66</b>	<b>2.83</b>	<b>1.16</b>	<b>0.6</b>	<b>2.83</b>

**B.Sc. Zoology Semester-IV**  
**SYLLABUS**  
**B-ZOO-401**  
**Cell Biology**

**Credits: 3**

**External Marks: 60**

**Internal Assessment: 15**

**Time allotted: 3 Hours**

**Objective:** To apprise students about the dynamics of cell and biology of cancer

**Course Outcomes:**

CO401.1. Students will understand the nature and basic concept of cell biology and genetics.

CO401.2. Students will be able to apply the knowledge of internal structure of cell and their role in many metabolic function of organism

**Note:** Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of short answer type 6 parts (2.0 marks each) covering the entire syllabus. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks.

**SECTION - A**

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. **Golgi complex:** Structure, associated enzymes and role of golgi-complex in animal cell.
5. **Ribosomes:** Types, biogenesis and role in protein synthesis.
6. **Lysosomes:** Structure, enzymes and their role; polymorphism
7. **Mitochondria:** Mitochondrial DNA as semiautonomous body, biogenesis, mitochondrial enzymes (only names), role of mitochondria.

**SECTION – B**

8. **Cytoskeleton:** Microtubules, microfilaments, centriole and basal body.
9. Cilia and Flagella
10. **Ultrastructure and functions of Nucleus:** Nuclear membrane, nuclear lamina, nucleolus, fine structure of chromosomes, nucleosome concept and role of histones, euchromatin and heterochromatin, lampbrush chromosomes and polytene chromosomes.
11. Mitosis and Meiosis (Cell reproduction)
12. Brief account of causes of cancer.
13. An elementary idea of cellular basis of Immunity.

**B.Sc. Zoology Semester-IV**  
**SYLLABUS**  
**B-ZOO-402**  
**Animal Genetics**

**Credits: 3**

**External Marks: 60**

**Internal Assessment: 15**

**Time allotted: 3 Hours**

**Objective:** To apprise the students about various concepts of genetics and its importance in human health

**Course Outcomes:**

CO402.1. Students will have acquaintance with the basic causes associated with inborn errors and other genetic disorder and will be able to give counseling to general people

CO402.2. Students will be able to explain the concept of gene interactions, Sex linked inheritance and their role in medical sciences.

**Note:** Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of short answer type 6 parts (2.0 marks each) covering the entire syllabus. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks.

**SECTION - A**

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.
4. **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.
5. **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
6. **Extra chromosomal and cytoplasmic inheritance:**
  - i) Kappa particles in Paramecium
  - ii) Shell coiling in snails
  - iii) Milk factor in mice

**SECTION - B**

7. **Multiple allelism:** Eye colour in Drosophila; A, B, O blood group in man.
8. **Human genetics:** Human karyotype, Chromosomal abnormalities involving autosomes and sex chromosomes, monozygotic and dizygotic twins.
9. **Inborn errors of metabolism** (Alcaptonuria, Phenylketonuria, Albinism, sickle-cell anaemia).
10. **Nature and function of genetic material:** Structure and type of nucleic acids; Replication and Protein synthesis.
11. Eugenics, eugenics and euphenics; 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)
12. **Applied genetics:** genetic counseling, pre-natal diagnosis, DNA-finger printing, transgenic animals.

**B.Sc. Zoology Semester-IV**  
**SYLLABUS**  
**B-ZOO-403**  
**(Zoology Practical Based on B-ZOO-401 & B-ZOO-402)**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours**

**Objective:** To develop the laboratory skill of preparing slides of cell divisions and genetic basis of karyotyping

**Course Outcomes:**

CO403.1. Students will be able to conduct the morphometric analysis of chromosomes and demonstrate cell division

CO403.2. Students will be able to identify variations in human chromosomes

**Cell biology and Genetics:**

1. Cell division: Prepared slides of stages of mitosis and meiosis.
2. Salivary gland and polytene chromosomes of *Drosophila*/ *Chironomus*.
3. Temporary squash preparations of onion root tip / grasshopper testis for the study of mitosis using acetocarmine stain.
4. Blood antigens and antibodies: Blood group testing
5. Preparation of Human Karyotype and Idiogram
5. Barr Body and Drum stick slide Preparations

**GUIDELINES/INSTRUCTIONS FOR PRACTICAL EXAMINATION (SEMESTER-IV)**

**Credits: 2**

**External Marks: 40**

**Internal Assessment : 10**

**Time allotted: 4 Hours (One session)**

**Note : Following exercises will be set in the examination as per marks assigned for each.**

	<b>Exercise</b>	<b>Marks allotted</b>
1.	Preparation of chromosome slide (root tip / grasshopper testis)	10
2.	Karyotype/Idiogram preparation	05
3.	Barr Body/Drum stick slide preparation	10
4.	Blood antigen/antibody testing	05
5.	Practical record and slides	05
6.	Viva-voce	05

