# Ramakrishna Mission
## Vivekananda Centenary College, Rahara

Department Of Zoology

# Programme Outcomes, Programme Specific Outcomes, Course Objectives and Course Outcomes of B.Sc. Honours Zoology Syllabus

2017-2018

Principal
Ramakrishna Mission
Vivekananda Centenary College
Rahara, Kolkata-700 118

**Program Outcome:**

After completion of the B.Sc. Degree program, the students will be able to

| PO No. | Program Outcome | Cognitive Level |
|---|---|---|
| PO 1 | Recognize the scientific tempers and attitudes, which in turn can prove to be beneficial for the society since the scientific developments can make a nation or society to grow at a rapid pace. | R |
| PO 2 | Understand scientific knowledge and exchange ideas with other stakeholders; make people aware about sustainable utilization of resources with ethical approach. | U |
| PO 3 | Understand and apply the issues of environmental contexts and sustainable development as a basic interdisciplinary concern. | U, Ap |
| PO 4 | Create the ability to perform experiments and to analyse & interpret the obtained accurate results and thus gain the ability to solve problems, to involve in critical, independent, and creative thinking. | An, E, C |
| PO 5 | Possess expertise to apply and formulate ideas which will provide them competitive advantage in pursuing higher studies from India or abroad; and seek jobs in academia, research or industries. | Ap, E |
| PO 6 | Assemble the acquired in-depth knowledge of applied subjects towards the inculcation of professional and employment skills so that students can make a career and become an entrepreneur in diverse fields. | C |

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**Programme Specific Outcome:**

After completion of the B.Sc. Zoology programme the students would be able to

| PSO No. | Program Specific Outcome | Cognitive Level |
|---|---|---|
| PSO 1 | Identify, classify and differentiate diverse nonchordates and chordates based on their morphological, anatomical and systemic organization, and understand their ecological and evolutionary significance, physiological adaptations, development, different behavioral aspects including reproduction. | R, U |
| PSO 2 | Understand the relationship or synchronization among structure and function at molecular, cellular, morphological, anatomical, biochemical, physiological and genetical aspect of animals and apply the acquired skills in the fields of ecology, genetics, molecular biology, biotechnology, biostatistics, bioinformatics, qualitative and quantitative microscopy, enzymology and analytical biochemistry. | U |
| PSO 3 | Understand and evaluate the physical features of environment to the structure of populations, communities, and ecosystems, environmental degradation and formulations for its protection, conservation of the species with reference to local importance. | U, E |
| PSO 4 | Describe and analyse economic, ecological and medical significance of various animals in human life and thus apply in the entrepreneurship of their own on sericulture, apiculture, fisheries, poultry farming, environment monitoring and parasitic disease management. | R, Ap,An |
| PSO 5 | Apply and implement the varied range of subject based skills to numerous fields that provide a foundation for future career in higher studies, government departments, environmental agencies, teaching, biotechnology, diagnostic, research laboratory, pharmaceutical, environmental and ecological fields. | Ap, C |

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**Abbreviations used:**

CC = CORE COURSES
DSE = DISCIPLINE SPECIFIC ELECTIVES
GE = GENERIC ELECTIVES
SEC = SKILL ENHANCEMENT COURSES
AECC = ABILITY ENHANCEMENT COMPULSORY COURSES

| List of Core Courses (14 Papers for the Students of Zoology_Honours) | | Semester |
|---|---|---|
| UGZOOCC 01 | NON-CHORDATES I : PROTISTS TO PSEUDOCOELOMATES | I |
| UGZOOCC 02 | PRINCIPLES OF ECOLOGY | |
| UGZOOCC 03 | NON-CHORDATES II : COELOMATES | II |
| UGZOOCC 04 | CELL BIOLOGY | |
| UGZOOCC 05 | DIVERSITY OF CHORDATES | III |
| UGZOOCC 06 | ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS | |
| UGZOOCC 07 | FUNDAMENTALS OF BIOCHEMISTRY | |
| UGZOOCC 08 | COMPARATIVE ANATOMY OF VERTEBRATES | IV |
| UGZOOCC 09 | ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS | |
| UGZOOCC10 | BIOCHEMISTRY OF METABOLIC PROCESSES | |
| UGZOOCC11 | MOLECULAR BIOLOGY | V |
| UGZOOCC12 | PRINCIPLES OF GENETICS | |
| UGZOOCC13 | DEVELOPMENTAL BIOLOGY | VI |
| UGZOOCC14 | EVOLUTIONARY BIOLOGY | |

| Choices for DSE (4 Papers to be selected by the Students of Zoology_Honours) | | Semester |
|---|---|---|
| UGZOODSE01 | IMMUNOLOGY | V |
| UGZOODSE02 | ANIMAL BEHAVIOUR AND CHRONOBIOLOGY | V |
| UGZOODSE03 | POLLINATION BIOLOGY | V |
| UGZOODSE04 | PROJECT WORK | V |
| UGZOODSE05 | BIODIVERSITY AND WILD LIFE CONSERVATION | VI |
| UGZOODSE06 | COMPUTATIONAL BIOLOGY | VI |
| GE | | |
| UGZOOGE 01 | ANIMAL DIVERSITY AND SYSTEMS | |
| UGZOOGE 02 | ECOLOGY, ECONOMIC AND MEDICAL ZOOLOGY | |

| | | |
|---|---|---|
| **UGZOOGE 03** | **BIOTECHNOLOGY: MICROBES TO ANIMALS** | |
| **UGZOOGE 04** | **INSECT, VECTORS AND DISEASES** | |
| **SEC** | | **Semester** |
| **UGZOOSEC01** | VALUE EDUCATION & INDIAN CULTURE | **III** |
| **UGZOOSEC02** | SPOKEN TUTORIAL FROM IIT BOMBAY | **IV** |

| **SEMESTER – I** | |
|---|---|
| **Course name** | **NON-CHORDATES I : PROTISTS TO PSEUDOCOELOMATES** |
| **Course code** | **UGZOOCC01** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands and apply the basic taxonomy, systematics and classification of Protozoa, Porifera, Cnidaria and Helminth groups, including Nematode- Plant interaction. |
| 2 | Understand and evaluate the life cycle of Protozoans, Platyhelminthes, Nematodes. |
| 3 | Understand and evaluate the host-parasite relationship and evolution of parasitism |
| 4 | Understand, apply and analyse the identification of invertebrate specimens and their life stages. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | PO Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Describe the protozoan reproduction, polymorphism in cnidarians, nervous system in molluscs | PO1 | PSO 1 | R |
| CO 2: | Apply and evaluate the biological and medicinal importance of various larvae and sponges respectively | PO 3 | PSO 1,5 | Ap, E |
| CO 3: | Understand the invertebrate defence and feeding mechanisms | PO 2 | PSO 1 | U |
| CO 4: | Analyse and discuss the adaptive radiation, evolution, affinities of a variety of invertebrates | PO 4 | PSO 1 | An, C |
| CO 5: | Acquire skills in teaching the structural and functional features of invertebrate animal life's diversity | PO 6 | PSO 5 | Ap |

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| SEMESTER – I | |
|---|---|
| **Course name** | **PRINCIPLES OF ECOLOGY** |
| **Course code** | **UGZOOCC02** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers and understands the various features and aspects of population ecology, community ecology and ecosystem ecology. |
| 2 | Understand and evaluate the components of ecosystem, nutrient and biogeochemical cycles and impact of man on the ecological balance. |
| 3 | Understand and evaluate the importance of biodiversity and its conservation |
| 4 | Understand and analyse the causes, effects and control environmental pollution and degradation |
| 5 | Apply the acquired knowledge to solve the environmental and ecological problems |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the components and characistics of population, community and the ecosystem | PO 1, 2 | PSO 1, 3 | R, U |
| CO 2: | Analyze, apply and evaluate the various concepts of population and community and relate the impact of man on the ecological balance | PO 4 | PSO 3 | An, Ap, E |
| CO 3: | Interpret and analyse the importance of biodiversity and its conservation management | PO 4 | PSO 3 | U, An |
| CO 4: | Demonstrate and evaluate the interactions among various environmental parameters | PO 2 | PSO 3 | U, E |
| CO 5: | Demonstrate and recommend environmental ethics related issues and management strategies. | PO 6 | PSO 3 | U, E |

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| SEMESTER – II | |
|---|---|
| **Course name** | **NON-CHORDATES II: COELOMATES** |
| **Course code** | **UGZOOCC03** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers and understands the classification of coelomate invertebrates and the structure, functional biology of these taxonomic categories. |
| 2 | Understand and evaluate different vector born diseases and the related life cycles, epidemiology, pathology, diagnosis, symptoms and treatments. |
| 3 | Understand and analyse the adaptive radiation, evolution and affinities of a variety of |

| | |
|---|---|
| | coelomates. |
| 4 | Understand and apply the basics of sericulture, apiculture, lac culture and pearl culture. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Demonstrate and distinguish different coelomate invertebrates and the structural and functional biology of these taxonomic categories | PO 2 | PSO 1 | U, An |
| CO 2: | Illustrate different vector born diseases and the related life cycles, epidemiology, pathology, diagnosis, symptoms and treatments and take part in controlling these diseases . | PO 1, 2 | PSO 4 | U, Ap |
| CO 3: | Define, interprete and analyse the adaptive radiation, evolution and affinities of a variety of coelomates | PO 3, | PSO 1 | R, U, An |
| CO 4: | Demonstrate and apply various techniques of sericulture, apiculture, lac culture and pearl culture. Thus create the enterprenureship. | PO 5, 6 | PSO 4, 5 | U, Ap, C |
| CO 5: | Compare and apply the compound vision in arthropods | PO 3, 6 | PSO 1, 5 | An, Ap |

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| SEMESTER – II | |
|---|---|
| **Course name** | **CELL BIOLOGY** |
| **Course code** | **UGZOOCC04** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Outline the structures and explain the functions of plasma membrane and all cellular organelles in details. |
| 2 | Acquire knowledge about chromosomes and cell divisions, both mitosis and meiosis. |
| 3 | Understand the mechanism of cell signalling and cancers. |
| 4 | Know how to measure and stain different cell types. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the structures and functions of plasma membrane and all cellular organelles in details. | PO 1, 2 | PSO 2 | R, U |
| CO 2: | Illustrate the structure and functions of endomembrane system and cytoskeleton | PO 2 | PSO 2 | U |
| CO 3: | Demonstrate and identify the detail structure of nucleus and compare the functional mechanism of different parts of the nucleus. | PO 2 | PSO 2 | U, Ap |
| CO 4: | Elaborate the mechanism of cell signalling and cancers. | PO 2 | PSO 2 | C |

| | | | | |
|---|---|---|---|---|
| CO 5: | Compare and apply the techniques to measure and stain different cell types. | PO 2, 6 | PSO 2, 5 | An, E |

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| SEMESTER – III | |
|---|---|
| **Course name** | **DIVERSITY OF CHORDATA** |
| **Course code** | **UGZOOCC05** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl No. | Course Objectives: |
|---|---|
| 1: | Understand the classification, structure, function and biology of chordates of different taxonomic classes. |
| 2: | Outline the origin of chordates |
| 3: | Explain some special topics like zoogeography, metamorphosis, snake bites, migration of birds, parental care of amphibian, echolocation of mammals, |
| 4: | Apply the knowledge of poultry managements and different breeds of domestic animals. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and classify different class of chordates. | PO 1, 2 | PSO 1 | R, U |
| CO 2: | Demonstrate and compare the structure, function and biology of chordates of different taxonomic classes. | PO 2 | PSO 1, 2 | U, C |
| CO 3: | Outline and evaluate the origin of chordates | PO 1 | PSO 1 | U, E |
| CO 4: | Illustrate and analyse some special topics like zoogeography, metamorphosis, snake bites, migration of birds, parental care of amphibian, echolocation of mammals. | PO 2 | PSO 1, 3 | U, An |
| CO 5: | Apply the knowledge of poultry managements and different breeds of domestic animals to build animal husbandary. | PO 5 | PSO 1, 4 | Ap, C |

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| SEMESTER – III | |
|---|---|
| **Course name** | **ANIMAL PHYSIOLOGY : CONTROLLING AND COORDINATING SYSTEMS** |
| **Course code** | **UGZOOCC06** |

**Course Objectives:**

After completion of this course the students will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remember and understand the basics of histology and functions of various tissues. |
| 2 | Understand the structure and physiology of muscles, nerves. |

| | |
|---|---|
| 3 | Explain the reproductive systems and distinguish the physiology of male and female reproduction. |
| 4 | Understand and evaluate the histology of endocrine glands and classify hormones, demonstrate their biosynthesis, receptors, mode of molecular actions, physiological function, feedback controls and related disorders. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the basics of histology and functions of various tissues. | PO 1, 2 | PSO 2 | R, U |
| CO 2: | Illustrate the structure and physiology of muscles, nerves. | PO 2 | PSO 2 | U |
| CO 3: | Explain the reproductive systems and distinguish the physiology of male and female reproduction. | PO 2, 4 | PSO 2 | U, An |
| CO 4: | Demonstrate and evaluate the histology of endocrine glands. | PO 2, 5 | PSO 2, 5 | U, E |
| CO 5: | Classify hormones and Explain their biosynthesis, receptors, mode of molecular actions, physiological function, feedback controls and related disorders. | PO 4, 5 | PSO 2,4, 5 | An, Ap |
| CO 6: | Examine histology different tissues through preparation of temporary and peranent slides | PO 6 | PSO 2, 4 | An |

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| SEMESTER – III | |
|---|---|
| **Course name** | **FUNDAMENTALS OF BIOCHEMISTRY** |
| **Course code** | **UGZOOCC07** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands the basic and fundamental biochemistry of carbohydrates, proteins, lipids and nucleic acids. |
| 2 | Understand the nature, mechanism, and kinetics of enzyme action. |
| 3 | Learn some instrumentation such as microscopy, chromatography, electrophoresis, centrifugation, spectrophotometry etc. |
| 4 | Analyse pH, carbohydrates, proteins, lipids and chromatographic separation of amino acids |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the basic and fundamental | PO 1, 2 | PSO 2 | R, U |

| | | | | |
|---|---|---|---|---|
| | biochemistry of carbohydrates, proteins, lipids and nucleic acids. | | | |
| CO 2: | Understand and apply the nature, mechanism, and kinetics of enzyme action. | PO 2, 4 | PSO 2 | U, Ap |
| CO 3: | Demonstrate, apply and evaluate some instrumentation such as microscopy, chromatography, electrophoresis, centrifugation, spectrophotometry etc. | PO 2, 4, 5 | PSO 2 | U, Ap, E |
| CO 4: | Analyse and estimate pH, carbohydrates, proteins, lipids and chromatographic separation of amino acids | PO 4, 6 | PSO 2, 5 | An, C |

