**KURUKSHETRA UNIVERSITY**

**KURUKSHETRA**

**Scheme of Examination and Syllabus for**

**Under-Graduate Programme**

**Course: Zoology**

**Under Multiple Entry-Exit, Internship and CBCS-LOCF in accordance to NEP-2020 w.e.f. 2022-23 (in phased manner)**

**KURUKSHETRA UNIVERSITY, KURUKSHETRA**

**Scheme of Examination for Under-Graduate Programme**

**Under Multiple Entry-Exit, Internship and CBCS-LOCF in accordance to NEP-2020**

**w.e.f. 2022-23 (in phased manner), Course: Zoology**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Semester** | **Course** | **Paper(s)** | **Nomenclature of Paper** | **Credits** | **Internal marks** | **External Marks** | **Total**  **Marks** | **Exam**  **Duration** | **Hours/**  **Week** |
| Sem-1 | **CC-1**  **Zoology** | B-ZOO-N101 | Animal Diversity of Non-Chordates from Protozoa to Aschelminthes | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N102 | Animal Diversity of Non-Chordates from Annelida to Hemichordata | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N103 | Practical based on B-ZOO-N101 & B-ZOO-N102 | 2 | 25 | 25 | 50 | 4 hrs. | 4 |
| Sem-2 | **CC-2**  **Zoology** | B-ZOO-N201 | Animal Diversity of Chordates from Protochordata to Pisces | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N202 | Animal Diversity of Chordates from Amphibia to Mammalia | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N203 | Practical based on B-ZOO-N201 & B-ZOO-N202 | 2 | 25 | 25 | 50 | 4 hrs. | 4 |
| Sem-3 | **CC-3**  **Zoology** | B-ZOO-N301 | Animal Biochemistry and Physiology | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N302 | Mammalian Physiology and endocrinology | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N303 | Practical based on B-ZOO-N301 & B-ZOO-N302 | 2 | 25 | 25 | 50 | 4 hrs. | 4 |
| Sem-4 | **CC- 4**  **Zoology** | B-ZOO-N401 | Cell Biology | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N402 | Animal Genetics | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N403 | Practical based on B-ZOO-N401 & B-ZOO-N402 | 2 | 25 | 25 | 50 | 4 hrs. | 4 |
| Sem-5  **(For Honors only)** | **CC-5**  **Zoology** | **B-ZOO-N501** | **Molecular Biology** | **2** | **25** | **25** | **50** | **3 hrs.** | **2** |
| **B-ZOO-N502** | **Recent techniques in Zoology** | **2** | **25** | **25** | **50** | **3 hrs.** | **2** |
| **B-ZOO-N503** | **Practical based on B-ZOO-N501 & B-ZOO-N502** | **2** | **25** | **25** | **50** | **4 hrs.** | **4** |
| Sem-5  **Choose one DSE from given options of Major subjects 1&2 each** | DSE-1  **Zoology** | B-ZOO-N504 | Ecology and Environment | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N505 | Evolution & Developmental Biology | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N506 | Practical Based on B-ZOO-N504 & B-ZOO-N505 | 2 | 25 | 25 | 50 | 4 hrs. | 4 |
