# Barrackpore Rastraguru Surendranath College

# Teaching Plan

2022-23

Department of Zoology

## NAME OF THE PROGRAMME

B.Sc. Zoology Honoursand General Course

## PROGRAMME OUTCOME

The students are expected to learn the courses with excitements of biology along with the universal molecular mechanisms of biological designs and their functions. They should be able to appreciate shifting their orientation of learning from a descriptive explanation of biology to a unique style of learning through graphic designs and quantitative parameters to realize how contributions from research and innovation have made the subjects modern, interdisciplinary and applied and laid the foundations of Zoology, Animal Sciences, Life Sciences, Molecular Biology and Biotechnology. These courses and their practical exercises will help the students to apply their knowledge in future course of their career development in higher education and research. In addition, they may get interested to look for engagements in industry and commercial activities employing Life Sciences, Molecular Biology and Biotechnology. They may also be interested in entrepreneurship and start some small business based on their interest and experience.

Notes:
You can merge cells in between and add students' seminars and class tests / internal assessment.
For incorporating PO / CO at UG level, you may refer to your WBSU CBCS syllabus.
If not there you can refer to the UGC model syllabus
https://www.ugc.ac.in/ugc_notices.aspx?id=MTA3Nw==

**B. Sc. Zoology Honours Course (CBCS)**

**SEMESTER 1**

<table>
<tr><td colspan="3">Semester</td><td colspan="4">I</td></tr>
<tr><td>Course Title</td><td colspan="6">Non-Chordates I (Theory)</td></tr>
<tr><td>Course Code</td><td colspan="2">ZOOACOR01T</td><td>Credit</td><td colspan="3">4</td></tr>
<tr><td>Course Outcome</td><td colspan="6">The course is a walk for the Bachelor’s entrant through the amazing diversity of living forms from simple to complex one. It enlightens how each group of organisms arose and how did they establish themselves in the environment with their special characteristics. It also deals with the differences and similarities between organisms on the basis of their morphology and anatomy which led to their grouping into taxa and clades.<br><br>After successfully completing this course, the students will be able to:<br> Develop understanding on the diversity of life with regard to protists, non chordates and chordates.<br><br> Group animals on the basis of their morphological characteristics/ structures.<br><br> Develop critical understanding how animals changed from a primitive cell to a collection of simple cells to form a complex body plan.<br><br> Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic/ cladistics tree.<br><br> The project assignment will also give them a flavour of research to find the process involved in studying biodiversity and taxonomy besides improving their writing skills. It will further enable the students to think and interpret individually due to different animal species chosen.</td></tr>
<tr><td colspan="7">Scheme of Instruction</td></tr>
<tr><td>Total Duration</td><td>60 hours</td><td>Class/Week</td><td>4</td><td>Hours/week</td><td colspan="2">4</td></tr>
<tr><td>Instruction Mode</td><td colspan="6">Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method.</td></tr>
<tr><td colspan="7">Scheme of Examination</td></tr>
<tr><td>Maximum Score</td><td>50</td><td>Internal</td><td>10</td><td>End Semester</td><td colspan="2">40</td></tr>
<tr><td colspan="7">Course Mapping</td></tr>
</table>

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| 1 | **Protista, Parazoa and Metazoa:** General characteristics and Classification up to classes Study of *Euglena*, *Amoeba* and *Paramoecium*Life cycle and pathogenicity of *Giardia intestinalis*, *Leishmania donovani*, *Entamoeba histolytica* and *Plasmodium vivax* Locomotion and Reproduction in Protista Evolution of symmetry and segmentation of Metazoa | 19 |
| 2 | **Porifera :**General characteristics and Classification up to classes Canal system and spicules in sponges | 7 |
| 3 | **Cnidaria:** General characteristics and Classification up to classes Metagenesis in *Obelia* Polymorphism in Cnidaria Corals and coral reefs: types, formation, distribution, conservation significance | 12 |
| 4 | **Ctenophora:** General characteristics | 4 |
| 5 | **Platyhelminthes:** General characteristics and Classification up to classes Life cycle and pathogenicity of *Fasciola hepatica* and *Taenia **solium*** | 10 |
| 6 | **Nemathelminthes:** General characteristics and Classification up to classes Life cycle, and pathogenicity of *Ascaris lumbricoides, Ancylostoma duodenale and Wuchereriabancrofti*Parasitic adaptations in helminths Origin and evolution of parasitic helminths. | 8 |

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|---|---|---|---|---|---|
| **Course Title** | **Non-Chordates I Lab** | | | | |
| **Course Code** | **ZOOACOR01P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | 4 | **Hours/week** | 4 |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 25 | **Internal** | 15 | **End Semester** | 10 |

| Course Mapping | | |
|---|---|---|
| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
| **1** | Study of whole mount of *Euglena, Amoeba and Paramoecium*, Binary fission and Conjugation in *Paramoecium* | 8 |
| **2** | Examination of freshwater pond water collected from different places for diversity of protists in it. | 8 |
| **3** | Study of Sycon (T.S. and L.S.), *Hyalonema, Euplectella, Spongilla* | 8 |
| **4** | Study of *Obelia, Physalia, Millepora, Aurelia, Tubipora, Corallium, Alcyonium, Gorgonia, Metridium, Pennatula, Fungia, Meandrina, Madrepora* | 16 |
| **5** | One specimen/slide of any Ctenophore | 4 |
| 6 | Study of adult *Fasciola hepatica, Taenia solium*and their life cycles (Slides/microphotographs) | 4 |
| 7 | Study of adult *Ascaris lumbricoides* and its life stages (Slides/micro-photographs) | 4 |
| 8 | To submit a Project Report on any related topic on pond water protozoan or invertebrate diversity/ life cycles of mosquitoes, butterfly/moth etc /coral and coral reefs | 8 |

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| **Semester** | **I** | | |
| **Course Title** | **Ecology (Theory)** | | |
| **Course Code** | **ZOOACOR02T** | **Credit** | **4** |
| **Course Outcome** | This course will take students on a journey through the physical workings of the Earth, the interactions between species and their environments. The course highlights on some of the important aspects *viz*. growth and survival of populations and communities in different habitats, energy flow in the ecosystems, interactions between the communities, exclusion of niches and consequences of changing<br>environment on the biodiversity.<br><br>After successfully completing this course, the students will be able | | |

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| | to:<br>□ Know the evolutionary and functional basis of animal ecology.<br>□ Understand what makes the scientific study of animal ecology a crucial and exciting endeavour.<br>□ Engage in field-based research activities to understand well the theoretical aspects taught besides learning techniques for gathering data in the field.<br>□ Analyse a biological problem, derive testable hypotheses and then design experiments and put the tests into practice.<br>□ Solve the environmental problems involving interaction of humans and natural systems at local or global level. |

| **Scheme of Instruction** | | | | | |
|---|---|---|---|---|---|
| **Total Duration** | **60 Hours** | **Class/Week** | 4 | **Hours/week** | 4 |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 50 | **Internal** | 10 | **End Semester** | 40 |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| **1** | **Introduction to Ecology:** History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of Physical factors, The Biosphere. | **4** |
| **2** | **Population:** Unitary and Modular populations Unique and group attributes of population: Demographic factors, life tables, fecundity tables, survivorship curves, dispersal and dispersion. Geometric, exponential and logistic growth, equation and patterns, r and K strategies Population regulation - density-dependent and independent factors Population Interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition. | **20** |
| **3** | **Community:** Community characteristics: species diversity, | **11** |

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| | abundance, dominance, richness, Vertical stratification, Ecotone and edge effect. Ecological succession and example of it. | |
| **4** | **Ecosystem:** Types of ecosystem with an example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies Nutrient and biogeochemical cycle with an example of Nitrogen cycle Human modified ecosystem**.** | **10** |
| **5** | **Applied Ecology:** Wildlife Conservation (in-situ and ex-situ conservation). Management strategies for tiger conservation; Wild life protection act '72 | 5 |

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|---|---|---|---|---|---|
| **Course Title** | **Ecology Lab** | | | | |
| **Course Code** | **ZOOACOR02P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | 60 Hours | **Class/Week** | 4 | **Hours/week** | 4 |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 25 | **Internal** | 15 | **End Semester** | 10 |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| **1** | Study of life tables and plotting of survivorship curves of different types from the Hypothetical/real data provided | 4 |
| **2** | Determination of population density of a natural/hypothetical population. Study of species diversity of a community by quadrat or any other suitable sampling method and calculation of Shannon-Weiner diversity index for the same community. | 20 |

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| **3** | Study of an aquatic ecosystem: Sampling of Phytoplankton and zooplankton, Measurements of temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO2. | 20 |
| **4** | Excursion: Visit to a National Park/Wild life sanctuary/ any other Protected Forests within West Bengal. Report (including the actual field diary) on the study of the landscape and habitat features, Types of Forests, Major Flora and Fauna, Man-animal conflicts and other problems, Management and conservation measures. | 36 |

**SEMESTER 2**

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|---|---|---|---|
| **Semester** | | **II** | |
| **Course Title** | **Non-Chordates II (Theory)** | | |
| **Course Code** | **ZOOACOR03T** | **Credit** | **4** |
| **Course Outcome** | The course makes a detailed comparison of the anatomy of the different taxa of higher non chordates. It also highlights how in the taxonomic hierarchy, there is an increase in the complexity of structure and function. The course thus gives an overview of the intricate life processes and adaptive radiations in non chordates.<br><br>After successfully completing this course, the students will be able to<br> Develop an understanding of the characters used to classify besides being able to differentiate the organisms belonging to different taxa.<br><br> Have hands on experience of materials demonstrating the diversity of higher non-chordates.<br><br> Understand the relative position of individual organs and associated structures through dissection of the invertebrate representatives.<br><br> Realize that very similar physiological mechanisms are used in very diverse organisms. | | |