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| SEMESTER – IV | |
|---|---|
| **Course name** | **COMPARATIVE ANATOMY OF VERTEBRATES** |
| **Course code** | **UGZOOCC08** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Define and understand the structures of different systems such as, integumentary, skeletal, digestive, respiratory, circulatory, urinogenital, nervous and sensory organs in comparative way among the vertebrate groups. |
| 2 | Distinguish the disarticulated skeleton of many vertebrates. |
| 3 | Understand and evaluate the skeletal modifications in vertebrates. |
| 4 | Understand the evolution of urinogenital ducts, heart and aortic arches. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate and compare the structures of different systems such as, integumentary, skeletal, digestive, respiratory, circulatory, urinogenital, nervous and sensory organs in the vertebrate groups. | PO 1, 2, 6 | PSO 1, 2, | R, U, E |
| CO 2: | Compare the disarticulated skeleton of many vertebrates. | PO 4 | PSO 1, 2 | An |
| CO 3: | Demonstrate and identify the skeletal modifications in vertebrates. | PO 2 | PSO 1, 2 | U, Ap |
| CO 4: | Discuss the evolution of urinogenital ducts, heart and aortic arches. | PO 2, 5 | PSO 1, 5 | C |

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| SEMESTER – IV | |
|---|---|
| **Course name** | **ANIMAL PHYSIOLOGY : LIFE SUSTAINING SYSTEMS** |
| **Course code** | **UGZOOCC09** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Learn the physiology of digestion, absorptions and hormonal control of enzyme secretion |
| 2 | Understand the histology and mechanism of respiratory system, circulation and excretion |
| 3 | Understand and analyse the adaptational Physiology. |
| 4 | Examine the histology of different tissue, ABO Blood group, red blood cells, white blood, haemoglobin and blood pressure |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and illustrate the physiology of digestion, absorptions and hormonal control of enzyme secretion | PO 1, 2 | PSO 2 | R, U |
| CO 2: | Demonstrate the respiratory system and is mechanism | PO 2 | PSO 2 | E |
| CO 3: | Explain the mechanisms of circulation and excretion | PO 4 | PSO 5 | E |
| CO 4: | Understand and analyse the adaptational Physiology. | PO 3, 5 | PSO 2, 5 | U, E |
| CO 5: | Compare and analyse the histology of different tissue, determine ABO Blood group, and examine red blood cells, white blood, haemoglobin and blood pressure | PO 4, 5 | PSO 2, 5 | An, E, C |

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| SEMESTER – IV | |
|---|---|
| **Course name** | **BIOCHEMISTRY OF METABOLIC PROCESSES** |
| **Course code** | **UGZOOCC10** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remember and understand the basics mechanisms and pathway of Metabolism. |
| 2 | Remembers, understands the metabolism of carbohydrates, lipids and proteins in details. |
| 3 | Understand and evaluate about oxidative phosphorylation and redox reactions. |
| 4 | Estimate total protein and detect SGOT and SGPT or GST and GSH in serum/ tissue. |
| 5 | Understand and evaluate enzymatic activity. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and explain the basic mechanisms and pathway of metabolism. | PO 1, 2 | PSO 2 | R, U |
| CO 2: | Demonstrate and compare the metabolism of carbohydrates, lipids and proteins in details. | PO 2, 5 | PSO 2 | U, E |
| CO 3: | Illustrate and experiment the oxidative phosphorylation and redox reactions. | PO 2, 6 | PSO 2, 5 | E, Ap |
| CO 4: | Estimate total protein and evaluate SGOT and SGPT or GST and GSH in serum/ tissue. | PO 2, 5 | PSO 2, 5 | E, C |
| CO 5: | Explain the enzymatic activity. | PO 5 | PSO 2 | U |

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| SEMESTER – V | |
|---|---|
| **Course name** | **MOLECULAR BIOLOGY** |
| **Course code** | **UGZOOCC11** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Acquire knowledge about the replication, transcription, translation. |
| 2 | Understand the post transcriptional and post translational modifications, gene regulation, DNA repair mechanisms and |
| 3 | Elaborate various molecular tools and techniques like PCR, southern, northern and western blotting, recombinant DNA technology etc. |
| 4 | Learn various tools and techniques related to bacterial microbiology, some aspects of applied microbiology and diseases related to microbiology. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and illustrate the replication, transcription, translation. | PO 1, 2 | PSO 2 | R,U |
| CO 2: | Demonstrate the post transcriptional and post translational modifications, gene regulation, DNA repair mechanisms and | PO 2 | PSO 2 | U |
| CO 3: | Demonstrate and apply various molecular tools and techniques like PCR, southern, northern and western blotting, recombinant DNA technology etc. | PO 2, 4 | PSO 2, 5 | U, Ap |
| CO 4: | Elaborate various tools and techniques related to bacterial microbiology and apply some aspects of applied microbiology and diseases related to microbiology. | PO 4, 5 | PSO 2, 5 | Ap, C |

| | | | | |
|---|---|---|---|---|
| CO 5: | Prepare bacterial culture and examine bacterial growth. | PO 4, 6 | PSO 2, 5 | An, C |
| CO 6: | Estimate of DNA and RNA | PO 4 | PSO 2, 5 | E |

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| SEMESTER – V | |
|---|---|
| **Course name** | **PRINCIPLES OF GENETICS** |
| **Course code** | **UGZOOCC12** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Learn the fundamental genetics like Mendelian and Non Mendelian inheritances, linkages, mutations. |
| 2 | Understand the sex determination of various animals, extrachromosomal inheritances, transposable genetic elements etc. |
| 3 | Understand various aspects of human genetics by covering chromosomal aberrations, gene mutation, etc.. |
| 4 | Understand the various aspects of biostatistics such as central tendency, t-test, chi-square, ANOVA, correlations and regression. |
| 5 | Inspect the Mendelian laws and gene interactions, draw linkage maps and examine chromosomes. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and explain fundamental genetics like Mendelian and Non Mendelian inheritances, linkages, mutations. | PO 1, 2 | PSO 2, 5 | R, U |
| CO 2: | Demonstrate sex determination of various animals, extrachromosomal inheritances, transposable genetic elements etc. | PO 2 | PSO 2 | Ap |
| CO 3: | Illustrate and compare various aspects of human genetics by covering chromosomal aberrations, gene mutation, etc.. | PO 2,4 | PSO 2, 5 | U, An |
| CO 4: | Apply and evaluate various aspects of biostatistics such as central tendency, t-test, chi-square, ANOVA, correlations and regression. | PO 5,6 | PSO 4, 5 | Ap, E |
| CO 5: | Test the Mendelian laws and gene interactions, draw linkage maps and examine chromosomes. | PO 4, 6 | PSO 5 | C |

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| SEMESTER – VI | |
|---|---|
| **Course name** | **DEVELOPMENTAL BIOLOGY** |
| **Course code** | **UGZOOCC13** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Understand the historical perspective and basic concepts of developmental biology |
| 2 | Learn the different aspects of early, late and post embryonic developments. |
| 3 | Acquire knowledge about implications of developmental biology in various fields, such as in teratogenesis, stem cell biology, in vitro fertilization, cryopreservation, cord blood transfusion etc. |
| 4 | Inspect the developmental stages, different sections of placenta. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the historical perspective and basic concepts of developmental biology | PO 1, 2 | PSO 2 | R, U |
| CO 2: | Explain and compare the different aspects of early, late and post embryonic developments. | PO 2, 5 | PSO 2 | An, E |
| CO 3: | Apply and adapt the knowledge of developmental biology in various fields, such as in teratogenesis, stem cell biology, in vitro fertilization, cryopreservation, cord blood transfusion etc. | PO 4, 5 | PSO 2, 5 | Ap, C |
| CO 4: | Inspect the developmental stages, different sections of placenta, . | PO 5 | PSO 2 | An |
| CO 5: | Compose study report on Drosophila culture and chick embryonic development | PO 4, 6 | PSO 5 | C |

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| SEMESTER – VI | |
|---|---|
| **Course name** | **EVOLUTIONARY BIOLOGY** |
| **Course code** | **UGZOOCC14** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Learn various evolutionary concepts and historical perspective about evolution. |
| 2 | Understand the importance and implication of the evidences of evolution. |
| 3 | Understand the population genetics and evaluate the evolutionary forces and its impact. |
| 4 | Understand the origin and evolution of man and draw phylogenetic trees |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Learn various evolutionary concepts and historical perspective about evolution. | PO 1 | PSO 2, | R |
| CO 2: | Demonstrate the importance and implication of the evidences of evolution. | PO 2, 3 | PSO 2, 3 | Ap |
| CO 3: | Explain the population genetics and evaluate the evolutionary forces and its impact. | PO 2, 5 | PSO 2, 3 | U |
| CO 4: | Illustrate the origin and evolution of man and draw phylogenetic trees | PO 2, 6 | PSO 2, 4 | An, C |
| CO 5: | Recall various evolutionary concepts and historical perspective about evolution. | PO 1, 2 | PSO 2, 3, 6 | E, Ap |
| CO 6: | Summerise the importance and implication of the evidences of evolution. | PO 2, 6 | PSO 6 | Ap |

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## DISCIPLINE SPECIFIC ELECTIVES (DSE)

| SEMESTER – V | |
|---|---|
| **Course name** | **IMMUNOLOGY** |
| **Course code** | **UGZOODSE01** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands the structures and function of immune cells, immunoglobulins, antigens and their interactions with antibodies. |
| 2 | Understand the MHC molecules, cytokines, hyper sensitivity reactions and cellular mode of immunity development. |
| 3 | Understand the immune diffusion technique and ELISA |
| 4 | Understand the histology of spleen, thymus and lymph nodes and analyse the bloodcells, blood groups and immune reactions |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the structures and function of immune cells, immunoglobulins, antigens and their interactions with antibodies. | PO 2 | PSO 2 | R,U |
| CO 2: | Demonstrate and explain the MHC molecules, cytokines, hyper sensitivity reactions and cellular mode of immunity development. | PO 2 | PSO 2 | U, E |
| CO 3: | Compare and elaborate the cellular immune response | PO 2, 5, 6 | PSO 2, 5 | An, C |

| | | | | |
|---|---|---|---|---|
| CO 4: | Understand and identify the histology of spleen, thymus and lymph nodes and analyse the bloodcells, blood groups and immune reactions | PO 2, 4 | PSO 2, 5 | U, Ap, An |
| CO 5: | Demonstrate and apply immune diffusion technique and ELISA | PO 2, 3 | PSO 2, 5 | U, Ap |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – V | |
|---|---|
| **Course name** | **Animal Behavior and Chronobiology** |
| **Course code** | **UGZOODSE02** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands the details about patterns of behaviours, survival strategies, social and cooperative behaviours. |
| 2 | Understand the design of signals and its application in ecology and evolution |
| 3 | Understand and evaluate the chronobiology |
| 4 | Understand nesting habits of animals, analyse the ethogram and prepare a short report on behavioural activities of animals |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the details about patterns of behaviours, survival strategies, social and identify the cooperative behaviours. | PO 1, 2, 3 | PSO 1, 3 | R, U, Ap |
| CO 2: | Explain the design of signals and analyse its application in ecology and evolution | PO 2, 3, 5 | PSO 1, 3 | U, An |
| CO 3: | Illustrate and evaluate the chronobiology | PO 3, 5 | PSO 1, 3 | U, E |
| CO 4: | Compare nesting habits of animals, analyse the ethogram and prepare a short report on behavioural activities of animals | PO 5, 6 | PSO 1, 5 | An, C |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – V | |
|---|---|
| **Course name** | **POLLINATION BIOLOGY** |
| **Course code** | **UGZOODSE03** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands and apply the knowledge about flowering of plants in natural environment and its relation with pollination, and above all ecological impact. |

| | |
|---|---|
| 2 | Understand and evaluate know about the basic principle and modes of pollination, types and identification of flower visitors, pollinator diseases, colour vision capabilities of insect pollinators. |
| 3 | Understand and evaluate the Importance of Pollination and threats to Pollinators and conservation of pollinators |
| 4 | Understand and analyse Gymnosperms & Angiosperms pollination systems |
| 5 | Dissect, identify and draw the flowering plants and mouthparts of the pollinating insects |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate and apply the knowledge about flowering of plants in natural environment and its relation with pollination, and above all ecological impact. | PO 1, 2, 3 | PSO 1, 3 | R, U, Ap |
| CO 2: | Illustrate and evaluate the basic principle and modes of pollination, types and identification of flower visitors, pollinator diseases, colour vision capabilities of insect pollinators. | PO 3 | PSO 1,3, 5 | U, E |
| CO 3: | Explain and analyse the importance of pollination and threats to pollinators and conservation of pollinators | PO 5, 6 | PSO 1, 3, 4 | U, An |
| CO 4: | Demonstrate and analyse Gymnosperms & Angiosperms pollination systems | PO 3 | PSO 5 | U, An |
| CO 5: | Evaluate and prepare report on the relationship between the flowering plants and mouthparts of the pollinating insects | PO 3, 6 | PSO 1, 5 | E, C |

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| SEMESTER – V | |
|---|---|
| **Course name** | **PROJECT WORK (BIOINFORMATICS AND MOLECULAR BIOLOGY)** |
| **Course code** | **UGZOODSE04** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remember and understand the basic concepts in bioinformatics and molecular biology. |
| 2 | Apply various bioinformatics tools to analyse various biological data. |
| 3 | Identify research questions and design insilico experiments. |
| 4 | Solve research problems. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the basic concepts in bioinformatics and molecular biology. | PO 1, 2 | PSO 2 | R, U |

| | | | | |
|---|---|---|---|---|
| CO 2: | Apply various bioinformatics tools, analyse and interprete various biological data. | PO 2, 4 | PSO 2 | Ap, An |
| CO 3: | Identify research questions and design insilico experiments | PO 4, 5 | PSO 2,4 | Ap, C |
| CO 4: | Perform and solve the research problems. | PO 5, 6 | PSO 2, 5 | Ap, C |
| CO 5: | Discuss the results and prepare scientific reports. | PO 6 | PSO 2, 5 | E, Ap |

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| SEMESTER – VI | |
|---|---|
| **Course name** | **BIODIVERSITY AND WILD LIFE CONSERVATION** |
| **Course code** | **UGZOODSE05** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands the various issues related to biodiversity loss and conservation as well as status, conditions and conservation of forests and wildlife. |
| 2 | Understand and apply the various tools used in field biology |
| 3 | Compare and evaluate the pitfall/ trail / transect monitoring for abundance and diversity estimation. |
| 4 | Prepare on complete report on excursion or field visit. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and understand the various issues related to biodiversity loss and conservation as well as status, conditions and conservation of forests and wildlife. | PO | PSO 3 | R, U |
| CO 2: | Understand and apply the various tools used in field biology | PO | PSO 3, 5 | U, Ap |
| CO 3: | Compare and evaluate the pitfall/ trail / transect monitoring for abundance and diversity estimation | PO | PSO 3, 5 | An, E |
| CO 4: | Prepare complete report on excursion or field visit. | PO | PSO 3, 5 | C |