| DSE-2  **Zoology** | B-ZOO-N507 | Biology of Insects | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N508 | Pest Management | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N509 | Practical Based on B-ZOO-N507 & B-ZOO-N508 | 2 | 25 | 25 | 50 | 4 hrs. | 4 |
| DSE-3  **Zoology** | B-ZOO-N510 | Comparative Anatomy-I | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N511 | Comparative Anatomy-II | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N512 | Practical based on B-ZOO-N510 & B-ZOO-N511 | 2 | 25 | 25 | 50 | 4 hrs. | 4 |
| DSE-4  **Zoology** | B-ZOO-N513 | Cytogenetics-I | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N514 | Cytogenetics-II | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N515 | Practical based on B-ZOO-N513 & B-ZOO-N514 | 2 | 25 | 25 | 50 | 4 hrs. | 4 |
| DSE-5  **Zoology** | B-ZOO-N516  MOOC\* | MOOC from  Swayam Portal | \* | \* | \* | \* | \* | \* |
| Sem-5  **Opt SEC\* Major-1 /Major-2**  **With choice** | **SEC-1\***  **Zoology** | B-ZOO-S1 | Applied Zoology | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-SP1 | Practical based on B-ZOO-S1 | 4 | 50 | 50 | 100 | 4 hrs. | 8 |
| **SEC-2\***  **Zoology** | B-ZOO-S2 | Medical Diagnosis | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO- SP2 | Practical based on B-ZOO-S2 | 4 | 50 | 50 | 100 | 4 hrs. | 8 |
| **Semester** | **Course** | **Paper(s)** | **Nomenclature of Paper** | **Credits** | **Internal marks** | **External Marks** | **Total**  **Marks** | **Exam**  **Duration** | **Hours/**  **Week** |
| Sem-6  **(For Honors only)** | **CC-6**  **Zoology** | **B-ZOO-N601** | **Animal Behaviour** | **2** | **25** | **25** | **50** | **3 hrs.** | **2** |
| **B-ZOO-N602** | **Chronobiology** | **2** | **25** | **25** | **50** | **3 hrs.** | **2** |
| **B-ZOO-N603** | **Practical based on B-ZOO-N601 & B-ZOO-N602** | **2** | **25** | **25** | **50** | **4 hrs.** | **4** |
| Sem-6  **Choose one DSE from given options of Major subjects 1&2 each** | DSE-**6**  **Zoology** | B-ZOO-N604 | Animal Taxonomy | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N605 | Biodiversity Conservation & Wildlife management | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N606 | Practical based on B-ZOO-N604 & B-ZOO-N605 | 2 | 25 | 25 | 50 | 4 hrs. | 4 |
| DSE-7  **Zoology** | B-ZOO-N607 | Fishery and Aquaculture | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N608 | Conservation Biology | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N609 | Practical Based on B-ZOO-N607 & B-ZOO-N608 | 2 | 25 | 25 | 50 | 4 hrs. | 4 |
| DSE-8  **Zoology** | B-ZOO-N610 | Reproductive Biology-I | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N611 | Reproductive Biology-II | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N612 | Practical based on B-ZOO-N610 & B-ZOO-N611 | 2 | 25 | 25 | 50 | 4 hrs. | 4 |