<b>Semester-IV Core Course-Zoology</b>													
<b>B-ZOO-401</b>				<b>Cell Biology</b>									
<b>B-ZOO-402</b>				<b>Animal Genetics</b>									
<b>B-ZOO-403</b>				<b>Zoology Practical Based on B-ZOO-401 &amp; B-ZOO-402</b>									
<b>CO#</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO401.1.</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>
<b>CO401.2.</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>
<b>CO402.1.</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>
<b>CO402.2.</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>
<b>CO403.1.</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>
<b>CO403.2.</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>
<b>Average</b>	<b>2.66</b>	<b>1.16</b>	<b>1.83</b>	<b>1.5</b>	<b>1.83</b>	<b>1</b>	<b>2.5</b>	<b>2.5</b>	<b>1.33</b>	<b>1.33</b>	<b>1.33</b>	<b>1</b>	<b>2</b>

## Scheme of B.Sc. Zoology V & VI Semester

Semester	Course	Paper(s)		Credits	Internal marks	External Marks	Total	Exam Duration
		Scheme (i)	Scheme (ii)					
V	DSE* <b>Zoology</b>	B-ZOO-501(i)	B-ZOO-501(ii)	2	10	40	50	3 hrs.
		B-ZOO-502 (i)	B-ZOO-502 (ii)	2	10	40	50	3 hrs.
		B-ZOO-503(i)	B-ZOO-503(ii)	2	10	40	50	4 hrs.
VI	DSE* <b>Zoology</b>	B-ZOO-601(i)	B-ZOO-601(ii)	2	10	40	50	3 hrs.
		B-ZOO-602 (i)	B-ZOO-602 (ii)	2	10	40	50	3 hrs.
		B-ZOO-603(i)	B-ZOO-603(ii)	2	10	40	50	4 hrs.

**\*Students have to opt one option/scheme of DSE Zoology either (i) or (ii)**

**B.Sc. Zoology Semester-V**  
**SYLLABUS**  
**B-ZOO-501 (i)**  
**Ecology and Environment**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 3 Hours**

**Objective:** To apprise the students about interaction between organisms and environment and exchange of nutrients within the ecosystem.

**Course Outcomes:**

CO501(i).1. Students will be able to describe the various biological interactions and relation between abiotic and biotic factors.

CO501(i).2. Students will be able to understand the causes of different types of pollution and their management strategies.

Note: Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of 8 parts (1.0 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks.

**SECTION - A**

1. **Basic concepts of ecology:** Definition, significance. Concepts of habitat and ecological Niche.
2. **Factors affecting environment:** Abiotic factors (light-intensity, quality and duration), temperature, humidity, wind, Rainfall, topography; edaphic factors; Biotic factors.
3. Introduction to major ecosystems of the world.
4. **Ecosystem:** Concept, components, properties and functions; Ecological energetics and energy flow-food chain, food web, trophic structure; ecological pyramids, concept of productivity.
5. **Biogeochemical cycles:** Concept, reservoir pool, gaseous cycles and sedimentary cycles.

**SECTION - B**

6. **Population:** Growth and regulation.
7. Concept of biodiversity and conservation of natural resources.
8. Migration in fishes and birds.
9. Parental care in animals.
10. **Population interactions:** Competition, predation, parasitism, commensalisms and mutualism.
11. **Environmental Pollution:** Air, water, soil and management strategies.

**B.Sc. Zoology Semester-V**  
**SYLLABUS**  
**B-ZOO-502 (i)**  
**Evolution and Developmental Biology**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 3 Hours**

**Objectives:**

1. To make students aware how species evolve and the theory of natural selection, population dynamics.
2. To understand how organisms maintain gametic population and understand fertilization process.

**Course Outcomes:**

- CO502(i).1. This course will enable the students to understand the evolution of life on earth and theories in evolutionary biology.
- CO502(i).2. Students will be able to describe the events that lead up to fertilization, its stages and cellular mechanisms for gastrulation, and embryonic development.

Note: Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of 8 parts (1.0 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks.

**SECTION - A**

1. Origin of life.
2. Concept and evidences of organic evolution.
3. Theories of organic evolution.
4. Concept of micro, macro-and mega-evolution.
5. Concept of species
6. Phylogeny of horse.
7. Evolution of man.

**SECTION - B**

8. Historical perspectives, aims and scope of developmental biology.
9. Generalized structure of mammalian ovum & sperm, spermatogenesis and Oogenesis, fertilization, parthenogenesis, different types of eggs and patterns of cleavage.
10. Process of blastulation and fate-map construction in frog and chick.
11. Gastrulation in frog and chick upto the formation of three germinal layers.
12. Elementary knowledge of primary organizers.
13. Elementary knowledge of extra embryonic membranes.
14. Concepts of competence, determination and differentiation.
15. Concept of regeneration.