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| SEMESTER – VI | |
|---|---|
| **Course name** | **COMPUTATIONAL BIOLOGY** |
| **Course code** | **UGZOODSE06** |

**Course Objectives:**

After completion of this course the students will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remember, understand the importance, Goal and Scope of bioinformatics |
| 2 | Understand, evaluate and use the biological databases to retrieve biological data |

| | |
|---|---|
| 3 | Understand the basic concept of sequence alignment |
| 4 | Understand and apply the Bioinformatics and biostatistics |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and explain the importance, goal and scope of bioinformatics | PO | PSO 2 | R, U |
| CO 2: | Illustrate, inspect and apply the biological databases to retrieve biological data | PO | PSO 2 | U,Ap, An |
| CO 3: | Demonstrate and apply the basic concept of sequence alignment. | PO | PSO 2 | U, Ap |
| CO 4: | Demonstrate and apply the tools in bioinformatics and biostatistics | PO | PSO 2 | U, Ap |
| CO 5: | Construct the graphical representations of statistical data. | PO | PSO 2 | C |

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## GENERIC ELECTIVES

| SEMESTER – I/II | |
|---|---|
| **Course name** | **ANIMAL DIVERSITY AND SYSTEMS** |
| **Course code** | **UGZOOGE01** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers the general characters and special features in different animal groups. |
| 2 | Understands and apply the taxonomy and classifications of animals. |
| 3 | Remember and understand the basic endocrinology and histology of animals. |
| 4 | Remember and understand the basics of developmental biology in animals. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the general characters and special structures in different animal groups. | PO 1 | PSO 2 | R, U |
| CO 2: | Demonstrate and apply the taxonomy and classifications of animals. | PO 2 | PSO 2, 3 | U, Ap |
| CO 3: | Define, demonstrate and illustrate the basic endocrinology and histology of animals. | PO 5 | PSO 2 | R, U, E |
| CO 4: | Define, demonstrate and illustrate the basics of developmental biology in animals. | PO 2, 3 | PSO 2 | R, U, E |

| SEMESTER – I/II | |
|---|---|
| **Course name** | **ECOLOGY, ECONOMIC AND MEDICAL ZOOLOGY** |
| **Course code** | **UGZOOGE02** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands and apply the definition, principle and scope of fisheries and aquaculture, lac culture and pest management |
| 2 | Understand and evaluate the concept of ecology, biodiversity and wildlife conservation. |
| 3 | Remember, understand the concept of parasitism and evaluate the life history, pathogenicity and clinical features of selected parasites. |
| 4 | Remember, Understand the basic principles of biotechnology and immunology. |

1.

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate and apply the definition, principle and scope of fisheries and aquaculture, lac culture and pest management | PO 1, 6 | PSO 2, 5 | R, U, Ap |
| CO 2: | Illustrate, analyse and evaluate the concept of ecology, biodiversity and wildlife conservation. | PO 1, 3 | PSO 2, 3 | U, E |
| CO 3: | Define, demonstrate and apply the concept of parasitism and evaluate the life history, pathogenicity and clinical features of selected parasites. | PO 6 | PSO 4, 5 | R, U, Ap |
| CO 4: | Define and understand the basic principles of biotechnology and immunology. | PO 1, 5 | PSO 2 | R, U |

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| SEMESTER – II | |
|---|---|
| **Course name** | **BIOTECHNOLOGY: MICROBES TO ANIMALS** |
| **Course code** | **UGZOOGE03** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands the concept of biotechnology. |
| 2 | Understand and evaluate the techniques in gene manipulation. |
| 3 | Understand and evaluate the application of microbes in biotechnology. |
| 4 | Remember, understand and analyse the method of transgenic animal production. |
| 5 | Remember and extend the basic concept in biotechnology and human welfare. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate and apply the concept of biotechnology. | PO 1 | PSO 2 | R, U, Ap |
| CO 2: | Demonstrate and analysing the techniques in gene manipulation | PO 2 | PSO 2 | U, An |
| CO 3: | Demonstrate and evaluate the application of microbes in biotechnology | PO 2 | PSO 2 | U, E |
| CO 4: | Define, demonstrate and evaluate the method of transgenic animal production. | PO 2, 3 | PSO 2 | R, U, E |
| CO 5: | Extend the basic concept in biotechnology and human welfare and perform experiments. | PO 3, 5 | PSO 2, 3 | U, C |

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| SEMESTER – II | |
|---|---|
| **Course name** | **INSECT, VECTORS AND DISEASES** |
| **Course code** | **UGZOOGE04** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands the characteristic and morphological features of Insects. |
| 2 | Understand and evaluate the insects as vectors. |
| 3 | Understand and analyse different vectors of different orders. |
| 4 | Understand, identify and analyse different vectors and their associated diseases. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate the characteristic and morphological features of Insects. | PO 1 | PSO 1 | R, U |
| CO 2: | Illustrate and evaluate the insects as vectors. | PO 2, 3 | PSO 3, 4 | U, E |
| CO 3: | Demonstrate and analyse different vectors of different orders. | PO 4 | PSO 4, | U, An |
| CO 4: | Demonstrate, identify and prepare report on different vectors and their associated diseases. | PO 6 | PSO 1, 5 | U, Ap, C |

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## SKILL ENHANCEMENT COURSE (SEC)

| SEMESTER – III | |
|---|---|
| **Course name** | **Value Education and Indian Culture** |
| **Course code** | **UGZOOSEC01** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Attain awareness about daily routine, self-evaluation & Integral Personality Development |
| 2 | Understand the educational needs, the Power of thoughts and the Science of Peace |
| 3 | Understand the relation: Values and enlightened citizenship |
| 4 | Attain awareness about the Indian Practice and Culture |
| 5 | Demonstrate the importance of Four Yogas |
| 6 | Acquire idea about Modern India: her hopes, challenges and Swami Vivekananda |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | PO Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, understand and apply the daily routine, self-evaluation & Integral Personality Development | PO1 | PSO - 5 | R, U, Ap |
| CO 2: | Learn, and apply the Power of thoughts & the Science of Peace | PO 3 | PSO - 5 | U, Ap |
| CO 3: | Understand the relation: Values and enlightened citizenship | PO 2 | PSO - 5 | U |
| CO 4: | Discuss the awareness about the Indian Practice and Culture | PO 4 | PSO - 5 | C |
| CO 5: | Demonstrate and practice the Four Yogas | PO 6 | PSO - 5 | U, Ap |
| CO 6: | Explain and analyse the idea about Modern India: her hopes, challenges and Swami Vivekananda | PO 6 | PSO - 5 | U, An |

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| SEMESTER – IV | |
|---|---|
| **Course name** | **Spoken Tutorial on CellDesigner** |
| **Course code** | **UGZOOSEC02** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Install and start the CellDesigner program |
| 2 | Understand various aspects of CellDesigner system |
| 3 | Create a new model |
| 4 | Running the simulation |

| | |
|---|---|
| 5 | Viewing a Model and connect to Database |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Recall how to install and use the CellDesigner programme | PO 5 | PSO 2, 5 | R |
| CO 2: | Build gene-regulatory and biochemical networks by CellDesigner, a structured diagram editor. | PO 5 | PSO 2, 5 | Ap |
| CO 3: | Design models of biochemical reaction networks in Computer-readable format. | PO 5, 6 | PSO 2, 5 | AP |
| CO 4: | Analyze simulation and other analysis packages. | PO 5, 6 | PSO 2, 5 | An |
| CO 5: | Relate data representation with various pictorial representations. | PO 5, 6 | PSO 2, 5 | U |
| CO 6: | Browse and modify existing SBML models with references to existing databases, simulate and view the dynamics through an intuitive graphical interface. | PO 5, 6 | PSO 2, 5 | E, C |

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**AECC**

| SEMESTER – I | |
|---|---|
| **Course name** | **English Communication** |
| **Course code** | **UGZOOAECC01** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Demonstrate mastery of the discipline by detailing the development and current practices of Listening, Speaking, Reading and Writing as Language skills. |
| 2 | Conduct research that engages and responds to diverse audiences of scholars, students, and community members. |
| 3 | Demonstrate values and ethics in all activities |

**Course Outcome**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Enhance their English language proficiency in the aspects of reading, writing, listening and speaking. | PO1, PO2, PO3 | PSO - 5 | U, A |
| CO 2: | Develop academic literacy required for undergraduate learning, further studies and research | PO1, PO2, PO3 | PSO - 5 | C |
| CO 3: | Apply the requisite communicative skills and strategies to future careers | PO1, PO2, PO3 | PSO - 5 | Ap, |
| CO 4: | Gain an insight into cultural literacy and cross-cultural awareness and engage in self-directed English language learning | PO3, PO5 | PSO - 5 | Ap, C |

| | | | | |
|---|---|---|---|---|
| CO 5: | Be responsible and ethical English users | PO3, PO5 | PSO - 5 | Ap |

| SEMESTER – II | |
|---|---|
| **Course name** | **ENVIRONMENTAL SCIENCE (ENVS)** |
| **Course code** | **UGAECC02** |

**Course Objectives:**

After completion of this course the student will be able to

| CO No. | Course Objectives: |
|---|---|
| CO 1: | Remembers and understands the concept, components and function of natural resources and ecosystems. |
| CO 2: | Understand and evaluate the Cause, effects and control measures of various environmental pollutants. |
| CO 3: | Understand the basic idea about the disasters and its management. |
| CO 4: | Understand and apply the knowledge about the social, environmental issues and environmental legislation. |

**Course Outcomes:**

**After completion of this course the student will be able to**

| CO No. | Course Outcomes: | PO Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the concept, components and function of natural resources and ecosystems. | PO1 | PSO 3 | R, U |
| CO 2: | Define, illustrate and analyse the cause, effects and control measures of various environmental pollutants. | PO 3 | PSO 3 | R, U, An |
| CO 3: | Demonstrate the basic idea about the disasters and its management. | PO 3 | PSO 3 | U |
| CO 4: | Illustrate and apply the knowledge about the social, environmental issues and environmental legislation. | PO 4 | PSO 3 | U, Ap |
| CO 5: | Define, demonstrate and evaluate the impact of human population on the Environment | PO 6 | PSO 3, 5 | R, U, E |

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Ramakrishna Mission
Vivekananda Centenary College
Rahara, Kolkata-700 118

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# Ramakrishna Mission
## Vivekananda Centenary College, Rahara

## Department Of Zoology

# Programme Outcomes, Programme Specific Outcomes, Course Objectives and Course Outcomes of B.Sc. Honours Zoology Syllabus

2021-2022

Principal
Ramakrishna Mission
Vivekananda Centenary College
Rahara, Kolkata-700 118

**Program Outcome:**

After completion of the B.Sc. Degree program, the students will be able to

| PO No. | Program Outcome | Cognitive Level |
|---|---|---|
| PO 1 | Recognize the scientific tempers and attitudes, which in turn can prove to be beneficial for the society since the scientific developments can make a nation or society to grow at a rapid pace. | R |
| PO 2 | Understand scientific knowledge and exchange ideas with other stakeholders; make people aware about sustainable utilization of resources with ethical approach. | U |
| PO 3 | Understand and apply the issues of environmental contexts and sustainable development as a basic interdisciplinary concern. | U, Ap |
| PO 4 | Create the ability to perform experiments and to analyse & interpret the obtained accurate results and thus gain the ability to solve problems, to involve in critical, independent, and creative thinking. | An, E, C |
| PO 5 | Possess expertise to apply and formulate ideas which will provide them competitive advantage in pursuing higher studies from India or abroad; and seek jobs in academia, research or industries. | Ap, E |
| PO 6 | Assemble the acquired in-depth knowledge of applied subjects towards the inculcation of professional and employment skills so that students can make a career and become an entrepreneur in diverse fields. | C |

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**Programme Specific Outcome:**

After completion of the B.Sc. Zoology programme the students would be able to

| PSO No. | Program Specific Outcome | Cognitive Level |
|---|---|---|
| PSO 1 | Identify, classify and differentiate diverse nonchordates and chordates based on their morphological, anatomical and systemic organization, and understand their ecological and evolutionary significance, physiological adaptations, development, different behavioral aspects including reproduction. | R, U |
| PSO 2 | Understand the relationship or synchronization among structure and function at molecular, cellular, morphological, anatomical, biochemical, physiological and genetical aspect of animals and apply the acquired skills in the fields of ecology, genetics, molecular biology, biotechnology, biostatistics, bioinformatics, qualitative and quantitative microscopy, enzymology and analytical biochemistry. | U |
| PSO 3 | Understand and evaluate the physical features of environment to the structure of populations, communities, and ecosystems, environmental degradation and formulations for its protection, conservation of the species with reference to local importance. | U, E |
| PSO 4 | Describe and analyse economic, ecological and medical significance of various animals in human life and thus apply in the entrepreneurship of their own on sericulture, apiculture, fisheries, poultry farming, environment monitoring and parasitic disease management. | R, Ap,An |
| PSO 5 | Apply and implement the varied range of subject based skills to numerous fields that provide a foundation for future career in higher studies, government departments, environmental agencies, teaching, biotechnology, diagnostic, research laboratory, pharmaceutical, environmental and ecological fields. | Ap, C |

