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| **Program Educational Objectives (PEOs)** | |
| The **M. Sc. Zoology** program describe accomplishments that graduates are expected to attain within five to seven years after graduation | |
| PEO1 | M.Sc., graduates can take up teaching profession. They can teach biology to the undergraduates and school children |
| PEO2 | They can involve in domestication of animals by keeping profitable pet shops and they can become animal trainers too. |
| PEO3 | They can equip themselves to work in the fields of aquaria, poultry, piggery, pisciculture, etc.… |
| PEO4 | They can create public awareness on environment, pollutions and ecosystem through social media, industrial sectors and pollution control boards and seek jobs in public concerns and NGOs. |
| PEO5 | They can find employment in farms, zoological parks, museums and zoos by developing personal skills to conserve the animals and nature. |
| PEO6 | They can enter into biotechnology and microbiology companies by acquiring laboratory skills. |
| PEO7 | They can earn and shine in agriculture and farming through ‘Integrated farming management’ where animal wastes could be turned into wealth. |
| PEO8 | They can get opportunity to work in veterinary sector, wild life conservator and forestry jobs. |
| PEO9 | They can become medical laboratory technicians and find jobs in clinical labs and hospitals as health workers. |
| PEO10 | They can become scientists & researchers by doing Ph.D. and they can compete for competitive examinations like TNPSC, NET, SET, IAS, IFS and any equivalent exams with strong knowledge of biology. |

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| **Program Specific Outcomes (PSOs)** | |
| After the successful completion of **Zoology** program, the students are expected to | |
| PSO1 | Elucidate animal-animal, animal-plant, animal-microbe interactions and their consequences to animals, humans and the environment. |
| PSO2 | Develop deeper understanding of key concepts of biology at biochemical, molecular and cellular level, physiology and reproduction at organismal level, and  ecological impact on animal behavior. |
| PSO3 | Strengthen the genetics and cytogenetic principles in light of advancements by understanding human genome and genomes of other model organisms. |
| PSO4 | Describe the expression of genome, revealing multiple levels of regulation and strategies to manipulate the same in the benefit of the mankind. |
| PSO5 | Learn handling of DNA sequence, data and its analysis which equip students to get employed in R&D industry involved in DNA sequencing services, diagnostics, and micro biome analysis. |
| PSO6 | Understand relationships of variations in phenotypic expression of genomes and their genome wide interaction with other organisms. |
| PSO7 | Develop an understanding of zoological science for its application in medical entomology, apiculture, aquaculture, agriculture and modern medicine. |
| PSO8 | Develop theoretical and practical knowledge in handling the animals and using them as model organism. |
| PSO9 | Maintain high standards of learning in animal sciences |
| PSO10 | Focus to prepare them with research-oriented approach in frontier areas of research in Zoology and preparing them for advancements |

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| **Program Outcomes (POs)** | |
| On successful completion of the M. Sc. Zoology program | |
| PO1 | Expected to attain written skills via assignment, projects, reports& seminar |
| PO2 | To develop presentation & communication skills through research |
| PO3 | To attain analytical skills like understanding & interpreting the results |
| PO4 | To know the basics of instrumentation |
| PO5 | To develop taxonomical skills by identifying the animal species |
| PO6 | To learn about animal biodiversity, bioinformatics and ecosystem |
| PO7 | To understand human beings by studying biology, anatomy, physiology etc., |
| PO8 | To create an awareness of the impact of Zoology on the environment, society, and development outside the scientific community. |
| PO9 | To study and understand the classification of whole phyla included in  Non chordates and Chordates with the help of charts/models/pictures. |
| PO10 | To inculcate the scientific temperament in the students and outside the  Scientific community. |

**BHARATHIAR UNIVERSITY: COIMBATORE 641 046**

**M.Sc., ZOOLOGY DEGREE COURSE (COLLEGES - CBCS PATTERN) REVISED SCHEME OF EXAMINATION**

*(For the students admitted during the academic year 2025 – 2026 onwards)*

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| **Course Code** | **Paper** | **Title of the Course** | **Credits** | **Hours** | | **Maximum Marks** | | |
| **Theory** | **Practical** | **CIA** | **ESE** | **Total** |
| **FIRST SEMESTER** | | | | | | | | |
| 13A | Core I | Structure and functions of Invertebrates | 4 | 6 | - | 25 | 75 | 100 |
| 13B | Core II | Comparative anatomy of Vertebrates | 4 | 6 | - | 25 | 75 | 100 |
| 13C | Core III | Animal Biodiversity & Conservation | 4 | 6 | - | 25 | 75 | 100 |
| 13D | Core IV | Ecology | 4 | 6 | - | 25 | 75 | 100 |
| 23P | Practical I | (Comprises of Papers I, II&III) | - | - | 2 | - | - | - |
| 23Q | Practical II | (Comprises of Papers IV&V) | - | - | 2 | - | - | - |
| 23R | Practical III | (Comprises of Papers VI, VII&VIII) | - | - | 2 | - | - | - |
|  |  | **Total** | **16** |  |  |  |  | **400** |
|  |  | **SECOND SEMESTER** | | | | | | |
| 23A | Core V | Biophysics & Biostatistics | 4 | 6 | - | 25 | 75 | 100 |
| 23B | Core VI | Biochemistry | 4 | 6 | - | 25 | 75 | 100 |
| 23C | Core VII | Cell & Molecular Biology | 4 | 6 | - | 25 | 75 | 100 |
| 23D | Core VIII | Developmental Biology | 4 | 6 | - | 25 | 75 | 100 |
| 23P | Practical I | (Comprises of Papers I, II&III) | 4 | - | 2 | 25 | 75 | 100 |
| 23Q | Practical II | (Comprises of Papers IV&V) | 4 | - | 2 | 25 | 75 | 100 |
| 23R | Practical III | (Comprises of Papers VI, VII&VIII) | 4 | - | 2 | 25 | 75 | 100 |
|  |  | **Total** | **28** |  |  |  |  | **700** |
|  |  | **THIRD SEMESTER** | | | | | | |
| 33A | Core IX | Animal Physiology | 4 | 6 | - | 25 | 75 | 100 |
| 33B | Core X | Immunology | 4 | 6 | - | 25 | 75 | 100 |
| 3EC | Elective I | Elective I: Entomology Paper I | 4 | 5 | - | 25 | 75 | 100 |
| 3EA  3EB | Elective II | Elective II A: Microbiology (or)  **Elective II B \*Research Methodology** | 3 | 5 | - | 25 | 75 | 100 |
| **\*3** | **5** | **-** | 25 | 75 | **100** |
|  |  | Health and Wellness | 1 | - | - | - | - | - |
| 43P | PracticalIV | (Comprises of Papers IX&X) | - | - | 2 | - | - | - |
| 43Q | Practical V | (Comprises of Papers XI&XII) | - | - | 2 | - | - | - |
| 4EP | Elective  Practical I | Elective I Practical (Comprises of Paper  Elective I) | - | - | 2 | - | - | - |
| 4EQ | Elective Practical II | Elective II Practical (Comprises of Paper Elective II) (or) **\* Project work** | - | - | 2 | - | - | - |
| - |  | **\*2** | - | - | - |
|  |  | **Total** | **16** |  |  |  |  | **400** |

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| **FOURTH SEMESTER** | | | | | | | | |
| 43A | Core XI | Genetics | 4 | 6 | - | 25 | 75 | 100 |
| 43B | Core XII | Evolution | 4 | 6 | - | 25 | 75 | 100 |
| 4EC | Elective I | Elective I: Entomology Paper II | 4 | 5 | - | 25 | 75 | 100 |
| 4EA  4EB | Elective II | Elective II A - Bioinstrumentation, Biological Techniques, Biotechnology & Genetic Engineering (or) **Elective II B \*Project work** | 4 | 5 | - | 25 | 75 | 100 |
| - | - | - | - | - | - |
| 43P | Practical IV | (Comprises of Papers IX&X) | 4 | - | 2 | 25 | 75 | 100 |
| 43Q | Practical V | (Comprises of Papers XI&XII) | 4 | - | 2 | 25 | 75 | 100 |
| 4EP | Elective  Practical I | Elective I Practical (Comprises of Paper  Elective I) | 3 | - | 2 | 20 | 55 | 75 |
| 4EQ | Elective Practical II | Elective II Practical (Comprises of Paper Elective II) (or) **\* Project work** | 3 | - | 2 | 20 | 55 | 75 |
| **\*3** | - | 2 | **50** | 125 | **\*175** |
|  |  | **Total** | **30** |  |  |  |  | **750** |
|  |  | **Grand Total** | **90** |  |  |  |  | **2250** |

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| **List of Elective Papers (Opted by the colleges)** | | |
| Elective-II  Choose A or B | **A** | 1. Elective II A: Microbiology– IIISemester  2. Bioinstrumentation, BiologicalTechniques, Biotechnology&  Genetic Engineering - IV Semester |
| **B** | 1. Elective II B: Research Methodology– IIISemester  2.**Project work**– IV Semester |

\* For Elective II, if \*B is opted,

\*Theory Paper – Research Methodology will carry100 marks and

\*For Project 175 marks (Project work =125 marks and Viva-voce =50 marks).

**Project Guidelines:**

1. Internal and External Examiners will evaluate the project work and award marksout

of 125.

2. Internal andExternal Examinerswill conduct viva-voce examination and award

marks out of50.

**First**

**Semester**

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| **Course code** | | **13A** | **STRUCTURE AND FUNCTIONS OF INVERTEBRATES** | **L** | **T** | **P** | | **C** |
| **Core/Elective/Supportive** | | | **Core Paper I** | **6** | **0** | **0** | | **4** |
| **Pre-requisite** | | | Basic knowledge about Invertebrate forms andtheir functions | **Syllabus**  **version** | | **2025 -26** | | |
| **Course Objectives:** | | | | | | | | |
| The main objectives of this course are:  1. To understand about the procedures and trends in taxonomy.  2. To understand important physiological functions in various Invertebrate forms.  3. To know about the larval forms of Invertebrates.  4. To know about the organization of Minor Phyla and its characters. | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | |
| 1 | Understand concepts of taxonomy, its procedures, methods in collection and preservation of animals as well as classification of animals based on coelom. | | | | | | K2 | |
| 2 | Categorize locomotory organs, methods of locomotion, feeding and digestion in various Invertebrates. | | | | | | K3 | |
| 3 | Understand about organs of respiration, respiratory pigments, their mechanism, organs and products of excretion, mechanism and its relation to osmoregulation. | | | | | | K2 | |
| 4 | Discern the organization and function of nervous system in various Invertebrates and its evolutionary advances. | | | | | | K4 | |
| 5 | Integrate the strategies and evolutionary significance of free living and parasitic larval forms of Invertebrates as well as organization and characters of Minor Phyla groups. | | | | | | K5 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | |
|  | | | | | | | | |
| **Unit:1** | | **PRINCIPLES OF ANIMAL TAXONOMY** | | | **15 hours** | | | |
| **Structure and function of invertebrates:** Principles of Animaltaxonomy; Speciesconcept;Internationalcodeofzoologicalnomenclature; Taxonomic procedures; New trends intaxonomy | | | | | | | | |
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| **Unit:2** | | **ORGANIZATION OFCOELOM AND LOCOMOTION** | | | **15 hours** | | | |
| **Organization ofcoelom:** Acoelomates; Pseudocoelomates; Coelomates: Protostomia andDeuterostomia; Locomotion: Flagella and ciliary movement inProtozoa; Hydrostatic movement in Coelenterata, Annelida andEchinodermata | | | | | | | | |
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| **Unit:3** | | **NUTRITION, DIGESTION AND RESPIRATION** | | | **15 hours** | | | |
| **Nutrition andDigestion:** Patterns of feeding and digestion in lowermetazoan; Filter feeding in Polychaeta, Mollusca andEchinodermata. Respiration: Organs of respiration: Gills, lungs andtrachea; Respiratorypigments; Mechanism of respiration | | | | | | | | |
|  | | | | | | | | |
| **Unit:4** | | **EXCRETION AND NERVOUS SYSTEM** | | | **15 hours** | | | |
| **Excretion:** Organsofexcretion:coelom,coelomoducts,NephridiaandMalpighiantubules; Mechanisms ofexcretion; Excretion andosmoregulation. Nervoussystem: Primitive nervous system: Coelenterata andEchinodermata;Advanced nervous system: Annelida, Arthropoda (Crustacea and lnsecta) and Mollusca (Cephalopoda); Trends in neuralevolution | | | | | | | | |
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| **Unit:5** | | **LARVAL FORMS AND MINOR PHYLA** | | | **15 hours** | | | |
| Invertebratelarvae: Larval forms of free-livinginvertebrates - Larval forms ofparasites; Strategies and Evolutionary significance of larvalforms. MinorPhyla: Concept andsignificance; Organization and generalcharacters of Rotifera, Phoronida and Chaetognatha | | | | | | | | |
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| **Unit:6** | | **Contemporary Issues** | **2 hours** |
| Expert lectures, online seminars – webinars | | | |
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|  | | **Total Lecture hours** | **77hours** |
| **Text Book(s)** | | | |
| 1 | Parker, T,J., Haswell, W.A. Text Book of Zoology, Macmillan Co., London | | |
| 2 | Barnes, R.D. Invertebrate Zoology, III edition. W.B. Saunders Co., Philadelphia | | |
| 3 | Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson and Sons Ltd., London | | |
| 4 | Young, J.Z. Life of Invertebrates, Clarendon Press, Oxford. | | |
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| **Reference Books** | | | |
| 1 | Hyman, L.H. The invertebrates. Vol. l Protozoa through Ctenophora, McGraw-Hill Co.,  New York. | | |
| 2 | Hyman, L.H. The Invertebrates. Vol.2. McGraw Hill Co., New York. | | |
| 3 | Hyman, L.H. The Invertebrate smaller coelomate groups, Vol.5. McGraw Hill Co., New York | | |
| 4 | Hyman, L.H. The Invertebrates. Vol.8. McGraw Hill Co., New York and London | | |
| 5 | Russel-Hunter, W.D. A biology of higher Invertebrates, the Macmillan Co. Ltd., London | | |
| 6 | Jagerstein, G. Evolution of Metazoan life cycle, Academic Press, New York & London. | | |
| 7 | Narendran, T.C. An Introduction to Taxonomy, Zoological Survey of India. | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | Systems Biology (NPTEL) web https://nptel.ac.in/courses/102/106/102106035/ | | |
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| **Mapping with Programme Outcomes\*** | | | | | | | | | | |
| **Cos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | M | S | S | S | M | S | S | S |
| **CO2** | S | S | M | M | S | S | M | M | S | S |
| **CO3** | S | M | S | M | S | S | M | M | S | S |
| **CO4** | S | M | S | M | S | S | M | M | S | M |
| **CO5** | S | M | S | M | S | S | M | M | S | M |