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| | □ Get a flavor of research by working on project besides improving their writing skills. It will further enable the students to think and interpret individually.<br>□ Undertake research in any aspect of animal physiology in future. |

| **Scheme of Instruction** | | | | | |
|---|---|---|---|---|---|
| **Total Duration** | **60 Hours** | **Class/Week** | 4 | **Hours/week** | 4 |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |

| **Scheme of Examination** | | | | | |
|---|---|---|---|---|---|
| **Maximum Score** | 50 | **Internal** | 10 | **End Semester** | 40 |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| **1** | **Introduction to Coelomates:** Evolution of coelom and metamerism**:** | 4 |
| **2** | **Annelida:** General characteristics and Classification up to classes Excretion in Annelida | 8 |
| **3** | **Arthropoda:** General characteristics and Classification up to classes Vision and Respiration in Arthropoda Metamorphosis in Insects Social life in bees and termites | 12 |
| **4** | **Onychophora:** General characteristics and Evolutionary significance | 4 |
| **5** | **Mollusca:** General characteristics and Classification up to classes Respiration in Mollusca Torsion and detorsion in Gastropoda Pearl formation in bivalves Evolutionary significance of trochophore larva | 12 |
| 6 | **Echinodermata:** General characteristics and Classification up to classes Water-vascular system in Asteroidea Larval forms in Echinodermata Affinities with Chordates | 12 |
| 7 | **Hemichordata:** General characteristics of phylum Hemichordata. Phylogenetic relationship with non-chordates and chordates (only | 8 |

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| | recent concept)* | |

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| **Course Title** | **Non-Chordates II Lab** | | | | |
| **Course Code** | **ZOOACOR03P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | 4 | **Hours/week** | 4 |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 25 | **Internal** | 15 | **End Semester** | 10 |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| **1** | Study of following specimens:<br>Annelids - *Aphrodita, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheretima, Hirudinaria ;* Arthropods - *Limulus, Palamnaeus, Palaemon, Daphnia, Balanus, Sacculina, Cancer, Eupagurus, Scolopendra, Julus, Bombyx, Periplaneta,* termites and honey bees; Onychophora - *Peripatus ;* Molluscs - *Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus;* Echinodermates - *Pentaceros/Asterias, Ophiura, Clypeaster, Echinus, Cucumaria and Antedon;* Hemichordates- *Saccoglossus* | 36 |
| **2** | Digestive system, septal nephridia and pharyngeal nephridia of earthworm | 4 |
| **3** | T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm | 4 |
| **4** | Mount of mouth parts and dissection of digestive system and nervous system of Periplaneta | 8 |

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| **5** | To submit a Project Report (mostly literature review) on any related topic to larval forms (crustacean, mollusc and echinoderm) | 8 |

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| **Semester** | | **II** | | | |
| **Course Title** | **Cell Biology (Theory)** | | | | |
| **Course Code** | **ZOOACOR04T** | **Credit** | **4** | | |
| **Course Outcome** | The course provides a detailed insight into basic concepts of cellular structure and function. It also gives an account of the complex regulatory mechanisms that control cell function.<br><br>After successfully completing this course, the students will be able to<br> Understand the functioning of nucleus and extra nuclear organelles and understand the intricate cellular mechanisms involved.<br><br> Acquire the detailed knowledge of different pathways related to cell signaling and apoptosis thus enabling them to understand the anomalies in cancer.<br><br> Develop an understanding how cells work in healthy and diseased states and to give a 'health forecast' by analyzing the genetic database and cell information.<br><br> Get new avenues of joining research in areas such as genetic engineering of cells, cloning, vaccines development, human fertility programme, organ transplant, etc.<br><br> Understand how tissues are produced from cells in a normal course and about any malfunctioning which may lead to benign or malignant tumor. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | 60 Hours | **Class/Week** | 4 | **Hours/week** | 4 |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |

| Scheme of Examination | | | | | |
|---|---|---|---|---|---|
| **Maximum Score** | 50 | **Internal** | 10 | **End Semester** | 40 |

| Course Mapping | | |
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| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
| **1** | **Overview of Cells:** Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions | 8 |
| **2** | **Plasma Membrane:** Various models of plasma membrane structure Transport across membranes: Active and Passive transport, Facilitated transport Cell junctions: Tight junctions, Desmosomes, Gap junctions Extracellular Matrix-Cell Interactions | 12 |
| **3** | **Endomembrane System:** Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes | 8 |
| **4** | **Mitochondria and Peroxisomes:** Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis Peroxisomes | 8 |
| **5** | **Cytoskeleton** Structure and Functions: Microtubules, Microfilaments and Intermediate filaments | 8 |
| 6 | **Nucleus:** Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus Chromatin: Euchromatin and Heterochromatin and packaging (nucleosome) | 8 |
| 7 | **Cell Division:** Mitosis and Meiosis Cell cycle and its regulation Cancer (Concept of oncogenes and tumor suppressor genes) Mechanisms of cell death: brief overview | 8 |
| 8 | **Cell Signaling:** Cell signalling transduction pathways; Types of signaling molecules and receptors GPCR and Role of second messenger (cAMP) | 8 |

| **Course Title** | **Cell Biology Lab** | | |
|---|---|---|---|
| **Course Code** | **ZOOACOR04P** | **Credit** | **2** |

| Scheme of Instruction | | | | | |
|---|---|---|---|---|---|
| **Total Duration** | **60 Hours** | **Class/Week** | 4 | **Hours/week** | 4 |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 25 | **Internal** | 15 | **End Semester** | 10 |

**Course Mapping**

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| **1** | Preparation of temporary stained squash of onion root tip to study various stages of mitosis | 12 |
| **2** | Study of various stages of meiosis (in pre-prepared slides and/or in photographs obtained from websites). | 12 |
| **3** | Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells. | 8 |
| **4** | Preparation of permanent slide to demonstrate:<br>a. DNA by Feulgen reaction<br>b. Mucopolysaccharides by PAS reaction<br>c. Proteins by Mercurobromophenol blue/Fast Green | 24 |
| **5** | Cell viability study by Trypan Blue staining | 4 |

**SEMESTER 3**

| Semester | III | | |
|---|---|---|---|
| **Course Title** | **Chordates (Theory)** | | |
| **Course Code** | **ZOOACOR05T** | **Credit** | **4** |

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| **Course Outcome** | The course is a compilation of amazing diversity of Chordata. It enlightens how each group of organisms arose and how did they establish themselves in the environment.<br>After successfully completing this course, the students will be able to:<br> Develop understanding on the diversity of life with regard to proto-chordates and chordates.<br><br> Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic/ cladistics tree.<br><br> Understand how morphological change due to change in environment helps drive evolution over a long period of time.<br><br> The project assignment will also give them a flavour of research to find the process of evolutionary pathways | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | 4 | **Hours/week** | 4 |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 50 | **Internal** | 10 | **End Semester** | 40 |

**Course Mapping**

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| 1 | **Introduction to Chordates:** General characteristics and outline classification of Phylum Chordata | 2 |
| 2 | **Protochordata:** General characteristics and classification of sub-phylum Urochordata and Cephalochordata up to Classes. Metamorphosis in Ascidia Chordate Features and Feeding in Branchiostoma | 8 |
| 3 | **Origin of Chordata:** Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata | 4 |
| 4 | **Agnatha:** General characteristics and classification of cyclostomes up to order | 2 |

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| **5** | **Pisces:** General characteristics and classification of Chondrichthyes and Osteichthyes up to Subclasses Accessory respiratory organ, migration and parental care in fishes Swim bladder in fishes. Classification up to Sub-Classes | 8 |
| 6 | **Amphibia:** General characteristics and classification up to living Orders Metamorphosis and parental care in Amphibia | 8 |
| 7 | **Reptilia:** General characteristics and classification up to living Orders Poison apparatus and Biting mechanism in Snake | 8 |
| 8 | **Aves:** General characteristics and classification up to Sub-Classes Exoskeleton and migration in Birds Principles and aerodynamics of flight | 8 |
| 9 | **Mammals:** General characters and classification up to living orders Phylogenetic significance of Prototheria Exoskeleton derivatives of mammals Adaptive radiation in mammals with reference to locomotory appendages | 8 |
| **10** | **Zoogeography:** Zoogeographical realms, Plate tectonic and Continental drift theory, Distribution of birds and mammals in different realms | 4 |

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|---|---|---|---|---|---|
| **Course Title** | **Chordates Lab** | | | | |
| **Course Code** | **ZOOACOR05P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **30 Hours** | **Class/Week** | 4 | **Hours/week** | 4 |
| **Instruction Mode** | Laboratory Demonstration method, Project Method, , Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 25 | **Internal** | 15 | **End Semester** | 10 |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|

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|---|---|---|
| **1** | **Protochordata:** *Herdmania, Branchiostoma*, Colonial Urochordates; Sections of Balanoglossus through proboscis and branchiogenital regions, Sections of Amphioxus through pharyngeal, intestinal and caudal regions, *Herdmania*spicules | 4 |
| **2** | **Agnatha:** *Petromyzon, Myxine* | 2 |
| **3** | **Fishes:** Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetraodon, Anabas, Flat fish | 4 |
| **4** | **Amphibia:** Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra | 2 |
| **5** | **Reptilia:** Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus Key for Identification of poisonous and non-poisonous snakes | 8 |
| 6 | **Aves:** Study of six common birds from different orders (Stork, Owl/Falcon, Sun Bird, Jacanna, Duck)- types of beaks and claws. | 2 |
| 7 | **Mammalia:** Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceous. | 2 |
| 8 | Mount of weberian ossicles of Mystus or Grass Carp, Pecten from Fowl head, Dissection of Fowl head/ Power point presentation on study of any two animals from two different classes by students | 6 |

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| **Semester** | **III** | | |
| **Course Title** | **Physiology: Controlling and Coordinating Systems (Theory)** | | |
| **Course Code** | **ZOOACOR06T** | **Credit** | **4** |
| **Course Outcome** | The course deals with various physiological functions in mammals. It also gives an account of the metabolic/ biochemical pathways and the probable impact of environment on them.<br><br>After successfully completing this course, the students will be able to:<br>□ Understand the physiology at cellular and system levels.<br>□ Understand the mechanism and regulation of breathing, oxygen consumption and determination of respiratory quotient.<br>□ Understand how mammalian body gets nutrition from different biomolecules.<br>□ Understand the process of digestion and excretion.<br>□ Understand the organization of nervous system and process of | | |