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**Abbreviations used:**

CC = CORE COURSES
DSE = DISCIPLINE SPECIFIC ELECTIVES
GE = GENERIC ELECTIVES
SEC = SKILL ENHANCEMENT COURSES
AECC = ABILITY ENHANCEMENT COMPULSORY COURSES

| List of Core Courses (14 Papers for the Students of Zoology_Honours) | | Semester |
|---|---|---|
| UGZOOCC 01 | NON-CHORDATES I : PROTISTS TO PSEUDOCOELOMATES | I |
| UGZOOCC 02 | PRINCIPLES OF ECOLOGY | |
| UGZOOCC 03 | NON-CHORDATES II : COELOMATES | II |
| UGZOOCC 04 | CELL BIOLOGY | |
| UGZOOCC 05 | DIVERSITY OF CHORDATES | III |
| UGZOOCC 06 | ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS | |
| UGZOOCC 07 | FUNDAMENTALS OF BIOCHEMISTRY | |
| UGZOOCC 08 | COMPARATIVE ANATOMY OF VERTEBRATES | IV |
| UGZOOCC 09 | ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS | |
| UGZOOCC10 | BIOCHEMISTRY OF METABOLIC PROCESSES | |
| UGZOOCC11 | MOLECULAR BIOLOGY | V |
| UGZOOCC12 | PRINCIPLES OF GENETICS | |
| UGZOOCC13 | DEVELOPMENTAL BIOLOGY | VI |
| UGZOOCC14 | EVOLUTIONARY BIOLOGY | |

| Choices for DSE (4 Papers to be selected by the Students of Zoology_Honours) | | Semester |
|---|---|---|
| UGZOODSE01 | IMMUNOLOGY | V |
| UGZOODSE02 | ANIMAL BEHAVIOUR AND CHRONOBIOLOGY | V |
| UGZOODSE03 | POLLINATION BIOLOGY | V |
| UGZOODSE04 | PROJECT WORK | V |
| UGZOODSE05 | BIODIVERSITY AND WILD LIFE CONSERVATION | VI |
| UGZOODSE06 | COMPUTATIONAL BIOLOGY | VI |
| GE | | |
| UGZOOGE 01 | ANIMAL DIVERSITY AND SYSTEMS | |
| UGZOOGE 02 | ECOLOGY, ECONOMIC AND MEDICAL ZOOLOGY | |

| | | |
|---|---|---|
| **UGZOOGE 03** | **BIOTECHNOLOGY: MICROBES TO ANIMALS** | |
| **UGZOOGE 04** | **INSECT, VECTORS AND DISEASES** | |
| **SEC** | | **Semester** |
| **UGZOOSEC01** | VALUE EDUCATION & INDIAN CULTURE | **III** |
| **UGZOOSEC02** | SPOKEN TUTORIAL FROM IIT BOMBAY | **IV** |

| **SEMESTER – I** | |
|---|---|
| **Course name** | **NON-CHORDATES I : PROTISTS TO PSEUDOCOELOMATES** |
| **Course code** | **UGZOOCC01** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands and apply the basic taxonomy, systematics and classification of Protozoa, Porifera, Cnidaria and Helminth groups, including Nematode- Plant interaction. |
| 2 | Understand and evaluate the life cycle of Protozoans, Platyhelminthes, Nematodes. |
| 3 | Understand and evaluate the host-parasite relationship and evolution of parasitism |
| 4 | Understand, apply and analyse the identification of invertebrate specimens and their life stages. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | PO Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Describe the protozoan reproduction, polymorphism in cnidarians, nervous system in molluscs | PO1 | PSO 1 | R |
| CO 2: | Apply and evaluate the biological and medicinal importance of various larvae and sponges respectively | PO 3 | PSO 1,5 | Ap, E |
| CO 3: | Understand the invertebrate defence and feeding mechanisms | PO 2 | PSO 1 | U |
| CO 4: | Analyse and discuss the adaptive radiation, evolution, affinities of a variety of invertebrates | PO 4 | PSO 1 | An, C |
| CO 5: | Acquire skills in teaching the structural and functional features of invertebrate animal life's diversity | PO 6 | PSO 5 | Ap |

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| SEMESTER – I | |
|---|---|
| **Course name** | **PRINCIPLES OF ECOLOGY** |
| **Course code** | **UGZOOCC02** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers and understands the various features and aspects of population ecology, community ecology and ecosystem ecology. |
| 2 | Understand and evaluate the components of ecosystem, nutrient and biogeochemical cycles and impact of man on the ecological balance. |
| 3 | Understand and evaluate the importance of biodiversity and its conservation |
| 4 | Understand and analyse the causes, effects and control environmental pollution and degradation |
| 5 | Apply the acquired knowledge to solve the environmental and ecological problems |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the components and characistics of population, community and the ecosystem | PO 1, 2 | PSO 1, 3 | R, U |
| CO 2: | Analyze, apply and evaluate the various concepts of population and community and relate the impact of man on the ecological balance | PO 4 | PSO 3 | An, Ap, E |
| CO 3: | Interpret and analyse the importance of biodiversity and its conservation management | PO 4 | PSO 3 | U, An |
| CO 4: | Demonstrate and evaluate the interactions among various environmental parameters | PO 2 | PSO 3 | U, E |
| CO 5: | Demonstrate and recommend environmental ethics related issues and management strategies. | PO 6 | PSO 3 | U, E |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – II | |
|---|---|
| **Course name** | **NON-CHORDATES II: COELOMATES** |
| **Course code** | **UGZOOCC03** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers and understands the classification of coelomate invertebrates and the structure, functional biology of these taxonomic categories. |
| 2 | Understand and evaluate different vector born diseases and the related life cycles, epidemiology, pathology, diagnosis, symptoms and treatments. |
| 3 | Understand and analyse the adaptive radiation, evolution and affinities of a variety of |

| | |
|---|---|
| | coelomates. |
| 4 | Understand and apply the basics of sericulture, apiculture, lac culture and pearl culture. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Demonstrate and distinguish different coelomate invertebrates and the structural and functional biology of these taxonomic categories | PO 2 | PSO 1 | U, An |
| CO 2: | Illustrate different vector born diseases and the related life cycles, epidemiology, pathology, diagnosis, symptoms and treatments and take part in controlling these diseases . | PO 1, 2 | PSO 4 | U, Ap |
| CO 3: | Define, interprete and analyse the adaptive radiation, evolution and affinities of a variety of coelomates | PO 3, | PSO 1 | R, U, An |
| CO 4: | Demonstrate and apply various techniques of sericulture, apiculture, lac culture and pearl culture. Thus create the enterprenureship. | PO 5, 6 | PSO 4, 5 | U, Ap, C |
| CO 5: | Compare and apply the compound vision in arthropods | PO 3, 6 | PSO 1, 5 | An, Ap |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – II | |
|---|---|
| **Course name** | **CELL BIOLOGY** |
| **Course code** | **UGZOOCC04** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Outline the structures and explain the functions of plasma membrane and all cellular organelles in details. |
| 2 | Acquire knowledge about chromosomes and cell divisions, both mitosis and meiosis. |
| 3 | Understand the mechanism of cell signalling and cancers. |
| 4 | Know how to measure and stain different cell types. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the structures and functions of plasma membrane and all cellular organelles in details. | PO 1, 2 | PSO 2 | R, U |
| CO 2: | Illustrate the structure and functions of endomembrane system and cytoskeleton | PO 2 | PSO 2 | U |
| CO 3: | Demonstrate and identify the detail structure of nucleus and compare the functional mechanism of different parts of the nucleus. | PO 2 | PSO 2 | U, Ap |
| CO 4: | Elaborate the mechanism of cell signalling and cancers. | PO 2 | PSO 2 | C |

| | | | | |
|---|---|---|---|---|
| CO 5: | Compare and apply the techniques to measure and stain different cell types. | PO 2, 6 | PSO 2, 5 | An, E |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – III | |
|---|---|
| **Course name** | **DIVERSITY OF CHORDATA** |
| **Course code** | **UGZOOCC05** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl No. | Course Objectives: |
|---|---|
| 1: | Understand the classification, structure, function and biology of chordates of different taxonomic classes. |
| 2: | Outline the origin of chordates |
| 3: | Explain some special topics like zoogeography, metamorphosis, snake bites, migration of birds, parental care of amphibian, echolocation of mammals, |
| 4: | Apply the knowledge of poultry managements and different breeds of domestic animals. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and classify different class of chordates. | PO 1, 2 | PSO 1 | R, U |
| CO 2: | Demonstrate and compare the structure, function and biology of chordates of different taxonomic classes. | PO 2 | PSO 1, 2 | U, C |
| CO 3: | Outline and evaluate the origin of chordates | PO 1 | PSO 1 | U, E |
| CO 4: | Illustrate and analyse some special topics like zoogeography, metamorphosis, snake bites, migration of birds, parental care of amphibian, echolocation of mammals. | PO 2 | PSO 1, 3 | U, An |
| CO 5: | Apply the knowledge of poultry managements and different breeds of domestic animals to build animal husbandary. | PO 5 | PSO 1, 4 | Ap, C |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – III | |
|---|---|
| **Course name** | **ANIMAL PHYSIOLOGY : CONTROLLING AND COORDINATING SYSTEMS** |
| **Course code** | **UGZOOCC06** |

**Course Objectives:**

After completion of this course the students will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remember and understand the basics of histology and functions of various tissues. |
| 2 | Understand the structure and physiology of muscles, nerves. |

| | |
|---|---|
| 3 | Explain the reproductive systems and distinguish the physiology of male and female reproduction. |
| 4 | Understand and evaluate the histology of endocrine glands and classify hormones, demonstrate their biosynthesis, receptors, mode of molecular actions, physiological function, feedback controls and related disorders. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the basics of histology and functions of various tissues. | PO 1, 2 | PSO 2 | R, U |
| CO 2: | Illustrate the structure and physiology of muscles, nerves. | PO 2 | PSO 2 | U |
| CO 3: | Explain the reproductive systems and distinguish the physiology of male and female reproduction. | PO 2, 4 | PSO 2 | U, An |
| CO 4: | Demonstrate and evaluate the histology of endocrine glands. | PO 2, 5 | PSO 2, 5 | U, E |
| CO 5: | Classify hormones and Explain their biosynthesis, receptors, mode of molecular actions, physiological function, feedback controls and related disorders. | PO 4, 5 | PSO 2,4, 5 | An, Ap |
| CO 6: | Examine histology different tissues through preparation of temporary and peranent slides | PO 6 | PSO 2, 4 | An |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – III | |
|---|---|
| **Course name** | **FUNDAMENTALS OF BIOCHEMISTRY** |
| **Course code** | **UGZOOCC07** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands the basic and fundamental biochemistry of carbohydrates, proteins, lipids and nucleic acids. |
| 2 | Understand the nature, mechanism, and kinetics of enzyme action. |
| 3 | Learn some instrumentation such as microscopy, chromatography, electrophoresis, centrifugation, spectrophotometry etc. |
| 4 | Analyse pH, carbohydrates, proteins, lipids and chromatographic separation of amino acids |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the basic and fundamental | PO 1, 2 | PSO 2 | R, U |

| | | | | |
|---|---|---|---|---|
| | biochemistry of carbohydrates, proteins, lipids and nucleic acids. | | | |
| CO 2: | Understand and apply the nature, mechanism, and kinetics of enzyme action. | PO 2, 4 | PSO 2 | U, Ap |
| CO 3: | Demonstrate, apply and evaluate some instrumentation such as microscopy, chromatography, electrophoresis, centrifugation, spectrophotometry etc. | PO 2, 4, 5 | PSO 2 | U, Ap, E |
| CO 4: | Analyse and estimate pH, carbohydrates, proteins, lipids and chromatographic separation of amino acids | PO 4, 6 | PSO 2, 5 | An, C |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – IV | |
|---|---|
| **Course name** | **COMPARATIVE ANATOMY OF VERTEBRATES** |
| **Course code** | **UGZOOCC08** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Define and understand the structures of different systems such as, integumentary, skeletal, digestive, respiratory, circulatory, urinogenital, nervous and sensory organs in comparative way among the vertebrate groups. |
| 2 | Distinguish the disarticulated skeleton of many vertebrates. |
| 3 | Understand and evaluate the skeletal modifications in vertebrates. |
| 4 | Understand the evolution of urinogenital ducts, heart and aortic arches. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate and compare the structures of different systems such as, integumentary, skeletal, digestive, respiratory, circulatory, urinogenital, nervous and sensory organs in the vertebrate groups. | PO 1, 2, 6 | PSO 1, 2, | R, U, E |
| CO 2: | Compare the disarticulated skeleton of many vertebrates. | PO 4 | PSO 1, 2 | An |
| CO 3: | Demonstrate and identify the skeletal modifications in vertebrates. | PO 2 | PSO 1, 2 | U, Ap |
| CO 4: | Discuss the evolution of urinogenital ducts, heart and aortic arches. | PO 2, 5 | PSO 1, 5 | C |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – IV | |
|---|---|
| **Course name** | **ANIMAL PHYSIOLOGY : LIFE SUSTAINING SYSTEMS** |
| **Course code** | **UGZOOCC09** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Learn the physiology of digestion, absorptions and hormonal control of enzyme secretion |
| 2 | Understand the histology and mechanism of respiratory system, circulation and excretion |
| 3 | Understand and analyse the adaptational Physiology. |
| 4 | Examine the histology of different tissue, ABO Blood group, red blood cells, white blood, haemoglobin and blood pressure |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and illustrate the physiology of digestion, absorptions and hormonal control of enzyme secretion | PO 1, 2 | PSO 2 | R, U |
| CO 2: | Demonstrate the respiratory system and is mechanism | PO 2 | PSO 2 | E |
| CO 3: | Explain the mechanisms of circulation and excretion | PO 4 | PSO 5 | E |
| CO 4: | Understand and analyse the adaptational Physiology. | PO 3, 5 | PSO 2, 5 | U, E |
| CO 5: | Compare and analyse the histology of different tissue, determine ABO Blood group, and examine red blood cells, white blood, haemoglobin and blood pressure | PO 4, 5 | PSO 2, 5 | An, E, C |