**B.Sc. Zoology Semester-V**  
**SYLLABUS**  
**B-ZOO-503 (i)**  
**(Zoology Practical Based on B-ZOO-501(i) & B-ZOO-502(i))**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours**

**Objective:** To impart practical knowledge to the students to perform experiments to identify stages of chick development, preparation of histological slides and analyse water quality

**Course Outcomes:**

CO503(i).1. Students will be able to prepare and identify the histological slides of various organs and different stages of developing embryo

CO503(i).2. Learners will be and will able to analyze the level of pollution and quality of water in any aquatic system.

1. Preparation of permanent/temporary slides of developmental stages of frog/mosquito.
2. Study of Life History of Frog.
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. **Histology:** Preparation of permanent histological slides of testis, ovary, kidney, intestine, liver of rat (H & E staining).
6. Chemical analysis of pond water and soil ecosystem for pH, dissolved oxygen, BOD, free CO<sub>2</sub>, nitrates, phosphates and chlorides.

**GUIDELINES/INSTRUCTIONS FOR PRACTICAL EXAMINATION (SEMESTER-V)**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours (One session)**

**Note : Following exercises will be set in the examination as per marks assigned for each.**

	<b>Exercise</b>	<b>Marks allotted</b>
1.	Preparation of Chick window / W.M. of Chick embryo	10
2.	Permanent preparation of histological slides (Staining, mounting, identification & sketch)	10
3.	Permanent slides – Two (Identification with reasons)	04 (2x2)
4.	Chemical analysis of water/soil	06
5.	Practical record and slides	05
6.	Viva-voce	05

**Semester-V**  
**Discipline Specific Elective (DSE) –Zoology (i)**

<b>B-ZOO-501(i)</b>				<b>Ecology and Environment</b>									
<b>B-ZOO-502(i)</b>				<b>Evolution and Developmental Biology</b>									
<b>B-ZOO-503(i)</b>				<b>Zoology Practical Based on B-ZOO-501(i) &amp; B-ZOO-502(i)</b>									
<b>CO#</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO501(i).1.</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>
<b>CO501(i).2.</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO502(i).1.</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>
<b>CO502(i).2.</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>
<b>CO503(i).1.</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>
<b>CO503(i).2.</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>
<b>Average</b>	<b>2.5</b>	<b>1</b>	<b>1.33</b>	<b>1.33</b>	<b>2</b>	<b>2.5</b>	<b>2.33</b>	<b>2.33</b>	<b>1.5</b>	<b>1.66</b>	<b>1.33</b>	<b>1.5</b>	<b>2</b>

**B.Sc. Zoology Semester-V**  
**SYLLABUS**  
**B-ZOO-501 (ii)**  
**Applied Zoology**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 3 Hours**

**Objective:** To identify various methodology and perspectives of applied branches of zoology for the possibilities of self-employment and for the use of knowledge in human welfare and food security.

**Course Outcomes:**

CO501(ii).1. Students will be able to identify different species and casts of honeybees and species of silkworm.

CO501(ii)2. Students will be able to use the tools and techniques used in apiculture, sericulture, aquaculture, piggery poultry and leather Industry and capabilities to initiate startups will develop

Note: Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of 8 parts (1.0 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks.

**SECTION - A**

1. Apiculture: History and Introduction; Honey bee and kinds; Social organization and colony nests; Lifecycle; Honey composition, quality and importance; Bee keeping, selection, methods, products.
2. Sericulture: Silkworm moth species and their life cycle; Silk composition, kind and uses; Rearing of silkworm, silk reeling, twisting and weaving; Diseases and pests of silkworm
3. Prawn Culture: Introduction to Prawns, species; Prawn Farming methods, processing and preservation of prawns.
4. Pearl Culture: Historical Background, species; Pearl formation, composition, quality and commercial value, Artificial culturing, synthetic pearl types and their manufacturing, methods of harvesting.

**SECTION - B**

5. Pisciculture: Economically important fresh water and marine fishes; Fish culture, Fish farming technologies, Problems of seed collection from natural resources, Induced breeding methods, Products and by products from pisciculture
6. Poultry: Nomenclature and breeds of poultry birds; Egg structure and quality, nutritive values, factors affecting size and egg processing, Poultry products and by products
7. Fur and Leather Industry: Fur producing animals; Fur farming, dressing, processing and dyeing, Fur industry in India; Animals of leather industry, processing of skin, flaying, curing salting and tanning.
8. Piggery and other Utilities of Animals: Characteristics of swine and important breeds, Products and by products; Pharmaceuticals from animals; Uses of animals in vaccine production

**B.Sc. Zoology Semester-V**  
**SYLLABUS**  
**B-ZOO-502 (ii)**  
**Recent techniques in Zoology**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 3 Hours**

**Objective:** To acquaint students about the biological processes at chemical, biochemical and molecular level to perform wide range of analytical techniques to explore biological activities.