\*S - Strong; M - Medium; L - Low

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| **Course code** | | **13B** | **COMPARATIVE ANATOMY OF VERTEBRATES** | **L** | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **Core Paper II** | **6** | | **0** | | **0** | **4** |
| **Pre-requisite** | | | Basic knowledge about vertebrate anatomy and  physiology | **Syllabus**  **version** | | | **2024 -**  **2025** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are | | | | | | | | | |
| 1. To understand about vertebrate morphology and its origin. 2. To study about structure and function of Protochordate types. 3. To study about vertebrate classification and development, structure and function of integument types. 4. To understand the flow of blood and evolution of circulatory organs and process of respiration. 5. To know about the various aspects of skeletal system and evolution of urinogenital system 6. To understand the working of nervous system and sense organs. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | Understand the origin of Chordata, concept of Protochordates, importance of Vertebrate morphology and biology of some Protochordates. | | | | | | | K2 | |
| 2 | Comprehend about Vertebrate classification, as well as structure and function of integument and its derivatives. | | | | | | | K2 | |
| 3 | Analyze the evolution of heart, aortic arches and portal systems, blood components as well as respiratory mechanisms and organs in various Vertebrates. | | | | | | | K4 | |
| 4 | Distinguish the comparative form and function of skeletal system and its parts and analyze the evolution of urinogenital system in different Vertebrates. | | | | | | | K2&  K5 | |
| 5 | Analyze comparatively the anatomy of nervous system and its components in different Vertebrates as well as receptors of olfaction, taste and hearing and other organs. | | | | | | | K4 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | |
|  | | | | | | | | | |
| **Unit:1** | | **PROTOCHORDATA AND CHORDATE MORPHOLOGY** | | | **15hours** | | | | |
| Origin of vertebrates: Concept of protochordates; The nature of vertebratemorphology; Definition,scopeandrelationtootherdisciplines; Importance of the study of vertebratemorphology. | | | | | | | | | |
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| **Unit:2** | | **VERTEBRATE CLASSIFICATION ANDINTEGUMENT** | | | **15hours** | | | | |
| Origin and classification ofvertebrates; Vertebrate integument and itsderivatives. Development,generalstructureandfunctionsofskinanditsderivatives; Glands, scales, horns, claws, nails, hoofs, feathers andhairs. | | | | | | | | | |
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| **Unit:3** | | **CIRCULATION AND RESPIRATION** | | | **15hours** | | | | |
| General plan of circulation in variousgroups; Blood; Evolution ofheart; Evolution of aortic arches and portalsystems. Respiratorysystem: Characters of respiratorytissue; Internal and external respiration; Comparative account of respiratoryorgans | | | | | | | | | |
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| **Unit:4** | | **SKELETAL SYSTEM AND URINOGENITAL**  **SYSTEM** | | | **15hours** | | | | |
| Skeletalsystem: Form, function, body size and skeletal elements of thebody; Comparative account of jawsuspensorium, Vertebral column; Limbs andgirdles; Evolution of Urinogenital system in vertebrateseries. | | | | | | | | | |

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| **Unit:5** | | **SENSE ORGANS AND NERVOUS SYSTEM** | **15hours** |
| Senseorgans: Simplereceptors; Organs of Olfaction andtaste; Lateral linesystem; Electroreception. Nervous system: Comparative anatomy of the brain in relation to itsfunctions; Comparative anatomy of spinalcord; Nerves-Cranial, Peripheral and Autonomous nervoussystems. | | | |
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| **Unit:6** | | **Contemporary Issues** | **2 hours** |
| Expert lectures, online seminars – webinars | | | |
|  | | | |
|  | | **Total Lecture hours** | **77hours** |
| **Text Book(s)** | | | |
| 1 | Kingsley J S. Outline of Comparative Anatomy of Vertebrates. Central Book Depot, Allahabad. | | |
| 2 | Kent, George C &Carr, Robert K. Comparative Anatomy of Vertebrates, Mc Graw-Hill Science. | | |
| 3 | Young, J.Z. Life of vertebrates. The Oxford University Press, London. | | |
| 4 | Weichert, C.K. and Presch, W. Elements of chordate anatomy, 4th Edn. McGraw Hall Books Co., New  York | | |
| 5 | Malcom Jollie, Chordata morphology. East-West Press Pvt. Ltd., New Delhi. | | |
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| **Reference Books** | | | |
| 1 | Smith, H.S. Evolution of chordate structure. Hold Rinehart and Winstoin Inc., NewYork | | |
| 2 | MilltonHilderbrand. Analysis of vertebrate structure. IV. Ed. John Wiley and Sons Inc., New York. | | |
| 3 | Romer, A.S. Vertebrate body, III Ed. W.B. Saunders Co., Philadelphia. | | |
| 4 | Montagna, W. Comparative anatomy. John Wiley and Sons Inc. | | |
| 5 | Walters, H.E. and Sayles, L.D. Biology of vertebrates. Macmillan & Co., New York | | |
| 6 | Torrey, T.W. Morphogenesis of vertebrates, John Wiley and Sons Inc.,New York and London | | |
| 7 | Colbert, E.H. Evolution of the vertebrates, John Wiley and Sons Inc., New York. | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | General Human Anatomy (WMA): htt[ps://www.mooc](http://www.mooc-list.com/course/general-human-)-[list.com/course/general-human-](http://www.mooc-list.com/course/general-human-)  anatomy-wma | | |
| 2 | Evolutionary Biology: <https://onlinecourses.swayam2.ac.in/cec20_bt06/preview> | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | L | S | M | S | M | S | M | S |
| **CO2** | S | L | L | S | M | S | M | M | M | M |
| **CO3** | S | M | L | S | M | S | M | L | M | M |
| **CO4** | S | L | L | S | L | S | M | L | M | L |
| **CO5** | S | M | L | S | S | S | M | S | M | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | | **13C** | | **ANIMAL BIODIVERSITY AND CONSERVATION** | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | **Core Paper III** | **6** | | | **0** | | **0** | **4** |
| **Pre-requisite** | | | | | | To know the distribution and about abundance of organisms | **Syllabus Version** | | | | **2024-2025** | | |
| **Course Objectives:** | | | | | | | | | | | | | |
| The main objectives of this course are to:  1. Acquire the knowledge of biodiversity in different geographical areas.  2. Understand the strategies evolved to conserve bio diversities and their habitats.  3. Know the measures in vogue to restore the biodiversity and environment.  4. Levels of organization in animals.  5. Analyze the evolutionary affinities of vertebrates.  6. Create awareness against wildlife crimes and pollution in conserving biodiversity. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | |
| 1 | | | Understand the significance of conservation of biodiversity. | | | | | | | | | K2 | |
| 2 | | | Appreciate the various conservation strategies to protect biodiversity. | | | | | | | | | K4 | |
| 3 | | | Know the comparative anatomy and evolutionary affinities of vertebrates. | | | | | | | | | K2 | |
| 4 | | | Admire the values of ethical committee in animal research | | | | | | | | | K3 | |
| 5 | | | Develop awareness against wildlife crimes and wildlife degradation by pollution | | | | | | | | | K5 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| **Unit:1** | | | | | **BIODIVERSITY** | | | | **15 hours** | | | | |
| Biodiversity – Types: Genetic, species and ecological diversities - Species – Endemic, Keystone, flagship and ecological indicator - Major Biomes of India and wildlife diversity - Tropical Humid Forests, Tropical Deciduous Forests, Tropical rain forests, Warm deserts and semi-deserts, Coniferous forests and Alpine meadows- Hotspots – significance of Western Ghats, Indo-Burma region and Gulf of Mannar - Biosphere reserves of India - Rare endemic and endangered species of India – IUCN Red list category. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| **Unit:2** | | | | | **CONSERVATION BIOLOGY** | | | **15 hours** | | | | | |
| In-situ and Ex-situ conservation - Project Tiger and Project Elephant - Population explosion - Deforestation, Human animal conflicts, Poaching, Forest fire and Afforestation - CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora - Animal ethics – Ethical committee Discontinuation of dissection in educational institutions - Biodiversity measurement – significance - Simpson’s diversity index. | | | | | | | | | | | | | |
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| **Unit:3** | | | | | **SYSTEMATIC ZOOLOGY** | | **15 hours** | | | | | | |
| Species concept - Levels of structural organization – Unicellular – Multicellular forms – Colonial - Levels of organization: Kingdom Animalia – salient features of all phylum – classification up to class for invertebrates and up to orders for vertebrates with examples | | | | | | | | | | | | | |
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| **Unit:4** | | | | | **SCOPE AND IMPORTANCE OF WILDLIFE OF INDIA** | | **15 hours** | | | | | | |
| India - the country of mega wildlife biodiversity - Objectives of wildlife conservation - Biodiversity loss and causes of wildlife depletion - Biodiversity and climate change - Economic importance of wildlife. | | | | | | | | | | | | | |
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| **Unit:5** | | | | | MODERN CONCEPTS IN WILDLIFE CONSERVATION | | **15 hours** | | | | | | |
| Wildlife Crimes: Wildlife forensics and its applications in detecting wildlife crimes - Wildlife toxicology: Types of contaminants, concentration, bio accumulation and bio magnifications in wildlife populations - Environmental Impact Assessment (EIA) Methods and their role in wildlife conservation - Geographical information system - Biodiversity exploration & conservation - Artificial intelligence technology in conserving biodiversity-Environmental policy of India and legislations. | | | | | | | | | | | | | |
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| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | **77 hours** | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | |
| 1 | Textbook of Biodiversity - K V Krishnamurthy, by Science Publishers. | | | | | | | | | | | | |
| 2 | The Biodiversity of India – ErachBarucha | | | | | | | | | | | | |
| 3 | Biodiversity: An Introduction, 2nd Edition- Kevin J. Gaston, John I. Spicer, WileyBlackwell. | | | | | | | | | | | | |
| 4 | Comparative Anatomy, Function, Evolution – Kenneth V.Kardong | | | | | | | | | | | | |
| 5 | The life of vertebrates – J.Z.Young 6. Comparative anatomy – Nigam | | | | | | | | | | | | |
| 6 | Manual of Zoology – EgambaranatharIyyer | | | | | | | | | | | | |
| 7 | The life of vertebrates – J.Z.Young | | | | | | | | | | | | |
| 8 | An advanced Text book on biodiversity: Principles and Practice – K.V. Krishnamurthy | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | |
| 1 | Biodiversity loss in the 21stCentuary – Griffin. N | | | | | | | | | | | | |
| 2 | Glimpses of Biodiversity- B.Blosetti. | | | | | | | | | | | | |
| 3 | Agrobiodiversity -David Wood, Jillian M. Lenné, CABI Pub., Nature | | | | | | | | | | | | |
| 4 | Biodiversity -WILLIAM MN | | | | | | | | | | | | |
| 5 | Biodiversity: Conserving Endangered Species - [Anne Elizabeth Maczulak](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Anne+Elizabeth+Maczulak%22) | | | | | | | | | | | | |
| 6 | Conservation - [Clive Hambler](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Clive+Hambler%22), [Susan M. Canney](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Susan+M.+Canney%22) | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | |
| 1 | | Ecology and Wildlife Conservation (FutureLearn): https://www.mooclist.com/course/ecology-and-wildlife-conservation- | | | | | | | | | | | |
| 2 | | Wildlife Conservation: https://nptel.ac.in/courses/102/104/102104068/ | | | | | | | | | | | |
| 3 | | Wildlife Ecology: <https://swayam.gov.in/nd1_noc20_bt38/preview> | | | | | | | | | | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | L | S | S | M | M | M | S |
| **CO2** | S | S | S | L | S | S | M | M | M | S |
| **CO3** | S | S | S | L | S | S | S | S | S | S |
| **CO4** | S | S | S | L | S | M | M | M | S | S |
| **CO5** | S | S | S | L | S | S | S | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **13D** | **ECOLOGY** | | **L** | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **Core Paper IV** | | **6** | | **0** | | **0** | **4** |
| **Pre-requisite** | | | Basic understanding about our own  environment | | **Syllabus**  **version** | | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | | |
| The main objectives of this course are,   1. To explain the core concepts of ecology for a better understanding of the environment. 2. To motivate,identify and solve environmental problems. 3. To create awareness about the improvement and protection of the environment. 4. To understand the need for conservation of biodiversity and natural resources. 5. To help understand the concepts of exobiology. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | Understand the ecological dynamics and the significance of environmental  integrity. | | | | | | | | K2 | |
| 2 | Recognize various global and regional environmental concerns that affectsthe biosphere and analyze the impact of human activities on the environment. | | | | | | | | K1 | |
| 3 | Appreciate the significance of the conservation of native biodiversity. | | | | | | | | K4 | |
| 4 | Scrutinize specific cases of environmental pollution , challenges, and their impacts on ecology. | | | | | | | | K5 | |
| 5 | Apply knowledge of chemistry, biology, molecular biology and microbiology to arrive at innovative solutions to environment issues and extra-terrestrial habitats | | | | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | |
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| **Unit:1** | | **THE ENVIRONMENT** | | | | **15 hours** | | | | |
| The Environment: Physical environment; biotic environment; biotic and abiotic interactions. Habitat and niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement. | | | | | | | | | | |
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| **Unit:2** | | **POPULATION ECOLOGY** | | | | **15 hours** | | | | |
| Population ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); concept of metapopulation-demes and dispersal, interdemic extinctions, age structured populations -action taken to control population explosion. | | | | | | | | | | |
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| **Unit:3** | | **COMMUNITY ECOLOGY** | | **15 hours** | | | | | | |
| Species interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis. Community ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones. Ecological succession: Types; mechanisms; changes involved in succession; concept of climax | | | | | | | | | | |
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| **Unit:4** | | **ECOLOGY OF ECOSYSTEM** | | **15 hours** | | | | | | |
| Ecosystem: Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine). Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India. | | | | | | | | | | |
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| **Unit:5** | | **APPLIED ECOLOGY** | | **15 hours** | | | | | | |
| Applied ecology: Environmental pollution; global environmental change; biodiversity-status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches - Waste management. Conservation biology: Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves). | | | | | | | | | | |

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| **Unit:6** | | **Contemporary Issues** | **2 hours** |
| Expert lectures, online seminars – webinars | | | |
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|  | | **Total Lecture hours** | **77hours** |
| **Text Book(s)** | | | |
| 1 | Odum: Fundamentals of Ecology | | |
| 2 | Odum: Basic Ecology | | |
| 3 | Turk and Turk: Environmental Science | | |
| 4 | Environmental biology – Dr.P.S. Verma & Dr. V.K. Agarwal | | |
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| **Reference Books** | | | |
| 1 | Controlled Ecological Life Support system – NASA conference publication (2378) (e-content) | | |
| 2 | **Environmental Science: Earth as a Living Planet by Daniel B. Botkin, Edward A. Keller** | | |
| 3 | **Environmental Science: Systems and solutions – Michael L. McKinney & Robert M.Schoch.** | | |
| 4 | **Ecology and Environment – P.D. Sharma** | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | Primark: A Primer of Conservation Biology | | |
| 2 | Calabrese: Pollutants and High-Risk Groups | | |
| 3 | Controlled Ecological Life Support system – NASA conference publication (2378) (e-content) | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | M | M | S | M | S | S | M | S |
| **CO2** | S | S | M | M | L | S | S | S | M | M |
| **CO3** | S | M | M | L | M | S | L | L | S | L |
| **CO4** | M | M | S | S | M | L | L | S | S | S |
| **CO5** | M | S | S | M | S | M | L | M | L | S |