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| SEMESTER – IV | |
|---|---|
| **Course name** | **BIOCHEMISTRY OF METABOLIC PROCESSES** |
| **Course code** | **UGZOOCC10** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remember and understand the basics mechanisms and pathway of Metabolism. |
| 2 | Remembers, understands the metabolism of carbohydrates, lipids and proteins in details. |
| 3 | Understand and evaluate about oxidative phosphorylation and redox reactions. |
| 4 | Estimate total protein and detect SGOT and SGPT or GST and GSH in serum/ tissue. |
| 5 | Understand and evaluate enzymatic activity. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and explain the basic mechanisms and pathway of metabolism. | PO 1, 2 | PSO 2 | R, U |
| CO 2: | Demonstrate and compare the metabolism of carbohydrates, lipids and proteins in details. | PO 2, 5 | PSO 2 | U, E |
| CO 3: | Illustrate and experiment the oxidative phosphorylation and redox reactions. | PO 2, 6 | PSO 2, 5 | E, Ap |
| CO 4: | Estimate total protein and evaluate SGOT and SGPT or GST and GSH in serum/ tissue. | PO 2, 5 | PSO 2, 5 | E, C |
| CO 5: | Explain the enzymatic activity. | PO 5 | PSO 2 | U |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – V | |
|---|---|
| **Course name** | **MOLECULAR BIOLOGY** |
| **Course code** | **UGZOOCC11** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Acquire knowledge about the replication, transcription, translation. |
| 2 | Understand the post transcriptional and post translational modifications, gene regulation, DNA repair mechanisms and |
| 3 | Elaborate various molecular tools and techniques like PCR, southern, northern and western blotting, recombinant DNA technology etc. |
| 4 | Learn various tools and techniques related to bacterial microbiology, some aspects of applied microbiology and diseases related to microbiology. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and illustrate the replication, transcription, translation. | PO 1, 2 | PSO 2 | R,U |
| CO 2: | Demonstrate the post transcriptional and post translational modifications, gene regulation, DNA repair mechanisms and | PO 2 | PSO 2 | U |
| CO 3: | Demonstrate and apply various molecular tools and techniques like PCR, southern, northern and western blotting, recombinant DNA technology etc. | PO 2, 4 | PSO 2, 5 | U, Ap |
| CO 4: | Elaborate various tools and techniques related to bacterial microbiology and apply some aspects of applied microbiology and diseases related to microbiology. | PO 4, 5 | PSO 2, 5 | Ap, C |

| | | | | |
|---|---|---|---|---|
| CO 5: | Prepare bacterial culture and examine bacterial growth. | PO 4, 6 | PSO 2, 5 | An, C |
| CO 6: | Estimate of DNA and RNA | PO 4 | PSO 2, 5 | E |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – V | |
|---|---|
| **Course name** | **PRINCIPLES OF GENETICS** |
| **Course code** | **UGZOOCC12** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Learn the fundamental genetics like Mendelian and Non Mendelian inheritances, linkages, mutations. |
| 2 | Understand the sex determination of various animals, extrachromosomal inheritances, transposable genetic elements etc. |
| 3 | Understand various aspects of human genetics by covering chromosomal aberrations, gene mutation, etc.. |
| 4 | Understand the various aspects of biostatistics such as central tendency, t-test, chi-square, ANOVA, correlations and regression. |
| 5 | Inspect the Mendelian laws and gene interactions, draw linkage maps and examine chromosomes. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and explain fundamental genetics like Mendelian and Non Mendelian inheritances, linkages, mutations. | PO 1, 2 | PSO 2, 5 | R, U |
| CO 2: | Demonstrate sex determination of various animals, extrachromosomal inheritances, transposable genetic elements etc. | PO 2 | PSO 2 | Ap |
| CO 3: | Illustrate and compare various aspects of human genetics by covering chromosomal aberrations, gene mutation, etc.. | PO 2,4 | PSO 2, 5 | U, An |
| CO 4: | Apply and evaluate various aspects of biostatistics such as central tendency, t-test, chi-square, ANOVA, correlations and regression. | PO 5,6 | PSO 4, 5 | Ap, E |
| CO 5: | Test the Mendelian laws and gene interactions, draw linkage maps and examine chromosomes. | PO 4, 6 | PSO 5 | C |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – VI | |
|---|---|
| **Course name** | **DEVELOPMENTAL BIOLOGY** |
| **Course code** | **UGZOOCC13** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Understand the historical perspective and basic concepts of developmental biology |
| 2 | Learn the different aspects of early, late and post embryonic developments. |
| 3 | Acquire knowledge about implications of developmental biology in various fields, such as in teratogenesis, stem cell biology, in vitro fertilization, cryopreservation, cord blood transfusion etc. |
| 4 | Inspect the developmental stages, different sections of placenta. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the historical perspective and basic concepts of developmental biology | PO 1, 2 | PSO 2 | R, U |
| CO 2: | Explain and compare the different aspects of early, late and post embryonic developments. | PO 2, 5 | PSO 2 | An, E |
| CO 3: | Apply and adapt the knowledge of developmental biology in various fields, such as in teratogenesis, stem cell biology, in vitro fertilization, cryopreservation, cord blood transfusion etc. | PO 4, 5 | PSO 2, 5 | Ap, C |
| CO 4: | Inspect the developmental stages, different sections of placenta, . | PO 5 | PSO 2 | An |
| CO 5: | Compose study report on Drosophila culture and chick embryonic development | PO 4, 6 | PSO 5 | C |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – VI | |
|---|---|
| **Course name** | **EVOLUTIONARY BIOLOGY** |
| **Course code** | **UGZOOCC14** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Learn various evolutionary concepts and historical perspective about evolution. |
| 2 | Understand the importance and implication of the evidences of evolution. |
| 3 | Understand the population genetics and evaluate the evolutionary forces and its impact. |
| 4 | Understand the origin and evolution of man and draw phylogenetic trees |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Learn various evolutionary concepts and historical perspective about evolution. | PO 1 | PSO 2, | R |
| CO 2: | Demonstrate the importance and implication of the evidences of evolution. | PO 2, 3 | PSO 2, 3 | Ap |
| CO 3: | Explain the population genetics and evaluate the evolutionary forces and its impact. | PO 2, 5 | PSO 2, 3 | U |
| CO 4: | Illustrate the origin and evolution of man and draw phylogenetic trees | PO 2, 6 | PSO 2, 4 | An, C |
| CO 5: | Recall various evolutionary concepts and historical perspective about evolution. | PO 1, 2 | PSO 2, 3, 6 | E, Ap |
| CO 6: | Summerise the importance and implication of the evidences of evolution. | PO 2, 6 | PSO 6 | Ap |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

## DISCIPLINE SPECIFIC ELECTIVES (DSE)

| SEMESTER – V | |
|---|---|
| **Course name** | **IMMUNOLOGY** |
| **Course code** | **UGZOODSE01** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands the structures and function of immune cells, immunoglobulins, antigens and their interactions with antibodies. |
| 2 | Understand the MHC molecules, cytokines, hyper sensitivity reactions and cellular mode of immunity development. |
| 3 | Understand the immune diffusion technique and ELISA |
| 4 | Understand the histology of spleen, thymus and lymph nodes and analyse the bloodcells, blood groups and immune reactions |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the structures and function of immune cells, immunoglobulins, antigens and their interactions with antibodies. | PO 2 | PSO 2 | R,U |
| CO 2: | Demonstrate and explain the MHC molecules, cytokines, hyper sensitivity reactions and cellular mode of immunity development. | PO 2 | PSO 2 | U, E |
| CO 3: | Compare and elaborate the cellular immune response | PO 2, 5, 6 | PSO 2, 5 | An, C |

| | | | | |
|---|---|---|---|---|
| CO 4: | Understand and identify the histology of spleen, thymus and lymph nodes and analyse the bloodcells, blood groups and immune reactions | PO 2, 4 | PSO 2, 5 | U, Ap, An |
| CO 5: | Demonstrate and apply immune diffusion technique and ELISA | PO 2, 3 | PSO 2, 5 | U, Ap |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – V | |
|---|---|
| **Course name** | **Animal Behavior and Chronobiology** |
| **Course code** | **UGZOODSE02** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands the details about patterns of behaviours, survival strategies, social and cooperative behaviours. |
| 2 | Understand the design of signals and its application in ecology and evolution |
| 3 | Understand and evaluate the chronobiology |
| 4 | Understand nesting habits of animals, analyse the ethogram and prepare a short report on behavioural activities of animals |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the details about patterns of behaviours, survival strategies, social and identify the cooperative behaviours. | PO 1, 2, 3 | PSO 1, 3 | R, U, Ap |
| CO 2: | Explain the design of signals and analyse its application in ecology and evolution | PO 2, 3, 5 | PSO 1, 3 | U, An |
| CO 3: | Illustrate and evaluate the chronobiology | PO 3, 5 | PSO 1, 3 | U, E |
| CO 4: | Compare nesting habits of animals, analyse the ethogram and prepare a short report on behavioural activities of animals | PO 5, 6 | PSO 1, 5 | An, C |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – V | |
|---|---|
| **Course name** | **POLLINATION BIOLOGY** |
| **Course code** | **UGZOODSE03** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands and apply the knowledge about flowering of plants in natural environment and its relation with pollination, and above all ecological impact. |

| | |
|---|---|
| 2 | Understand and evaluate know about the basic principle and modes of pollination, types and identification of flower visitors, pollinator diseases, colour vision capabilities of insect pollinators. |
| 3 | Understand and evaluate the Importance of Pollination and threats to Pollinators and conservation of pollinators |
| 4 | Understand and analyse Gymnosperms & Angiosperms pollination systems |
| 5 | Dissect, identify and draw the flowering plants and mouthparts of the pollinating insects |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate and apply the knowledge about flowering of plants in natural environment and its relation with pollination, and above all ecological impact. | PO 1, 2, 3 | PSO 1, 3 | R, U, Ap |
| CO 2: | Illustrate and evaluate the basic principle and modes of pollination, types and identification of flower visitors, pollinator diseases, colour vision capabilities of insect pollinators. | PO 3 | PSO 1,3, 5 | U, E |
| CO 3: | Explain and analyse the importance of pollination and threats to pollinators and conservation of pollinators | PO 5, 6 | PSO 1, 3, 4 | U, An |
| CO 4: | Demonstrate and analyse Gymnosperms & Angiosperms pollination systems | PO 3 | PSO 5 | U, An |
| CO 5: | Evaluate and prepare report on the relationship between the flowering plants and mouthparts of the pollinating insects | PO 3, 6 | PSO 1, 5 | E, C |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – V | |
|---|---|
| **Course name** | **PROJECT WORK (BIOINFORMATICS AND MOLECULAR BIOLOGY)** |
| **Course code** | **UGZOODSE04** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remember and understand the basic concepts in bioinformatics and molecular biology. |
| 2 | Apply various bioinformatics tools to analyse various biological data. |
| 3 | Identify research questions and design insilico experiments. |
| 4 | Solve research problems. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the basic concepts in bioinformatics and molecular biology. | PO 1, 2 | PSO 2 | R, U |

| | | | | |
|---|---|---|---|---|
| CO 2: | Apply various bioinformatics tools, analyse and interprete various biological data. | PO 2, 4 | PSO 2 | Ap, An |
| CO 3: | Identify research questions and design insilico experiments | PO 4, 5 | PSO 2,4 | Ap, C |
| CO 4: | Perform and solve the research problems. | PO 5, 6 | PSO 2, 5 | Ap, C |
| CO 5: | Discuss the results and prepare scientific reports. | PO 6 | PSO 2, 5 | E, Ap |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – VI | |
|---|---|
| **Course name** | **BIODIVERSITY AND WILD LIFE CONSERVATION** |
| **Course code** | **UGZOODSE05** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands the various issues related to biodiversity loss and conservation as well as status, conditions and conservation of forests and wildlife. |
| 2 | Understand and apply the various tools used in field biology |
| 3 | Compare and evaluate the pitfall/ trail / transect monitoring for abundance and diversity estimation. |
| 4 | Prepare on complete report on excursion or field visit. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and understand the various issues related to biodiversity loss and conservation as well as status, conditions and conservation of forests and wildlife. | PO | PSO 3 | R, U |
| CO 2: | Understand and apply the various tools used in field biology | PO | PSO 3, 5 | U, Ap |
| CO 3: | Compare and evaluate the pitfall/ trail / transect monitoring for abundance and diversity estimation | PO | PSO 3, 5 | An, E |
| CO 4: | Prepare complete report on excursion or field visit. | PO | PSO 3, 5 | C |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – VI | |
|---|---|
| **Course name** | **COMPUTATIONAL BIOLOGY** |
| **Course code** | **UGZOODSE06** |

**Course Objectives:**

After completion of this course the students will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remember, understand the importance, Goal and Scope of bioinformatics |
| 2 | Understand, evaluate and use the biological databases to retrieve biological data |

| | |
|---|---|
| 3 | Understand the basic concept of sequence alignment |
| 4 | Understand and apply the Bioinformatics and biostatistics |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and explain the importance, goal and scope of bioinformatics | PO | PSO 2 | R, U |
| CO 2: | Illustrate, inspect and apply the biological databases to retrieve biological data | PO | PSO 2 | U,Ap, An |
| CO 3: | Demonstrate and apply the basic concept of sequence alignment. | PO | PSO 2 | U, Ap |
| CO 4: | Demonstrate and apply the tools in bioinformatics and biostatistics | PO | PSO 2 | U, Ap |
| CO 5: | Construct the graphical representations of statistical data. | PO | PSO 2 | C |

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## GENERIC ELECTIVES

| SEMESTER – I/II | |
|---|---|
| **Course name** | **ANIMAL DIVERSITY AND SYSTEMS** |
| **Course code** | **UGZOOGE01** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers the general characters and special features in different animal groups. |
| 2 | Understands and apply the taxonomy and classifications of animals. |
| 3 | Remember and understand the basic endocrinology and histology of animals. |
| 4 | Remember and understand the basics of developmental biology in animals. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the general characters and special structures in different animal groups. | PO 1 | PSO 2 | R, U |
| CO 2: | Demonstrate and apply the taxonomy and classifications of animals. | PO 2 | PSO 2, 3 | U, Ap |
| CO 3: | Define, demonstrate and illustrate the basic endocrinology and histology of animals. | PO 5 | PSO 2 | R, U, E |
| CO 4: | Define, demonstrate and illustrate the basics of developmental biology in animals. | PO 2, 3 | PSO 2 | R, U, E |

| SEMESTER – I/II | |
|---|---|
| **Course name** | **ECOLOGY, ECONOMIC AND MEDICAL ZOOLOGY** |
| **Course code** | **UGZOOGE02** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands and apply the definition, principle and scope of fisheries and aquaculture, lac culture and pest management |
| 2 | Understand and evaluate the concept of ecology, biodiversity and wildlife conservation. |
| 3 | Remember, understand the concept of parasitism and evaluate the life history, pathogenicity and clinical features of selected parasites. |
| 4 | Remember, Understand the basic principles of biotechnology and immunology. |

1.