**Course Outcomes:**

CO502(ii).1. Students will be able to use and explain the tools and techniques available for studying biochemical and biophysical nature of life.

CO502(ii).2. Students will be able to carry out small project work and research based on these techniques

Note: Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of 8 parts (1.0 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks.

**SECTION - A**

1. **Centrifugation:** Basic principles, theory and applications of preparative and analytical centrifugation, Rotor types, sedimentation co-efficient and care of rotors.
2. **Chromatography:** Theory, principle and application of column, paper, thin layer, ion-exchange affinity chromatography.
3. **Spectroscopy:** Lambert Beer's law, theory, principles and instrumentation of single and double beam UV/Visible spectroscopy.
4. **Electrophoresis:** Theory and application of SDS-PAGE and Agarose gel electrophoresis.

**SECTION - B**

5. **Radioisotopic techniques:-** Basic concepts of radioisotopy, Theory and applications of Geiger-Muller tube, solid and liquid scintillation counters, primary and secondary fluors, safety rules for radioisotopic studies, biological applications.
6. **Microscopy-** Principles and techniques of Microscopy, Light Microscopy, Phase contrast, Fluorescence, Stereomicroscope and Electron Microscope (SEM and TEM). Principles and uses of pH Meter, Calorimeter, Microtome.
7. **PCR-**General principle, working and its applications.

**B.Sc. Zoology Semester-V**  
**SYLLABUS**  
**B-ZOO-503 (ii)**  
**(Zoology Practical Based on Zoo-501(ii) & Zoo-502(ii))**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours**

**Objective:** To provide the students with the knowledge about the equipments, their working and use for water analysis.

**Course Outcomes:**

CO503(ii).1. Students will develop skills in basic laboratory techniques and understand the principles in biology.

CO503(ii).2. Students will be capable to apply the scientific method to the process of experimentation.

1. Demonstration of safety rules in laboratory like proper handling of equipments, specimens and disposal of syringes, needles, etc. Use of autoclave, centrifuge and spectrophotometer. Parts of microscope, its functioning and care.
2. Cleaning and sterilization of glasswares using hot air oven, autoclave, etc.
3. Life history stages of honeybee.
4. Morphology of Carp, Cat fish and Perch.
5. Preparation of permanent slides of phytoplankton and zooplanktons which constitute the food of commercial fishes, their identification and study of important characters.
6. Electrophoresis techniques-preparations of gels, media, buffers and demonstration of gel electrophoresis.
7. Perform thin layer chromatography for the separation of compounds.
8. Estimation of following chemical parameters of pond water:- Temperature, pH, Dissolved oxygen, Total dissolved solids, Hardness.
9. Visit to apiary/fish pond and fish market/sericulture unit/Prawn farm and preparation of report.

**GUIDELINES/INSTRUCTIONS FOR PRACTICAL EXAMINATION (SEMESTER-V)**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours (One session)**

**Note : Following exercises will be set in the examination as per marks assigned for each.**

	<b>Exercise</b>	<b>Marks allotted</b>
1.	Preparation of permanent mount (Staining, Mounting, identification and sketch)	10
2.	Spots (5) (Fish, Stage of honey bee) (Identification with reasons)	10 (2x5)
3.	Write up for any one experiment (Electrophoresis, TLC)	04
4.	Chemical analysis of water/soil	06
5.	Practical record, Field report and slides	05
6.	Viva-voce	05

<b>Semester-V</b>													
<b>Discipline Specific Elective (DSE) –Zoology (ii)</b>													
<b>B-ZOO-501 (ii)</b>			<b>Applied Zoology</b>										
<b>B-ZOO-502 (ii)</b>			<b>Recent techniques in Zoology</b>										
<b>B-ZOO-503 (ii)</b>			<b>Zoology Practical Based on B-ZOO-501(ii) &amp; B-ZOO-502(ii)</b>										
<b>CO#</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO501(ii).1.</b>	2	2	1.5	2	2.5	2	2.25	3	3	2.5	2.5	2.75	3
<b>CO501(ii).2.</b>	2.5	2.5	2	2.75	2.5	3	2.75	2.75	3	2.5	2.75	2	2.5
<b>CO502(ii).1.</b>	3	2.5	2.5	3	3	2.5	2.5	3	2.75	2.75	2.5	2	3
<b>CO502(ii).2.</b>	2	2	2.75	2.5	2.5	3	2.5	2.5	3	2.5	2.5	2.75	3
<b>CO503(ii).1.</b>	2	2.25	2	2.25	2.5	2.75	3	3	3	2.75	2.25	2.5	3
<b>CO503(ii).2.</b>	2.75	2.5	2	2.5	2.5	3	2.5	2.75	3	3	2.5	2.75	3
<b>Average</b>	2.37	2.29	2.12	2.5	2.5	2.7	2.58	2.83	2.95	2.66	2.5	2.45	2.91

**B.Sc. Zoology Semester-VI**  
**SYLLABUS**  
**B-ZOO-601 (i)**  
**Aquaculture**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 3 Hours**

**Objective:** To apprise the students with the necessary basic information about fishery and aquaculture and to provide the technical and general knowledge necessary for competent fisheries management.