\*S-Strong; M-Medium; L-Low

**Second Semester**

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| **Course code** | | | **23A** | **BIOPHYSICS AND BIOSTATISTICS** | | | **L** | | **T** | | **P** | **C** | |
| **Core/Elective/Supportive** | | | | **Core Paper V** | | | **6** | | **0** | | **0** | **4** | |
| **Pre-requisite** | | | | Basic knowledge about Biophysics and  Biostatistics **V** | | | **Syllabus**  **version** | | | **2024 -**  **2025** | | | |
| **Course Objectives:** | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To develop awareness about the application of statistics inZoology. 2. To train how the biological data are processed and interpretations are made. 3. To develop skill in understanding & handling molecular science &instrumentation. | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | |
| 1 | | Illustrate the basic concepts of probability and biostatistics. | | | | | | | | | K5 | | |
| 2 | | The course will give an idea how data should be managed & processed. | | | | | | | | | K2 | | |
| 3 | | The course will develop the research aptitude of the students. | | | | | | | | | K4 | | |
| 4 | | The students will be capable of interpreting and understanding the basis of molecular  biology. | | | | | | | | | K2 | | |
| 5 | | The learner will be trained in preparing solutions and handling instruments at basic level. | | | | | | | | | K4 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | |
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| **Unit:1** | | | **BIOELECTRICITY AND RADIATION** | | | | **15hours** | | | | | | |
| **Bioelectricity**  Membrane, Resting and action potential. Ionic distribution and membrane potential, recording of action potential.  **Radiation**  Electromagnetic radiation. Laws of light absorption - Beer Lamberts law, biological applications of X-rays, Infra-red rays, and Ultra violet rays. | | | | | | | | | | | | | |
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| **Unit:2** | | | **BIOENERGETICS** | | | | **15hours** | | | | | | |
| Laws of thermodynamics, concept of free energy, oxidation reduction (redox) reactions. Energy  coupling reactions, energy rich compounds, ATP cycle, standard free energy and negative entropy changes in living systems, enzyme catalysis. | | | | | | | | | | | | | |
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| **Unit:3** | | | **BIOLOGICAL DATA, MEASUREMENTS AND VARIABLES** | | | | | **15hours** | | | | | |
| **Biological data**  Source, Collection – Classification – Tabulation, Diagrammatic representation. Frequency curves, Frequency Polygon, Ogive  **Measurements and variables**  Central tendency - Arithmetic mean, Median and Mode Dispersions, Deviations, Co–efficient of variance. Standard Deviations and standard Error. | | | | | | | | | | | | | |
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| **Unit:4** | | | **TEST OF SAMPLES** | | | **15hours** | | | | | | | |
| Sampling, distribution ofsamplesandsamplingerrors.Chi–squaretest,Student―t‖test,ANOVA  one way and two way. | | | | | | | | | | | | | |
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| **Unit:5** | | | **PROBABILITY** | | | **15hours** | | | | | | | |
| Correlation – types, methods - Karl Pearson’s co-efficient,Regression–types and significance - calculation of regression co–efficient, Probability- Definition, Types, Additional and Multiplication theorems. | | | | | | | | | | | | | |
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| **Unit:6** | | | **Contemporary Issues** | | **2 hours** | | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | |
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|  | | | **Total Lecture hours** | | **77 hours** | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | |
| 1 | Casey. 1993 Biophysics | | | | | | | | | | | |
| 2 | Shiv Kumar Practical Statistics *Chand & Sons,* Delhi. | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | |
| 1 | Sokal R R&Rohlf F J Biostatistics *Freeman,* San Francisco | | | | | | | | | | | |
| 2 | Giese. A.C. 1969 Cell Physiology | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | |
| 1 | Biophysical chemistry: <https://onlinecourses.nptel.ac.in/noc20_cy33/preview> | | | | | | | | | | | |
| 2 | Biostatistics and Mathematical Biology: https://swayam.gov.in/nd2\_ugc19\_ma03/preview | | | | | | | | | | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **Cos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | S | L | L | L | L | L | S |
| **CO3** | S | S | S | S | L | L | L | L | L | S |
| **CO3** | S | S | S | S | L | L | L | L | L | S |
| **CO4** | S | S | S | S | L | L | L | L | L | M |
| **CO5** | S | S | S | S | L | L | L | L | L | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **23B** | **BIOCHEMISTRY** | **L** | | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | **Core Paper VI** | **6** | | | **0** | **0** | **4** |
| **Pre-requisite** | | | Basic knowledgeaboutBiochemistry | **Syllabus**  **version** | | | | **2024-**  **2025** | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:  1. To understand the fundamental principles that governs complex biological systems.  2. To understand the molecular machinery of living cells and mechanisms of metabolic control.  3. To demonstrate knowledge and understanding basic biological and chemical facts and to be  familiar in the concepts in biochemistry.  4.To gain knowledge about principles of chemical reactivity, bonding, thermodynamics and  Kinetics. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | The student will learn about structure of atoms, chemical bonds and get knowledge about principles of biophysical chemistry | | | | | | | K2 | |
| 2 | Learn about the chemical nature of biomolecule, their structural and metabolic role in cellular system. | | | | | | | K2 | |
| 3 | Gain knowledge about enzymes, mechanism of enzyme action and able to identify the enzyme kinetics. | | | | | | | K3 | |
| 4 | Understand the simple changes in molecules and interactions in biochemical process and cellular functions. | | | | | | | K4 | |
| 5 | Understand and analyze the structure and properties of Nucleosides and Nucleotides. | | | | | | | K4 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | |
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| **Unit:1** | | **BASIC PRINCIPLES** | | | | **15hours** | | | |
| Structure of atoms, molecules and chemical bonds, Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties). | | | | | | | | | |
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| **Unit:2** | | **STABILIZING INTERACTION** | | | | **15hours** | | | |
| Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Composition, nature of bonds/linkages, structure of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). | | | | | | | | | |
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| **Unit:3** | | **BIOENERGETICS** | | | **15hours** | | | | |
| Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological  energy transducers. Principles of catalysis, classification of enzymes and enzyme kinetics, enzyme regulation, inhibitors of enzymes - mechanism of enzyme catalysis, isozymes | | | | | | | | | |
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| **Unit:4** | | **CONFORMATION OF PROTEINS** | | | **15hours** | | | | |
| Conformation of proteins (Ramachandran plot, primary, secondary, tertiary and quaternary structures, domains, motif and folds). Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA). | | | | | | | | | |
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| **Unit:5** | | **METABOLISM** | | | **15hours** | | | | |
| Stability of proteins and nucleic acids. Metabolism of amino acids, carbohydrates, lipids, nucleotidesand vitamins. | | | | | | | | | |
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| **Unit:6** | | **Contemporary Issues** | | | **2 hours** | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | |
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|  | | **Total Lecture hours** | | | **77hours** | | | | |

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| **Text Book(s)** | |
| 1 | Arumugam. (2016).*Fundamentals of Biochemistry,* Saras publication, Nagercoil, Tamilnadu |
| 2 | Prasanna Kumar S, Arumugam N, Narayanan LM, Meyyan RP and Nallasingam K. (2019). *Biochemistry,* 6th edition*,* Saras publication, Nagercoil, Tamilnadu. |
| 3 | Satyanarayana, chakrapani. (2017). *Biochemistry*, 5th edition, Elesvier Publication, India. |
| 4 | SeemaPavgiUpadhye. (2020).*Textbook of Biochemistry,* Publication, Dreamtech Press, India. |
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| **Reference Books** | |
| 1 | [Appling Dean](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=R.+Appling+Dean&search-alias=stripbooks)  R, Anthony-Cahill Spencer J and Mathews Christopher K. (2017). 1st edition, *Biochemistry*, Concepts and Connections, Pearson Education Publication, India. |
| 2 | [Naik P.](https://genialebooks.com/author/ebooks/naik-p/) (2012).*Essentials of Biochemistry*, 2nd edition, Jaypee Brothers Medical Publication,  New Delhi. |
| 3 | VoetDandVoet JG. (2016). *Biochemistry*, 5th edition, John wiley and Sons, New Jersey. |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | |
| 1 | Biochemistry: <https://swayam.gov.in/nd1_noc20_cy10/preview> |
| 2 | Biochemistry & Molecular Biology: <https://swayam.gov.in/nd2_cec19_bt02/preview> |
| 3 | Biochemistry: Biomolecules, Methods, and Mechanisms (edX):https://www.mooc-  list.com/course/biochemistry-biomolecules-methods-and-mechanisms-edx |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | M | S | L | L | S | M | L | M |
| **CO2** | S | S | L | M | L | L | S | M | L | M |
| **CO3** | S | S | M | M | L | L | S | M | L | M |
| **CO4** | S | S | M | M | L | L | S | M | L | M |
| **CO5** | S | S | L | M | L | L | S | M | L | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **23C** | **CELL AND MOLECULAR BIOLOGY** | **L** | | **T** | | **P** | **C** | |
| **Core/Elective/Supportive** | | | **Core Paper VII** | **6** | | **0** | | **0** | **4** | |
| **Pre-requisite** | | | Basic knowledge about Cell and its functions | **Syllabus**  **version** | | | **2024-**  **2025** | | | |
| **Course Objectives:**   1. To provide an overview of cell structure, basic components of cells and theirfunction. 2. To learn the fundamental concepts of cell structure, dynamic character of cellular organelles andrelationship betweenmolecular levels. 3. To make aware of how cellular components generate and utilize energy inside the cells. | | | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | Understand and apply the principles and techniques of molecular biology in basic research, or in the health professions. | | | | | | | K3 | | |
| 2 | Gain knowledge about molecular level regulation of cellular processes, cellsignaling, transportation and proliferation in cells. | | | | | | | K2 | | |
| 3 | Analyze the picture of the cellular environment and regulation of cellular process  at the molecular level. | | | | | | | K4 | | |
| 4 | Students will learn about the mechanisms and regulation of cell communication,gene expression, genome maintenance and regulation involved in the flow of genetic information. | | | | | | | K4 | | |
| 5 | Ensuring accurate macromolecular biosynthesis, unity and diversity at the  molecular and cellular levels and the relationship. | | | | | | | K5 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | |
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| **Unit:1** | | **INTRODUCTION OF BIOMEMBRANE** | | | **15 hours** | | | | |
| General features of the cell: Basic structure of prokaryotic and eukaryotic cells - Protoplasm and deutroplasm - cell organelles; cell theory; Diversity of cell size and shapes. Cellular organization: Membrane structure and functions - Structure of model membrane, lipid bilayer and membrane proteins diffusion, osmosis, ion channels, active transport, ion pumps, mechanism and regulation of intracellular transport, electrical properties of membranes. | | | | | | | | | | |
| **Unit:2** | | **CYTOSKELETON** | | | **15 hours** | | | | |
| Structure and functions of Intracellular organelles: Nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles and chloroplasts. | | | | | | | | | | |
| **Unit:3** | | **CELL DIVISION AND MOLECULAR BIOLOGY OF CELL** | | | **15 hours** | | | | |
| Cell division and Cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle and control of cell cycle. Molecular biology of cell: Structure of DNA and RNA; Process of DNA replication, transcription and translation in pro- and eukaryotic cells; Genetic maps. | | | | | | | | | | |
| **Unit:4** | | **CELL COMMUNICATION AND CELL SIGNALING** | | | **15 hours** | | | | |
| Cell communication and cell signaling: Membrane- associated receptors for peptide and steroid hormones - signaling through G-protein coupled receptors, signal transduction pathways. General principles of cell communication: extracellular space and matrix, interaction of cells with other cells and non-cellular structures. | | | | | | | | | | |
| **Unit:5** | | **Cancer cells** | | | **15 hours** | | | | |
| Cancer cells: Characteristic features of normal and cancer cells; Carcinogens: types and cancer induction; Metastasis; Oncogenes and tumor suppressor genes, apoptosis; therapeutic interventions of uncontrolled cell growth. | | | | | | | | | | |