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate and apply the definition, principle and scope of fisheries and aquaculture, lac culture and pest management | PO 1, 6 | PSO 2, 5 | R, U, Ap |
| CO 2: | Illustrate, analyse and evaluate the concept of ecology, biodiversity and wildlife conservation. | PO 1, 3 | PSO 2, 3 | U, E |
| CO 3: | Define, demonstrate and apply the concept of parasitism and evaluate the life history, pathogenicity and clinical features of selected parasites. | PO 6 | PSO 4, 5 | R, U, Ap |
| CO 4: | Define and understand the basic principles of biotechnology and immunology. | PO 1, 5 | PSO 2 | R, U |

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| SEMESTER – II | |
|---|---|
| **Course name** | **BIOTECHNOLOGY: MICROBES TO ANIMALS** |
| **Course code** | **UGZOOGE03** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands the concept of biotechnology. |
| 2 | Understand and evaluate the techniques in gene manipulation. |
| 3 | Understand and evaluate the application of microbes in biotechnology. |
| 4 | Remember, understand and analyse the method of transgenic animal production. |
| 5 | Remember and extend the basic concept in biotechnology and human welfare. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate and apply the concept of biotechnology. | PO 1 | PSO 2 | R, U, Ap |
| CO 2: | Demonstrate and analysing the techniques in gene manipulation | PO 2 | PSO 2 | U, An |
| CO 3: | Demonstrate and evaluate the application of microbes in biotechnology | PO 2 | PSO 2 | U, E |
| CO 4: | Define, demonstrate and evaluate the method of transgenic animal production. | PO 2, 3 | PSO 2 | R, U, E |
| CO 5: | Extend the basic concept in biotechnology and human welfare and perform experiments. | PO 3, 5 | PSO 2, 3 | U, C |

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| SEMESTER – II | |
|---|---|
| **Course name** | **INSECT, VECTORS AND DISEASES** |
| **Course code** | **UGZOOGE04** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Remembers, understands the characteristic and morphological features of Insects. |
| 2 | Understand and evaluate the insects as vectors. |
| 3 | Understand and analyse different vectors of different orders. |
| 4 | Understand, identify and analyse different vectors and their associated diseases. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate the characteristic and morphological features of Insects. | PO 1 | PSO 1 | R, U |
| CO 2: | Illustrate and evaluate the insects as vectors. | PO 2, 3 | PSO 3, 4 | U, E |
| CO 3: | Demonstrate and analyse different vectors of different orders. | PO 4 | PSO 4, | U, An |
| CO 4: | Demonstrate, identify and prepare report on different vectors and their associated diseases. | PO 6 | PSO 1, 5 | U, Ap, C |

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## SKILL ENHANCEMENT COURSE (SEC)

| SEMESTER – III | |
|---|---|
| **Course name** | **Value Education and Indian Culture** |
| **Course code** | **UGZOOSEC01** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Attain awareness about daily routine, self-evaluation & Integral Personality Development |
| 2 | Understand the educational needs, the Power of thoughts and the Science of Peace |
| 3 | Understand the relation: Values and enlightened citizenship |
| 4 | Attain awareness about the Indian Practice and Culture |
| 5 | Demonstrate the importance of Four Yogas |
| 6 | Acquire idea about Modern India: her hopes, challenges and Swami Vivekananda |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | PO Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, understand and apply the daily routine, self-evaluation & Integral Personality Development | PO1 | PSO - 5 | R, U, Ap |
| CO 2: | Learn, and apply the Power of thoughts & the Science of Peace | PO 3 | PSO - 5 | U, Ap |
| CO 3: | Understand the relation: Values and enlightened citizenship | PO 2 | PSO - 5 | U |
| CO 4: | Discuss the awareness about the Indian Practice and Culture | PO 4 | PSO - 5 | C |
| CO 5: | Demonstrate and practice the Four Yogas | PO 6 | PSO - 5 | U, Ap |
| CO 6: | Explain and analyse the idea about Modern India: her hopes, challenges and Swami Vivekananda | PO 6 | PSO - 5 | U, An |

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| SEMESTER – IV | |
|---|---|
| **Course name** | **Spoken Tutorial on CellDesigner** |
| **Course code** | **UGZOOSEC02** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Install and start the CellDesigner program |
| 2 | Understand various aspects of CellDesigner system |
| 3 | Create a new model |
| 4 | Running the simulation |

| | |
|---|---|
| 5 | Viewing a Model and connect to Database |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Recall how to install and use the CellDesigner programme | PO 5 | PSO 2, 5 | R |
| CO 2: | Build gene-regulatory and biochemical networks by CellDesigner, a structured diagram editor. | PO 5 | PSO 2, 5 | Ap |
| CO 3: | Design models of biochemical reaction networks in Computer-readable format. | PO 5, 6 | PSO 2, 5 | AP |
| CO 4: | Analyze simulation and other analysis packages. | PO 5, 6 | PSO 2, 5 | An |
| CO 5: | Relate data representation with various pictorial representations. | PO 5, 6 | PSO 2, 5 | U |
| CO 6: | Browse and modify existing SBML models with references to existing databases, simulate and view the dynamics through an intuitive graphical interface. | PO 5, 6 | PSO 2, 5 | E, C |

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**AECC**

| SEMESTER – I | |
|---|---|
| **Course name** | **English Communication** |
| **Course code** | **UGZOOAECC01** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1 | Demonstrate mastery of the discipline by detailing the development and current practices of Listening, Speaking, Reading and Writing as Language skills. |
| 2 | Conduct research that engages and responds to diverse audiences of scholars, students, and community members. |
| 3 | Demonstrate values and ethics in all activities |

**Course Outcome**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Enhance their English language proficiency in the aspects of reading, writing, listening and speaking. | PO1, PO2, PO3 | PSO - 5 | U, A |
| CO 2: | Develop academic literacy required for undergraduate learning, further studies and research | PO1, PO2, PO3 | PSO - 5 | C |
| CO 3: | Apply the requisite communicative skills and strategies to future careers | PO1, PO2, PO3 | PSO - 5 | Ap, |
| CO 4: | Gain an insight into cultural literacy and cross-cultural awareness and engage in self-directed English language learning | PO3, PO5 | PSO - 5 | Ap, C |

| | | | | |
|---|---|---|---|---|
| CO 5: | Be responsible and ethical English users | PO3, PO5 | PSO - 5 | Ap |

| SEMESTER – II | |
|---|---|
| **Course name** | **ENVIRONMENTAL SCIENCE (ENVS)** |
| **Course code** | **UGAECC02** |

**Course Objectives:**

After completion of this course the student will be able to

| CO No. | Course Objectives: |
|---|---|
| CO 1: | Remembers and understands the concept, components and function of natural resources and ecosystems. |
| CO 2: | Understand and evaluate the Cause, effects and control measures of various environmental pollutants. |
| CO 3: | Understand the basic idea about the disasters and its management. |
| CO 4: | Understand and apply the knowledge about the social, environmental issues and environmental legislation. |

**Course Outcomes:**

**After completion of this course the student will be able to**

| CO No. | Course Outcomes: | PO Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate the concept, components and function of natural resources and ecosystems. | PO1 | PSO 3 | R, U |
| CO 2: | Define, illustrate and analyse the cause, effects and control measures of various environmental pollutants. | PO 3 | PSO 3 | R, U, An |
| CO 3: | Demonstrate the basic idea about the disasters and its management. | PO 3 | PSO 3 | U |
| CO 4: | Illustrate and apply the knowledge about the social, environmental issues and environmental legislation. | PO 4 | PSO 3 | U, Ap |
| CO 5: | Define, demonstrate and evaluate the impact of human population on the Environment | PO 6 | PSO 3, 5 | R, U, E |

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Ramakrishna Mission
Vivekananda Centenary College
Rahara, Kolkata-700 118

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Rahara
Kolkata - 118

# Ramakrishna Mission
## Vivekananda Centenary College, Rahara

## Department Of Zoology

# Programme Outcomes, Programme Specific Outcomes, Course Objectives and Course Outcomes of M.Sc. Zoology syllabus

## Session 2020-2021

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Vivekananda Centenary College
Rahara, Kolkata-700 118

After completion of the M.Sc. Degree programme, the students will be able to

| PO No. | PROGRAMME OUTCOMES | Cognitive Level |
|---|---|---|
| PO 1 | Outline and demonstrate the basic concepts by acquiring a comprehensive knowledge in the newer emerging field of knowledge. | R, U |
| PO 2 | Perform experiments, analyse & interpret the obtained accurate results and thus gain the ability to solve problems. | Ap, An, E |
| PO 3 | Apply and evaluate the basic ideas to their thoughts, actions, and interventions for the societal benefits through the development of entrepreneurships. | Ap, E |
| PO 4 | Develop the ability to involve in critical, independent, and inventive thinking for the engagement in research and development on the emerging topics. | C |

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**PROGRAMME SPECIFIC OUTCOMES**

After completion of these programme the student would be able to

| PSO No. | PROGRAMME OUTCOMES | Cognitive Level |
|---|---|---|
| PSO 1 | Define, Demonstrate and apply the value of animal life's diversity and complexity as learn the various aspects on morphology, physiology, developmental biology, Neurobiology, cellular and molecular biology and biochemistry. | R, U, Ap |
| PSO 2 | Demonstrate and apply the basic models in ecological and environmental sciences those may inculcate them to design sustainable management policies for global, regional or local ecosystem. | U, Ap, C |
| PSO 3 | Illustrate, examine and evaluate the sophisticated scientific methodologies in practical and advanced zoological sciences by gaining cognitive and hands-on experience. | U, E |
| PSO 4 | Apply, analyse and elaborate statistical methods, bioinformatics software, and biology-integrated technology on different scientific areas namely, immunology, endocrinology, biotechnology, microbiology and genetics to solve biological challenges | Ap, An, C |
| PSO 5 | Apply and compile the varied range of subject based skills to various fields that provide a foundation for future career in disciplines such as Health Sciences, Agriculture, Environmental Management, Biotechnology, Teaching and Research | Ap, C |

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## POST GRADUATE COURSE IN ZOOLOGY

| Semester - I | | July - December | | |
|---|---|---|---|---|
| Paper Code | | Topic | Marks | Credit |
| PGZOOCC 1.1 | | Diversity and biology of Nonchordates | 50 | 4 |
| PGZOOCC 1.2 | | Diversity and biology of Chordates | 50 | 4 |
| PGZOOCC 1.3 | | Cell biology & Instrumentations | 50 | 4 |
| PGZOOCC 1.4 | | Genetics | 50 | 4 |
| PGZOOCC 1.5 | | Structures & systems of organisms | 50 | 4 |
| PGZOOCC 1.6 | | Tools & techniques in biological study | 50 | 4 |
| | | **Total** | = 300 | 24 |
| PGZOOSOC 1 | | Yoga | 25 | 1 |
| **Semester - II** | | **January - June** | | |
| **Paper Code** | | **Topic** | **Marks** | **Credit** |
| PGZOOCC 2.1 | | Biochemistry & Metabolism | 50 | 4 |
| PGZOOCC 2.2 | | Molecular biology & Biotechnology | 50 | 4 |
| PGZOOCC 2.3 | | Ethology & chronobiology | 50 | 4 |
| PGZOOCC 2.4 | | Ecological sciences | 50 | 4 |
| PGZOOCC 2.5 | | Biochemical and molecular aspects of life | 50 | 4 |
| PGZOOCC 2.6 | | Ethology & Ecology | 50 | 4 |
| | | **Total** | = 300 | 24 |
| PGZOOSOC 2 | | Communicative English | = 25 | 1 |
| **Semester - III** | | **July - December** | | |
| **Paper Code** | | **Topic** | **Marks** | **Credit** |
| PGZOOCC 3.1 | | Parasitology and Immunology | 50 | 4 |
| PGZOOCC 3.2 | | Developmental biology and Neurobiology | 50 | 4 |
| PGZOOCC 3.3 | | Endocrine physiology | 50 | 4 |
| PGZOOEC 3.1A/1B | | Elective paper 1A (Entomology) / 1B (Cellular and Molecular Biology) | 50 | 4 |
| PGZOOCC 3.4 | | Immunology, Parasitology, Developmental biology & Endocrinology | 50 | 4 |
| PGZOOEC 3.2A/2B | | Dissertation and practical of elective paper 2A/ 2B | 50 | 4 |
| | | **Total** | = 300 | 24 |
| PGZOOSOC 3 | | Value Education and Indian Culture | = 25 | 1 |
| | | | | |
| **Semester - IV** | | **January - June** | | |
| **Paper Code** | | **Topic** | **Marks** | **Credit** |
| PGZOOCC 4.1 | | Taxonomy and Biostatistics | 50 | 4 |
| PGZOOCC 4.2 | | Bioinformatics and Computational Biology | 50 | 4 |
| PGZOOCC 4.3 | | Bio python and LaTeX | 50 | 4 |
| PGZOOEC 4.1A/1B | | Elective paper 1A (Entomology)/ 1B (Cellular and Molecular Biology) | 50 | 4 |
| PGZOOCC 4.4 | | Phylogenetics, Biostatistics and Bioinformatics | 50 | 4 |
| PGZOOEC 4.2A/2B | | Submission of final dissertation and practical of elective paper 2A / 2B | 50 | 4 |
| | | **Total** | = 300 | 24 |
| PGZOOSOC 4 | | Fundamentals of remote sensing and GIS | = 25 | 1 |
| | | **Total** | **= 1300** | **100** |

| SEMESTER – I | |
|---|---|
| **Course name** | **Diversity and Biology of Nonchordate** |
| **Course code** | **PGZOOCC 1.1** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Remembers, understands and apply the protozoan reproduction, polymorphism in cnidarians, nervous system in molluscs and importance of sponges and various larvae |
| 2: | Understand and evaluate the invertebrate defence and feeding mechanisms |
| 3: | Understand and evaluate the adaptive radiation, evolution, affinities of a variety of invertebrates |
| 4: | Understand and analyse the compound vision in arthropods, insect flight mechanism |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Describe and demonstrate the protozoan reproduction, polymorphism in cnidarians, nervous system in molluscs | PO 1 | PSO 1 | R, U |
| CO 2: | Apply the biological and medicinal importance of various larvae and sponges respectively | PO 3 | PSO 1 | Ap |
| CO 3: | Demonstrate the invertebrate defence and feeding mechanisms | PO 1 | PSO 1 | U |
| CO 4: | Analyse and discuss the adaptive radiation, evolution, affinities of a variety of invertebrates | PO 1 | PSO 1, 5 | An, C |
| CO 5: | Compare and apply the compound vision in arthropods, insect flight mechanism | PO 3 | PSO 1, 5 | E, Ap |
| CO 6: | Acquire skills in teaching about the structural and functional features of invertebrate animal life's diversity | PO 4 | PSO 4, 5 | Ap |

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| SEMESTER – I | |
|---|---|
| **Course name** | **Diversity and Biology of Chordates** |
| **Course code** | **PGZOOCC 1.2** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Remembers and understands the characteristic features and affinities of Protochordata (Hemichordata Urochordata, Cephalochordata), Cyclostomes, Dipnoi |
| 2: | Understand and evaluate the origin of birds and mammals |
| 3: | Understand and evaluate the Skeletal system and its functional and evolutionary significance |

| | |
|---|---|
| 4: | Understand, analyse and apply the Circulatory systems, Nervous system and Sense organ |
| 5: | Understand and analyse Structural Adaptation of different vertebrates |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Describe the characteristic features and explain the affinities of Protochordata (Hemichordata Urochordata, Cephalochordata), Cyclostomes, Dipnoi | PO 1 | PSO 1 | R, U |
| CO 2: | Demonstrate and evaluate the origin of birds and mammals | PO 3 | PSO 1, 2 | U, E |
| CO 3: | Demonstrate and analyse the Skeletal system and its functional and evolutionary significance | PO 2, 3 | PSO 1 | U, An |
| CO 4: | Illustrate and apply the Circulatory systems, Nervous system and Sense organ | PO 3 | PSO 1, 5 | U, Ap |
| CO 5: | Analyse and discuss structural adaptation of different vertebrates | PO 4 | PSO 1, 5 | An, C |