**Course Outcomes:**

CO601(i).1. Students will understand concepts of fisheries, fishing tools and site selection for a fishery/aquaculture industry

CO601(i).2. Students will be capable to undertake the small Aqua culture projects and will be able to explain induced breeding and post harvesting techniques.

Note: Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of 8 parts (1.0 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks

**SECTION - A**

1. **Introduction to world fisheries:** Production, utilization and demand.
2. **Fresh Water fishes of India:** River system, reservoir, pond, tank fisheries; captive and culture fisheries, cold water fisheries.
3. Fishing crafts and gears.
4. Fin fishes, Crustaceans, Molluscs and their culture.

**SECTION - B**

5. **Seed production:** Natural seed resources – its assessment, collection, Hatchery production
6. **Nutrition:** Sources of food (Natural, Artificial) and feed composition (Calorie and Chemical ingredients).
7. **Field Culture:** Culture, Culture in Pond-running waters; recycled water culture, cage culture; poly culture.
8. **Culture technology:** Induced breeding in fishes, techniques and hormones; Fish Biotechnology (Transgenesis and Cryopreservation of gametes).

**B.Sc. Zoology Semester-VI**  
**SYLLABUS**  
**B-ZOO-602 (i)**  
**Pest Management**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 3 Hours**

**Objective:** To impart knowledge for the identification of the different species of insect pests and learning of pest management techniques with the understanding of practical application of pesticides and their proper use.

**Course Outcomes:**

CO602(i).1. Students will be able to understand ecologically important and harmful insects.

CO602(i).2. Will be able to recognize ecology and morphology of insect pest and the nature of damage done by them.

Note: Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of 8 parts (1.0 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks

**SECTION - A**

Study of important insect pests of crops and vegetables:

1. **Sugarcane:** (With their systematic position, habits and nature of damage cause. Life cycle and control of *Pyrilla perpusilla* only).
  - (a) Sugarcane leaf-hopper (*Pyrilla perpusilla*)
  - (b) Sugarcane Whitefly (*Aleurolobus barodensis*)
  - (c) Sugarcane top borer (*Sciropophaga nivella*)
  - (d) Sugarcane root borer (*Emmalocera depresella*)
  - (e) Gurdaspur borer (*Bissetia steniellus*)
2. **Cotton:** (With their systematic position, habits and nature of damage caused. Life cycle and control of *Pectinophora gossypiella*)
  - (a) Pink bollworm (*Pectinophora gossypiella*)
  - (b) Red cotton bug (*Dysdercus cingulatus*)
  - (c) Cotton grey weevil (*Myloccerus undecimpustulatus*)
  - (d) Cotton Jassid (*Amrasca devastans*)
3. **Wheat:** Wheat stem borer (*Sesamia inferens*) with its systematics position, habits, nature of damage caused. Life cycle and control.
4. **Paddy:** (With their systematic position, habits and nature of damage caused. Life cycle and control of *Leptocorisa acuta*)
  - (a) Gundhi bug (*Leptocorisa acuta*)
  - (b) Rice grasshopper (*Hieroglyphus banian*)
  - (c) Rice stem borer (*Scirpophaga incertullus*)
  - (d) Rice Hispa (*Diceladispera armigera*)
5. **Vegetables:** (Their systematics position, habits and nature of damage caused. Life cycle and control of *Aulacophora faveicollis*)
  - (a) *Raphidopalpa faveicollis* – The Red pumpkin beetle.
  - (b) *Dacus cucurbitas* – The pumpkin fruit fly.
  - (c) *Tetranychus tecarius* – The vegetable mite.
  - (d) *Epilachna* – The Hadda beetle

**SECTION - B**

6. **Stored grains:** (Their systematic position, habits and nature of damage caused. Life cycle and control of *Trogoderma granarium*)
  - (a) Pulse beetle (*Callosobruchus maculatus*)
  - (b) Rice weevil (*Sitophilus oryzae*)
  - (c) Wheat weevil (*Trogoderma granarium*)
  - (d) Rust Red Flour beetles (*Tribolium castaneum*)
  - (e) Lesser grain borer (*Rhizopertha dominica*)
  - (f) Grain & Flour moth (*Sitotroga cerealella*)
  
7. **Insect control:** Biological control, its history, requirement and precautions and feasibility of biological agents for control.
  
8. **Chemical control:** History, Categories of pesticides, important pesticides from each category to pests against which they can be used, insect repellants and attractants.
  