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| **Unit:6** | | **Contemporary Issues** | **2 hours** |
| Expert lectures, online seminars – webinars | | | |
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|  | | **Total Lecture hours** | **77hours** |
| **Text Book(s)** | | | |
| 1 | Arumugam N, (2007) 6 th edition. *CellBiology*, Saras Publications,Nagercoil. | | |
| 2 | Meyyan RP. (2005). Cell Biology, Saras Publications, Nagercoil. | | |
| 3 | Singh SP and Thomas BS. (2012). *Cellbiology*. Rastogi Publications, Meerut - 02, | | |
| 4 | Verma, PS and Agarwal VK (2004). *Cell biology, Genetics, Molecular Biology, Evolution*  *and Ecology.* S.Chand& Company Ltd. New Delhi. | | |
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| **Reference Books** | | | |
| 1 | Chariotte J. Averse. (1995). *MolecularCellBiology*. AddisionWesley Publ. Co. | | |
| 2 | [De Robertis](https://www.flipkart.com/author/e-d-p-de-robertis)EDP and [De Robertis](https://www.flipkart.com/author/e-d-p-de-robertis)EMF, (1987).*CellandMolecularBiology*, Lippincott Williams &Wilkins., India. | | |
| 3 | Gupta PK., (2008). *Cellandmolecularbiology*, Rastogi publications, Shivaji Road, Meerut | | |
| 4 | Power CB. (2009).*CellBiology*, Himalaya Publishing House, Mumbai. | | |
| 5 | Tomar and Singh, (1999). *CellBiology*. Rastogi Publication, Meerut. | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | <https://www.classcentral.com/course/swayam-cell-biology-13937> | | |
| 2 | <https://www.universalclass.com/i/course/cell_molecular_biology_101.htm> | | |
| 3 | <https://www.edx.org/learn/cellular-biology> | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | L | L | L | L | S | S | S | M | M | M |
| **CO2** | M | M | M | S | S | S | S | M | S | M |
| **CO3** | S | S | S | M | M | S | M | M | L | S |
| **CO4** | M | M | S | L | S | S | L | M | S | S |
| **CO5** | S | M | M | S | S | S | S | M | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | | **23D** | **DEVELOPMENTAL BIOLOGY** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | **Core Paper VIII** | | **6** | **0** | | **0** | **4** |
| **Pre-requisite** | | | | | Basic information on animal embryology | | **Syllabus Version** | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | | | |
| The main objectives of this course are to:   1. To make aware of the students about the theories, concepts and basics of DevelopmentalBiology. 2. To provide students the idea of sex cells, fertilization, cleavage, differentiation and development oforgans. 3. To make aware of the induction, organizers and development of extra embryonicstructures. | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | |
| 1 | | The learner will be able to understand methodological approaches to the study of  embryonic development and the characteristics of the principle experimental models. | | | | | | | | K2 | |
| 2 | | The students will be able to identify embryonic structures in preparations, photographsand diagrams | | | | | | | | K5 | |
| 3 | | The students will able to develop an idea, how to arrange sequences in developmental  processes in order. | | | | | | | | K4 | |
| 4 | | The learner will be able to understand the derivatives of embryonic structures. | | | | | | | | K2 | |
| 5 | | The students will attain a basic conceptual knowledge of the principle cellular mechanisms of development and identify the genetic and molecular elements that are  involved. | | | | | | | | K4 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | |
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| **Unit:1** | | | **BASIC CONCEPTS OF DEVELOPMENT AND GAMETOGENESIS** | | | | | **15hours** | | | |
| Pattern of animal development: Chief events in animal development; History of thoughts and conceptual developments. Gametogenesis: Origin of germ cells, Spermatogenesis - Sperm morphology in relation to the type of fertilization, Oogenesis - Oogenesis in insects and amphibians; Composition and synthesis of yolk in invertebrates (insects and crustaceans) and vertebrates; Genetic control of vitellogenin synthesis in amphibians | | | | | | | | | | | |
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| **Unit:2** | | | **FERTILIZATION** | | | | | **15hours** | | | |
| Fertilization: Sperm aggregation, Sperm activation, Chemotaxis, Sperm maturation and capacitaion in mammals, Acrosome reaction. Sperm – egg interaction. Sperm entry into the egg - Egg activation - Intracellular calcium release - Cortical reaction - Physiological polyspermy - Fusion of male and female pronuclei - Post fertilization metabolic activation - Parthenogenesis | | | | | | | | | | | |
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| **Unit:3** | | | **CLEAVAGE AND GASTRULATION** | | | | | **15hours** | | | |
| .Cleavage and gastrulation: Pattern of embryonic cleavage, mechanisms of cleavage, mid blastula transition - Determinate and regulatory embryos, Factors affecting gastrulation, mechanisms and types of gastrulation in respective animal embryos (Sea urchin, Amphioxus, Amphibians, Aves, Mammals); Fate maps - (Amphibian and Chick), Epigenesis and preformation – Formation of primary germ layers | | | | | | | | | | | |
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| **Unit:4** | | | **EMBRYONIC DEVELOPMENT** | | | | | **15hours** | | | |
| Embryonic Development; Embryonic development of fish and birds, formation of extra embryonic membranes in mammalian – Organogenesis - Development of endodermal, mesodermal and ectodermal derivatives. Embryonic Induction and neurulation; Formation and migration of neural crest cells - types of neural crest cells and their patterning - primary and secondary neurulation. Gene and development; Anterior- posterior axis in determination in drosophila, Maternal effect genes - Bicoid and Nanos proteins; Generation of dorsal - ventral polarity- Genetic control of segmentation – Gap genes; pair rule genes; Homeotic genes | | | | | | | | | | | |
| **Unit:5** | | | **METAMORPHOSIS, AGING AND EXPERIMENTAL EMBRYOLOGY** | | | | | **15hours** | | | |
| Post embryonic development metamorphosis: Endocrine control of metamorphosis in insect and amphibian - Endocrine control of moulting and growth in crustaceans and insects - Neoteny and pedogenesis. Regeneration: Formation of ectodermal cap and regeneration blastema – Types of regeneration in planaria, Regenerative ability in different animal groups, Factors stimulating regeneration – Biochemical changes assosciated with regeneration. Aging and senescences: Biology of senescence - cause of aging- mechanism involved in apoptosis. Experimental Embryology: Mammalian reproduction: Mammalian reproductive cycle, Hormonal regulation, Endocrine changes associated with normal pregnancy, Induced ovulation in humans – Cryopreservation of gametes/embryos - Ethical issues in cryopreservation | | | | | | | | | | | |
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| **Unit:6** | | | **Contemporary Issues** | | | | | **2 hours** | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | |
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|  | | | **Total Lecture hours** | | | **77hours** | | | | | |
| **Text Book(s)** | | | | | | | | | | | |
| 1 | Balinsky., Introduction to Embryology | | | | | | | | | | |
| 2 | Grant, Biology of Developing System | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | |
| 1 | Austen, C.R. and short, R.V., Reproduction in animals. | | | | | | | | | | |
| 2 | Schatten and Schatten. Molecular biology of fertilization. | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | |
| 1 | NOC: Introduction to Developmental Biology, Prof. Subramaniam K, IIT Madras,  https://nptel.ac.in/courses/102/106/102106084/] | | | | | | | | | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | M | S | S | L | S | M | L | M |
| **CO2** | S | S | S | S | S | L | S | S | S | S |
| **CO3** | S | M | S | S | S | S | S | L | L | M |
| **CO4** | S | S | S | S | S | M | S | S | S | L |
| **CO5** | S | S | S | M | S | S | S | L | L | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | | **23P** | | **STRUCTURE AND FUNCTION OF INVERTEBRATES, COMPARATIVE**  **ANATOMY OF CHORDATES ANDANIMAL BIODIVERSITY &ORGANIZATION** | | **L** | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | **PRACTICAL – I** | | **0** | | **0** | | **2** | **4** |
| **Pre-requisite** | | | | | | Fundamental knowledge on animal anatomy and  biodiversity | | **Syllabus Version** | | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand important physiological functions in various Invertebrateforms. 2. To understand the working of nervous system and senseorgans. 3. Acquire the knowledge of biodiversity in different geographicalareas. | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | |
| 1 | | | Attain knowledge about locomotory organs, locomotion,feeding and digestion in  various Invertebrates. | | | | | | | | | K2 | |
| 2 | | | Integrate the strategies and evolutionary significance of free living and parasitic larval forms of Invertebrates as well as organization and characters of Minor  Phyla groups. | | | | | | | | | K5 | |
| 3 | | | Understand the origin of Chordata, concept of Protochordata, importance of  Vertebrate morphology and biology of some Protochordates. | | | | | | | | | K1 | |
| 4 | | | Gain knowledge about Vertebrate classification, as well as structure and function  of integument and its derivatives. | | | | | | | | | K2 | |
| 5 | | | Appreciate the various conservation strategies to protect biodiversity. | | | | | | | | | K4 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | |
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| **STRUCTURE AND FUNCTIONS OF INVERTEBRATA** | | | | | | | | | **12 hours** | | | | |
| 1. Comparative study of system: Invertebrates (any twoanimals)   Appendages, external morphology, digestive system, nervous system and reproductive system.   1. Culture of earthworm in laboratory to identify the stages. 2. Culture and identification of morphology ofDrosophila. | | | | | | | | | | | | | |
| **COMPARATIVE ANATOMY OF CHORDATES** | | | | | | | | | **12 hours** | | | | |
| 1. Comparative study of system: chordate (any two animals) External morphology, digestive and reproductivesystem. 2. Identification of Beak and feet in different birds (any locally available birds) Photography of Beak andfeet. 3. Comparative study of scales of any preserved fish Cycloid, ctenoid, placoid and ganoidscales. 4. Comparative study of different types of chordate bones (any four animals) Skull, fore limb, hind limb. 5. Morphological modification of limb in fish, amphibia, reptiles, birds andmammals. | | | | | | | | | | | | | |
| **ANIMAL BIODIVERSITY AND ORGANIZATION** | | | | | | | | | **12 hours** | | | | |
| 1. Plankton identification of from fresh/marine water (5 slidespreparation). 2. Quantitative estimation of plankton usinghemocytometer. | | | | | | | | | | | | | |
| **SPOTTERS (non-chordate and chordate) (each any five specimens)** | | | | | | | | | **12 hours** | | | | |
| 1. Biologicalimportance 2. Medicalimportance 3. Beneficialpests 4. Evolutionarysignificance 5. Economicimportance | | | | | | | | |  | | | | |
| **FIELD STUDY AND FIELD TRIP** – Zoological visit, biodiversity area | | | | | | | | | | | | | |
| **Submission at the time of Practical Examination**   1. Plankton: 5slides 2. Report on the Field study and Fieldtrip 3. BonafideRecord | | | | | | | | | | | | | |
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|  | | | | **Total Lecture hours** | | **48hours** | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | |
| 1 | Advanced Practical Zoology by Sinha, J., Chatterjeee A.K., Chattopadhyay P. 2011.  Arunabha Sen Publishers. | | | | | | | | | | | | |
| 2 | Practical Zoology Invertebrate by H.S. Bhamrah. 2003. Dominant Publishers. | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | |
| 1 | Modern Experimental Zoology by PreetiGuptha and MridulaChaturvedi. 2000 | | | | | | | | | | | | |
| 2 | Manual of Practical Zoology: Chordates by Verma.(2000. S. Chand Publishing | | | | | | | | | | | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | M | S | S | L | S | M | S | S | M | L |
| **CO2** | S | M | M | L | S | S | S | M | S | M |
| **CO3** | S | M | M | L | S | S | S | M | S | M |
| **CO4** | L | L | L | L | S | M | S | M | S | S |
| **CO5** | M | M | S | L | S | S | S | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **23Q** | **ECOLOGY, BIOPHYSICS & BIOSTATISTICS** | **L** | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | **PRACTICAL – II** | **0** | **0** | **2** | **4** |
| **Pre-requisite** | | | Basic information on ecology, biophysics and  data analysis | **Syllabus**  **Version** | **2024 -**  **2025** | | |
| **Course Objectives:** | | | | | | | |
| The main objectives of this course are to:   1. Explain core concepts in ecology, and summarize our ecological understanding of environmentalproblems. 2. To train how the biological data are processed and interpretations aremade. 3. To develop skill in understanding & handling molecular science &instrumentation. | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | |
| 1 | Investigate specific cases of environmental pollution or natural challenges, and  their impact | | | | | K5 | |
| 2 | Apply chemistry, biology, molecular biology and microbiology skill to  environment issues | | | | | K3 | |
| 3 | The students will be capable of interpreting and understanding the basis of molecularbiology. | | | | | K2 | |
| 4 | The learner will be trained in preparing solutions and handling instruments at basic level. | | | | | K4 | |
| 5 | The course will develop the research aptitude of the students. | | | | | K4 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | |
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| **I. ANALYSIS OF WATER** | | | | | **12 hours** | | |
| **Determination of:**   1. pH 2. Total dissolvedsolids 3. Turbidity / lightpenetration 4. CO2 andO2 5. Hardness (Temporary andpermanent) 6. Calcium andMagnesium 7. BOD and COD (Demonstration only) 8. All the above parameters in a) Pond/pool water b) Canal/River water c) Sewage water | | | | | | | |
| **II. ANALYSIS OF SOIL (ANY THREE)** | | | | | **12 hours** | | |
| **Determination of:**   1. SoilMoisture 2. Chlorides 3. Sulphates 4. Nitrates 5. TotalPhosphates 6. Total organic matter   All the above parameters in a) Clayey soil, b) Sandy soil, c) Garden soil / Red soil | | | | | | | |
| **III. BIOLOGICAL ANALYSIS (SPOTTERS)** | | | | | **12 hours** | | |
| 1. Qualitative analysis of organisms (Pollution indicator): **(any Ten)** | | | | | | | |
| **BIOPHYSICS:** | | | | | **12 hours** | | |
| 1. Preparation of buffers (acetate, phosphate, citrate, boratebuffers) 2. Determination of pH titration curve of proteins and calculate the pIvalues. 3. Determination of Glucose content of a given sample. (Calorimetermethod) | | | | | | | |

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| **BIOSTATISTICS:**   1. Construction of (a) Frequency polygon (b) Histograms from the Data given (The basic datamay be from any material availablearound) 2. Calculation of (a) Standard deviation (b) Correlation and (c) Student’s test from the givendata. | | | |
| **FIELD TRIPS** 1. Visit to – Drinking water treatment plant; Industrial effluent treatment plant;  Pollution control lab. | | | |
| **Submission at the time of Practical Examination**   1. Report on the Field study and Fieldtrips 2. BonafideRecord | | | |
|  | | **Total Lecture hours** | **48hours** |
| **Text Book(s)** | | | |
| 1 | Advanced Practical Zoology by Sinha, J., Chatterjeee A.K., Chattopadhyay P. 2011.  Arunabha Sen Publishers. | | |
| 2 | Environmental biology and ecology laboratory manual by Lynn. (2003). Kendall Hunt  Publishing | | |
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| **Reference Books** | | | |
| 1 | Modern Experimental Zoology by PreetiGuptha and Mridula Chaturvedi. 2000 | | |
| 2 | Fundamentals of Biochemistry by Jain J.L, Sunjay Jain, Nitin Jain. 2007. | | |
| 3 | Toxicology Laboratory Lab Manualby5. Oberdorster Eva. 2009. Kendall Hunt  Publishing | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | L | S | S | S | S | S | S |
| **CO2** | S | S | S | L | S | S | M | S | L | S |
| **CO3** | S | S | S | L | S | S | M | S | L | S |
| **CO4** | S | S | S | L | L | M | L | M | S | S |
| **CO5** | S | S | S | L | S | S | S | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **23R** | | **BIOCHEMISTRY, CELL & MOLECULAR BIOLOGY AND DEVELOPMENTAL**  **BIOLOGY** | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | **PRACTICAL – III** | **0** | **0** | | **2** | **4** |
| **Pre-requisite** | | | | Basic understanding on Biochemistry, cell  biology and developmental biology | **Syllabus Version** | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. To elucidate its interaction ofmolecules. 2. To provide an overview of cell structure, basic components of cells and theirfunction. 3. To provide students the idea of sex cells, fertilization, cleavage, differentiation and development oforgans. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | Understand the physical and chemical concepts in biology. | | | | | | | K2 | |
| 2 | Understand metabolism of nucleic acid, amino acid and lipid. | | | | | | | K2 | |
| 3 | Understand and apply the principles and techniques of molecular biology in basic  research, or in the health professions. | | | | | | | K3 | |
| 4 | Ensuring accurate macromolecular biosynthesis, unity and diversity at the  molecular and cellular levels and the relationship. | | | | | | | K5 | |
| 5 | The learner will able to understand methodological approaches to the study of  embryonic development and the characteristics of the principle experimental models. | | | | | | | K4 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | |
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| **BIOCHEMISTRY** | | | | | | **12 hours** | | | |
| 1. Qualitative and quantitative estimation of Carbohydrates, Proteins and Lipids from the given samples. 2. Preparation of Haemincrystals. 3. Quantitative estimation ofHaemoglobin. 4. Separation of plasma, serum and cells fromblood. 5. Colorimetric estimation of glucose fromblood 6. Estimation of cholesterol in theblood 7. Estimation of alkaline and acidphosphatases | | | | | | | | | |
| **CELL AND MOLECULAR BIOLOGY** | | | | | | **12 hours** | | | |
| 1. Mounting of Polytene chromosome from the salivary gland of a *Chironomus*larva. 2. Squash preparation of onion root tip to study the stages ofMitosis. 3. Isolation of DNA and RNA from an animal tissue (Demonstrationonly) 4. Study of different cells from the vertebrate animal (Brain, Liver, Gonad, Kidney andMuscle) | | | | | | | | | |
| **DEVELOPMENTAL BIOLOGY:** | | | | | | **12 hours** | | | |
| 1. Regeneration study inTadpole/Earth-worm 2. Study the life cycle of *Drosophilamelanogaster.* 3. Patterning of the adult wing and *Drosophila* and demonstration of the effect of cell death onthe pattering of the adultwing. 4. Effect of Thyroxin on the growth of tadpoles (Demonstrationonly) 5. Study of Embryonic developmental stages (Frog andChick) 6. Blastoderm mounting of chick embryo using vitalstains. | | | | | | | | | |
|  | | | **Total Lecture hours** | | | **36hours** | | | |

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| **Text Book(s)** | |
| 1 | Advanced Practical Zoology by Sinha, J., Chatterjeee A.K., Chattopadhyay P. 2011.  Arunabha Sen Publishers. |
| 2 | A Manual of Practical Zoology by Verma P.S. 2000. S Chand publication. |
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| **Reference Books** | |
| 1 | Clinical Embryology: A Practical Guideby1. Zsolt Peter Nagy, Alex C.Varghese,  Ashok Agarwal. 2013. Springer-Verlag New York Inc |
| 2 | Fundamentals of Biochemistry by Jain J.L, Sunjay Jain, Nitin Jain. 2007. |
| 3 | Cell and Molecular Biology: A Lab Manual by Chaitanya K.V. 2013. Prentice Hall India  Learning Private Limited |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | M | L | L | M | M | L | S |
| **CO2** | S | S | S | M | L | L | M | M | L | S |
| **CO3** | S | S | S | M | L | L | M | M | L | S |
| **CO4** | S | S | S | M | L | L | M | M | L | S |
| **CO5** | S | S | S | M | L | L | M | M | L | S |