| DSE-9  **Zoology** | B-ZOO-N613 | Forensic Biology and Serology-I | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N614 | Forensic Biology and Serology-II | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-N615 | Practical based on B-ZOO-N613 & B-ZOO-N614 | 2 | 25 | 25 | 50 | 4 hrs. | 4 |
| DSE-10  **Zoology** | B-ZOO-N616  **MOOC**\* | MOOC from  Swayam Portal | \* | \* | \* | \* | \* | \* |
| Sem-6  **Opt SEC\* of Major not opted in 5 sem. with choice** | **SEC-1\***  **Zoology** | B-ZOO-S1 | Applied Zoology | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO-SP1 | Practical based on B-ZOO-S1 | 4 | 50 | 50 | 100 | 4 hrs. | 8 |
| **SEC-2\***  **Zoology** | B-ZOO-S2 | Medical Diagnosis | 2 | 25 | 25 | 50 | 3 hrs. | 2 |
| B-ZOO- SP2 | Practical based on B-ZOO-S2 | 4 | 50 | 50 | 100 | 4 hrs. | 8 |
| Sem-7  **(For Non Honors Students)** | **CC-5**  **Zoology** | **B-ZOO-N501** | **Molecular Biology** | **2** | **25** | **25** | **50** | **3 hrs.** | **2** |
| **B-ZOO-N502** | **Recent techniques in Zoology** | **2** | **25** | **25** | **50** | **3 hrs.** | **2** |
| **B-ZOO-N503** | **Practical based on B-ZOO-N501 & B-ZOO-N502** | **2** | **25** | **25** | **50** | **4 hrs.** | **4** |
| Sem-7 | **RAEC**  **Zoology** | B-LS-704 | Research Ethics | 4 | 50 | 50 | 100 | 3 hrs. | 4 |
| B-LS-705 | Research Methodology | 4 | 50 | 50 | 100 | 3 hrs. | 4 |
| **Research Progression**  **Seminar** | B-ZOO-N706 | General Seminar & Report | 4 | - | - | 100 | - | - |
| B-ZOO-N707 | Synopsis writings & Seminar | 4 | - | - | 100 | - | - |
| Sem-8  **(For Non Honors Students)** | **CC-6**  **Zoology** | **B-ZOO-N601** | **Animal Behaviour** | **2** | **25** | **25** | **50** | **3 hrs.** | **2** |
| **B-ZOO-N602** | **Chronobiology** | **2** | **25** | **25** | **50** | **3 hrs.** | **2** |
| **B-ZOO-N603** | **Practical based on B-ZOO-N601 & B-ZOO-N602** | **2** | **25** | **25** | **50** | **4 hrs.** | **4** |
| Sem-8 | **RAEC**  **Zoology** | B-ZOO-N804 | Research (Dissertation/Thesis) | 20 | - | - | - | - | - |
| B-ZOO-N805 | Mid-term Seminar | 2 |  |  | 50 |  |  |
| B-ZOO-N801 | Pre-submission Seminar | 2 | - | - | 50 | - | - |
| * **CC- Core Courses; DSE- Discipline Specific Elective; SEC- Skill Enhancement Courses; RAEC- Research ability enhancement courses** * **Opt SEC\* Major-1/Major-2 with choice in 5th semester and Opt second SEC\* of Major-1/2 (not opted in 5 semester) in 6th semester with choice** * **CC-5 & CC-6 are compulsorily in semester 7 & 8, if these courses are not completed as CC-5 & CC-6 in semester 5 & 6** * **Internal assessment (50%) shall be based on clearly defined components of class attendance and participation (10%), mid-term exam of 2 hour duration (30%) and assignments-presentations (10%) of the credit and the rest (50%) through End term Examination.** * **Internship@10 credits (450 hours) after 2nd semester (only for exit options)** * **Internship@10 credits (450 hours) after 4th semester (compulsory for all)** | | | | | | | | | |