9. Integrated pest management.
  
10. Important bird and rodent pests of agriculture & their management.

## B.Sc. Zoology Semester-VI

### SYLLABUS

#### B-ZOO-603 (i)

(Zoology Practical Based on B-ZOO-601(i) & B-ZOO-602(i))

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours**

**Objective:** To develop observational, analytical and Evaluation skills related to B-ZOO -601 and B-ZOO -602 paper

**Course Outcomes:**

CO603(i).1. Students will able to identify insect pests and the nature of damage caused by them

CO603(i).2. They will also understand the ecology and life history of these insect pests

- External morphology, identification marks, nature of damage and host of the following pests:-
  - Sugarcane** : Sugarcane leaf-hopper, Sugarcane whitefly, Sugarcane top borer, Sugarcane root borer, Gurdaspur borer (any two).
  - Cotton** : Red Cotton bug
  - Wheat** : Wheat stem borer
  - Paddy** : Gundhi bug, Rice grasshopper, Rice stem borer, Rice hispa (any one).
  - Vegetables:** *Aulocophora faveicollis*, *Dacus cucurbitas*, *Tetranychus tecarius*, *Epilachna* (any three).
  - Pests of stored grains:** Pulse beetle, Rice weevil, Grain & Flour moth, Rust-red flour beetle, lesser grain borer (any three).
- Stages of life history of silk moth and honey bee.
- Identification of *Catla*, *Labeo rohita*, *L. calbasu*, *Cirrhinus*, *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*.
- A study of the slides of fish parasites.
- A study of the different types of nets, e.g., cast net, gill net, drift net and drag net.
- A visit to lake/reservoir/fish breeding centre.
- Adaptive modifications in feet and beaks of birds.
- Preparation of permanent/temporary slides for identification of mosquitoes

### GUIDELINES/INSTRUCTIONS FOR PRACTICAL EXAMINATION (SEMESTER-VI)

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours (One session)**

**Note :** Following exercises will be set in the examination as per marks assigned for each.

	<b>Exercise</b>	<b>Marks allotted</b>
1.	Preparation of Mosquito Head Slides and identification	10
2.	Museum specimens/slides – Eight (Identification and classification)	16 (8x2)
3.	Adaptive modification exercise	04
5.	Practical record, Field report and slides	05
6.	Viva-voce	05

**Semester-VI**  
**Discipline Specific Elective (DSE) –Zoology (i)**

<b>B-ZOO-601(i)</b>				<b>Aquaculture</b>									
<b>B-ZOO-602(i)</b>				<b>Pest Management</b>									
<b>B-ZOO-603(i)</b>				<b>Zoology Practical Based on B-ZOO-601(i) &amp; B-ZOO-602(i)</b>									
<b>CO#</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO601(i).1.</b>	<b>3</b>	<b>2.5</b>	<b>3</b>	<b>2.5</b>	<b>2</b>	<b>2.75</b>	<b>2.75</b>	<b>3</b>	<b>2</b>	<b>2.75</b>	<b>2.5</b>	<b>2.5</b>	<b>2.75</b>
<b>CO601(i).2.</b>	<b>3</b>	<b>2.25</b>	<b>3</b>	<b>2.5</b>	<b>2</b>	<b>2.5</b>	<b>2.25</b>	<b>3</b>	<b>2.5</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2.5</b>
<b>CO602(i).1.</b>	<b>2.75</b>	<b>2.5</b>	<b>2.75</b>	<b>2.75</b>	<b>2.5</b>	<b>2.75</b>	<b>2.5</b>	<b>2.75</b>	<b>2</b>	<b>2.75</b>	<b>2.5</b>	<b>2</b>	<b>3</b>
<b>CO602(i).2.</b>	<b>3</b>	<b>2</b>	<b>2.75</b>	<b>2.5</b>	<b>2.5</b>	<b>3</b>	<b>2.75</b>	<b>2.75</b>	<b>2</b>	<b>3</b>	<b>2.75</b>	<b>2</b>	<b>3</b>
<b>CO603(i).1.</b>	<b>2.5</b>	<b>2.75</b>	<b>3</b>	<b>2.5</b>	<b>2</b>	<b>2.75</b>	<b>2.5</b>	<b>2.75</b>	<b>2.5</b>	<b>2.75</b>	<b>2.5</b>	<b>2.75</b>	<b>2.75</b>
<b>CO603(i).2.</b>	<b>3</b>	<b>2.5</b>	<b>3</b>	<b>2.75</b>	<b>2.5</b>	<b>3</b>	<b>2.5</b>	<b>3</b>	<b>2.5</b>	<b>3</b>	<b>2.5</b>	<b>2.5</b>	<b>3</b>
<b>Average</b>	<b>2.87</b>	<b>2.41</b>	<b>2.91</b>	<b>2.58</b>	<b>2.25</b>	<b>2.79</b>	<b>2.54</b>	<b>2.87</b>	<b>2.25</b>	<b>2.87</b>	<b>2.45</b>	<b>2.29</b>	<b>2.83</b>

**B.Sc. Zoology Semester-VI**  
**SYLLABUS**  
**B-ZOO-601 (ii)**  
**Animal Taxonomy**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 3 Hours**

**Objectives:** To understand the nomenclature, taxonomy and preservation of organism, and classifying species into larger groups that have biological meaning.