\*S-Strong; M-Medium; L-Low

**Third**

**Semester**

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| **Course code** | | | **33A** | **ANIMAL PHYSIOLOGY** | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | **Core Paper IX** | **6** | | | **0** | | **0** | **5** |
| **Pre-requisite** | | | | Basic knowledge about the Physiological activities of all the systems in both non-chordates and chordates **V** | **Syllabus**  **version** | | | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | | | |
| The main objectives of this course are to:   1. To study about the adaptive characters in animals 2. To acquire knowledge on the physiological aspects about all organ systems. 3. To acquire knowledge on the osmo and thermoregulatory mechanisms. 4. Understand the concepts of hormonal activities 5. To understand the role of hormones in the biological activities such as pregnancy and lactation | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | |
| 1 | | Acquire the knowledge of organisms surviving in various environments. | | | | | | | | K4 | |
| 2 | | Learn the significance of osmo and thermo regulations to cope well with the ecological stress. | | | | | | | | K3 | |
| 3 | | Understand the physiological responses of the meditation practices in human | | | | | | | | K2 | |
| 4 | | Factors involved in the mechanism of respiratory, excretory physiology, neural and muscular physiology and the influence of hormones in reproduction. | | | | | | | | K2 | |
| 5 | | Evaluate the various mode of life and adaptive modification of their organ systems in animals | | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **Unit: I** | | | **DIGESTIVE SYSTEM** | | | **15hours** | | | | | |
| Digestive system: Digestion, absorption, energy balance, BMR. Excretory system: Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **Unit: II** | | | **BLOOD AND CIRCULATION** | | | **15hours** | | | | | |
| Blood and circulation: Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis. Cardiovascular system: Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above | | | | | | | | | | | |
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| **Unit: III** | | | **RESPIRATORY PHYSIOLOGY** | | | **15hours** | | | | | |
| Respiratory system: Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration | | | | | | | | | | | |
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| **Unit: IV** | | | **NERVOUS SYSTEM** | | | | **15hours** | | | | |
| Nervous system: Neurons, action potential, gross neuro-anatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture. Sense organs: Vision, hearing and tactile response | | | | | | | | | | | |
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| **Unit: V** | | | **ENDOCRINOLOGY** | | | | **15hours** | | | | |
| Endocrinology and reproduction: Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, gametogenesis, ovulation, neuroendocrine regulation. Thermoregulation: Comfort zone, body temperature- physical, chemical, neural regulation, acclimatization: Stress and adaptation | | | | | | | | | | | |
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| **Unit: VI** | | | **Contemporary Issues** | | | | **2 hours** | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | |
|  | | | | | | | | | | | |
|  | | | **Total Lecture hours** | | | | **77hours** | | | | |
| **Text Book(s)** | | | | | | | | | | | |
| 1 | Animal Physiology Vol I &II by Chatterjee | | | | | | | | | | |
| 2 | Animal Physiology by Verma & Agarwal | | | | | | | | | | |
| 3 | Essential of ANIMAL Physiology by Rastogi | | | | | | | | | | |
| 4 | Principles of Animal Physiology by Christopher Moyes and Patricia Schulte | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | |
| 1 | Comparative Animal physiology by Philip C Withers | | | | | | | | | | |
| 2 | Comparative Physiology: Primitive Mammals” by Knut Schmidt-Nielsen and Liana Bolis | | | | | | | | | | |
| 3 | “Advances in Comparative and Environmental Physiology: Animal Adaptation to Cold” by  J A Boulant and R J Brooks | | | | | | | | | | |
| 4 | “Advances in Comparative and Environmental Physiology” by J Machin and S H Wright | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | |
| 1 | https://swayam.gov.in/ | | | | | | | | | | |
| 2 | https://www.mooc.org/ | | | | | | | | | | |
| 3 | https://nptel.ac.in/ | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | M | S | M | S | M | L | S | M | S | S |
| **CO2** | S | S | M | S | S | S | S | M | S | S |
| **CO3** | S | M | S | S | S | M | L | S | M | S |
| **CO4** | S | S | S | S | S | L | M | S | S | M |
| **CO5** | S | S | S | M | M | M | M | L | L | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | **33B** | **IMMUNOLOGY** | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | **Core Paper X** | **6** | | | **0** | | **0** | **4** |
| **Pre-requisite** | | | | Basic knowledge abouttheimmunology | **Syllabus**  **version** | | | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | | | |
| The main objectives of this course are to:   1. To provide the basic knowledge of different elements of immune system and describe the role of immune system in both maintaining health and contributing todiseases. 2. To identify the cellular and molecular basis of immuneresponsiveness. 3. To explain immunological response and how it is triggered andregulated. | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | |
| 1 | | Understanding the multiple interaction between different components of the immune system during the normal immune response. | | | | | | | | K2 | |
| 2 | | Apply basic techniques for identifying antigen antibody reaction, familiarize with  the terminology related with Immunology. | | | | | | | | K3 | |
| 3 | | Apply basic techniques for identifying antigen antibody interactions | | | | | | | | K3 | |
| 4 | | Make clear the stages of immune responses, uptake and antigen presentation, cell  activation, effector and memory cell and apoptosis mechanisms. | | | | | | | | K4 | |
| 5 | | Elucidate the reasons for immunization and the effect of immune system including  Allergy, hypersensitivity and autoimmunity. | | | | | | | | K5 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **Unit:1** | | | **INTRODUCTION TO IMMUNOLOGY** | | | **15hours** | | | | | |
| Introduction to Immunology:An overview; Scope of immunology, recognition of self and non-self as a basic functional feature of immune system; Concepts of external and internal defense systems; External (first line / innate) defense system: components, distribution, salient functions; Internal (second line / acquired) immune system: cellular and humoral immune components- distribution, salient functions-primary and secondary immune responses; Immune tissues / organs: types, anatomical location, structure and development; lymphocyte traffic during development; Types of immunity: innate and acquired - types, functional features; concept of adaptive immunity | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **Unit:2** | | | **ANTIGENS** | | | **15hours** | | | | | |
| Antigens:Definition, characteristic features and classification; Antigenicity versus immunogenicity; Adjuvants: definition, types and applications | | | | | | | | | | | |
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| **Unit:3** | | | **COMPONENTS OF CELLULAR IMMUNE SYSTEM** | | | | **15hours** | | | | |
| Major effector components of cellular immune system:Lymphocytes - types, morphology, clones; sub-populations, distribution, B and T cell receptors, B and T cell epitopes, Toll-like receptors; Antigen presenting cells: antigen processing and presentation, MHC molecules and their immunologic significance | | | | | | | | | | | |
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| **Unit:4** | | | **COMPONENTS OF HUMORAL IMMUNE SYSTEM** | | **15hours** | | | | | | |
| Major effector components of humoral immune system: Antibodies **-** Primary structure, classification, variants and antigen-antibody interactions; Structural and functional characteristics of various antibody classes; Generation of diversity; Monoclonal antibodies: definition, production and applications; Antibody engineering and its applications. Complement system **-** Components, three major activation pathways, and immune functions including anaphylaxis and inflammation. Cytokines -Definition and salient functional features; Interleukins: definition, types (lymphokines and monokines), and functions. Interferons **-** Origin, types and functions | | | | | | | | | | | |
| **Unit:5** | | | **DISEASES AND IMMUNE RESPONSES** | | **15hours** | | | | | | |
| Diseases and immune responses: Hypersensitivity: definition, Types I to IV and immune manifestations; Auto-immune diseases: onset, spectrum of diseases, and major immune responses; Immunodeficiency diseases: types including SCID and consequences; Viral (HIV), bacterial (tuberculosis) and parasitic (malaria) diseases: etiology, host immune responses and evasion by pathogens; Vaccines: types, preparations, efficacies and recent developments | | | | | | | | | | | |
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| **Unit:6** | | | **Contemporary Issues** | | **2 hours** | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | |
|  | | | | | | | | | | | |
|  | | | **Total Lecture hours** | | **77hours** | | | | | | |
| **Text Book(s)** | | | | | | | | | | | |
| 1 | Abul Abbas Andrew Lichtman Shiv Pillai. (2015). *Basic Immunology-Function and Disorder*  *of the Immune System.* Imprint**-**Elsevier. | | | | | | | | | | |
| 2 | Dulsy Fatima and Arumugam N. (2000). *Immunology.* Saras Publications., Nagercoil. | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | |
| 1 | Benjamini E, Coico R and Sunskise G. (2000). *Immunology*-*A short course.* Wiley – Liss  Publication, NY. | | | | | | | | | | |
| 2 | Chapel H and Halbey M. (1986). *Essentials of Clinical Immunology*. ELBS. 1986. | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | |
| 1 | https://[www.edx.org/learn/immunology](http://www.edx.org/learn/immunology) | | | | | | | | | | |
| 2 | https://[www.classcentral.com/course/edx-fundamentals-of-immunology-part-1-1597](http://www.classcentral.com/course/edx-fundamentals-of-immunology-part-1-1597) | | | | | | | | | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **Cos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | S | S | S | S | M | S | S | S |
| **CO2** | S | S | M | S | S | S | M | M | S | S |
| **CO3** | S | M | M | S | S | S | S | S | S | M |
| **CO4** | M | S | M | M | S | S | S | S | S | M |
| **CO5** | M | S | S | S | M | S | M | S | S | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **3EC** | **ENTOMOLOGY – I** | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **Elective I** | **5** | **0** | | **0** | **4** |
| **Pre-requisite** | | | Basic knowledgeabout Insects **V** | **Syllabus**  **version** | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | |
| The main objectives of this course are to:   1. To make the students understand the insectworld. 2. To study the systems and its organization ininsects. 3. To evaluate the importance ofinsects. | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, student will be able: | | | | | | | | |
| 1 | To identify the insects based on external features. | | | | | | K1 | |
| 2 | To understand the organization of systems | | | | | | K2 | |
| 3 | To evaluate the physiological differences. | | | | | | K5 | |
| 4 | To understand the protective mechanisms | | | | | | K2 | |
| 5 | To analyze the significance of endocrines | | | | | | K4 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | |
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| **Unit:1** | | **CLASS INSECTA** | | **15hours** | | | | |
| Classification up to order with example for each order Identification of insects using keys  **Insect Collection** Methods, preservation and significance. | | | | | | | | |
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| **Unit:2** | | **COMPARATIVE MORPHOLOGY** | | **15hours** | | | | |
| Head, thorax, abdomen and appendages ***Functional Morphology*** Mouthparts, genitalia (male,  female) | | | | | | | | |
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| **Unit:3** | | **COMPARATIVE PHYSIOLOGY** | | **15hours** | | | | |
| Digestive system, Respiratory system, Circulatory system, Excretory system, Nervous system Reproductive system. | | | | | | | | |
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| **Unit:4** | | **INTEGUMENT** | | **15hours** | | | | |
| **Integument –** Structure, clinical competition and functions, Synthesis of chitin  Moulting: Apolysis, ecdysis and sclerotisation**Growth -** Insect growth, Metamorphosis: types, significance and hormonal regulations | | | | | | | | |
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| **Unit:5** | | **INSECT ENDOCRINOLOGY** | | **15hours** | | | | |
| Endocrine Glands, Hormones and Neurohormones –functions ***Insect adaptations*** Adaptations to  environmental stress, Diapauses, pheromones, insect flight, the biomimetics. | | | | | | | | |
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| **Unit:6** | | **CONTEMPORARY ISSUES** | | **2 hours** | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | |
|  | | | | | | | | |
|  | | **Total Lecture hours** | | **77hours** | | | | |

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| **Text Book(s)** | |
| 1 | Imms 1986 Textbook of Entomology |
| 2 | Snodgrass 1983 Insect Morphology |
| 3 | Chapman 1973 Insect Structure and Morphology |
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| **Reference Books** | |
| 1 | Wigglesworth 1969 Insect Physiology |
| 2 | Alka Prakash 1996 Applied Entomology |
|  | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | |
| 1 | Applied Entomology: <https://onlinecourses.swayam2.ac.in/cec20_bt02/preview> |
| 2 | Insect-Human Interactions (Coursera): htt[ps://www.mooc](http://www.mooc-list.com/course/bugs-101-insect-)-[list.com/course/bugs-101-insect-](http://www.mooc-list.com/course/bugs-101-insect-)  human-interactions-coursera |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **Cos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | L | S | S | M | S | S | S |
| **CO2** | S | S | S | L | S | S | M | S | S | S |
| **CO3** | S | S | S | L | S | S | M | S | S | S |
| **CO4** | S | S | S | L | S | S | M | S | S | S |
| **CO5** | S | S | S | L | S | S | M | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **3EB** | **MICROBIOLOGY** | **L** | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **Elective II** | **5** | | **0** | | **0** | **4** |
| **Pre-requisite** | | | Knowing the microbial world and its  Implications | **Syllabus Version** | | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. The course is intended to make aware of the students about the classification, diversity, organization, application and pathogenicity of the microorganisms existing theecosystem. 2. The course will help the students to learn about the various microbial culture techniques and its handling. 3. The course will give an idea that how microbes are used in various industries for generation of various products related to day to daylife. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | The students will be able to explain the taxonomy, diversity and general structure of  micro-organisms. | | | | | | | K4 | |
| 2 | They will develop knowledge about the culture, sterilization, handling, identification  and assessing growth characters of microorganisms. | | | | | | | K4 | |
| 3 | The students will develop knowledge about the general microbial techniques for isolation of pure cultures of bacteria, fungi and algae and will master the aseptic techniques to perform routine culture handling tasks safely and effectively. | | | | | | | K2 | |
| 4 | The students will get idea about the microbial spoilage and the potentials in the usage ofmicrobes in agriculture. | | | | | | | K5 | |
| 5 | The students will develop an awareness about the various microbial diseases and the  causative organisms. | | | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | |
|  | | | | | | | | | |
| **Unit:1** | | **INTRODUCTION– SCOPE AND HISTORY OF MICROBIOLOGY** | | | **15hours** | | | | |
| **Introduction– Scope and History of microbiology** –Classification of bacteria, fungi, yeastand  virus. Structure and functions of bacteria and virus. Reproduction in bacteria – Transformation, conjugation, transduction. | | | | | | | | | |
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| **Unit:2** | | **CULTIVATION AND CONTROL OF MICROORGANISM** | | | **15hours** | | | | |
| **Cultivation and control of microorganism** – Methods of collection of samples – methods of estimation of microorganism in soil, water and air – Isolation and identification of bacteria. Methods of sterilization and disinfection – Microbial control – Physical and chemical –techniques of pureculture. | | | | | | | | | |
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| **Unit:3** | | **MICROBIAL ECOLOGY** | | | **15hours** | | | | |
| **Microbial Ecology:** Distribution of microorganism in soil, water and air – Environmental factors  influencing the distribution of microorganism – Role of microorganisms in the cycling of nutrients – Carbon and Nitrogen cycle. | | | | | | | | | |
| **Unit:4** | | **FOOD MICROBIOLOGY** | | | **15 hours** | | | | |
| **Food Microbiology:** Sources, types, incidence of microorganism in vegetables, meats, milk and  dairy products – spoilage of food, fruits, vegetables, cereals, meat, caned products – Factors influencing spoilage – Principles of food preservation. | | | | | | | | | |

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| **Unit:5** | | **MICROBIAL TECHNOLOGY** | **15 hours** |
| **Microbial Technology:** Genetically modified organisms in food production – Single Cell Protein  (SCP) production – Production of organic acids (acetic acid), ethanol – Antibiotics – Microbial toxins | | | |
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| **Unit:6** | | **Contemporary Issues** | **2 hours** |
| Expert lectures, online seminars – webinars | | | |
|  | | | |
|  | | **Total Lecture hours** | **77hours** |
| **Text Book(s)** | | | |
| 1 | Burden, K.L. and R.P. Williams (6th Ed.) 1968. Microbiology. The Macmillan Co., London P.  818. | | |
| 2 | Dawes, E.A. (Ed.) 1986. Energy conservation in bacterial photosynthesis. In: Microbial  energetics. Blackie & Son Ltd., Glasgon, 133-144pp | | |
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| **Reference Books** | | | |
| 1 | Doelle, H.W. (Ed.) 1969. Fermentation acetic acid bacteria and lactic acid bacteria. In: Bacterial  metabolism. Academic Press. New York, London. 256 – 351 pp. | | |
| 2 | Hay, J.M. (Ed.) 1986. Modern Food Microbiology. CBS publishers, Delhi. 622 pp. | | |
|  | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | Food Microbiology and Food Safety:  <https://onlinecourses.swayam2.ac.in/cec20_ag13/preview> | | |
| 2 | Food Microbiology: <https://onlinecourses.swayam2.ac.in/cec20_ag09/preview> | | |
| 3 | Applied Environmental Microbiology: https://onlinecourses.nptel.ac.in/noc20\_ce17/preview | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | M | S | L | M | S | S | S |
| **CO2** | S | S | S | M | S | L | M | S | S | S |
| **CO3** | S | S | S | M | S | L | M | S | S | S |
| **CO4** | S | S | S | M | S | L | M | S | S | S |
| **CO5** | S | S | S | M | S | L | M | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **3EB** | **RESEARCH METHODOLOGY** | | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **Elective II** | | **5** | **0** | | **0** | **4** |
| **Pre-requisite** | | | Basic information about research and research  articles | | **Syllabus**  **version** | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. To familiarize the basics ofresearch 2. To know the literaturecollection 3. To understand the perfection ofresearch. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | To understand and improve the art of scientific writing. | | | | | | | K2 | |
| 2 | To familiarize the various literature sources. | | | | | | | K3 | |
| 3 | To analyze the raw data and its interpretation | | | | | | | K4 | |
| 4 | To apply the tools to substantiate scientific findings | | | | | | | K3 | |
| 5 | To create an awareness on publication skills. | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | |
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| **Unit:1** | | **BASICS OF RESEARCH** | | | **15hours** | | | | |
| Topic selection - Planning research – defining objectives - Preparation of work plans. Identification of suitable methodology - Preparation of project proposal – Funding agencies – Student project  scheme of TNSCST & TANSCHE. | | | | | | | | | |
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| **Unit:2** | | **COLLECTION OF LITERATURE** | | | **15hours** | | | | |
| Collection of literature- News articles – Newsletters – Journals. Digital library and search of articles  - Key words and search - Internet – Google Scholar – Pub med – Inflibnet – Medline – Agricola – Science direct -Open access Journals - virtual sources - other sources. | | | | | | | | | |
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| **Unit:3** | | **DATA ANALYSIS** | | **15hours** | | | | | |
| Collection of samples / data – Data analysis – Microsoft Excel – Construction of tables – headings -  footer - hypothesis testing – Test of Significance – Tabulation – Presentation of results. | | | | | | | | | |
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| **Unit:4** | | **THESIS STRUCTURE** | | **15 hours** | | | | | |
| Thesis structure –Components - Writing Introduction – review of literature – Materials & Methods – Presentation of results – Discussion of Results based on literature – Arrangement of Bibliography and how to quote reference in thesis - Appendix. | | | | | | | | | |
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| **Unit:5** | | **PUBLISHING OF ARTICLES** | | **15hours** | | | | | |
| Publishing of Articles in newspapers /newsletters - Selection of journals – ISSN Number – Peer reviewed Journals – Science citation index – impact factor and importance. Manuscripts preparation for Journals – components – Submission and Publication. | | | | | | | | | |
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| **Unit:6** | | **Contemporary Issues** | | **2 hours** | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | |
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|  | | **Total Lecture hours** | | **77hours** | | | | | |