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| | nerve conduction.<br>□ Understand the process of vision and hearing.<br>□ Understand the process of muscle contraction.<br>□ Learn the determination of hemoglobin content, blood groups and blood pressure. |

| **Scheme of Instruction** | | | | | |
|---|---|---|---|---|---|
| **Total Duration** | **60 Hours** | **Class/Week** | 4 | **Hours/week** | 4 |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |

| **Scheme of Examination** | | | | | |
|---|---|---|---|---|---|
| **Maximum Score** | 50 | **Internal** | 10 | **End Semester** | 40 |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| **1** | **Tissues:** Structure, locations, classification and functions of epithelial tissues, connective tissues, muscular tissues and nerve tissues | **4** |
| **2** | **Bone and Cartilage:** Structure and types of bones and cartilages, Ossification | **4** |
| **3** | **Nervous System:** Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and Neuromuscular junction; Reflex action and its types | **10** |
| **4** | **Muscular system:** Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle fiber | **10** |
| **5** | **Reproductive System:** Histology of testis and ovary; Physiology of Reproduction | **6** |
| **6** | **Endocrine System:** Histology and function of pituitary, thyroid, pancreas and adrenal; Classification of hormones; Mechanism of Hormone action; Signal transduction pathways for Steroidal and Non steroidal hormones; Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system; Placental hormones | **16** |

| **Course Title** | **Physiology: Controlling and Coordinating Systems Lab** |
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|---|---|---|---|---|---|
| **Course Code** | **ZOOACOR06P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | 30 Hours | **Class/Week** | 4 | **Hours/week** | 4 |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 25 | **Internal** | 15 | **End Semester** | 10 |

**Course Mapping**

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| **1** | Recording of simple muscle twitch with electrical stimulation (or Virtual) | 4 |
| **2** | Preparation of temporary mounts: Squamous epithelium, Striated muscle fibers and nerve cells | 8 |
| **3** | Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid | 6 |
| **4** | Microtomy: Preparation of permanent slide of any five (lung, salivary gland, stomach, small intestine, large intestine only) mammalian (white rat) tissues | 12 |

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| **Semester** | | **III** | | | |
| **Course Title** | **Biochemistry (Theory)** | | | | |
| **Course Code** | **ZOOACOR07T** | **Credit** | **4** | | |
| **Course Outcome** | The course provides an introduction to the structure of biomolecules with emphasis on the techniques used for structure determination and analysis. The course covers basic aspects of sample preparation for analysis and aims to enlighten the students how structural information can be utilized for better understanding of biological processes.<br><br>After successfully completing this course, the students will be able to:<br> Understand the structure and biological significance of carbohydrates, amino acids, proteins, lipids and nucleic acids.<br> Understand the structure and function of immunoglobulins.<br> Understand the concept of enzyme, its mechanism of action and regulation. .<br> Learn the preparation of models of peptides and nucleotides.<br> Learn biochemical tests for amino acids, carbohydrates, proteins and nucleic acids.<br> Learn measurement of enzyme activity and its kinetics. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | 4 | **Hours/week** | 4 |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 50 | **Internal** | 10 | **End Semester** | 40 |

**Course Mapping**

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| 1 | **Fundamentals of biochemical reactions and metabolism:** Ionization of water, weak acids and bases, buffering and pH | 4 |

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| | changes in living systems Metabolism: Catabolism and Anabolism, Compartmentalization of metabolic pathways, Shuttle systems and membrane transporters; ATP as "Energy Currency of cell"; coupled reactions; Use of reducing equivalents and cofactors; Intermediary metabolism and regulatory mechanisms | |
| **2** | **Carbohydrates:** Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides; Derivatives of Monosachharides Carbohydrate metabolism: Glycolysis, Citric acid cycle, Pentose phosphate pathway, Gluconeogenesis | 8 |
| **3** | **Lipids:** Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Triacylglycerols, Phospholipids, Sphingolipid, Glycolipids, Steroids, Eicosanoids and terpinoids. Lipid metabolism: β-oxidation of fatty acids; Fatty acid biosynthesis | 8 |
| **4** | **Proteins:** Amino acids Structure, Classification, General and Electro chemical properties of α-amino acids; Physiological importance of essential and non-essential amino acids Proteins Bonds stabilizing protein structure; Levels of organization Protein metabolism: Transamination, Deamination, Urea cycle, Fate of C-skeleton of Glucogenic and Ketogenic amino acids | 12 |
| **5** | **Nucleic Acids:** Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids Types of DNA and RNA, Complementarity of DNA, Hypo- Hyperchromaticity of DNA Outlines of nucleotide metabolism | 8 |
| 6 | **Enzymes:** Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Derivation of Michaelis-Menten equation, Lineweaver-Burk plot; Factors affecting rate of enzyme-catalyzed reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Strategy of enzyme action- Catalytic and Regulatory (Basic concept with one example each) | 12 |
| 7 | **Oxidative Phosphorylation:** Redox systems; Review of mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System | 8 |

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|---|---|---|---|---|---|
| **Course Title** | **Biochemistry Lab** | | | | |
| **Course Code** | **ZOOACOR07P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **30 Hours** | **Class/Week** | 4 | **Hours/week** | 4 |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 25 | **Internal** | 15 | **End Semester** | 10 |

**Course Mapping**

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| **1** | Qualitative tests of functional groups in carbohydrates, proteins and lipids. | 10 |
| **2** | Paper chromatography of amino acids. | 4 |
| **3** | Quantitative estimation by Lowry Method | 4 |
| **4** | Demonstration of proteins separation by SDS-PAGE. | 4 |
| **5** | Study of the enzymatic activity of Trypsin and Lipase. | 4 |
| 6 | Performing the Acid and Alkaline phosphatase assay from serum/ tissue. | 4 |

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| **Semester** | **III** | | |
| **Course Title** | **Skill Enhancement Courses (SEC) Sericulture** | | |
| **Course Code** | **ZOOSSEC001** | **Credit** | **2** |
| **Course Outcome** | The course gives insight into the principles of sustainable sericulture and how theseprinciples can guide your silkmoth rearing into an enduring practice. The students will knowabout the laws and by laws governing | | |

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| | keeping silkmoth.<br><br>Upon successful completion of this course, the student should be able to:<br>□ Generation of skilled man power in the field of sericulture<br>□ To impart training in extension management and transfer of technology<br>□ To impart training in Post Cocoon Technology, and<br>□ To provide field exposure |

| **Scheme of Instruction** | | | | | |
|---|---|---|---|---|---|
| **Total Duration** | **30 hours** | **Class/Week** | **2** | **Hours/week** | **2** |
| **Instruction Mode** | | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **25** | **Internal** | **15** | **End Semester** | **10** |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| **1** | **Introduction:** Sericulture: Definition, history and present status; Silk route Types of silkworms, Distribution and Races Exotic and indigenous races Mulberry and non-mulberry Sericulture | 4 |
| **2** | **Biology of Silkworm:** Life cycle of Bombyx mori Structure of silk gland and secretion of silk | 4 |
| **3** | **Rearing of Silkworms:** Selection of mulberry variety and establishment of mulberry garden Rearing house and rearing appliances Disinfectants: Formalin, bleaching powder, RKO Silkworm rearing technology: Early age and Late age rearing Types | 10 |

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| | of mountages Spinning, harvesting and storage of cocoons | |
| **4** | **Pests and Diseases:** Pests of silkworm: Uzi fly, dermestid beetles and vertebrates Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial Control and prevention of pests and diseases | 8 |
| **5** | **Entrepreneurship in Sericulture:** Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres. | 4 |
| | **Mandatory Students'Seminar on Individual Topic related to Sericulture [Assessed for Internal Marks]** | |

**SEMESTER 4**

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|---|---|---|---|
| **Semester** | | **IV** | |
| **Course Title** | **Comparative Anatomy (Theory)** | | |
| **Course Code** | **ZOOACOR08T** | **Credit** | **4** |
| **Course Outcome** | The course offers insight into the Chordate anatomy. This course also explores vertebrate morphology with the aims of understanding major events in the history of vertebrate evolution and integrating the morphology of vertebrates with their ecology, behaviour and physiological adaptation in diverse habitats. Selective pressures that shape to different physiological phenotypes will also be addressed in the course.<br><br>After successfully completing this course, the students will be able to:<br> Develop an understanding of the evolution of vertebrates thus integrating structure, function and development.<br><br> Have an overview of the evolutionary concepts including homology and homoplasy, and detailed discussions of major organ systems.<br><br> Develop an understanding of the related disciplines, such as cell biology, neurophysiology, pharmacology, biochemistry etc.<br><br> Get a flavor of research besides improving their writing skills and | | |

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| | making them well versed with the current trends. It will further enable the students to think and interpret individually due to different aspects chosen.<br><br> Undertake research in any aspect of animal physiology in future. |

| **Scheme of Instruction** | | | | | |
|---|---|---|---|---|---|
| **Total Duration** | **60 hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |

| **Scheme of Examination** | | | | | |
|---|---|---|---|---|---|
| **Maximum Score** | **50** | **Internal** | **10** | **End Semester** | **40** |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| **1** | **Integumentary System:** Structure, function and derivatives of integument in amphibian, birds and mammals | 6 |
| **2** | **Skeletal System:** Overview of axial and appendicular skeleton; Jaw suspension; Visceral arches. | 6 |
| **3** | **Digestive System:** Comparative anatomy of stomach; dentition in mammals | 8 |
| **4** | **Respiratory System:** Respiratory organs in fish, amphibian, birds and mammals | 6 |
| **5** | **Circulatory System:** General plan of circulation, Comparative account of heart and aortic arches | 8 |
| **6** | **Urinogenital System:** Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri | 6 |
| **7** | **Nervous System:** Comparative account of brain, Cranial nerves in mammals | 6 |
| **8** | **Sense Organs:** Classification of receptors, Brief account of auditory receptors in vertebrate | 4 |

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|---|---|---|---|---|---|
| **Course Title** | **Comparative Anatomy Lab** | | | | |
| **Course Code** | **ZOOACOR08P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | 30 hours | **Class/Week** | 4 | **Hours/week** | 4 |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 25 | **Internal** | 15 | **End Semester** | 10 |