**Course Outcomes:**

CO601(ii).1. Students will have Knowledge of Taxonomy and be able to recognize the diversity of animals.

CO601(ii).2. Will be able to explain the relationships among the various animals of different phyla, their distribution and interaction with the environment

Note: Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of 8 parts (1.0 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks

**SECTION-A**

**1. Fundamental concepts of Taxonomy**

Introduction to Taxonomy, Application and Importance of Biosystematics in zoology, Cyto taxonomy, Chemo taxonomy, Molecular taxonomy

**2. Zoological Nomenclature**

International code of Zoological Nomenclature (ICZN): ICZN, Binomial and trinomial of classification

**SECTION-B**

**3. Taxonomic Procedures**

Taxonomic collections, preservation, curating and process of identifying  
Taxonomic characters: Morphological, embryologic, cytogenetical,  
biochemical numeral components of classification and Linnaean hierarchy,  
Taxonomic keys- different kinds, their merits and demerits

**4. Species Concept**

Concepts of speciation and Subspeciation  
Potential mode of speciation

**B.Sc. Zoology Semester-VI**  
**SYLLABUS**  
**B-ZOO-602 (ii)**

**Biodiversity Conservation & Wildlife management**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 3 Hours**

**Objective:** To enable the students for basic understanding of animal diversity, its significance in our life and environment.

**Course Outcomes:**

CO602(ii).1. Students will have the knowledge for conservation of our rich natural resources and diversified life forms

CO602(ii).2. Will enable the students to have understanding for protected areas in conserving biodiversity ("biodiversity outcomes" such as population increase, or decreased rate of decline), and to establish mechanisms to maintain such analysis into the future for wildlife management.

Note: Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of 8 parts (1.0 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks

**SECTION-A**

1. Introduction to Animal Diversity
2. Wildlife zones of India
3. Techniques of animal counts (Examples of Tiger count)
4. Conservation of biodiversity: in-situ and ex-situ
5. Concept of Protected Area Systems
6. Important Protected Areas of India (Biosphere reserve, National Park & Wildlife sanctuaries)

**SECTION-B**

7. Red Data Book
8. IUCN Categories of wildlife species
9. Climate change and loss of biodiversity
10. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
11. Wildlife Tourism

**B.Sc. Zoology Semester-VI**  
**SYLLABUS**  
**B-ZOO-603 (ii)**  
**(Zoology Practical Based on B-ZOO-601(ii) & B-ZOO-602(ii))**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours**

**Objective:** To develop observational, analytical and evaluation skills related to the conservation of diversity and to identify the different animals around us.

**Course Outcomes:**

CO603(ii).1. Students will be able to identify the diversity of animals and their taxonomic status

CO603(ii).2. Learners will also develop awareness for the conservation of animal species

1. Study of biodiversity among various vertebrates (Listing of all the animals found in and around your house and also try to find out their Zoological names).
2. Identification and photography of various vertebrate species.
3. Visits to a local animal park or zoo to identify and study the captive fauna and preparation of report.
4. Study of adaptive characteristics of various vertebrates in different climate.
5. Taxonomic key formation and conversion.
6. Study of biodiversity in grassland and pond water by using Shannon -Weiner index.
7. Comparison of two species of birds belonging to same genus (Interspecific difference).

**GUIDELINES/INSTRUCTIONS FOR PRACTICAL EXAMINATION (SEMESTER-VI)**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 4 Hours (One session)**

**Note : Following exercises will be set in the examination as per marks assigned for each.**

	<b>Exercise</b>	<b>Marks allotted</b>
1.	Museum specimens– Eight (Identification and classification)	16 (8x2)
2.	Exercise on Calculation of Species Diversity	08
3.	Adaptive modification exercise/Exercise on Comparison of bird species	06
4.	Practical record, Field report and slides	05
5.	Viva-voce	05