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| **Text Book(s)** | |
| 1 | Anderson, Durston&Polle 1970: Thesis and assignment, writing Wiley Eastern Limited |
| 2 | Fisher R.A, 1950: Statistical methods of research workers |
| 3 | Freumd J E, 1967: Modern elementary statistics, Prentice Hall, Inc. Englewood cliffs, N J. |
|  | |
| **Reference Books** | |
| 1 | Malter K, 1972: Statistical analysis in Biology, Chapmen Hall, London. |
| 2 | Rajendrakumar C 2008 Research Methodology SB Nanja for APHA publishing Corporation  New Delhi |
|  | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | |
| 1 | Research Methodology: <https://swayam.gov.in/nd2_cec20_hs17/preview> |
| 2 | Understanding Research Methods: htt[ps://www.mooc](http://www.mooc-list.com/course/understanding-)-[list.com/course/understanding-](http://www.mooc-list.com/course/understanding-)  research-methods-coursera |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | S | L | L | L | M | L | S |
| **CO2** | S | S | S | S | L | L | L | M | L | S |
| **CO3** | S | S | S | S | L | L | L | M | L | S |
| **CO4** | S | S | S | S | L | L | L | M | L | S |
| **CO5** | S | S | S | S | L | L | L | M | L | S |

\*S-Strong; M-Medium; L-Low

**Fourth Semester**

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| **Course code** | | | **43A** | **GENETICS** | **L** | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | **Core Paper XI** | **6** | | **0** | | **0** | **4** |
| **Pre-requisite** | | | | Basic knowledge about GenesandChromosomes **S**  which have learned inundergraduatecourse | **Syllabus version** | | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | | |
| The main objectives of this course are to:   1. To study the nature and function of Genes andChromosomes 2. To acquire knowledge on the structure of Mendelian principles, Gene mapping methods, Microbial genetics, Human genetics, Mutation and MolecularGenetics. 3. To acquire knowledge on the Gene concepts and their role ininheritance. 4. Understand the Chromosomes and theirnature. 5. To understand the role of DNA, RNA and Nucleotides and theirfunctions. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | | Acquire knowledge on the Nature and functions of Genes and learn the  mechanism of their action | | | | | | | K4 | |
| 2 | | Learn the structure and functions of Gene mapping and Mutations and familiarize  on their functions | | | | | | | K3 | |
| 3 | | Understand the Microbial genetics and Molecular Genetics and their rolein  molecular biology | | | | | | | K2 | |
| 4 | | Able to learn the Structure and functions of the Nucleotides | | | | | | | K2 | |
| 5 | | Know the factors about genes and their role in the development of an organism | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | |
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| **Unit:1** | | | **BASIC CONCEPTS OF GENETICS** | | **15hours** | | | | | |
| Mendelian principles: Dominance, segregation, independent assortment. Concept of gene: Allele, multiple alleles, pseudoallele, complementation tests Extensions of Mendelian principles: Co-dominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters. | | | | | | | | | | |
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| **Unit:2** | | | **GENETIC MATERIALS** | | **15hours** | | | | | |
| Structure, properties and functions of genetic materials:DNA as the genetic Materials - Basic structure of DNA and RNA, alternate and unusual forms of DNA - Physical and Chemical properties of nucleic acid, base properties, denaturation and renaturation, Tm and cot values, hybridization. Genetic code - Methods of deciphering the genetic code and general features of the code word dictionary. Chromosomal genetics: Molecular structure of chromosomes - Variation in chromosome number and structure - Chromosome nomenclature - Chromosomal syndromes. | | | | | | | | | | |
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| **Unit:3** | | | **MICROBIAL GENETICS AND HUMAN GENETICS** | | **15hours** | | | | | |
| Microbial Genetics:Genetics of Virus - Viral chromosome, Lytic cycle, Lysogenic cycle - Bacterial genetics -Bacterial genome - Gene transfer mechanisms in bacteria and virus - conjugation, transduction and transformation. Human Genome Project. Quantitative genetics: Polygenic inheritance, heritability and its measurements, | | | | | | | | | | |
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| **Unit:4** | | | **RECOMBINANT DNA TECHNOLOGY** | | **15hours** | | | | | |
| Recombinant DNA technology: Recombinant DNA technology - Overview - Tools for Recombinant DNA Technology – Vectors - types - Techniques used in recombinant DNA technology - generation of DNA fragments - Restriction endonucleases, DNA modifying enzymes, Ligases | | | | | | | | | | |
| **Unit:5** | | | **rDNA INTO HOST CELL** | | | **15hours** | | | | |
| Introduction of rDNA into host cell - calcium chloride mediated gene transfer - *Agrobacterium* mediated DNA transfer, electroporation, microinjection, liposome fusion, particle gun bombardment - Selection and screening of transformed cells - Expression of cloned gene; Application of rDNA technology in human welfare - Environment, Medicine and Agriculture | | | | | | | | | | |
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| **Unit:6** | | | **Contemporary Issues** | | | **2 hours** | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | |
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|  | | | **Total Lecture hours** | | | **77hours** | | | | |
| **Text Book(s)** | | | | | | | | | | |
| 1 | Gardner, E. J., M. J. Simmons and D.P. Snustad. 2006. Principles of Genetics. 8th Edition, John Wiley & Sons. INC. New York. | | | | | | | | | |
| 2 | Brooker, R. J. 2014. Genetics: Analysis and Principles. 5th Edition, McGraw Hill Publsiher, | | | | | | | | | |
| 3 | Basics of Human Genetics-VershaKatira | | | | | | | | | |
| 4 | Russell, P.J. 2005. Genetics: A Molecular Approach (2nd Edition). Pearson/Benjamin Cummings, San Francisco | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | |
| 1 | Recombinant DNA technology –James.D.Watson, | | | | | | | | | |
| 2 | Emery’s Elements of Medical Genetics | | | | | | | | | |
| 3 | Concepts of Genetics. -Klug W.S | | | | | | | | | |
| 4 | Watson, J. D., T. A. Baker S. P. Bell, A. Cann, M. Levine and R. Losick, 2014. Molecular Biology of Gene 7th Edition, Pearson Education RH Ltd. India. | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | |
| 1 | https://swayam.gov.in/ | | | | | | | | | |
| 2 | htt[ps://www.mooc.or](http://www.mooc.org/)g[/](http://www.mooc.org/) | | | | | | | | | |
| 4 | https://nptel.ac.in/ | | | | | | | | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | L | L | S | S | S | L | M | S |
| **CO2** | S | M | M | M | S | M | M | M | L | S |
| **CO3** | M | S | L | L | M | S | M | L | S | L |
| **CO4** | S | M | S | M | M | S | S | S | S | S |
| **CO5** | S | S | S | M | E | S | M | S | M | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **43B** | **EVOLUTION** | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **Core Paper XII** | **6** | | | **0** | | **0** | **4** |
| **Pre-requisite** | | | Basic information aboutevolutionary principles  and process | **Syllabus**  **version** | | | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | | |
| The main objectives of this course are to:   1. To impart knowledge on evolution and its concepts. 2. To make them understand how lifeoriginated. 3. To realize the current working ofevolution and genetic diversity. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | To understand the prehistoric life and its origin. | | | | | | | | K2 | |
| 2 | To evaluate the impact of evolution and make them aware of key events in human evolution. | | | | | | | | K4 | |
| 3 | To analyze how the higher animals evolved by speciation | | | | | | | | K5 | |
| 4 | To understand the evolution of genes by educating phylogeny | | | | | | | | K2 | |
| 5 | To imagine how the future evolution will be by comparing the past. | | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | |
|  | | | | | | | | | | |
| **Unit:1** | | **THEORIES OF EVOLUTION** | | | **15hours** | | | | | |
| Emergence of evolutionary thoughts:Lamarck and Darwin – concepts of variation, adaptation, struggle, fitness and natural selection – Spontaneity of mutations - The evolutionary synthesis | | | | | | | | | | |
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| **Unit:2** | | **ORIGIN OF CELLS AND UNICELLULAR EVOLUTION** | | | **15hours** | | | | | |
| Origin of cells and unicellular evolution:Origin of basic biological molecules - Abiotic synthesis of organic monomers and polymers - Concept of Oparin and Haldane - Experiment of Miller (1953) - The first cell - Evolution of prokaryotes - Origin of eukaryotic cells - Evolution of unicellular eukaryotes - Anaerobic metabolism, photosynthesis and aerobic metabolism | | | | | | | | | | |
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| **Unit:3** | | **PALEONTOLOGY AND EVOLUTIONARY HISTORY** | | | | **15hours** | | | | |
| Paleontology and evolutionary history:The evolutionary time scale - Eras, periods and epoch - Major events in the evolutionary time scale - Origins of unicellular and multi cellular organisms - Stages in primitive evolution including *Homosapiens* | | | | | | | | | | |
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| **Unit:4** | | **MOLECULAR EVOLUTION** | | | | **15hours** | | | | |
| Molecular evolution: Molecular divergence - Molecular tools in phylogeny, classification and identification - Protein and nucleotide sequence analysis - Origin of new genes and proteins - Gene duplication and divergence | | | | | | | | | | |
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| **Unit:5** | | **POPULATION GENETICS** | | | | **15hours** | | | | |
| The mechanisms:Population genetics - Populations, Gene pool, Gene frequency - Hardy-Weinberg Law - concepts and rate of change in gene frequency through natural selection, migration and random genetic drifth - Adaptive radiation - Isolating mechanisms – Speciation - Allopatricity and Sympatricity - Convergent evolution - Sexual selection - Co-evolution - Altruism and evolution | | | | | | | | | | |
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| **Unit:6** | | **Contemporary Issues** | | | | **2 hours** | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | |
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|  | | **Total Lecture hours** | | | | **77hours** | | | | |

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| **Text Book(s)** | |
| 1 | Verma P.S & Agarwal V.K., Concept of Evolution, S.Chand& Co, 2002 |
| 2 | Dobzhansky, Th. Genetic and Origin of Species. Columbia University Press. |
| 3 | Dobzhansky, Th., F.J. Ayala, G.L. Stebbines and J.M Valentine. Evolution. Surjeet Publication,  Delhi |
| 4 | Jha, A.P. Genes and Evolution. John Publication, New Delhi. |
|  | |
| **Reference Books** | |
| 1 | Futuyama, D.J. Evolution Biology, Suinuaer Associates, INC Publishers, Dunderland. |
| 2 | Hartl, D.L. A Primer of Population Genetics. Sinauer Associates. Inc, Massachusetts. |
| 3 | Strickberger, M.W(2005). Evolution, Jones and Bartett publishes, London. |
| 4 | Arthur, W-2011 – Evolution – A developmental approach, wiley – Blackwell, oxford, U.K. |
|  | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | |
| 1 | Paleontology: Theropod Dinosaurs and the Origin of Birds:  htt[ps://www.classc](http://www.classcentral.com/course/theropods-birds-5236)e[ntral.com/course/theropods-birds-5236](http://www.classcentral.com/course/theropods-birds-5236) |
| 2 | Evolutionary Biology: <https://swayam.gov.in/nd2_cec20_bt06/preview> |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | M | S | M | S | M | L | S | M | L | M |
| **CO2** | S | S | L | S | S | L | S | S | S | S |
| **CO3** | S | M | S | S | S | S | S | L | L | M |
| **CO4** | S | S | S | S | S | M | S | S | S | L |
| **CO5** | S | S | S | M | M | S | S | L | L | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **4EC** | **ENTOMOLOGY - II** | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **Elective** | **5** | | | **0** | | **0** | **4** |
| **Pre-requisite** | | | Basic information about agricultural pest, insect  vectors and itscontrolmeasures | **Syllabus**  **version** | | | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | | |
| The main objectives of this course are to:   1. To make the students understand the interaction ofinsects 2. How to control the insect pests without affecting theenvironment 3. To understand the modern controlmeasures. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | To understand how the insect life helps in its control | | | | | | | | K2 | |
| 2 | To analyze the methods of integrated pest management | | | | | | | | K4 | |
| 3 | To elucidate the importance of insects | | | | | | | | K5 | |
| 4 | To know the principles of insect toxicology. | | | | | | | | K2 | |
| 5 | To apply the biological knowledge to control the pests. | | | | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | |
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| **Unit:1** | | **INTERACTION OF INSECTS** | | | **15hours** | | | | | |
| **Interaction of Insects** Social Insects: Caste differentiation and social behaviour of Termite, Honey Bee and Ant, Insect – Plant interaction, Insect vector – Host relationship.  **Bionomics and control measures** a. *Locustamigratoria* – Polyphagus grasshopper b. *Odentotermisobesus*– Polyphagus  termite c. *Heliothisarmigera* – Polyphagus moth d. *Spodopteralitura* – Polyphagus caterpillar e. *Oryctusrhynocerus* – Coconut beetle | | | | | | | | | | |
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| **Unit:2** | | **BIOLOGY AND CONTROL MEASURES OF INSECT PESTS** | | | **15hours** | | | | | |
| Biology and Control measures of Insect pest Economic crops – Cotton and Sugarcane, Stored  grains – Paddy, Wheat and Flour. Insect control methods Cultural, physical, mechanical, biological and chemical control methods, Integrated pest management | | | | | | | | | | |
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| **Unit:3** | | **INSECT VECTORS** | | | | **15hours** | | | | |
| **Insect Vectors** Systematics, biology and control measures of insect vectors of human diseases. Flies-*Anopheles*sp, *Culex*sp and *Aedes* sp. and *Muscadomestica* Roaches and bugs – *Periplanataamericana*and *Cimexindicus***Insects of Commercial Importance -** Honey Bee – Types and differences in nest building, production of honey. Silk Moth – Types and the differences in life cycles and production of silk. Lac Insect – Indian typeonly | | | | | | | | | | |
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| **Unit:4** | | **INSECT TOXICOLOGY** | | | | **15hours** | | | | |
| **Insect Toxicology** Principles and Scope. **Chemistry and mode of action of the Insecticides-**  Inorganic compounds, Arsenic and fluorine compounds Organic compounds: Organochloride, organophosphorus and carbamates, Botanical Insecticides | | | | | | | | | | |
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| **Unit:5** | | **INSECTS AND MODERN CHEMICALS** | | | | **15hours** | | | | |
| **Insects and Modern chemicals.**Growth regulatorycompoundsMicrobialinsecticides, Pheromones and pestcontrol | | | | | | | | | | |