**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 Under-Graduate Programme of Course Zoology**

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 UG 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.

**SEMESTER-I**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course** | **Paper** | **Nomenclature of Paper** | **Credits** | **Internal marks** | **External Marks** | **Total**  **Marks** | **Exam**  **Duration** | **Hours/**  **week** |
| **CC-1**  **Zoology** | **B-ZOO-N101** | **Animal Diversity of Non-Chordates from Protozoa to Aschelminthes** | **2** | **25** | **25** | **50** | **3 hrs.** | **2** |

**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:**

**CO-N101.1.** Student will be able to describe unique characters and recognize life functions of phylum Protozoa, Porifera, Coelenterate and Helminthes

**CO-N101.2.** Students will be capable to identify the diversity and ecological role of phylum Protozoa, Porifera, Coelenterate and Helminthes.

**Note:** Seven 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 5 parts (1.0 mark each) covering the entire syllabus. Out of remaining six, three 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 class level

ii) Biodiversity and economic importance of Protozoans; Life cycle and Etiology of *Entamoeba*, *Giardia*

1. Type study of *Plasmodium*

2. **Phylum Porifera:**

i) General characters and classification up to class level

ii) Biodiversity and economic importance

1. Type study – *Sycon*
2. Canal system in sponges
3. Spicules in sponges

**SECTION - B**

3. **Phylum – Coelentrata:**

i) General characters and classification up to class level, Cnidaria v/s ctenophora

ii) Biodiversity and economic importance of cnidarians

1. Type Study - *Obelia*
2. Corals and coral reefs
3. Polymorphism in Siphonophores

4. **Phylum – Platyhelminthes and Aschelminthes:**

i) General characters and classification up to class level

ii) Biodiversity and economic importance of flat worms

1. Type study – *Fasciola hepatica*
2. Common roundworms and their economic importance

**SEMESTER-I**

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| **Course** | **Paper** | **Nomenclature of Paper** | **Credits** | **Internal marks** | **External Marks** | **Total**  **Marks** | **Exam**  **Duration** | **Hours/**  **week** |
| **CC-1**  **Zoology** | **B-ZOO-N102** | **Animal Diversity of Non-Chordates from Annelida to Hemichordata** | **2** | **25** | **25** | **50** | **3 hrs.** | **2** |

**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:**

**CO-N102.1.** Student will be able to describe unique characters and recognize life functions of Phylum Annelida up to Hemichordata.

**CO-N102.2.** Students will be capable to identify the diversity and ecological role of Phylum Annelida up to Hemichordata.

**Note:** Seven 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 5 parts (1.0 mark each) covering the entire syllabus. Out of remaining six, three 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 class level

ii) Biodiversity and economic importance of Annelida

1. Type study – *Pheretima* (Earthworm)

vi) Metamerism in Annelida, larval forms in Annelids

2. **Phylum – Arthropoda:**

i) General characters and classification up to class level

ii) Biodiversity and economic importance of insects (insect vectors, lac insects, honey bee, insect pest) & crustaceans

iii) Type study – *Periplanata/*Cockroach

iv) Evolutionary significance of *Peripatus*

**SECTION - B**

3. **Phylum - Mollusca:**

i) General characters and classification up to class level

ii) Biodiversity and economic importance

1. Type study - *Pila*
2. Torsion and detorsion in gastropoda

4. **Phylum – Enchinodermata:**

i) General characters and classification up to class level

ii) Biodiversity and economic importance of echinoderms

1. Type study – *Asterias* (Sea Star)
2. Echinoderm larvae
3. Aristotle’s Lantern

5. **Phylum Hemichordata:** General Characters of Hemichordates with examples

**SEMESTER-I**

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| **Course** | **Paper** | **Nomenclature of Paper** | **Credits** | **Internal marks** | **External Marks** | **Total**  **Marks** | **Exam**  **Duration** | **Hours/**  **week** |
| **CC-1**  **Zoology** | **B-ZOO-N103** | **Practical Based on B-ZOO-N101 & B-ZOO-N102** | **2** | **25** | **25** | **50** | **4 hrs.** | **4** |

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

**Course Outcome:**

**CO-N103.1.** Students will be capable of identifying the characters and classification of invertebrates species.

**CO-N103.2.** Students will be able to realize and explain ecological and economic importance of different invertebrate species

**PRACTICAL SYLLABUS**

**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 formaniferan ooze.
2. Parazoa (Porifera): *Sycon, Grantia, Euplectella, Hyalonema, Spongilla, Euspongia*
3. Coelenterata: *Porpita, Valella, 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. Playhelminthes: *Dugesia, Fasciola, Taenia, Echinocoecus.* Permanent prepared slides: *Miracidium, Sporocyst, Redia, Cercaria, Scolex* and *Proglotttids 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), *Poecilocerus* (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* (beg 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 a*nd *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