**Course Mapping**

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| **1** | Study of placoid, cycloid and ctenoid scales through permanent slides/photographs | 5 |
| **2** | Study of disarticulated skeleton of Toad, Pigeon and Guineapig | 5 |
| **3** | Demonstration of Carapace and plastron of turtle | 5 |
| **4** | Identification of mammalian skulls: One herbivorous (Guineapig) and one carnivorous (Dog) animal | 5 |
| **5** | Dissection of Tilapia: Circulatory system, Brain, pituitary, urinogenital system | 10 |

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| **Semester** | | | **IV** | | |
| **Course Title** | **Physiology: Life Sustaining system (Theory)** | | | | |
| **Course Code** | **ZOOACOR09T** | **Credit** | **4** | | |
| **Course Outcome** | The course deals with various physiological functions in mammals. It also gives an account of the metabolic/ biochemical pathways and the probable impact of environment on them.<br>**Learning outcomes**<br>After successfully completing this course, the students will be able to:<br>□ Understand the physiology at cellular and system levels.<br>□ Understand the mechanism and regulation of breathing, oxygen consumption and determination of respiratory quotient.<br>□ Understand how mammalian body gets nutrition from different biomolecules.<br>□ Understand the process of digestion and excretion.<br>□ Understand the organization of nervous system and process of nerve conduction.<br>□ Understand the process of vision and hearing.<br>□ Understand the process of muscle contraction.<br>□ Learn the determination of hemoglobin content, blood groups and blood pressure. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **50** | **Internal** | **10** | **End Semester** | **40** |
| **Course Mapping** | | | | | |
| **Units** | **Course Content** | | | | **Lecture Hour (Cumulative)** |

| | | |
|---|---|---|
| 1 | **Physiology of Digestion:** Structural organisation and functions of Gastrointestinal tract and Associated glands; Mechanical and chemical digestion of food, absorption of Carbohydrates, Lipids, Proteins and Nucleic Acids; Digestive enzymes | 12 |
| 2 | **Physiology of Respiration:** Mechanism of Respiration, Respiratory volumes and capacities, transport of Oxygen and Carbon dioxide in blood, Dissociation curves and the factors influencing it, respiratory pigments; Carbon monoxide poisoning | 10 |
| 3 | **Physiology of Circulation:** Components of Blood & their functions; Structure & functions of haemoglobin; Haemostasis; Blood clotting system, Fibrinolytic system; Haemopoiesis: Basic steps & its regulation; Blood groups; ABO & Rh factor | 12 |
| 4 | **Physiology of Heart:** Structure of mammalian heart, Coronary Circulation, Structure and working of conducting myocardial fibers, Origin and conduction of cardiac impulses; Cardiac Cycle and cardiac output; Blood pressure and its regulation | 10 |
| 5 | **Thermoregulation & Osmoregulation:** Physiological classification based on thermal biology. Thermal biology of endotherms; Osmoregulation in aquatic vertebrates; Extra-renal osmo-regulatory organs in vertebrates | 8 |
| 6 | **Renal Physiology:** Structure of Kidney and its functional unit, Mechanism of urine formation, Regulation of acid-base balance | 8 |

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|---|---|---|---|---|---|
| **Course Title** | **Animal Physiology: Life Sustaining system Lab** | | | | |
| **Course Code** | **ZOOACOR09P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **30 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **25** | **Internal** | **15** | **End Semester** | **10** |

| Course Mapping | | |
|---|---|---|
| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
| 1 | Determination of ABO Blood group | 6 |
| 2 | Enumeration of red blood cells and white blood cells using haemocytometer | 6 |
| 3 | Estimation of haemoglobin using Sahli's haemoglobinometer | 6 |
| 4 | Preparation of haemin and haemochromogen crystals | 6 |
| 5 | Recordingof blood pressure using a digital meter or Spghymomanometer. | 6 |

| **Semester** | | **IV** | |
|---|---|---|---|
| **Course Title** | **Immunology (Theory)** | | |
| **Course Code** | **ZOOACOR10T** | **Credit** | **4** |
| **Course Outcome** | This is a detailed insight into the topic of Immunology that provides the students with the fundamental knowledge of the immune system and its protective roles against diseases.<br><br>After successfully completing this course, the students will be able to:<br>□ Identify the major cellular and tissue components which comprise the innate and adaptive immune system.<br>□ Understand how are immune responses by CD4 and CD8 T cells, and B | | |

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| | cells, initiated and regulated.<br>□ Understand how does the immune system distinguish self from non-self | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **50** | **Internal** | **10** | **End Semester** | **40** |

**Course Mapping**

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| 1 | **Overview of Immune System:** Basic concepts of health and diseases, Historical perspective of Immunology, Organs (Primary & Secondary lymphoid organs and its importance) and Cells of the Immune system, Concept of Haematopoiesis and development of progenitor cells of the Immune system (Brief idea) | 4 |
| 2 | **Innate and Adaptive Immunity:** Principle of Innate and Adaptive Immunity.<br>• Components of innate immunity – Epithelial barriers (skin and mucosal membranes [concept]) – Cellular mechanisms (phagocytes, NK cells, mast cells, eosinophils, inflammation [concept]) – Humoral mechanisms (complement, cytokines, chemokines etc. [concept])<br>• Components of adaptive immunity – Cellular mechanisms (Cell-Mediated Immune System (CMIS) or TCell Immunity [concept]) – Humoral mechanisms (Formation of Plasma B cells and Memory B cells [concept]) | 6 |
| 3 | **Antigen, Antigen presentation & MHC:** Concept of Antigen, Immunogen, Allergen & Pathogen. Adjuvants and haptens, Factors influencing immunogenicity, Epitope. Types of Antigen Presenting Cells (APC), Structure of Major Histocompatibility | 6 |

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| | Complex (MHC) molecules.<br><br>Mechanism of antigen presentation and involvement of MHC molecules (both MHC-I & MHC-II) in details. Co-stimulatory molecules on APC. | |
| 4 | **T Cell development:** Structure of T cell receptors, Co-stimulatory molecules on T cells Concept of synapse between APC & T cells (between MHC≈TCR & between Costimulatory molecules) in details. Central differentiation of T cells; T cell selection in thymus Peripheral differentiation of T cells; Th1 & Th2 | 6 |
| 5 | **Immunoglobulins:** Structure and functions of different classes of immunoglobulins, Antigen- antibody interactions, Immunoassays (ELISA and RIA), Hybridoma technology, Monoclonal antibody production | 6 |
| 6 | **Cytokines & Chemokines:** Brief concept on types of Cytokines & Chemokines Cytokines (source & function of IL-1, IL-2, IL-4, IL-5, IL-6, IL-8, IL-10, IL-12, Interferons, Tumor Necrosis Factors, Tumor Growth Factors, GM-CSF, M-CSF). Chemokines (source & function of CCL2, CCL3, CCL4, CCL5, CxCL8, CxCL10) | 4 |
| 7 | **Complement System:** Components and pathways of complement activation. | 4 |
| 8 | **Hypersensitivity:** Gell and Coombs' classification and brief description of various types of hypersensitivities | 4 |
| 9 | **Immunology of diseases:** Malaria, Visceral Leishmaniasis, Filariasis, Dengue and Tuberculosis | 6 |
| **10** | **Vaccines:** Various types of vaccines. Active & passive immunization (Artificial and natural). | 4 |

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|---|---|---|---|---|---|
| **Course Title** | **Immunology Lab** | | | | |
| **Course Code** | **ZOOACOR10P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **30 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |

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| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. |

| **Scheme of Examination** | | | | | |
|---|---|---|---|---|---|
| **Maximum Score** | **25** | **Internal** | **15** | **End Semester** | **10** |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| 1 | Demonstration of lymphoid organs. | 6 |
| 2 | Histological study of spleen, thymus and lymph nodes through slides/ photographs | 6 |
| 3 | Preparation of stained blood film to study various blood cells | 6 |
| 4 | ABO blood group determination | 6 |
| 5 | Demonstration of ELISA using kit | 6 |

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| **Semester** | **IV** | | |
| **Course Title** | **Skill Enhancement Courses (SEC) Apiculture** | | |
| **Course Code** | **ZOOSSEC003** | **Credit** | **2** |
| **Course Outcome** | This course tells the students what tools and equipment will be needed, the main activities in beekeeping, discover the principles of<br><br>sustainable beekeeping and how these principles can guide beekeeping into an enduring practice. This course will impart additional knowledge and enhances exposure beyond discipline leading to moral and ethical awareness.<br><br>Upon successful completion of this course, the student should be able to:<br><br>□ Explain what are the prerequisite to get started in beekeeping.<br><br>□ Modern techniques of bee keeping and sustainable apiculture.<br><br>□ Discuss the responsibilities of urban beekeepers. | | |

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| | □ Describe bee biology and anatomy |

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| **Scheme of Instruction** | | | | | |
| **Total Duration** | **30 hours** | **Class/Week** | **2** | **Hours/week** | **2** |
| **Instruction Mode** | • Interactive Lecture Method<br>• Demonstration Method<br>• Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method.<br>• Seminar Method | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **25** | **Internal** | **15** | **End Semester** | **10** |

**Course Mapping**

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| 1 | **Biology of Bees:** History, Classification and Biology of Honey Bees Social Organization of Bee Colony | 8 |
| 2 | **Rearing of Bees:** Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth Bee Pasturage Selection of Bee Species for Apiculture Bee Keeping Equipment Methods of Extraction of Honey (Indigenous and Modern) | 10 |
| 3 | **Diseases and Enemies:** Bee Diseases and Enemies Control and Preventive measures | 4 |
| 4 | **Bee Economy:** Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc. | 4 |

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| 5 | **Entrepreneurship in Apiculture:** Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens | 4 |
| | **Mandatory Students'Seminar on Individual Topic related to Apiculture [Assessed for Internal Marks** | |