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| SEMESTER – I | |
|---|---|
| **Course name** | **Cell biology & Instrumentations** |
| **Course code** | **PGZOOCC 1.3** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Understand, analyse and apply the buffer systems and its importance in biological science |
| 2: | Acquire and apply various knowledge on tolls and techniques in cell biology |
| 3: | Remember and understand the structure and function of cell membrane and cell organelles |
| 3: | Remember, understand, and apply the cellular communications mechanisms |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Explain, analyse and apply the buffer systems | PO 2 | PSO 1 | U, Ap, An |
| CO 2: | Define, explain and apply centrifugation, spectrophotometry, electrophoresis & bloating and microscopy. | PO 1, 3 | PSO 3, 4 | R, U, Ap |
| CO 3: | Demonstrate the cell membrane and demonstrate and evaluate cell transport mechanisms. | PO 1 | PSO 1, 3 | U, E |
| CO 4: | Define and demonstrate the structure and function of cellular organelles | PO 1 | PSO 1 | R, U |
| CO 5: | Demonstrate, apply and discuss the cell signalling system. | PO 4 | PSO 1, 5 | U, Ap, C |

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| SEMESTER – I | |
|---|---|
| **Course name** | **Genetics** |
| **Course code** | **PGZOOCC 1.4** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Understand the fine structure and function of chromatin and chromosomes and their metabolic pathways |
| 2: | Understand, analyse and apply the concept of crossing over & linkage to construct gene map |
| 3: | Understand and evaluate the mechanism of gene mutation and DNA repair |
| 4: | Remember, understand and analyse human karyotyping and chromosomal disorders |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and explain the chromosome structure and its metabolic pathways | PO 1 | PSO 1, 5 | R, U |
| CO 2: | Demonstrate and apply the concept of crossing over & linkage to construct gene map | PO 3 | PSO 5 | U, Ap, C |
| CO 3: | Demonstrate and evaluate the mechanism of gene mutation and DNA repair | PO 3 | PSO 1, 5 | U, E |
| CO 4: | Explain and discuss cause of epigenetic modifications | PO 2 | PSO 1, 4, 5 | U, C |
| CO 5: | Define, demonstrate and analyse human karyotyping and chromosomal disorders | PO 1, 4 | PSO 1, 5 | R, U, An |

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| SEMESTER – I | |
|---|---|
| **Course name** | **Structures & systems of organisms** |
| **Course code** | **PGZOOCC 1.5** |
| **Course type** | **Practical** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Relate and evaluate various organ and systems in selected invertebrates and vertebrates and correlate the structure and function of organs in animals |
| 2: | Demonstrate and apply the knowledge of hypophysation technique |
| 3: | Acquire, apply and evaluate knowledge on aquaculture firm operation. |
| 3: | Obtain knowledge on collection, preservation and identification of museum specimens |

**Course Outcomes:**

**After completion of this course the student will be able to**

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Develop knowledge on dissection of various organ and systems in animals and analyse the corelation | PO 1 | PSO 1, 3 | Ap, An |
| CO 2: | Demonstrate, apply and design the hypophysation technique | PO 2, 3, 4 | PSO 1, 3, 5 | U, Ap, C |
| CO 3: | Explain, evaluate and design the aquaculture firm operation. | PO 3, 4 | PSO 1, 3, 5 | U, E, C |
| CO 4: | Define and explain the process of collection, preservation and identification of museum specimens | PO 1 | PSO 1, 2, 3 | R, E |

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| SEMESTER – I | |
|---|---|
| **Course name** | **Tools & techniques in biological study** |
| **Course code** | **PGZOOCC 1.6** |
| **Course type** | **Practical** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Apply the knowledge of spectrophotometric techniques to estimate protein and nucleic acids |
| 2: | Analyse the adulteration and estimate the insulin applying the knowledge on HPLC and ELISA respectively |
| 3: | Apply the knowledge of chromosome structure in man and drosophila |
| 4: | Apply the knowledge on survey of Mendelian traits, analyse the pedigree |
| 5: | Apply the knowledge of Hardy Weinberg law of population genetics |
| 6: | Apply the knowledge on preparation, purification and gel ectrophoresis of extrachromosomal DNA |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Analyse and estimate protein and nucleic acids using spectrophotometric techniques | PO 2 | PSO 3, 5 | An, E |
| CO 2: | Analyse the adulteration and estimate the insulin using HPLC and ELISA respectively | PO 2 | PSO 3, 5 | An, E |

| | | | | |
|---|---|---|---|---|
| **CO 3:** | Discuss and compare chromosome structure in man and drosophila | PO 2, 4 | PSO 3, 5 | E, C |
| **CO 4:** | Analyse, evaluate and construct the pedigree | PO 2, 4 | PSO 3 | An, E, C |
| **CO 5:** | Apply and estimate the Hardy Weinberg law in population dynamics study | PO 2, 3 | PSO 3 | Ap, C |
| **CO 6:** | Evaluate and estimate the extrachromosomal DNA through DNA preparation, purification and gel ectrophoresis. | PO 3 | PSO 3, 5 | E, C |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| **SEMESTER – I** | |
|---|---|
| **Course name** | **Yoga** |
| **Course code** | **PGZOOSOC 1** |
| **Course type** | **Soft Skill** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Attain general awareness about health |
| 2: | Manage life style of students' life |
| 3: | Increase of concentration |
| 4: | Improve the decision-making capacity |
| 5: | Build up confidence in their life |

**Course Outcomes:**

**After completion of this course the student will be able to**

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate and apply general awareness about health | PO 1, 4 | PSO 1, 5 | R, U, Ap |
| CO 2: | Learn and apply how to manage life style of students' life | PO 3 | PSO 5 | R, Ap |
| CO 3: | Discover and apply how to increase concentration | PO 1 | PSO 5 | An, Ap |
| CO 4: | Demonstrate and improve the decision-making capacity | PO 4 | PSO 5 | U, C |
| CO 5: | Build up confidence in their life | PO 4 | PSO 5 | C |

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| SEMESTER – II | |
|---|---|
| **Course name** | **Biochemistry & Metabolism** |
| **Course code** | **PGZOOCC 2.1** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Define, Understand and evaluate the structure and function of biomolecules |
| 2: | Understand and apply the principles of biophysical chemistry |
| 3: | Explain and evaluate different metabolic pathways |
| 4: | Understand the process of fatty acids and nucleic acids synthesis |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| **CO 1:** | Define, explain and evaluate the molecular conformations and interactions of carbohydrates, proteins, lipids and nucleic acids | PO 1 | PSO 1, 4 | R, U, E |
| **CO 2:** | Demonstrate and apply the law of thermodynamics in biophysical chemistry | PO 1, 2 | PSO 1, 3 | U, Ap |
| **CO 3:** | Demonstrate, evaluate and analyse the different metabolic pathways | PO 3 | PSO 1, 4 | U, E, An |
| **CO 4:** | Demonstrate, apply and discuss the synthesis of fatty acids and nucleic acids | PO 4 | PSO 1, 5 | U, Ap, C |

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| SEMESTER – II | |
|---|---|
| **Course name** | **Molecular Biology & Biotechnology** |
| **Course code** | **PGZOOCC 2.2** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Define, demonstrate and evaluate the central dogma concept |
| 2: | Understand and apply the gene regulation mechanism and role of non-coding RNAs |
| 3: | Remember, understand the transposable elements and microbial genetics |
| 4: | Explain, evaluate and apply different genetic engineering tools |
| 5: | Understand the mechanism of cancer biology |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate and analyse the mechanisms and regulation of replication, transcription and translation | PO 1 | PSO 1, 3 | R, U, An |
| CO 2: | Demonstrate and apply the gene regulation, gene silencing and non-coding RNAs interference for drug development | PO 1, 3 | PSO 1, 3 | U, Ap, C |
| CO 3: | Demonstrate, evaluate and discuss the importance of transposable elements and microbial genetics | PO 1, 3 | PSO 1, 3, 5 | U, E, C |
| CO 4: | Explain, adapt and apply different genetic engineering tools | PO 1, 3 | PSO 1, 3 | U, C, Ap |
| CO 5: | Demonstrate the mechanism of cancer formation and access the role of carcinogens | PO 1 | PSO 1, 3 | U, E |
| CO 6: | Demonstrate and apply the transgenic organism's production and ethical issues | PO 1, 4 | PSO 1, 2, 3 | U, A, C |

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| SEMESTER – II | |
|---|---|
| **Course name** | **Ethology & Chronobiology** |
| **Course code** | **PGZOOCC 2.3** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Define, demonstrate and analyse the social organization and the communications in animals |
| 2: | Define and understand the learning behaviours in animals |
| 3: | Learn and demonstrate the migration and defence systems in animals |
| 4: | Learn, understand and apply the biological rhythms and chronobiology |
| 5: | Understand and evaluate the development of behaviour in animals |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate and analyse the various types of social organization in animals | PO 1, 3 | PSO 1, 2 | R, U, An |
| CO 2: | Demonstrate and apply the animal's communications system in resource exploration and discuss the significance | PO 1, 3 | PSO 1, 2, 5 | U, Ap, C |
| CO 3: | Demonstrate, analyse and apply the learning behaviours in animals | PO 3 | PSO 1, 5 | U, An, Ap |
| CO 4: | Demonstrate and evaluate the migration and defence systems in animals | PO 1, 3 | PSO 1, 2 | D, E |

| | | | | |
|---|---|---|---|---|
| CO 5: | Demonstrate, analyse and discuss the development of behaviour and biological rhythms and chronobiology in animals and human | PO 1, 4 | PSO 1, 5 | U, An, C |

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| SEMESTER – II | |
|---|---|
| **Course name** | **Ecological Sciences** |
| **Course code** | **PGZOOCC 2.4** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Define, understand and analyse the population and community ecology |
| 2: | Remember, understand and apply the ecosystem concepts |
| 3: | Learn, demonstrate and evaluate the riverine ecosystem and its importance |
| 4: | Understand, apply and formulate the riverine ecosystem management |
| 5: | Understand, evaluate and adapt the wetland ecosystem management |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Demonstrate, analyse and design models in the population and community ecology | PO 1, 4 | PSO 2, 5 | U, An, C |
| CO 2: | Define, demonstrate, and apply the ecosystem concepts and theory in different ecosystems | PO 1, 3 | PSO 2, 5 | R, U, Ap |
| CO 3: | Explain, evaluate and apply the riverine ecosystem composition, interactions and impact | PO 1, 3, 4 | PSO 2, 5 | U, E, Ap |
| CO 4: | Demonstrate, apply and formulate the riverine ecosystem pollution management strategy | PO 1, 4 | PSO 2, 5 | U, Ap, C |
| CO 5: | Demonstrate, evaluate and adapt the wetland biodiversity and pollution management | PO 1, 4 | PSO 2, 5 | U, E, C |

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| SEMESTER – II | |
|---|---|
| **Course name** | **Biochemical and molecular aspects of life** |
| **Course code** | **PGZOOCC 2.5** |
| **Course type** | **Practical** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|

| | |
|---|---|
| 1: | Estimate glucose, lipids and lipid peroxidation products |
| 2: | Quantification of oxidative stress enzymes and redox cycle enzymes |
| 3: | Apply the knowledge of Spectrofluorimetric technique on quaternary haemoglobin protein |
| 4: | Apply the knowledge of gene cloning and gene expression |
| 5: | Apply the knowledge of cell culture lab protocols |
| 6: | Apply the knowledge DNA sequencing |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Analyse, evaluate and estimate glucose, lipids and lipid peroxidation products | PO 2 | PSO 4, 5 | An, E, C |
| CO 2: | Evaluate and examine of oxidative stress enzymes and redox cycle enzymes | PO 2 | PSO 4, 5 | An, E |
| CO 3: | Identify and evaluate the quaternary haemoglobin protein | PO 2 | PSO 4 | Ap, E |
| CO 4: | Construct the gene clone and evaluate gene expression | PO 2, 4 | PSO 4, 5 | C, E |
| CO 5: | Apply the cell culture lab protocols and maintain cell culture | PO 2, 4 | PSO 4, 5 | Ap |
| CO 6: | Identify, analyse and solve DNA sequence | PO 2, 4 | PSO 4, 5 | Ap, An, C |

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| SEMESTER – II | |
|---|---|
| **Course name** | **Ethological & Ecological studies** |
| **Course code** | **PGZOOCC 2.6** |
| **Course type** | **Practical** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Analyse and evaluate the nesting behaviour of birds |
| 2: | Analyse and evaluate the FAP and aggressive behaviour in fishes and birds |
| 3: | Prepare report and documentary on field visit |
| 4: | Perform toxicity test, |
| 5: | Analyse and evaluate physicochemical parameters of water and soil |
| 6: | Apply the knowledge of population ecology |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Analyse, evaluate and apply the nesting behaviour of birds | PO 3 | PSO 2, 3 | Ap, An, E |

| | | | | |
|---|---|---|---|---|
| CO 2: | Demonstrate, analyse and evaluate the FAP and aggressive behaviour in fishes and birds | PO 1, 3 | PSO 2, 3 | U, An, E |
| CO 3: | Analyse and prepare report and documentary on field visit | PO 3, 4 | PSO 2, 5 | An, C |
| CO 4: | Perform toxicity test, physicochemical parameters of water and soil | PO 2, 3 | PSO 2, 5 | Ap, An, E |
| CO 5: | Apply, analyse and adapt the knowledge of population ecology to solve ecological problems | PO 2, 3, 4 | PSO 2, 5 | Ap, An, C |

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| SEMESTER – II | |
|---|---|
| **Course name** | **Communicative English** |
| **Course code** | **PGZOOSOC 2** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Demonstrate mastery of the discipline by detailing the development and current practices of Listening, Speaking, Reading and Writing as Language skills. |
| 2: | Conduct research that engages and responds to diverse audiences of scholars, students, and community members. |
| 3: | Demonstrate values and ethics in all activities |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Enhance their English language proficiency in the aspects of reading, writing, listening and speaking. | PO 3 | PSO 5 | U, A |
| CO 2: | Develop academic literacy required for undergraduate learning, further studies and research | PO 3 | PSO 5 | C |
| CO 3: | Apply the requisite communicative skills and strategies to future careers | PO 3 | PSO 5 | Ap |
| CO 4: | Gain an insight into cultural literacy and cross-cultural awareness and engage in self-directed English language learning | PO 3 | PSO 5 | Ap, C |
| CO 5: | Be responsible and ethical English users | PO 3 | PSO 5 | Ap |

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| SEMESTER – III | |
|---|---|
| **Course name** | **Parasitology and Immunology** |
| **Course code** | **PGZOOCC 3.1** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Understand and apply parasitology, host parasite interactions |
| 2: | Learn and understand the mechanisms of innate immunity |
| 3: | Extend their knowledge on immunogens, antigens, cytokines, immunoglobulins and different immune cells and their functions |

| | |
|---|---|
| 4: | Understand the hypersensitivity reactions, Immunological tolerance, autoimmunity and diseases |
| 5: | Explain and apply the immunological mechanisms of infectious and noncommunicable disease formation |
| 6: | Learn the basic idea about organ transplantation and vaccination |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, explain and analyse the parasites detection, diagnosis, prophylaxis and host parasite interactions | PO 1, 3 | PSO 4 | R, U, An |
| CO 2: | Demonstrate and apply the mechanisms of innate immunity | PO 1, 3 | PSO 4, 5 | U, Ap |
| CO 3: | Illustrate, analyse and discuss the importance of immunogens, antigens, cytokines, immunoglobulins and different immune cells and their functions | PO 1, 4 | PSO 4, 5 | U, An, C |
| CO 4: | Demonstrate and apply the hypersensitivity reactions, Immunological tolerance, autoimmunity and diseases | PO 1 | PSO 4 | U, Ap |
| CO 5: | Explain and apply the knowledge on immunological mechanisms of infectious and noncommunicable disease formation | PO 1, 3 | PSO 4, 5 | Ap, E |
| CO 6: | Demonstrate and explain the basic idea about organ transplantation and vaccination | PO 1 | PSO 4 | U, E |