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| **Insecticides and Introduction to insect genetics** Formulation and appliances, Mechanism of  Insecticide resistance – Genetical, Physiological and Biochemical. | | | |
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| **Unit:6** | | **Contemporary Issues** | **2 hours** |
| Expert lectures, online seminars – webinars | | | |
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|  | | **Total Lecture hours** | **77hours** |
| **Text Book(s)** | | | |
| 1 | Imms 1986 Textbook of Entomology | | |
| 2 | Snodgrass 1983 Insect Morphology | | |
| 3 | Alka Prakash 1996 Applied Entomology | | |
|  | | | |
| **Reference Books** | | | |
| 1 | Chapman 1973 Insect Structure and Morphology | | |
| 2 | Wigglesworth 1969 Insect Physiology | | |
|  | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | Applied Entomology: <https://onlinecourses.swayam2.ac.in/cec20_bt02/preview> | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | L | S | M | M | M | M | S |
| **CO2** | S | S | S | L | S | M | M | M | M | S |
| **CO3** | S | S | S | L | S | M | M | M | M | S |
| **CO4** | S | S | S | L | S | M | M | M | M | S |
| **CO5** | S | S | S | L | S | M | M | M | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **4EA** | **BIOINSTRUMENTATION, BIOLOGICAL TECHNIQUES, BIOTECHNOLOGY AND GENETIC ENGINEERING** | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **ELECTIVE - IIB** | **5** | | | **0** | | **0** | **4** |
| **Pre-requisite** | | | Basic knowledge on Bioinstrumentation,Biological techniques, Biotechnology and Genetic Engineering | **Syllabus**  **version** | | | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | | |
| The main objectives of this course are to:  1. The objective of this course is to give a firm foundation in the fundamentals of modern Molecular techniques.  2. The course will give idea various protocols followed in Biotechnology in relation to animal science. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | To develop an idea about the various techniques used in modern biotechnology. | | | | | | | | K1 | |
| 2 | To understand the basic principles of all techniques | | | | | | | | K2 | |
| 3 | To analyze the latest techniques and its implication | | | | | | | | K4 | |
| 4 | To know how to isolate & sequence a gene | | | | | | | | K5 | |
| 5 | To apply the knowledge in purifying the environment. | | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | |
| **Unit:1** | | BIOINSTRUMENTATION | | | **15hours** | | | | | |
| Microscopy – Fluorescence Microscope, Phase Contrast Microscope, Electron Microscope (TEM& SEM). Centrifugation – Principle and applications,types.pH meter. Spectrophotometry – Visible and UV spectrophotometry. Spectrophotometer. Chromatographic techniques – Principle and applications of chromatography – Paper and TLC. Electrophoresis Principles and applications. | | | | | | | | | | |
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| **Unit:2** | | BIOLOGICAL TECHNIQUES | | | **15hours** | | | | | |
| Southern Blotting, Western Blotting, DNA finger printing techniques. Hybridoma technologyproduction and applications of monoclonal antibodies. Geiger Muller counter – Principles and applications. Liquid Scintillation counter – principle and applications. Applications of radio isotopes in biological sciences. Autoradiography. Applications of Flow cytometry, Cell separation and culture techniques. | | | | | | | | | | |
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| **Unit:3** | | GENE TRANSFER METHODS AND TRANSGENIC ORGANISMS | | | | **15hours** | | | | |
| Gene Transfer Methods in Animals – Transgenic animals. Somatic cell hybridization – mechanism and applications. Recombinant DNA Techniques Recombinant DNA – PCR, Restriction enzymes for cloning – Techniques used in recombinant DNA technology – Cloning vectors for rDNA – Construction of Chimeric DNA – Molecular Probes – Construction and screening of genomic libraries. | | | | | | | | | | |
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| **Unit:4** | | ISOLATION, SYNTHESES AND SEQUENCING OF GENES | | | | **15hours** | | | | |
| Isolation, Syntheses and Sequencing Genes Isolation of genes – using DNA and RNA probes; Gene therapy- types of gene therapy. Industrial Biotechnology Fermentation – Designing of bioreactors – stages of fermentation and fermentation productsconversion of waste into biogas – conversion of waste into ethanol | | | | | | | | | | |

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| **Unit:5** | | | ENVIRONMENTAL BIOTECHNOLOGY | **15hours** |
| Biotechnological methods of pollution control – biological treatment of waste water – biotechnology for solid waste management – microbial bioremediation of polluted environment – aerobic and anaerobic treatment – bioleaching and bio mining for recovery of resources – compost making. | | | | |
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| **Unit:6** | | | **Contemporary Issues** | **2 hours** |
| Expert lectures, online seminars – webinars | | | | |
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|  | | | **Total Lecture hours** | **77hours** |
| **Text Book(s)** | | | | |
| 1 | Dubey, R.C. 2002. A text book of biotechnology. S. Chand and Company Ltd., New Delhi. | | | |
| 2 | Gabriel Melchias, 2001. Biodiversity and conservation, Oxford IBH Publ. Co. Pvt. Ltd, NewDelhi, Calcutta. | | | |
| 3 | Glazer, A.N. and Hiroshi Nikaido, 1995. Microbial biotechnology: Fundamentals of Applied Biotechnology, W.H. Freeman and Company, New York. | | | |
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| **Reference Books** | | | | |
| 1 | RodenyF.Boyer – Modern Experimental Biochemistry – Pearson publication | | | |
| 2 | Gupta, P.K. 2003. Elements of Biotechnology, Rastogi Publ. Meerut. | | | |
| 3 | Rao, C.V. 2002. An introduction to immunology, Narosa publishing House, New Delhi. | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | |
| 1 | Fundamentals of Biotechnology: https://nptel.ac.in/courses/102/103/102103045/ | | | |
| 2 | | Biomedical Signal Processing: https://onlinecourses.nptel.ac.in/noc20\_ee41/preview | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | S | L | L | L | M | L | S |
| **CO2** | S | S | S | S | L | L | L | M | L | S |
| **CO3** | S | S | S | S | L | L | L | M | L | S |
| **CO4** | S | S | S | S | L | L | L | M | L | S |
| **CO5** | S | S | S | S | L | L | L | M | L | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **43P** | **ANIMAL PHYSIOLOGY AND IMMUNOLOGY** | **L** | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **PRACTICAL - IV** | **0** | | **0** | | **2** | **4** |
| **Pre-requisite** | | | **Basic understanding on Physiology and**  **immunology of animals** | **Syllabus**  **Version** | | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. To make them understand physiology throughpractical’s 2. To equip them to do the experimentsindividually 3. To understand the basics ofimmunology | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | To understand the physiological mechanisms | | | | | | | K2 | |
| 2 | To evaluate the experimental design | | | | | | | K5 | |
| 3 | To interact their results | | | | | | | K6 | |
| 4 | To present their findings and discuss on it | | | | | | | K2 | |
| 5 | To handle the instruments | | | | | | | K3 | |
| **K1** – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate; **K6** – Create | | | | | | | | | |
|  | | | | | | | | | |
| **ANIMAL PHYSIOLOGY**  **(Use any two cultured species which are not in endangered list)** | | | | | **12 hours** | | | | |
| 1. Determination of the rate of activity of salivary amylase (Humansaliva).    1. Ptyalin activity in relation to temperature and calculation ofQ10.    2. Ptyalin activity in relation to pH and calculation ofQ10. 2. Recording of diastolic and systolic pressure during, standing, sitting & lyingposture. 3. Biological responses of animals to various osmotic concentrations and their effects i) Change in weight of Earthworm in heteroosmotic media ii) Pattern of osmotic responses of crab in hetero osmotic media iii) Active uptake of Na+ and Cl- of a fish from the environmental water and change insalinity. 4. Determination of the specific gravity of the blood of a vertebrate animal-by copper sulphate method. 5. Effect of temperature on the opercular movement of fish and calculation ofQ10. 6. Determination of the median threshold concentration of sucrose for houseflypopulation. 7. Effect of drugs on the heartbeat of cockroach (Result with graphical representation corresponding to different concentration and time intervalsexpected) 8. Determination of the rate of ammonia and urea excretion infish. 9. Determination of the hemoglobin content in fishblood. | | | | | | | | | |
| **IMMUNOLOGY:** | | | | | **12 hours** | | | | |
| 1. Study of Antigen and Antibody reaction through the study of Bloodgrouping. 2. Study of Rh factor through the study of Bloodgrouping. 3. Estimation of protein by Lowry’smethod 4. Widal Test 5. Western blotting (Demonstrationonly) 6. ELISA (Demonstration only) 7. Separation of lymphocytes from wholeblood | | | | | | | | | |
| **Total Lecture hours** | | | | | **24 hours** | | | | |

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| **Text Book(s)** | |
| 1 | Advanced Practical Zoology by Sinha, J., Chatterjeee A.K., Chattopadhyay P. 2011.  Arunabha Sen Publishers. |
| 2 | Medical Laboratory Technology, Methods and Interpretations by RamnikSood. 2006. Jaypee  publishers. |
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| **Reference Books** | |
| 1 | Modern Experimental Zoology by PreetiGuptha and Mridula Chaturvedi. 2000 |
| 2 | Richard L. Myers Immunology: A Laboratory Manual. 1994. McGraw-Hill Inc., US; 2nd  Revised edition edition. |
| 4 | Cell and Molecular Biology: A Lab Manual by Chaitanya K.V. 2013. Prentice Hall India  Learning Private Limited |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | S | L | L | S | M | M | S |
| **CO2** | S | S | S | S | L | L | S | M | M | S |
| **CO3** | S | S | S | S | L | L | S | M | M | S |
| **CO4** | S | S | S | S | L | L | S | M | M | S |
| **CO5** | S | S | S | S | L | L | S | M | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **43Q** | **GENETICS AND EVOLUTION** | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **PRACTICAL – V** | **0** | | | **0** | | **2** | **4** |
| **Pre-requisite** | | | Basic knowledge about genetics and evolution of  Animals | **Syllabus**  **Version** | | | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | | |
| The main objectives of this course are to:   1. To study the nature and function of Genes andChromosomes 2. To acquire knowledge on the structure of Mendelian principles, Gene mapping methods, Microbial genetics, Human genetics, Mutation and MolecularGenetics. 3. To realize the current working ofevolution. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | Acquire knowledge on the Nature and functions of Genes and learn the  mechanism of their action | | | | | | | | K4 | |
| 2 | Learn the structure and functions of Gene mapping and Mutations and familiarize  on their functions | | | | | | | | K3 | |
| 3 | Able to learn the Structure and functions of the Nucleotides | | | | | | | | K2 | |
| 4 | To analyze how the higher animals evolved. | | | | | | | | K5 | |
| 5 | To understand the evolution of genes. | | | | | | | | K2 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | |
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| **GENETICS:** | | | | | **20 hours** | | | | | |
| 1. Genetic characteristics of a class roomsample.    1. Dermatoglyphic patterns (Fingerprint),    2. Earlobe,    3. Rolling oftongue,    4. Mid digitalhairs,    5. Widow’speak,    6. Inward bending of littlefinger. 2. Study of morphology of Drosophilamelanogaster 3. Culture of Drosophilamelanogaster 4. Identification of sex and mutant characters Drosophilamelanogaster 5. Demonstration of dosage compensation in Drosophila males andfemales. 6. Preparation of genital plate of Drosophilamelanogaster 7. Estimation of allelic Frequency based on ABO BloodGroup. 8. Identification of Rh factor in bloodgroups 9. Preparation of buccal smear to show squamous epithelialcells. 10. Study of Barr body using buccal smear ofvolunteers 11. Study of stages of mitosis and meiotic chromosomes of grasshopper by observation of permanent slides and calculation of chiasmafrequency | | | | | | | | | | |
| **EVOLUTION:** | | | | | | **10 hours** | | | | |
| 1. Evolutionary significances: Fossils of each any five from non-chordate andchordate. 2. Analogous and homologous organs of vertebrate animals (Frog, *Calotes*, Pigeon andRabbit) 3. Mimicry and colouration ofanimals. | | | | | | | | | | |
| **Total Lecture hours** | | | | | | **30 hours** | | | | |

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| **Text Book(s)** | |
| 1 | Advanced Practical Zoology by Sinha, J., Chatterjeee A.K., Chattopadhyay P. 2011.  Arunabha Sen Publishers. |
| 2 | Manual of Practical Zoology: Chordates by Verma.(2000. S. Chand Publishing |
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| **Reference Books** | |
| 1 | Cell and Molecular Biology: A Lab Manual by Chaitanya K.V. 2013. Prentice Hall India  Learning Private Limited |
| 2 | A Manual of Practical Zoology: Invertebrates by Verma P.S.. 2010. S Chand publication. |
| 3 | A Manual of Practical Zoology by Verma P.S. 2000. S Chand publication. |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | L | L | L | M | M | L | S |
| **CO2** | S | S | S | L | L | L | M | M | L | S |
| **CO3** | S | S | S | L | L | L | M | M | L | S |
| **CO4** | S | S | S | L | L | L | M | M | L | S |
| **CO5** | S | S | S | L | L | L | M | M | L | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **4EP** | **ENTOMOLOGY I & II)**  **(Avoid collecting animals from Wild)** | **L** | **T** | | | **P** | **C** |
| **Core/Elective/Supportive** | | | **ELECTIVE I PRACTICAL** | **0** | **0** | | | **2** | **4** |
| **Pre-requisite** | | | Necessary understanding about Biology of  Insects | **Syllabus**  **Version** | | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. To make the students understand the insectworld. 2. To study the systems and its organization ininsects. 3. How to control the insect pests without affecting theenvironment | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | To identify the insect based on external feature. | | | | | | | K1 | |
| 2 | To understand the organization of systems | | | | | | | K2 | |
| 3 | To analyze the significance of endocrines | | | | | | | K4 | |
| 4 | To know the principles of insect toxicology. | | | | | | | K2 | |
| 5 | To apply the biological knowledge to control the pests. | | | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | |
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| **1. IDENTIFICATION OF INSECTS** | | | | | | **04 hours** | | | |
| 1. Key to eachorder 2. One insect for each order (South Indian insectsonly) | | | | | | | | | |
| **2. DISSECTION** | | | | | | **10 hours** | | | |
| Digestive system, Nervous system and Reproductive system - Cockroach, Gryllotalpa, Nepa,Cybister, Silk moth(Any two insects) | | | | | | | | | |
| **3. MOUNTING** | | | | | | **06 hours** | | | |
| Mouthparts, Salivary gland and Sting apparatus - Honey bee, Cockroach, House fly,  Mosquito(Any two insects) | | | | | | | | | |
| 1. Morphological studies of different types of antennae and legs ofinsects. 2. Qualitative study of haemocytes in the haemolymph ofcockroach 3. Qualitative study of lipids, carbohydrates and proteins in the haemolymph of cockroach. 4. Identification of Insect pests of the following (3 major pests ineach)    1. Paddy    2. Cotton    3. Sugarcane    4. Vegetables    5. Storageproducts 5. Collection and preservation ofinsects. | | | | | | **06 hours** | | | |
| **9. SPOTTERS** | | | | | | **04 hours** | | | |
| 1. Systematic 2. Pests 3. Medicalimportance 4. Veterinaryimportance 5. Economicimportance | | | | | | | | | |

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| **Field study and visit** – Visits to agricultural fields and forests for on spot study of pests and damagecaused by them. | | | |
| **Submission at the time of Practical Examination**   1. Report on the Field study and Fieldtrips 2. BonafideRecord 3. Insect photographicalbum/chart | | | |
|  | | **Total Lecture hours** | **30hours** |
| **Text Book(s)** | | | |
| 1 | Advanced Practical Zoology by Sinha, J., Chatterjeee A.K., Chattopadhyay P. 2011.  Arunabha Sen Publishers | | |
| 2 | A Manual of Practical Zoology: Invertebrates by Verma P.S.. 2010. S Chand publication | | |
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| **Reference Books** | | | |
| 1 | Practical Zoology Invertebrate by H.S. Bhamrah. 2003. Dominant Publishers. | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | L | S | S | M | S | S | S |
| **CO2** | S | S | S | L | S | S | M | S | S | S |
| **CO3** | S | S | S | L | S | S | M | S | S | S |
| **CO4** | S | S | S | L | S | S | M | S | S | S |
| **CO5** | S | S | S | L | S | S | M | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **4EQ** | **MICROBIOLOGY, BIOINSTRUMENTATION, BIOLOGICAL TECHNIQUES, BIOTECHNOLOGY& GENETIC ENGINEERING** | **L** | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **ELECTIVE II PRACTICAL** | **0** | | **0** | | **2** | **4** |
| **Pre-requisite** | | | Basic information on biological techniques andits applications | **Syllabus version** | | | **2024-**  **2025** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:  1. The objective of this course is to give a firm foundation in the fundamentals of modern Molecular techniques.  2. The course is intended to make aware of the students about the classification, diversity, organization, application and pathogenicity of the microorganisms existing the ecosystem.  3. The course will give an idea that how microbes are used in various industries for generation of various products related to day-to-day life. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | To develop an idea about the various techniques used in modern biotechnology. | | | | | | | K1 | |
| 2 | To analyze the latest techniques and its implication | | | | | | | K4 | |
| 3 | The students will develop an awareness about the various microbial diseases and the causative organisms. | | | | | | | K3 | |
| 4 | The students will be able to explain the taxonomy, diversity and general structure of micro-organisms. | | | | | | | K4 | |
| 5 | The students will get idea about the microbial spoilage and the potentials in the usage of microbes in agriculture. | | | | | | | K5 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | |
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| **MICROBIOLOGY:** | | | | **15 hours** | | | | | |
| 1. Sterilization – Principles and methods 2. Media Preparation – Liquid and Solid media, Agar deep, slant and plate 3. Pure culture techniques – Streak plate, pour plate, spread plate 4. Identification of Gram positive and Gram-negative bacterial strains 5. Water quality analysis – MPN 6. Isolation of microorganisms from Spoiled foods – Meat, milk, cereals and bread 7. Milk quality – dye reduction test 8. Antibiotic sensitivity: oxidase test 9. Identification of Symbiotic bacterioids from rood nodules of leguminous plants | | | | | | | | | |
| BIOINSTRUMENTATION & BIOLOGICAL TECHNIQUES: | | | | **10hours** | | | | | |
| 1. Separation technique of amino acids using paper chromatography.  2. Separation of Proteins on gel electrophoresis  3. Study on the Principles of the Instruments and their uses.  1. pHMeter  2. Colorimeter  3. Spectrophotometer  4. Electrophoresisapparatus  5. Microtome  6. Centrifuge | | | | | | | | | |
| BIOTECHNOLOGY & GENETIC ENGINEERING | | | | | **10 hours** | | | | |
| 1. Fermenter design and working principle  2. Wine production  3. Antibacterial Sensitivity disc test  4. Isolation and estimation of DNA & RNA  5. Preparation of Tissue culture medium  6. PCR – Working Principle | | | | | | | | | |