**SEMESTER 5**

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| **Semester** | | | **V** | | |
| **Course Title** | **Molecular Biology (Theory)** | | | | |
| **Course Code** | **ZOOACOR11T** | | **Credit** | **4** | |
| **Course Outcome** | The course provides an insight into the life processes at the sub-cellular and molecular levels. Other important aspects include DNA and molecular genetics including gene cloning, sequencing and gene mapping in addition to the powerful techniques that revolutionized the pharmaceutical, health and agricultural industries.<br><br>After successfully completing this course, the students will be able to:<br> Develop an understanding of concepts, mechanisms and evolutionary significance and relevance of molecular biology in the current scenario.<br><br> Get well versed in recombinant DNA technology which holds application in biomedical & genomic science, agriculture, environment management, etc. Therefore, a fundamental understanding of Molecular Biology will help in career building in all these fields.<br><br> Apply their knowledge in problem solving and future course of their career development in higher education and research.<br><br> Get new avenues of joining research in related areas such as therapeutic strategies or related opportunities in industry. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |

| Scheme of Examination | | | | | |
|---|---|---|---|---|---|
| **Maximum Score** | **50** | **Internal** | **10** | **End Semester** | **40** |

| Course Mapping | | |
|---|---|---|
| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
| 1 | **Nucleic Acids:** Salient features of DNA and RNA Watson and Crick Model of DNA | 4 |
| 2 | **DNA Replication:** Mechanism of DNA Replication in Prokaryotes, Semi-conservative, bidirectional and discontinuous Replication, RNA priming, Replication of telomeres | 8 |
| 3 | **Transcription:** Mechanism of Transcription in prokaryotes and eukaryotes, Transcription factors, Difference between prokaryotic and eukaryotic transcription | 10 |
| 4 | **Translation:** Mechanism of protein synthesis in prokaryotes, Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination ofpolypeptide chain; Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation | 18 |
| 5 | **Post Transcriptional Modifications and Processing of Eukaryotic RNA:** Capping and Poly A tail formation in mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA | 6 |
| 6 | **Gene Regulation:** Regulation of Transcription in prokaryotes: lac operon and trp operon; Regulation of Transcription in eukaryotes: Activators, enhancers, silencer, repressors, miRNA mediated gene silencing, Genetic imprinting | 6 |
| 7 | **DNA Repair Mechanisms:** Types of DNA repair mechanisms, RecBCD model in prokaryotes, nucleotide and base excision repair, SOS repair | 4 |

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| 8 | **Molecular Lab Techniques:** PCR, Western and Southern blot, Northern Blot, Sanger DNA sequencing, cDNA technology | 4 |

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|---|---|---|---|---|---|
| **Course Title** | **Molecular Biology Lab** | | | | |
| **Course Code** | **ZOOACOR11P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **30Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **25** | **Internal** | **15** | **End Semester** | **10** |

**Course Mapping**

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| 1 | Demonstration of polytene Chromosome from Drosophila /Chironomid larvae | 10 |
| 3 | Isolation and quantification of genomic DNA using spectrophotometer (A260 measurement) | 10 |
| 3 | Agarose gel electrophoresis for DNA | 10 |
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| **Semester** | | **V** | | | |
| **Course Title** | **Genetics (Theory)** | | | | |
| **Course Code** | **ZOOACOR12T** | **Credit** | **4** | | |
| **Course Outcome** | The course is designed to revise basic concepts of Genetics and then move on to advanced concepts. Some key aspects include the mechanism of inheritance, gene structure and function, sex chromosomal and autosomal anomalies, aspects of human genetics, etc. will be covered. A strong emphasis will be laid on the modern tools and techniques used in genetics.<br><br>After successfully completing this course, the students will be able to:<br> Understand how DNA encodes genetic information and the function of mRNA and tRNA<br><br> Apply the principles of Mendelian inheritance.<br><br> Understand the cause and effect of alterations in chromosome number and structure.<br><br> Relate the conventional and molecular methods for gene manipulation in other biological systems.<br><br> Discuss and analyse the epigenetic modifications and imprinting and its role in diseases.<br><br> Get new avenues of joining research in related areas such as genetic engineering of cells, cloning, genetic disorders, human fertility programme, genotoxicity, etc. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |

| Maximum Score | 50 | Internal | 10 | End Semester | 40 |
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| Course Mapping | | |
|---|---|---|
| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
| 1 | **Mendelian Genetics and its Extension:** Background of Mendel's experiments Principles of Mendelian inheritance, Incomplete dominance and co-dominance, Epistasis, Multiple alleles, Lethal alleles, Pleiotropy, Sex-linked, sex- influenced and sex-limited inheritance, Polygenic Inheritance | 8 |
| 2 | **Linkage, Crossing Over and Chromosomal Mapping:** Linkage and Crossing Over, molecular basis of crossing over, Measuring Recombination frequency and linkage intensity using three factor crosses, Interference and coincidence | 12 |
| 3 | **Mutations:** 1. Types of gene mutations (Classification), Types of chromosomal aberrations (Classification with one suitable example of each), Chromosomal aberrations, gene mutations and human diseases (Down's, Klienfelter's, Turner's, Cri du Chat, Sickle cell, Haemophilia, Thallassimia, Albinism – only genetical aspects here, details of physiological consequences not required), Sex chromosomes and sex-linked inheritance<br><br>2. Non-disjunction and variation in chromosome number; Molecular basis of mutations in relation to UV light and chemical mutagens | 10 |
| 4 | **Sex Determination:** Mechanisms of sex determination in Drosophila with reference to alternative splicing Sex determination in mammals Dosage compensation in Drosophila & Human | 7 |
| 5 | **Extra-chromosomal Inheritance:** Criteria for extra chromosomal inheritance, Antibiotic resistance in Chlamyadomonas, Kappa particle in Paramoecium Shell spiralling in snail | 6 |
| 6 | **Recombination in Bacteria and Viruses:** Conjugation, Transformation, Transduction, Complementation test in Bacteriophage | 9 |

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| 7 | **Transposable Genetic Elements:** Transposons in bacteria, Ac-Ds elements in maize and P elements in Drosophila, LINE, SINE, Alu elements in humans | 8 |

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|---|---|---|---|---|---|
| **Course Title** | **Genetics Lab** | | | | |
| **Course Code** | **ZOOACOR12P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **30 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **25** | **Internal** | **15** | **End Semester** | **10** |

**Course Mapping**

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| 1 | **Chi-square analyses:** Statistical tests of data and decision making Chi square test for goodness of fit and student t test for comparing means of two small samples from normal populations (paired/unpaired) | 10 |
| 2 | Pedigree analysis of some inherited traits in human | 10 |
| 3 | Identification of chromosomal aberration in Drosophila from photographs | 10 |

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| **Semester** | **V** | | |
| **Course Title** | **Animal Behaviour and Chronobiology (Theory)** | | |
| **Course Code** | **ZOOADSE01T** | **Credit** | **4** |
| **Course Outcome** | This course encompasses study of animal behaviour and chronobiology of animals. Students will understand types of animal behaviour and their | | |

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| | importance to the organisms. The course will brig about the following outcomes:<br><br>• Enhance their observation, analysis, interpretation and documentation skills by taking short projects pertaining to Animal behaviour and chronobiology.<br><br>• Relate animal behaviour with other subjects such as Animal biodiversity, Evolutionary biology, Ecology, Conservation biology and Genetic basis of the behaviour.<br><br>• Understand various process of chronobiology in their daily life such as jet lag.<br><br>• Learn about the biological rhythm and their application in pharmacology and modern medicine.<br><br>• Realize, appreciate and develop passion to biodiversity; andy will respect the nature and environment.<br><br>After successfully completing this course, the students will be able to:<br><br>o Know about patterns of animal behaviours<br>o Survival strategies of animals<br>o Social and cooperative behaviours<br>o Design of signals and chronobiology<br>o hey will also know to construct ethograms |

| **Scheme of Instruction** | | | | | |
|---|---|---|---|---|---|
| **Total Duration** | **60 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |

| **Scheme of Examination** | | | | | |
|---|---|---|---|---|---|
| **Maximum Score** | **50** | **Internal** | **10** | **End Semester** | **40** |

| **Course Mapping** | | |
|---|---|---|
| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
| 1 | **Introduction to Animal Behaviour** | 14 |

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| | 1. A brief history of animal behaviour studies including the works of Fabre, Darwin, Von Frisch, Lorenz, Tinbergen, Jane Goodal, BirutéGaldikas, Dian Fossey, Salim Ali, Gopal Bhattacharyya, M. K. Chandrashekhar, Raghavendra Gadagkar.<br><br>2. The objectives of modern animal behaviour studies: Tinbergen's four questions.<br><br>3.Methods of studying behaviours: Observation vs Watching, Ad libitum observations, Focal animal studies, Instantaneous scan, etc.<br><br>4. Branches of Animal Behaviour Studies | |
| 2 | **Behaviours of Individuals**<br><br>1. Reflexes and Orientations<br><br>2. Instinct<br><br>3. Learning: Imprinting and other Programmed Learning, Habituation, Innovations and Cultural Transmission / Social Learning | 12 |
| 3 | **Social and Sexual Behaviour**<br><br>1. Social Behaviour: Concept of Sociality, Types of animal Society with examples, Altruism<br><br>2. Communications in animals- different types (e.g. pheromones, visuals, tactile, acoustics, etc) with common examples<br><br>3. Insects' society with Honey bee as example; Foraging in honey bee and advantages of the waggle dance.<br><br>4. Sexual Behaviour: Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice), Sexual conflict in parental care. | 12 |
| 4 | **Introduction to Chronobiology**<br><br>1. Historical developments in chronobiology; 2. Biological oscillation: the concept of Average, amplitude, phase and period<br><br>3. Adaptive significance of biological clocks | 10 |

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| 5 | **Biological Rhythm**<br>1. Types and characteristics of biological rhythms: Short- and Long- term rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms;<br>2. Concept of synchronization and masking; Photic and non-photic zeitgebers; Circannual rhythms;<br>3. Photoperiod and regulation of seasonal reproduction of vertebrates;Role of melatonin. | 12 |

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|---|---|---|---|---|---|
| **Course Title** | **Animal Behaviour and Chronobiology Lab** | | | | |
| **Course Code** | **ZOOADSE01P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **25** | **Internal** | **15** | **End Semester** | **10** |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| 1 | To study nests (non-invasively) and nesting habits of the birds and social insects (e.g. Social Wasps) . | 10 |
| 2 | To study the behavioural responses of rice weevil /wood lice to dry and humid conditions. | 10 |
| 3 | To study geotaxis behaviour in earthworms. | 10 |
| 4 | To study the phototaxis behaviour in insects/defensive behaviour in mosquito larvae. | 8 |