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| **CC-1**  **Zoology** | | | | | | | | | | | | | | |
| **B-ZOO-N101** | | | | | **Animal Diversity of Non-Chordates from Protozoa to Aschelminthes** | | | | | | | | | |
| **B-ZOO-N102** | | | | | **Animal Diversity of Non-Chordates from Annelida to Hemichordata** | | | | | | | | | |
| **B-ZOO-N103** | | | | | **Practical Based on B-ZOO-N101 & B-ZOO-N102** | | | | | | | | | |
| **CO#** | **PO1** | **PO2** | **PO3** | **PO4** | | **PO5** | **PO6** | **PO7** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** | **PSO6** |
| **CO-N101.1.** | **3** | **2** | **1** | **2** | | **2** | **1** | **3** | **3** | **3** | **2** | **3** | **3** | **3** |
| **CO-N101.2.** | **3** | **2** | **2** | **2** | | **3** | **3** | **2** | **2** | **3** | **3** | **2** | **2** | **3** |
| **CO-N102.1.** | **3** | **2** | **2** | **2** | | **3** | **3** | **1** | **3** | **2** | **2** | **3** | **3** | **3** |
| **CO-N102.2.** | **1** | **3** | **1** | **1** | | **2** | **2** | **2** | **2** | **3** | **3** | **3** | **3** | **3** |
| **CO-N103.1.** | **1** | **2** | **3** | **2** | | **3** | **2** | **1** | **3** | **2** | **3** | **2** | **2** | **2** |
| **CO-N103.2.** | **2** | **1** | **1** | **1** | | **2** | **2** | **2** | **3** | **3** | **3** | **2** | **3** | **3** |
| **Average** | **2.16** | **6** | **1.66** | **1.66** | | **2.5** | **2.16** | **1.83** | **2.66** | **2.66** | **2.66** | **2.5** | **2.66** | **2.83** |

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

**Credits: 2**

**External Marks: 25**

**Internal Assessment: 25**

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

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

**Exercise Marks allotted**

1. Internal Anatomy – One 02

(Labelled diagram)

2. Permanent Slide Preparation - one 05

(Staining, identification, sketch)

3. Museum specimens – Seven 7

(Identification and classification)

4. Ecological note – One specimen 02

5. Permanent slides – Two 04

(Identification with reasons)

6. Practical records and Viva 05

**SEMESTER-II**

|  |  |  |  |  |  |  |  |  |
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| **Course** | **Paper** | **Nomenclature of Paper** | **Credits** | **Internal marks** | **External Marks** | **Total**  **Marks** | **Exam**  **Duration** | **Hours/**  **Week** |
| **CC-2**  **Zoology** | **B-ZOO-N201** | **Animal Diversity of Chordates from Protochordata to Pisces** | **2** | **25** | **25** | **50** | **3 hrs.** | **2** |

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

**Course Outcomes:**

**CO-N201.1.** 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.

**CO-N201.2.** Will be able to understand the basic concepts of evolutionary relationship among protochordates and fishes.

**Note:** Seven 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 5 parts (1.0 mark each) covering the entire syllabus. Out of remaining six, three 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 of chordates.

2. **Protochordates**: Systematic position, distribution, ecology, morphology and affinities of protochordates

Urochordata: *Herdmania* – type Study

Cephalochordata: *Amphioxus* – type study

**SECTION - B**

3. Agnatha: General characters

Cyclostomata: General characters and classification upto class level. Ecological significance of cyclostomes

Petromyzon: Structural & functional morphology type study

4. **Pisces**: General characters and classification up to classes with examples emphasizing their biodiversity, Scales & Fins,

Type study of *Labeo*

**SEMESTER-II**

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| **Course** | **Paper** | **Nomenclature of Paper** | **Credits** | **Internal marks** | **External Marks** | **Total**  **Marks** | **Exam**  **Duration** | **Hours/**  **Week** |
| **CC-2**  **Zoology** | **B-ZOO-N202** | **Animal Diversity of Chordates from Amphibia to Mammalia** | **2** | **25** | **25** | **50** | **3 hrs.** | **2** |

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

**Course Outcomes:**

**CO-N202.1.** Students will be able to understand evolutionary lines of vertebrate class including amphibians, reptiles, birds, and mammals.

**CO-N202.2.** Students will be able to identify (based on morphological characters) and understand adaptations in vertebrate class including amphibians, reptiles, birds, and mammals.