<b>Semester-VI</b>													
<b>Discipline Specific Elective (DSE) –Zoology (ii)</b>													
<b>B-ZOO-601 (ii)</b>				<b>Animal Taxonomy</b>									
<b>B-ZOO-602 (ii)</b>				<b>Biodiversity Conservation &amp; Wildlife management</b>									
<b>B-ZOO-603 (ii)</b>				<b>Zoology Practical Based on B-ZOO-601(ii) &amp; B-ZOO-602(ii)</b>									
<b>CO#</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>CO601(ii).1.</b>	<b>3</b>	<b>2.5</b>	<b>3</b>	<b>2.5</b>	<b>2</b>	<b>2.75</b>	<b>2.5</b>	<b>3</b>	<b>2.5</b>	<b>2.75</b>	<b>2.5</b>	<b>2.5</b>	<b>2.75</b>
<b>CO601(ii).2.</b>	<b>3</b>	<b>2.5</b>	<b>2.5</b>	<b>2.75</b>	<b>2.5</b>	<b>2.75</b>	<b>2.25</b>	<b>3</b>	<b>2.5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2.75</b>
<b>CO602(ii).1.</b>	<b>3</b>	<b>2.5</b>	<b>2.75</b>	<b>3</b>	<b>2.5</b>	<b>3</b>	<b>2.5</b>	<b>2.75</b>	<b>2.75</b>	<b>3</b>	<b>2.5</b>	<b>3</b>	<b>3</b>
<b>CO602(ii).2.</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2.5</b>	<b>3</b>	<b>2.75</b>	<b>2.75</b>	<b>2.75</b>	<b>3</b>	<b>2.75</b>	<b>3</b>	<b>3</b>
<b>CO603(ii).1.</b>	<b>2.5</b>	<b>2.75</b>	<b>2.75</b>	<b>3</b>	<b>2.75</b>	<b>2.5</b>	<b>2.75</b>	<b>2.75</b>	<b>2.5</b>	<b>2.75</b>	<b>3</b>	<b>2.75</b>	<b>3</b>
<b>CO603(ii).2.</b>	<b>3</b>	<b>2.75</b>	<b>3</b>	<b>2.75</b>	<b>2.75</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2.5</b>	<b>3</b>	<b>3</b>	<b>2.5</b>	<b>3</b>
<b>Average</b>	<b>2.91</b>	<b>2.5</b>	<b>2.83</b>	<b>2.83</b>	<b>2.5</b>	<b>2.83</b>	<b>2.62</b>	<b>2.87</b>	<b>2.58</b>	<b>2.91</b>	<b>2.79</b>	<b>2.79</b>	<b>2.91</b>

**B.Sc. Zoology (Semester IV-VI)**

<b>Semester IV-VI</b>	<b>SEC- Zoology</b>	B-ZOO-S1	2	10	40	50	3 hrs.
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**SYLLABUS  
B-ZOO-S1  
Economic Zoology**

**Credits: 2**

**External Marks: 40**

**Internal Assessment: 10**

**Time allotted: 3 Hours**

**Objectives:** The aim of this paper is to impart basic understanding about the role of animals in human life and their economic value *vis-à-vis* animal health and conservation.

**Course Outcomes:**

B-ZOO-S1.1. Awareness about the strategies used for the culture of economically important animals and their applications for human as well as animal welfare.

B-ZOO-S1.2. Students will be able to explain the basic concepts of sericulture, apiculture, lac culture and other animal industries along with economics of pest management techniques.

Note: Nine questions are to be set in all and the candidates are required to attempt five questions including compulsory question. Question 1 is compulsory consisting of 8 parts (1.0 marks each) covering the entire syllabus. Answer to each part should not exceed 20 words. Out of remaining eight, four questions are to be set from each section A & B, possibly splitting them in parts. Candidate is required to attempt four questions, two from each section. All five questions carry equal marks

**SECTION-A**

1. Vertebrate and non vertebrate pest of Sugarcane and Wheat
2. Integrated pest management
3. Cultural control, Physical control, Mechanical control, Chemical control, Biological control, Herbal control and legal control and Pheromones involved in pest management.
4. Insects of Economic Importance : Biology, Control and damage caused by *Helicoverpa armigera*, *Pyrilla perpusilla* and *Papilio demoleus*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*

**SECTION-B**

5. Basics of Apiculture and Sericulture
6. Sericulture : Types of silk, species of silk moth (scientific names), Silkworms and their host plants, mulberry silk worm culture, agricultural aspects of mulberry plant cultivation, extraction and reeling of silk, natural enemies and diseases of silkworm and their control.
7. Apiculture : Species of honey bees in India, life history of *Apis cerana indica*, apiculture techniques, bee products and their uses, natural enemies and diseases of honey bee and their control.
8. Principles of poultry breeding, Management of breeding stock and broilers, Processing and Preservation of eggs, Poultry diseases - Viral, Bacterial, Fungal, Protozoan

**Semester- (IV-VI)**  
**Skill Enhancement Course (SEC) –Zoology**

<b>B-ZOO-S1</b>				<b>Economic Zoology</b>									
<b>CO#</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>B-ZOO-S1.1.</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>B-ZOO-S1.2.</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>
<b>Average</b>	<b>1.5</b>	<b>2</b>	<b>1.5</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2.5</b>	<b>3</b>	<b>2.5</b>	<b>2.5</b>	<b>3</b>	<b>2</b>	<b>2.5</b>