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| 5 | **Excursion: Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park (within West Bengal) to study behavioural activities of animals and prepare a short report.** | 10 |
| 6 | Study and actogram construction of locomotor activity of suitable animal models. | 6 |
| 7 | Study of circadian functions in humans (daily eating, sleep and temperature patterns). | 6 |

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| **Semester** | | | **V** | | |
| **Course Title** | **Endocrinology (Theory)** | | | | |
| **Course Code** | **ZOOADSE03T** | **Credit** | **4** | | |
| **Course Outcome** | The course envisages information on endocrine system with emphasis on the structure ofhypothalamus and anterior pituitary. The associated hormones and the related disorders willbe explained.<br>The students will learn the following-<br>□ Understand neurohormones and neurosecretions.<br>□ Learn about hypothalamo and hypapophysial axis.<br>□ Understand about different endocrine glands and their disorders.<br>□ Understand the mechanism of hormone action. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **50** | **Internal** | **10** | **End Semester** | **40** |

| Course Mapping | | |
|---|---|---|
| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
| 1 | **Introduction to Endocrinology**<br>General idea of Endocrine systems, Classification, Characteristic and Transport of Hormones, Neurosecretions and Neurohormones | 8 |
| 2 | **Epiphysis, Hypothalamo-hypophysial Axis** Structure of pineal gland, Secretions and their functions in biological rhythms and reproduction; Structure and functions of hypothalamus and Hypothalamic nuclei, Regulation of neuroendocrine glands, Feedback mechanisms; Structure of pituitary gland, Hormones and their functions, Hypothalamo-hypophysial portal system, Disorders of pituitary gland. | 20 |
| 3 | **Peripheral Endocrine Glands**<br>Structure, Hormones, Functions and Regulation of Thyroid gland, Parathyroid, Adrenal, Pancreas, Ovary and Testis; Hormones in homeostasis, Disorders of endocrine glands | 18 |
| 4 | **Regulation of Hormone Action**<br>Mechanism of action of steroidal, non-steroidal hormones with receptors Bioassays of hormones using RIA & ELISA; Estrous cycle in rat and menstrual cycle in human; Multifaceted role of Vasopressin & Oxytocin; Hormonal regulation of parturition | 14 |

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|---|---|---|---|---|---|
| **Course Title** | **Endocrinology Lab** | | | | |
| **Course Code** | **ZOOADSE03P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |

| Scheme of Examination | | | | | |
|---|---|---|---|---|---|
| **Maximum Score** | **25** | **Internal** | **15** | **End Semester** | **10** |

| Course Mapping | | |
|---|---|---|
| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
| 1 | Dissect and display of Endocrine glands in rat | 10 |
| 2 | Study of the permanent slides of all the endocrineglands | 10 |
| 3 | Tissue fixation, embedding in paraffin, microtomy and slide preparation of any endocrinegland | 16 |
| 4 | Estimation of plasma level of any hormone usingELISA | 10 |
| 5 | Designing of primers of any hormone. | 14 |

**SEMESTER 6**

| Semester | VI |
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|---|---|---|---|---|---|
| **Course Title** | **Developmental Biology (Theory)** | | | | |
| **Course Code** | **ZOOACOR13T** | **Credit** | **4** | | |
| **Course Outcome** | The course explains the sequence of events starting with a single cell to the production of a very complex organism. The course not only describes how embryos develop (embryology), but also highlights how the processes of development are brought about by changing individual cells into specialized cells with specific functions (the cellular level), and how genes within the genome of the organism drive and guide these changes (the molecular level). It also deals with a comparative account of development in some select groups of animals.<br><br>After successfully completing the course, the students will be able to<br> Develop critical understanding how a single-celled fertilized egg becomes an embryo and then a fully formed adult by going through three important processes of cell division, cell differentiation and morphogenesis.<br> Understand how developmental processes and gene functions within a particular tissue or organism can provide insight into functions of other tissues and organisms.<br> Realize that very similar mechanisms are used in very diverse organisms; and development is controlled through molecular changes resulting in variation in the expression and function of gene networks.<br> Understand how the field of developmental biology has changed since the beginning of the 19th century with different phases of developmental research predominating at different times.<br> Understand the relevance of developmental biology in medicine or its role in development of diseases. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **50** | **Internal** | **10** | **End Semester** | **40** |
| **Course Mapping** | | | | | |

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
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|---|---|---|
| 1 | Basic concepts: Phases of Development, Cell-cell interaction, Differentiation and growth, Differential gene expression | 9 |
| 2 | Gametogenesis, Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization (External and Internal): Changes in gametes, Blocks to polyspermy; Planes and patterns of cleavage; Types of Blastula; Fate maps (including Techniques); Early development of frog and chick up to gastrulation; Embryonic induction and organizers | 24 |
| 3 | Fate of Germ Layers; Extra-embryonic membranes in birds; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta) | 9 |
| 4 | Development of brain and Eye in Vertebrate Regeneration: Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each) | 10 |
| 5 | Teratogenesis: Teratogenic agents and their effects on embryonic development; In vitro fertilization, Stem cell (ESC), Amniocentesis | 8 |

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|---|---|---|---|---|---|
| **Course Title** | **Developmental Biology Lab** | | | | |
| **Course Code** | **ZOOACOR13P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **25** | **Internal** | **15** | **End Semester** | **10** |
| **Course Mapping** | | | | | |

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| 1 | Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and | 20 |

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| | Hamburger stages) | |
| 2 | Study of the developmental stages and life cycle of Drosophila from stock culture | 16 |
| 3 | Study of different sections of placenta (microphotographs/ slides) | 16 |
| 4 | Project report on Drosophila culture/chick embryo development | 8 |

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| **Semester** | | | **VI** | | |
| **Course Title** | **Evolutionary Biology (Theory)** | | | | |
| **Course Code** | **ZOOACOR14T** | **Credit** | **4** | | |
| **Course Outcome** | The present course gives insight into the origin of life and the related evolutionary processes. The evolutionary theories and the process of species formation will be elaborated in view of the natural selection process.<br><br>After successfully completing this course, the students will be able to:<br> Acquire an in-depth knowledge on the diversity and relationships in animal world.<br> Develop a holistic appreciation on the phylogeny and adaptations in animals.<br> Enable the students to understand the evolution of universe and life.<br> Understanding on the process and theories in evolutionary biology.<br> Develop an interest in the debates and discussion taking place in the field of evolutionary biology. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **50** | **Internal** | **10** | **End Semester** | **40** |
| **Course Mapping** | | | | | |
| **Units** | **Course Content** | | | **Lecture Hour** | |

| | | (Cumulative) |
|---|---|---|
| 1 | Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes, three domains of life | 3 |
| 2 | Pre-Darwinian Concepts and theories including Lamarckism, Darwininan Theory Neo-Darwinian Synthesis, Anti-evolutionary ideas of Creationism and their scientific refusal | 3 |
| 3 | Fossil records: types of fossils, geological time scale, transitional forms: examples of fossils depicting the evolutionary stages of the modern horses Molecular (universality of genetic code and protein synthesis machinery) evidences | 5 |
| 4 | Heritable variations present in natural populations (classical study of Lewontin and Hubby, 1966 in Drosphila, as example) | 4 |
| 5 | Concept of Populations and calculation of allele frequencies in a population Hardy-Weinberg Law and equilibrium (derivations, applications of law to find gene and genotype frequencies in human Populations) Evolutionary forces disrupting H-W equilibrium- Natural selection: Definition as the non-differential rate of reproductions and survivals of competing alleles, concept of fitness, selection coefficient, Types of natural selection with examples- Disrupting, Stabilizing, Directional. Genetic Drift- outline of its mechanism, basic concepts and examples of founder's effect, bottleneck phenomenon; Role of Gene flow and Mutation rates in changing allele frequencies in a population (No mathematical models) | 19 |
| 6 | Inter-population variations: clines, races, Species concepts and modes of speciation (just outlines of Allopatric, Sympatric and Parapatric speciation models with examples ), Isolating mechanisms Adaptive radiations/ macroevolution as exemplified by Galapagos finches | 10 |
| 7 | Major mass extinctions in the history of life and their impacts on biodiversity on earth (brief descriptions) | 4 |
| 8 | Unique hominid characteristics contrasted with primate characteristics (including social and cultural ones), Primate phylogeny: from *Dryopithecus* leading to *Homo sapiens*, | 7 |

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| | Molecular evidences of human origin and migrations (brief outline) | |
| 9 | The basic concept of molecular phylogeny, Neutral theory of molecular evolution, molecular clock (brief introductions) Example of evolution in vertebrate globin genes | 5 |

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| **Course Title** | **Evolutionary Biology Lab** | | | | |
| **Course Code** | **ZOOACOR14P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **25** | **Internal** | **15** | **End Semester** | **10** |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| 1 | Study of fossils from models/ photographs- Direct ancestors of horses, *Archaeopteryx* | 11 |
| 2 | Study of homology and analogy from suitable specimens (from Photographs/models) | 11 |
| 3 | Verification of Hardy-Weinberg equilibrium in a population by chi square analysis | 18 |
| 4 | Collection of a sample of height, weight, age, sex data from at least 100 individuals and applying of different statistical analyses (frequency distribution, mean, mode, standard deviations, correlations, etc) and graphical representations. | 20 |

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| **Semester** | | | **VI** | | |
| **Course Title** | **Parasitology (Theory)** | | | | |
| **Course Code** | **ZOOADSE05T** | **Credit** | **4** | | |
| **Course Outcome** | This is a composite course with remarkable utility and importance. Parasitology takes care of the parasites and parasitism, emphasizing the influence of parasites on the ecology and evolution of free living species, and the role of parasites in global, public, health. Immunology part provides the students with the fundamental knowledge of the immune system and its protective roles against diseases.<br><br>After successfully completing this course, the students will be able to:<br> Carry out common procedures for culturing, purifying and diagnostics of micro-organisms understand the disease-causing potential of bacteria and viruses, and the responses of the immune system.<br> Summarise and orally present current microbiological problem areas.<br> Describe the mechanisms for transmission, virulence and pathogenicity in pathogenic micro-organisms.<br> Diagnose the causative agents, describe pathogenesis and treatment for important diseases like malaria, leishmaniasis, trypanosomiasis, toxoplasmosis, schistosomiasis, cysticercosis, filariasis etc.<br> Assess the importance of incidence, prevalence and epidemiology in microbiological diagnostic activities.<br> Gain experience at reading and evaluating the scientific literature in the area. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |

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| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **50** | **Internal** | **10** | **End Semester** | **40** |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| 1 | Brief introduction of Parasitism and other animal associations, Parasite, Parasitoid and Vectors (mechanical and biological vector) Host parasite relationship and zoonosis | 7 |
| 2 | Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Entamoeba histolytica, Giardia intestinalis, Trypanosoma gambiense, Leishmania donovani, Plasmodium vivax ,Plasmodum falciparum and Toxoplasma gondii* | 12 |
| 3 | Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Fasciola hepatica, Paragonimuswestermani, Schistosoma haematobium, Taenia solium , Echinococcus granulosus and Hymenolepis nana* | 12 |
| 4 | Study of Morphology, Life Cycle, Prevalence, Epidemiology, Pathogenicity, Diagnosis, Prophylaxis and Treatment of *Ascaris lumbricoides, Ancylostoma duodenale, Wuchereriabancrofti* and *Trichinella spiralis*. Study of structure, life cycle and importance of Meloidogyne (root knot nematode), Pratylencus (lesion nematode) | 13 |
| 5 | Mosquitoes and flies as vectors of human pathogen Biology, importance and control of myiasis causing diptera Biology, importance and control of ticks, mites, *Pediculus humanus* (head and body louse), *Xenopsyllacheopis* and *Cimex lectularius* | 12 |
| 6 | A brief account of parasitic vertebrates; Cookiecutter Shark, Candiru, Hood Mockingbird and Vampire bat | 4 |

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|---|---|
| **Course Title** | **Parasitology Lab** |

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|---|---|---|---|---|---|
| **Course Code** | **ZOOADSE05P** | | **Credit** | **2** | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **25** | **Internal** | **15** | **End Semester** | **10** |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| 1 | Study of life stages of *Entamoeba histolytica, Giardia intestinalis, Trypanosoma gambiense, Leishmania donovani* and *Plasmodium vivax* through permanent slides/micro photographs | 11 |
| 2 | Study of adult and life stages of *Fasciola hepatica, Schistosoma haematobium, Taenia solium* and *Hymenolepis nana* through permanent slides/micro photographs | 11 |
| 3 | Study of adult and life stages of *Ascaris lumbricoides, Ancylostoma duodenale, Wuchereriabancrofti*and *Trichinella spiralis* through permanent slides/micro photographs. | 11 |
| 4 | Study of plant parasitic root knot nematode, Meloidogyne from the soil sample | 8 |
| 5 | Study of *Pediculus humanus* (Head louse and Body louse), *Xenopsyllacheopis* and *Cimex lectularius* through permanent slides/ photographs | 8 |
| 6 | Study of monogenea from the gills of fresh/marine fish [Gills can be procured from fish market as by product of the industry] | 6 |
| 7 | Study of nematode/cestode parasites from the intestines of Poultry bird [Intestine can be procured from poultry/market as a | 5 |

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| | by product] | |

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| **Semester** | | | **VI** | | |
| **Course Title** | **Wildlife and Conservation (Theory)** | | | | |
| **Course Code** | **ZOOADSE06T** | **Credit** | **4** | | |
| **Course Outcome** | The course is an introduction to wildlife management and gives an account of the tools used by wildlife managers. Topics covered are to equip students with adequate knowledge of various biodiversity monitoring methodologies, conservation and management issues of vertebrate pests, wildlife conflict and over abundant species, wildlife health and diseases.<br><br>After successfully completing this course, the students will be able to:<br> Develop an understanding of how animals interact with each other and their natural environment<br> Develop the ability to use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues<br> Develop the ability to work collaboratively on team-based projects<br> Demonstrate proficiency in the writing, speaking, and critical thinking skills needed to become a wildlife technician<br> Gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management<br> Develop an ability to analyze, present and interpret wildlife conservation management information. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | **50** | **Internal** | **10** | **End Semester** | **40** |
| **Course Mapping** | | | | | |
| **Units** | **Course Content** | | | **Lecture Hour** | |

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| | | **(Cumulative)** |
| 1 | Values of wild life; Importance of conservation; Causes of depletion of Wildlife in India | 5 |
| 2 | Forest habitats: major forest types of India and West Bengal Forest covers estimation: remote sensing and GIS | 4 |
| 3 | Management of Successional wild habitats Forest fire Restoration of degraded wild habitats (The above topics should be learnt mostly in reference to the protected areas in West Bengal) | 9 |
| 4 | Population and population density estimations: different methods in practice Sex Ratio computation and Fertility status | 6 |
| 5 | Traditional Conservation ethics and practices in India Conservation strategies and Practices: Wildlife Acts (IUCN, WPA of India, CITES etc) | 6 |
| 6 | Estimation of carrying capacity; Eco tourism / wild life tourism in forests; Concept of climax persistence; Ecology of perturbence. | 8 |
| 7 | Causes and consequences of human-wildlife conflicts; Mitigation of conflict – an overview; Wildlife/Ecotourism advantages and disadvantages | 10 |
| 8 | Major wildlife areas in India (all from West Bengal): Sanctuaries, National Parks, Tiger and other Wildlife Reserves, Biosphere reserves, etc. Community reserve: concepts and examples Management challenges in Tiger reserve | 12 |

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|---|---|---|---|---|---|
| **Course Title** | **Wildlife and Conservation Lab** | | | | |
| **Course Code** | **ZOOADSE06P** | **Credit** | **2** | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | **60 Hours** | **Class/Week** | **4** | **Hours/week** | **4** |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |

| Maximum Score | 25 | Internal | 15 | End Semester | 10 |
|---|---|---|---|---|---|

| Course Mapping | | |
|---|---|---|
| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
| 1 | **Excursion: Identification of common local flora, mammalian fauna, avian fauna, herpeto-fauna** | 7 |
| 2 | **Demonstration of basic equipments needed in wildlife studies use, care and maintenance (Compass, Binoculars, Range Finders, Global Positioning System, Various types of Cameras and lenses)** | 8 |
| 3 | **Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers, etc.** | 14 |
| 4 | **Demonstration of different field techniques for flora and fauna** | 7 |
| 5 | **Quadrat and other methods for ground cover assessment, Height-Girth relationships in trees, Canopy cover assessment in a patch of vegetations.** | 12 |
| 6 | **Trail / transect monitoring for abundance and diversity estimation of mammals and birds, butterflies (direct and indirect evidences)** | 12 |

**B.Sc. Zoology General Course (CBCS)**

| Semester | I |
|---|---|
| Course Title | Animal Diversity |

| | | | | | |
|---|---|---|---|---|---|
| **Course Code** | **ZOOHGE01T** | | **Credit** | 4 | |
| **Course Outcome** | Students will acquire the following skills after the course:<br>✓ To demonstrate salient features of different phyla and sub-taxa of kingdom Animalia and sub-kingdom Protozoa.<br>✓ To cite examples of different animals from different taxonomic categories.<br>✓ To demonstrate Anatomy and Physiology of several taxonomic groups. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | 50 Hours | **Class/Week** | 3 | **Hours/Week** | 3 |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 50 | **Internal** | 10 | **End Semester** | 40 |

**Course Mapping**

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| 1 | **Kingdom Protista:** General characters and classification of Subkingdom Protozoa up to Phylum (Levine et al., 1980); Locomotory Organelles and locomotion in Protozoa. | 3 |
| 2 | **Phylum Porifera:** General characters and classification up to classes; Canal System in Sycon. | 3 |
| 3 | **Phylum Cnidaria:** General characters and classification up to classes; Polymorphism in Hydrozoa. | 3 |
| 4 | **Phylum Platyhelminthes:** General characters and classification up to classes; Life history of *Taenia solium*. | 3 |
| 5 | **Phylum Aschelminthes:** General characters and classification up to classes; Life history of *Ascaris lumbricoides* and its parasitic adaptations. | 3 |
| 6 | **Phylum Annelida:** General characters and classification up to classes; Nephridia in Annelida. | 3 |

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|---|---|---|
| 7 | **Phylum Arthropoda:** General characters and classification up to classes; Vision in insect, Metamorphosis in Insects. | 5 |
| 8 | **Phylum Mollusca:** General characters and classification up to classes; Respiration in *Pila*. | 3 |
| 9 | **Phylum Echinodermata:** General characters and classification up to classes; Water-vascular system in *Asterias*. | 4 |
| 10 | **Protochordates:** General features; Feeding in *Branchiostoma*. | 2 |
| 11 | **Agnatha:** General features and classification up to classes (Young, '81). | 2 |
| 12 | **Pisces:** General features and Classification up to Subclasses (Romer, 1959); Osmoregulation in Fishes. | 3 |
| 13 | **Amphibia:** General features and Classification up to living orders (Duellman & Trueb, 1986); Metamorphosis in Toad. | 3 |
| 14 | **Reptiles:** General features and Classification up to living Subclass (Young, 1981); Poisonous and non-poisonous snakes, Biting mechanism in snakes. | 4 |
| 15 | **Aves:** General features and Classification up to orders (Young, 1981); Flight adaptations in birds | 3 |
| 16 | **Mammals:** Classification up to Subclasses (Young, 1981); Origin & distribution of Cranial nerves in *Cavia*. | 3 |

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|---|---|---|---|
| **Semester** | | **I** | |
| **Course Title** | **Animal Diversity Lab** | | |
| **Course Code** | **ZOOHGE01P** | **Credit** | 2 |
| **Course Outcome** | Students will acquire the following skills after the course:<br>✓ To identify different animals from different taxonomic categories.<br>✓ To demonstrate salient features of different phyla and sub-taxa of kingdom Animalia and sub-kingdom Protozoa.<br>✓ To apply knowledge of animal diversity in several related disciplines in future.<br>✓ To apply experience of laboratory instruments and equipments handling in further learning experiences. | | |

| **Scheme of Instruction** | | | | | |
|---|---|---|---|---|---|
| **Total Duration** | 50 Hours | **Class/Week** | 8 | **Hours/Week** | 8 |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 25 | **Internal** | 15 | **End Semester** | 10 |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| 1 | Spot identification of the following specimens: *Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Euspongia, Obelia, Physalia, Aurelia, ,Metridium, Taenia solium*, Male and female *Ascaris lumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria*, *Antedon, Balanoglossus, Herdmania, Branchiostoma,Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/ Ureotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis, Passer, Psittacula, Alcedo, Sorex, Pteropus, Funambulus, Suncus.* | 40 |
| 2 | Study permanent slides: Transverse section of male and female *Ascaris*. | 4 |
| 3 | Identification of poisonous and non-poisonous snakes | 4 |
| 4 | An “animal album” containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose. | 2 |

| **Semester** | **II** | | |
|---|---|---|---|
| **Course Title** | **Physiology and Biochemistry** | | |
| **Course Code** | **ZOOHGE02T** | **Credit** | 4 |