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| **Field Study and Visit: Visits to instrumentation lab in University or any Research Institute** | | | |
| **Total Lecture hours** | | | | **30 hours** | |
| **TEXT BOOK** | | | | | |
| 1 | | Advanced Practical Zoology by Sinha, J., Chatterjeee A.K., Chattopadhyay P. 2011.  Arunabha Sen Publishers. | | | |
| 2 | | Medical Laboratory Technology, Methods and Interpretations by RamnikSood. 2006. Jaypee  publishers. | | | |
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| **Reference Books** | | | | | |
| 1 | | Cell and Molecular Biology: A Lab Manual by Chaitanya K.V. 2013. Prentice Hall India  Learning Private Limited | | | |
| 2 | | Manual of Practical Physiology and Endocrinology by Harsh VardhanBhask. 2009.  Campus Books International | | | |
| 3 | | | Richard L. Myers Immunology: A Laboratory Manual. 1994. McGraw-Hill Inc., US; 2nd Revised edition | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | M | S | L | M | S | S | S |
| **CO2** | S | S | S | M | S | L | M | S | S | S |
| **CO3** | S | S | S | M | S | L | M | S | S | S |
| **CO4** | S | S | S | M | S | L | M | S | S | S |
| **CO5** | S | S | S | M | S | L | M | S | S | S |
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\*S-Strong; M-Medium; L-Low

**Annexure**

**General Instructions:**

1. **Elective Courses:** Minimum Two for EachSemester.
2. **Supportive Courses:** Minimum One for first threeSemesters.
3. **Value Added Courses:** Minimum 2 and maximum 5 for Each Department for Entire Program
4. **Job Oriented Certificate Courses:** Two Courses (Each one on First and Second Year)
5. All the Board of Studies are requested to follow the same template and use the TIMES NEW ROMAN FONT with the Size of12.
6. The Course Designer should be mentioned in each of thecorses.

**Details for the Certificate Course**

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| --- | --- | --- |
| **1** | **Name of the Course** |  |
| **2** | **Name of the Department** |  |
| **3** | **Name of the Faculty Member** |  |
| **4** | **Inter/Intra Department** |  |
| **5** | **Objectives of the Course** |  |
| **6** | **Topics to be Covered** |  |
| **7** | **Duration of the Course** |  |
| **8** | **Eligibility** |  |
| **9** | **Registration** |  |
| **10** | **Description of the Course** |  |
| **11** | **Job Opportunities** |  |
| **12** | **Number of Candidates** |  |
| **13** | **Course Fee** |  |

**BHARATHIAR UNIVERSITY: COIMBATORE**

REGULATIONS FOR POSTGRADUATE DEGREE COURSES

**In CBCS pattern with effect from 2010-2011**

# Definition:

**Programme :**

“Programme” means a course of study leading to the award of a degree in a discipline.

# **Course:**

“Course” refers to a subject offered under the degree programme.

# **Core Papers:**

“Core Papers” means “the core courses” related to the programme concerned including practicals and project work offered under the programme.

# **Electives:**

“Electives” means the courses offered under the programme related to the major or non-majorbut are to be selected by the students.

A detailed explanation of the above with relevant credits are given under “Scheme of Examinations along with Distribution of Marks and Credits”

# **1. Eligibility for Admission to theCourse**

A candidate who has passed the Degree Examination as main subject of study of this University or an examination of some other University accepted by the Syndicate as equivalent thereto shall be eligible for admission to the Master Degree of thisUniversity.

# **2. Duration of theCourse**

This Course of Study shall be based on Semester System. This Course shall consist of four Semesters covering a total of two Academic Years. For this purpose, each academic year shall be divided into two Semesters; the first and third Semesters; July to November and the second and the fourth Semesters; December to April. The Practical Examinations shall be conducted at the end of even Semester.

Each semester has 90 working days consists of 5 teaching hours per working day. Thus, each semester has 450 teaching hours and the whole programme has **1800 teachinghours**.

# **3. Course of Study**

The Course of the Degree of Master of Science/Arts/Commerce shall be under the Semester System according to the Syllabus to be prescribed from time to time. This Course consists of Core Subjects and Elective Subjects.

# **4. Scheme ofExaminations**

As given in the respective Board.

# **5. Requirement to appear for theExaminations**

1. A candidate will be permitted to take the University Examination for any Semester, if he/she secures not less than 75% of attendance out of the 90 instructional days during theSemester.
2. A candidate who has secured attendance less than 75% but 65% and above shall be permitted to take the Examination on the recommendation of the Head of the Institution to condone the lack of attendance as well as on the payment of the prescribed fee to theUniversity.
3. A candidate who has secured attendance less than 65% but 55% and above in any Semester, has to compensate the shortage of attendance in the subsequent Semester besides, earning the required percentage of attendance in that Semester and take the Examination of both the Semester papers together at the end of the latterSemester.
4. A candidate who has secured less than 55% of attendance in any Semester will not be permitted to take the regular Examinations and to continue the study in the subsequent Semester. He/she has to re-do the Course by rejoining the Semester in which the attendance is less than55%.
5. A candidate who has secured less than 65% of attendance in the final Semester has to compensate his / her attendance shortage in a manner to be decided by the Head of the Department concerned after rejoining the Course.

# **6. Restriction to take theExaminations**

1. Any candidate having arrear paper(s) shall have the option to take the Examinations in any arrear paper(s) along with the subsequent regular Semesterpapers.
2. Candidates who fail in any of the papers shall pass the paper(s) concerned within 5 years from the date of admission to the said programme. If they fail to do so, they shall take the Examination in the revised Text / Syllabus, if any, prescribed for the immediate next batch of candidates. If there is no change in the Text / Syllabus they shall take the Examination in that paper with the Syllabus in vogue, until there is a change in the Text orSyllabus.
3. In the event of removal of that paper consequent to the change of Regulations and / or Curriculum after a 5 year period, the candidates shall have to take up on equivalent paper in the revised syllabus as suggested by the Chairman and fulfill the requirements as per Regulations/Curriculum for the award of the Degree.

# **7. The Medium of Instruction andExaminations**

The medium of instruction and Examinations shall be in English, except languages. However, as per directives of the government, if the candidates answer in Tamil, their answer scripts will also be evaluated.

# **8. Submission of Record Notebooks for PracticalExaminations**

Candidates taking the Practical Examinations should submit bonafide Record Note Books prescribed for the Practical Examinations. Otherwise, the candidates will not be permitted to take the Practical Examinations.

# **9. The Minimum (Pass)Marks**

A candidate shall be declared to have passed in a paper if a student obtains not less than 50% of marks in that paper. A candidate shall be declared to have passed the whole Examination if the student passes in all the papers.

**10. Distribution ofmarks**

Table– 1(A): The following are the distribution of marks for external and internal for **theory papers** of PGcourses.

**DISTRIBUTION OF EXTERNAL AND INTERNAL MARKS FOR THEORY PAPERS**

**Table – 1(A**): Distribution of marks for **External** and **Internal** for University (external) examination and **Continuous Internal Assessment** and passing minimum marks for **TheoryPapers.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **TOTALMARKS** | **EXTERNAL** | | **INTERNAL** | | Overall Passing Minimum for total marks  **(Internal + External)** |
| Max. marks | Passing  Minimum for external alone | Max. marks |  | | |
| **100** | 75 | 38 | 25 | **50** | | |
| **75** | 55 | 28 | 20 | **38** | | |

**Table – 1(B)**: Distribution of marks for the **Continuous Internal Assessment** inthe

## Theory Papers of PG programmes.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **FOR THEORY PG-COURSES** | **Distribution of Marks** | |
| 1 | Tests (one best test out of 2 testsof 2 hours each) | 05 | 04 |
| 2 | End semester model test (3hours) | 10 | 08 |
| 3 | Assignments – 2Nos. | 05 | 4 |
| 4 | Seminar | 05 | 4 |
|  | **TOTAL MARKS** | **25** | **20** |

**DISTRIBUTION OF EXTERNAL AND INTERNAL MARKS FOR PRACTICALPAPERS**

**Table – 2(A):** Distribution of marks for **External** and **Internal** University (external) examinations and **Continuous Internal Assessments** and passing minimum marks for the **Practical Courses.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TOTALMARKS** | **EXTERNAL** | | **INTERNAL**  Max. marks | Overall Passing Minimum for total marks  **(Internal + External)** | | |
| Max. marks | Passing Minimum for external alone | Max.  marks | |  |
| **100** | 60 | 30 | 40 | | 50 |
| **75** | 45 | 23 | 30 | | 38 |

Table – 2(B): Distribution of marks for the **Continuous Internal Assessment** in

## PG Practical Courses.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **FOR PRACTICAL PG-COURSES** | **DISTRIBUTION OFMARKS** | |
| 1 | Minimum10 experiments to be conducted practical paper/semester. | 20 | 15 |
| 2 | Tests: Two tests out of which one shall be during the mid semester and the other to be conducted as model test at the end of the semester. | 15 | 10 |
| 3 | Record. | 05 | 5 |
|  | **TOTAL MARKS** | **40** | **30** |

# **BHARATHIAR UNIVERSITY: COIMBATORE 641 406**

**GUIDELINES FOR CONDUCTING VALUE ADDED COURSES**

**Course Structure**

1. Therequestforapprovalofsyllabus by the concerned authorities is mandatory atleast15 daysbeforethedateofcommencementofthecourse.TheSyllabus(15/30 hours),ScheduleandtheDetailsofFacultyhandlingthecourseapprovedbytheDepartmentalCommitteeandforwardedbyHead of the Department should be enclosed.
   1. Thecourseofferedshouldnotbethesameasanycourselistedinthecurriculumoftherespectiveprogramme/oranyotherprogrammeofferedin University /Colleges.
   2. Thevalue-addedcoursesmaybealsoconductedduringweekends/ vacation period.
   3. Thecoursecanbeofferedany semester in the PG Programmes.
   4. Industryexperts/eminentacademiciansfromotherInstitutesare also eligible to offer the value-addedcourse.
   5. The course can be offered only if there are atleast10 students opting for it.
   6. The students may be allowed to take value addedcourses offered by otherdepartmentsafterobtainingpermissionfromHeadoftheDepartment offering the course.

# Duration

1. Thedurationofvalue-addedcoursesis15(30)periodsoftheoryoramaximumoftheoryandLaboratorycoursesandthecoursecanhaveamaximumofthree hours per day.

Fortheone(two)creditcourseseither15(30)periodsoftheoryora combination of theory and Laboratory may be offered.

Where,**2 periods**oflaboratory =**1 period**of theoryEvaluation

1. Thevalue-addedcoursesshallcarry100marksandshallbeevaluatedthrough

# internal assessments only**.**

* 1. Two Assessments shall be conducted preferably one in the middle and theother at the end of the course by the Department concerned.
  2. The duration of assessment is one hour each.
  3. Thetotalmarksobtainedinthetestsshallbereducedto100marksand rounded to the nearest integer.
  4. The Headofthe Department may identify a facultymemberascoordinatorforthecourse.AcommitteeconsistingoftheHeadoftheDepartment, staffhandlingthecourse(ifavailable),coordinatorandaseniorFacultymembernominatedbytheHeadoftheDepartmentshallmonitortheevaluationprocess.Thegradesshallbeassignedtothestudentsbythe above committee based on their relative performance.
  5. Thecoordinatorforthecourseisresponsibleformaintainingand processing the records with regard to assessment marks andresults.

# Passing Requirement and Grading

1. Thepassingrequirementforvalueaddedcoursesshallbe50%ofthemarks prescribed for the course **(Internal assessment only)**
   1. ThegradesO, A+, A, B+, Bobtainedfortheone/twocreditshallfigureintheMarksheetunderthetitle **‘Value AddedCourses’**. TheothergradesRA, SA**will not figure in the mark sheet.**
   2. Thecreditsearnedthroughvalueaddedcoursesshallnotbeconsidered for calculating GPA and CGPA.
   3. Thecreditsearnedthroughvalueaddedcoursesshallnotbeconsideredforclassification of degree.
   4. Ifthecourseisofferedduringanysemester, itwillappearinthatsemester'smarksheet.However,ifthecourseisofferedinsummer/ wintervacations,thecoursewillbeincludedinthegradesheetofthe subsequent semester.

# Maximum Number of Courses

1. Astudentcanearnamaximumof 3credits during theentireprogrammeof studybyattendingvalueaddedcourseswhichwouldbeoverandabovetherequiredmaximum number of credits for the award of the degrees.

# Financial Commitment

1. Theexpendituretobeincurredfortheconductofvalue-addedcoursesshouldbemetfromnominalfeescollectedfromthestudentsataratefixedbythe University.However,anyadditionalexpendituremaybesupportedbythefunds of the Department.

**APPLICATION FOR CONDUCTING VALUE ADDED COURSES**

* 1. Name of the Department:
  2. PG programme:

# Details of the Value-Added Courses:

* 1. Name of the Value-Added Courses
  2. Type of Value-Added Courses (Theory/ Lab/ Lab integrated

Theory/others)

* 1. Short Description Enclosure1 enclosed -YES / NO
  2. Syllabus including Reference Enclosure 2 enclosed - YES / NO

# Target audience:

Semester (indicate if more than one) Others

# Details of Faculty handling the course:

* 1. Name of the Faculty handling the Value-Added course
  2. Details including designation and expertise Enclosure3enclosed-YES / NO
  3. Contact details

Email ID :

Phone No :

1. **Tentative Time Table** including dates

of internal assessments : Enclosure 4 enclosed - YES / NO

1. Number of students opting for the course:
2. Department Consultative Committee -

Minutes : Enclosure 5 enclosed - YES / NO

1. Name and Designation of the Coordinator:

Head of the Department (with date & seal)

**Note:**

* **Fees if any**

# **DETAILS OF COMPLETION OF VALUE-ADDED COURSE**

Name of the Department :

Name of the Value-Added course offered :

Name of the Faculty offeredthe course

: Academic / Industry

Name of the coordinator :

E- mail :

Contact :

Details of students attended the course:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S.No** | **Name of the student** | **Reg.No.** | **Programme** | **Semester** | **Marks** | **Grade** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

# (Faculty handling the (Senior Facultynominated byHOD)

**course (if available)**

**(Coordinator) (Head of the Department)**

**(with date &seal)**

**Vision**

To make the students biologically, socially, environmentally and ethically aware of current scientific issues by imparting zoological knowledge through the curriculum and equip them to care the welfare of the society.

**Mission**

To create the zoology students as bio-socially responsible citizens through laboratory works, field trips, study tour, visit to biodiversity spots, zoos and museums and research projects works.

To make them talented multi- visionary, and future oriented through various community activities, competitions, and celebrations of National& International days.

**Objectives**

To inculcate the values of life science, research-orientededucation has been focussed through seminars, presentations and publications and make them responsible future scientists.