**Note:** Seven 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 5 parts (1.0 mark each) covering the entire syllabus. Out of remaining six, three 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 class level;

Type study of frog (*Rana tigrina),* Parental Care and Neoteny in Amphibia

2. **Reptilia:** General Characters and Classification upto classes,

Type study of Lizard (*Hemidactylus*): Structural & Functional morphology, Extinct reptiles; Poisonous apparatus in snakes

**SECTION - B**

3. **Aves:** General Characters and Classifications upto classes.

Type study of Pigeon (*Columba livia)*; Structural & Functional morphology

Flight/Aerial adaptation in birds, *Archaeopteryx* as missing link

4. **Mammals:** General Characters and classification up to classes;

Type study of Rat;

Adaptive radiations of mammals, dentition in mammals.

**SEMESTER-II**

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| **Course** | **Paper** | **Nomenclature of Paper** | **Credits** | **Internal marks** | **External Marks** | **Total**  **Marks** | **Exam**  **Duration** | **Hours/**  **Week** |
| **CC-2**  **Zoology** | **B-ZOO-N203** | **Practical Based on B-ZOO-N201 & B-ZOO-N202** | **2** | **25** | **25** | **50** | **4 hrs.** | **4** |

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

**Course Outcomes:**

**CO-N203.1.** Students will be able to classify and identify vertebrates’ species and their skeleton

**CO-N203.2.** Learners will also realize and understand economic importance of the vertebrate species and will be aware about their conservation.

**PRACTICAL SYLLABUS**

1. Classification upto orders, habit, habitats, external characters and economic importance (if any):

* Protochordata: *Molqula, 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: *Casuarius, 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 *Orcyctolagus*/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.

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| **CC-2**  **Zoology** | | | | | | | | | | | | | | |
| **B-ZOO-N201** | | | | | **Animal Diversity of Chordates from Protochordata to Pisces** | | | | | | | | | |
| **B-ZOO-N202** | | | | | **Animal Diversity of Chordates from Amphibia to Mammalia** | | | | | | | | | |
| **B-ZOO-N203** | | | | | **Practical Based on B-ZOO-N201 & B-ZOO-N202** | | | | | | | | | |
| **CO#** | **PO1** | **PO2** | **PO3** | **PO4** | | **PO5** | **PO6** | **PO7** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** | **PSO6** |
| **CO-N201.1.** | **3** | **2** | **2** | **2** | | **2** | **1** | **1** | **2** | **3** | **2** | **3** | **3** | **3** |
| **CO-N201.2.** | **2** | **1** | **2** | **1** | | **1** | **3** | **2** | **3** | **2** | **2** | **3** | **3** | **2** |
| **CO-N202.1.** | **2** | **2** | **1** | **2** | | **2** | **3** | **3** | **3** | **2** | **3** | **3** | **2** | **3** |
| **CO-N202.2.** | **1** | **2** | **2** | **1** | | **2** | **2** | **2** | **3** | **2** | **3** | **3** | **3** | **2** |
| **CO-N203.1.** | **2** | **2** | **3** | **3** | | **1** | **3** | **1** | **3** | **3** | **2** | **2** | **3** | **2** |
| **CO-N203.2.** | **2** | **1** | **2** | **1** | | **2** | **2** | **2** | **3** | **3** | **3** | **3** | **3** | **3** |
| **Average** | **2.00** | **1.66** | **2.00** | **1.66** | | **1.66** | **2.33** | **1.83** | **2.83** | **2.5** | **2.5** | **2.83** | **2.83** | **2.5** |

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

**Credits: 2**

**External Marks: 25**

**Internal Assessment: 25**

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

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

**Exercise Marks allotted**

1. Internal Anatomy – One 02

(Labelled diagram)

2. Permanent Slide Preparation - one 05

(Staining, identification, sketch)

3. Museum specimens – Six 06

(Identification and classification)

4. Bone – Two pieces 04

(Identification with reasons)

5. Permanent slides – Two 03

(Identification with reasons)

6. Practical record, Field report and Viva 05