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| **Course Outcome** | Students will acquire the following skills after the course:<br>✓ To understand and demonstrate different features of the major systems of human body.<br>✓ To describe different physiological processes of the major systems of human body.<br>✓ To illustrate molecular organization of major biomolecules.<br>✓ To demonstrate properties of prime biomolecules.<br>✓ To describe different mechanisms of biochemical cascades. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | 53 Hours | **Class/Week** | 3 | **Hours/Week** | 3 |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 50 | **Internal** | 10 | **End Semester** | 40 |

**Course Mapping**

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| 1 | **Nerve and Muscle:** Structure of a neuron, Resting membrane potential, Graded potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres.<br>Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction. | 8 |
| 2 | **Digestion:** Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids. | 5 |
| 3 | **Respiration:** Pulmonary ventilation, Respiratory volumes and capacities, Transport of Oxygen and carbon dioxide in blood. | 5 |
| 4 | **Excretion:** Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism. | 5 |
| 5 | **Cardiovascular System:** Composition of blood, Homeostasis, Structure of Heart, Origin and conduction of the cardiac impulse, Cardiac cycle | 6 |

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|---|---|---|
| 6 | **Reproduction and Endocrine Glands:** Physiology of male reproduction: hormonal control of spermatogenesis; Physiology of female reproduction: hormonal control of menstrual cycle. Structure and function of pituitary, thyroid, pancreas and adrenal | 7 |
| 7 | **Carbohydrate: Structure and Metabolism:** Introduction to Carbohydrates, Structure & Types of Carbohydrates, Isomerism, Introduction to Intermediary metabolism: Glycolysis, Krebs cycle, Pentose phosphate pathway, Gluconeogenesis, Electron transport chain. | 8 |
| 8 | **Lipid: Structure and Metabolism:** Introduction to Lipids: Definitions; fats and oils; classes of lipids; Lipoproteins; Biosynthesis and β oxidation of palmitic acid | 5 |
| 9 | **Protein: Structure and metabolism:** Proteins and their biological functions, functions of amino acids, physicochemical properties of amino acids. Peptides – structure and properties; primary structure of protein, secondary, tertiary and quaternary structures. Transamination, Deamination and Urea Cycle. | 5 |
| 10 | **Enzymes:** Introduction, Classification of Enzymes, Mechanism of action, Enzyme Kinetics, Inhibition and Regulation. | 4 |

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|---|---|---|---|---|---|
| **Course Title** | **Physiology and Biochemistry Lab** | | | | |
| **Course Code** | **ZOOHGE02P** | **Credit** | 2 | | |
| **Course Outcome** | Students will acquire the following skills after the course:<br>✓ To isolate haemin crystals from mammalian blood sample and compare taxonomically.<br>✓ To compare mammalian organs based on histological properties.<br>✓ To perform qualitative experiments with carbohydrates as major biomolecules.<br>✓ To do quantitative assays with proteins and other major biomolecules.<br>✓ To analyze enzymatic activities and other properties.<br>✓ To handle different laboratory instruments like microscopes, spectrophotometers, colorimeter etc. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | 52 Hours | **Class/Week** | 8 | **Hours/Week** | 8 |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent | | | | |

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|---|---|---|---|---|---|
| | Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 25 | **Internal** | 15 | **End Semester** | 10 |
| **Course Mapping** | | | | | |

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| 1 | Preparation of haemin crystals. | 8 |
| 2 | Identification of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland, small intestine, liver, lung, kidney. | 16 |
| 3 | Qualitative tests to identify functional groups of carbohydrates in given solutions: Glucose (Benedict's test), Sucrose (Iodine test). | 8 |
| 4 | Quantitative estimation of total protein in given solutions by Lowry's method. | 16 |
| 5 | Study of activity of salivary amylase under optimum conditions. | 4 |

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| **Semester** | **III** | | |
| **Course Title** | **Insect, Vectors and Diseases** | | |
| **Course Code** | **ZOOHGE03T** | **Credit** | 4 |
| **Course Outcome** | Students will acquire the following skills after the course:<br><br>✓ To understand general bodily organization of insects.<br>✓ To demonstrate roles of insects as vectors for different diseases.<br>✓ To describe Parasitology of different insect-vectors borne diseases.<br>✓ To illustrate treatment and control mechanisms of different diseases. | | |

| Scheme of Instruction | | | | | |
|---|---|---|---|---|---|
| **Total Duration** | 50 Hours | **Class/Week** | 3 | **Hours/Week** | 3 |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 50 | **Internal** | 10 | **End Semester** | 40 |

**Course Mapping**

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| 1 | Introduction to Insects:<br>General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts with respect to feeding habit. | 6 |
| 2 | Concept of Vectors:<br>Brief introduction to Vectors (mechanical and biological), Reservoirs, Host-vector relationship, Adaptations as vectors, Host specificity. | 6 |
| 3 | Insects as Vectors:<br>Detailed features of insect orders as vectors – Diptera, Siphonoptera, Siphunculata, Hemiptera. | 8 |
| 4 | Dipteran as Disease Vectors:<br>Study of important Dipteran vectors – Mosquitoes, Sand fly, Houseflies Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral Encephalitis, Filariasis Control of mosquitoes. | 14 |
| 5 | Siphonaptera as Disease Vectors:<br>Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas. | 6 |
| 6 | Siphunculata as Disease Vectors:<br>Human louse (Head, Body and Pubic louse) as important insect vectors; | 4 |

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|---|---|---|
| | Control of human louse. | |
| 7 | Hempitera as Disease Vectors:<br><br>Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures | 6 |

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| **Course Title** | **Insect Vectors and Diseases Lab** | | | | |
| **Course Code** | **ZOOHGE03P** | **Credit** | 2 | | |
| **Course Outcome** | Students will acquire the following skills after the course:<br><br>✓ To mount mouth parts of insects and analyze different features.<br>✓ To compare different insect vectors based on morpho- anatomical properties.<br>✓ To illustrate management procedures for different insect-borne diseases.<br>✓ To handle different laboratory instruments like microscopes, spectrophotometers, colorimeter etc. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | 44 Hours | **Class/Week** | 8 | **Hours/Week** | 8 |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 25 | **Internal** | 15 | **End Semester** | 10 |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| 1 | Mounting and Study of different kinds of mouth parts of insects. | 8 |
| 2 | Spot identification of following insect vectors through permanent slides/photographs: *Aedes,Culex, Anopheles, Pediculus humanuscapitis, Pediculus humanuscorporis, Phithirus pubis, Xenopsyllacheopis, Cimex lectularius, Phlebotomus argentipes, Musca domestica*. | 20 |

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|---|---|---|
| 3 | Study of different diseases transmitted by above insect vectors. | 8 |
| 4 | Submission of a project report on any one of the insect vectors and disease transmitted. | 8 |

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| **Semester** | | **IV** | | | |
| **Course Title** | **Environment and Public Health** | | | | |
| **Course Code** | **ZOOHGE04T** | **Credit** | 4 | | |
| **Course Outcome** | Students will acquire the following skills after the course:<br>✓ To understand different aspects of environment- climate change, pollution etc.<br>✓ To understand different public health related issues.<br>✓ To demonstrate causes and management of different diseases. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | 50 Classes | **Class/Week** | 3 | **Hours/Week** | 3 |
| **Instruction Mode** | Interactive Lecture Method, Demonstration Method, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 50 | **Internal** | 10 | **End Semester** | 40 |

**Course Mapping**

| Units | Course Content | Lecture Hour (Cumulative) |
|---|---|---|
| 1 | **Introduction:** Sources of Environmental hazards, Hazard identification and accounting, Fate of toxic and persistent substances in the environment, Dose response evaluation, Exposure assessment. | 10 |
| 2 | **Climate Change:** Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health. | 10 |
| 3 | **Pollution:** Air, water, noise pollution sources and effects, Pollution control. | 5 |

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|---|---|---|
| 4 | **Waste Management:** Technologies Sources of waste, types and characteristics, Sewage disposal and its management, Solid waste disposal, Biomedical waste handling and disposal, Nuclear waste handling and disposal, Waste from thermal power plants. | 15 |
| 5 | **Diseases:** Causes, symptoms and control of tuberculosis, Asthma, Cholera, Minamata disease, Typhoid, Filariasis. | 10 |

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|---|---|---|---|---|---|
| | **Environment and Public Health Lab** | | | | |
| **Course Code** | **ZOOHGE04P** | **Credit** | 2 | | |
| **Course Outcome** | Students will acquire the following skills after the course:<br>✓ To analyze different physico-chemical parameters of water samples.<br>✓ To analyze different physico-chemical parameters of soil samples.<br>✓ To handle different laboratory instruments like microscopes, spectrophotometers, colorimeter etc. | | | | |
| **Scheme of Instruction** | | | | | |
| **Total Duration** | 32 Hours | **Class/Week** | 8 | **Hours/Week** | 8 |
| **Instruction Mode** | Heuristic method, Laboratory Demonstration method, Project Method, ICT based learning, Computer Assisted Instruction (CAI)/ ICT Dependent Instruction Method. | | | | |
| **Scheme of Examination** | | | | | |
| **Maximum Score** | 25 | **Internal** | 15 | **End Semester** | 10 |

**Course Mapping**

| **Units** | **Course Content** | **Lecture Hour (Cumulative)** |
|---|---|---|
| 1 | To determine pH, Cl, SO4, NO3 in soil and water samples from different locations. | 32 |