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| SEMESTER – III | |
|---|---|
| **Course name** | **Developmental biology and Neurobiology** |
| **Course code** | **PGZOOCC 3.2** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Acquire knowledge on the early developmental processes and morphogenetic movements |
| 2: | Develop a deep knowledge on the cellular and molecular aspects of regenerative biology and stem cell |
| 3: | Develop a knowledge of nervous system organization and brain structure through imaging |
| 4: | Understand the nerve impulse transmission |
| 5: | Demonstrate the brain aging and various neuropathological diseases |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate and analyse the mechanisms of early developmental processes and morphogenetic movements | PO 1, 2 | PSO 1, 4 | R, U, An |
| CO 2: | Demonstrate and analyse the cellular and molecular aspects of regenerative biology and stem cell | PO 1, 2 | PSO 1, 4 | U, An |

| | | | | |
|---|---|---|---|---|
| CO 3: | Demonstrate and explain the nervous system organization and brain structure through imaging | PO 1 | PSO 1, 4 | U, E |
| CO 4: | Demonstrate, apply and explain the nerve impulse transmission | PO 1, 2, 3 | PSO 1, 4 | U, Ap, E |
| CO 5: | Demonstrate and explain the brain aging and various neuropathological diseases | PO 1 | PSO 1, 4, 5 | U, E |

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| SEMESTER – III | |
|---|---|
| **Course name** | **Endocrine physiology** |
| **Course code** | **PGZOOCC 3.3** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Demonstrate the molecular mechanisms of hormone action |
| 2: | Explain the role of hormone in cancers, endocrine disorders, stress and obesity disorders |
| 3: | Analyse the hormonal regulation of male &female reproductive systems. |
| 4: | Demonstrate the structure and functions of melatonin and Prostaglandins |
| 5: | Illustrate the reproductive disorders endocrine disruptions |

**Course Outcomes:**

**After completion of this course the student will be able to**

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate and explain the role of receptors and signalling pathways and feedback mechanisms in hormone action | PO 1 | PSO 5 | R, U, E |
| CO 2: | Explain and evaluate the role of hormone in cancers, endocrine disorders, stress and obesity disorders | PO 1, 4 | PSO 5 | U, E |
| CO 3: | Demonstrate, apply and discuss the hormonal regulation of male & female reproductive systems. | PO 1 | PSO 1, 5 | U, Ap, C |
| CO 4: | Explain the structure, biosynthesis and functions of melatonin and Prostaglandins | PO 1 | PSO 5 | E |
| CO 5: | Illustrate and discuss the reproductive disorders endocrine disruptions | PO 1, 4 | PSO 1, 5 | U, C |

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| SEMESTER – III | |
|---|---|
| **Course name** | **Elective paper-Entomology** |
| **Course code** | **PGZOOEC 3.1A** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Attain a solid foundation in insect biology, including general entomology, basic systematics, morphology, physiology, and biodiversity |
| 2: | Understand insect reproduction, development and hormonal regulation |
| 3: | Understand evolution and biodiversity generation |

| | |
|---|---|
| 4: | Demonstrate the application of social insects |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate, and explain insect biology, including general entomology, basic systematics, morphology, physiology, and biodiversity | PO 1, 2 | PSO 1, 2, 5 | R, U, E |
| CO 2: | Demonstrate, apply and explain the insect reproduction, development and hormonal regulation | PO 1, 3 | PSO 1, 2, 3 | U, Ap, E |
| CO 3: | Demonstrate, apply and adapt the significance of parthenogenesis Paedogenesis in social insects | PO 1, 3 | PSO 1, 5 | U, Ap, C |
| CO 4: | Demonstrate, apply and explain the evolution and biodiversity generation | PO 1, 4 | PSO 1, 2, 5 | U, Ap, E |
| CO 5: | Demonstrate, evaluate, and discuss the application of social insects | PO 1, 4 | PSO 1, 5 | U, E, C |

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| SEMESTER – III | |
|---|---|
| **Course name** | **Elective paper -Cellular and Molecular Biology** |
| **Course code** | **PGZOOEC 3.1B** |
| **Course type** | **Theory (Elective)** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Remember and understand advanced issues related to structure and metabolism of Carbohydrates, Amino acids, Lipids, and nucleic acids |
| 2: | Demonstrate the diagnostic aspect of enzymology |
| 3: | Remember, understand the cellular organization, cell division and cell cycle |
| 4: | Understand and compare some essentials ideas of molecular biology |
| 5: | Demonstrate the applications of some tools and techniques in molecular biology |
| 6: | Elaborate the application of tools for genetic engineering |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and demonstrate advanced issues related to structure and metabolism of Carbohydrates, Amino acids, Lipids, and nucleic acids | PO 1 | PSO 1 | R, U |
| CO 2: | Demonstrate, apply and elaborate the role of various enzymes in disease formation and disease diagnosis | PO 1, 2 | PSO 1, 4 | U, Ap, C |
| CO 3: | Define, demonstrate the cellular organization, cell division and cell cycle | PO 1 | PSO 1 | R, U |
| CO 4: | Demonstrate, evaluate and compare the central dogma, its regulation and modifications | PO 1, 4 | PSO 1, 4 | U, An, E |
| CO 5: | Demonstrate, apply and discuss the tools and techniques in molecular biology | PO 1, 3, 4 | PSO 1,5 | U, Ap, C |

| | | | | |
|---|---|---|---|---|
| CO 6: | Demonstrate and elaborate the application of tools for genetic engineering | PO 1, 3, 4 | PSO 1, 5 | U, C |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – III | |
|---|---|
| **Course name** | **Immunology, Parasitology, Developmental Biology and Endocrinology** |
| **Course code** | **PGZOOCC 3.4** |
| **Course type** | **Practical** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl No. | Course Objectives: |
|---|---|
| 1: | Apply the knowledge of dissection or surgical procedure of various endocrine organs and microtome procedure |
| 2: | Analyse the bioassays of hormones like insulin and TSH |
| 3: | Quantify the glycogen/cholesterol/ascorbic and/fructose in given endocrine tissue |
| 4: | Apply the knowledge of chick embryo, mounting and stage identification |
| 5: | Apply the knowledge of preparation of stains, fixatives, culture media for parasites, and their spot identifications and blood smear examination |
| 6: | Apply the knowledge on preparation and gel electrophoresis of blood sera |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| **CO 1:** | Demonstrate and apply the knowledge of dissection or surgical procedure of various endocrine organs and microtome procedure | PO 1, 3 | PSO 1, 3 | U, Ap |
| **CO 2:** | Analyse and evaluate the bioassays of hormones like insulin and TSH | PO 2 | PSO 3, 4 | An, E |
| **CO 3:** | Analyse and estimate the glycogen/ cholesterol/ ascorbic and/fructose in given endocrine tissue | PO 2 | PSO 4 | An, C |
| **CO 4:** | Demonstrate and apply the knowledge of chick embryo, mounting and stage identification | PO 1, 2 | PSO 1, 3 | U, Ap |
| **CO 5:** | Demonstrate, apply and explain the knowledge of preparation of stains, fixatives, culture media for parasites, and their spot identifications and blood smear examination | PO 1, 2, 3 | PSO 1, 3 | U, Ap, E |
| **CO 6:** | Demonstrate and apply the knowledge on preparation and gel electrophoresis of blood sera | PO 2, 4 | PSO 4, 5 | U, Ap |

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| SEMESTER – III | |
|---|---|
| **Course name** | **Dissertation and practical of elective paper-Entomology** |
| **Course code** | **PGZOOEC 3.2A** |
| **Course type** | **Practical (Elective)** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|

| | |
|---|---|
| 1: | Apply the knowledge of Collection, Preservation, Curation, Identification and Classification of Major Insect Orders |
| 2: | Demonstrate the Dissection of Mouth parts, antenna and genitalia dissection of some major order of insects |
| 3: | Design and perform original research work in Entomology |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Demonstrate, explain and apply the knowledge of Collection, Preservation, Curation, Identification and Classification of Major Insect Orders | PO 1, 2, 3 | PSO 2, 3 | U, Ap, E |
| CO 2: | Demonstrate and evaluate the of Mouth parts, antenna and genitalia dissection of some major order of insects through dissection | PO 1, 2 | PSO 3 | U, E |
| CO 3: | Design and perform original research work in entomology | PO 4 | PSO 3, 5 | C |

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

| SEMESTER – III | |
|---|---|
| **Course name** | **Dissertation and practical of elective paper-Cellular and Molecular Biology** |
| **Course code** | **PGZOOEC 3.2B** |
| **Course type** | **Practicals (Elective)** |

**Course Objectives:**

**After completion of this course the student will be able to**

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Apply the knowledge of DNA and protein isolation and visualization |
| 2: | Apply the knowledge of bacterial culture and plasmid DNA preparation |
| 3: | Apply the knowledge of PCR primer designing |
| 4: | Design and perform original research work using molecular biology techniques |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Demonstrate, and apply the knowledge of DNA and protein isolation and evaluate the DNA quality through visualization | PO 1, 2 | PSO 3, 4 | U, Ap, E |
| CO 2: | Demonstrate perform and explain the bacterial culture and plasmid DNA preparation | PO 1, 2 | PSO 3, 4 | U, Ap, E |
| CO 3: | Demonstrate and design the PCR primer | PO 1, 2 | PSO 3, 4 | U, C |
| CO 4: | Design and perform original research work using molecular biology techniques | PO 2, 3, 4 | PSO 3, 5 | C |

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| SEMESTER – III | |
|---|---|
| **Course name** | **Value Education and Indian Culture** |
| **Course code** | **PGZOOSOC 3** |
| **Course type** | **Soft Skill** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Attain awareness about daily routine, self-evaluation & Integral Personality Development |
| 2: | Understand the educational needs, the Power of thoughts and the Science of Peace |
| 3: | Understand the relation: Values and enlightened citizenship |
| 4: | Attain awareness about the Indian Practice and Culture |
| 5: | Demonstrate the importance of Four Yogas |
| 6: | Acquire idea about Modern India: her hopes, challenges and Swami Vivekananda |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, demonstrate and apply the daily routine, self-evaluation & Integral Personality Development | PO 1 | PSO 5 | R, U, Ap |
| CO 2: | Learn, and apply the Power of thoughts & the Science of Peace | PO 4 | PSO 2, 5 | U, Ap |
| CO 3: | Demonstrate and explain the relation: Values and enlightened citizenship | PO 4 | PSO 5 | U |
| CO 4: | Discuss the awareness about the Indian Practice and Culture | PO 4 | PSO 5 | C |
| CO 5: | Demonstrate and practice the Four Yogas | PO 1 | PSO 5 | U, Ap |
| CO 6: | Explain and analyse the idea about Modern India: her hopes, challenges and Swami Vivekananda | PO 3, 4 | PSO 2, 5 | U, An |

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| SEMESTER – IV | |
|---|---|
| **Course name** | **Taxonomy and Biostatistics** |
| **Course code** | **PGZOOCC 4.1** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Understand, apply and analyse the basic concepts in taxonomy & phylogenetics and biostatistics |

| | |
|---|---|
| 2: | Analyse and evaluate the descriptive statistics and diagrammatic representation of data |
| 3: | Understand and apply research methodologies in future research |
| 4: | Understand, evaluate and apply the biological data analysis tools and techniques |
| 5: | Understand, analyse and apply the machine learning in biological data analysis and representation |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define and explain the basic statistical concepts. | PO 1 | PSO 3, 4 | R, E |
| CO 2: | Demonstrates, apply and analyse the descriptive statistics and construct skills in diagrammatic representations | PO 1, 2 | PSO 3, 4 | U, An, Ap, C |
| CO 3: | Apply various sampling techniques and statistical inference to solve various problems | PO 2, 3 | PSO 3, 4 | Ap, C |
| CO 4: | Formulate research objectives and research methodologies respectively | PO 3, 4 | PSO 5 | C |
| CO 5 | Apply machine learning tools to construct decisions | PO 3, 4 | PSO 4 | Ap, C |

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| SEMESTER – IV | |
|---|---|
| **Course name** | **Bioinformatics & Computational biology** |
| **Course code** | **PGZOOCC 4.2** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Understand the basic concepts in Bioinformatics/Computational biology and its applications in various fields |
| 2: | Understand, analyse and apply biological databases available online |
| 3: | Understand and apply algorithms for the sequence alignment and computational calculations used in bioinformatics tools |
| 4: | Understand, evaluate and apply the computational techniques in genomics, transcriptomics and proteomics |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Describe and explain various database used for nucleotides and proteins | PO 1 | PSO 4 | R, E |
| CO 2: | Demonstrate apply and discuss various algorithms for sequence analysis and molecular interactions | PO 1, 2 | PSO 4 | U, Ap, C |
| CO 3: | Analyses nucleotide and protein sequences using various databases and software tools | PO 2 | PSO 4 | An |
| CO 4: | Evaluate RNA interference and RNA regulatory networks. | PO 3 | PSO 4, 5 | E |
| CO 5: | Predict gene, ORF, protein structure and their functional role. | PO 4 | PSO 4 &5 | C |

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| SEMESTER – IV | |
|---|---|
| **Course name** | **Bio python And LaTeX** |
| **Course code** | **PGZOOCC 4.3** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Learn the handling and analysis of nucleotide, protein sequences and databases. |
| 2: | Create neural networks and learn genetic algorithms. |
| 3: | Create and design documents in LaTeX. |
| 4: | Prepare presentations in Beamer with confidence. |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | PSOs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Demonstrate, evaluate and apply the handling and analysis of nucleotide, protein sequences and databases. | PO 1, 2, 3 | PSO 1, 4 | R, E, Ap |
| CO 2: | Demonstrate, analyse and create neural networks and learn genetic algorithms. | PO 1, 2, 4 | PSO 1, 4, 5 | U, An, C |
| CO 3: | Organize documents into different sections, subsections, etc.., Formatting pages (margins, header, footer, orientation), Formatting text, create presentations using Beamer | PO 1 | PSO 4, 5 | Ap, C |
| CO 4: | Write complex mathematical formulae, Include tables and images, Cross-referencing, bibliography, and Indexing | PO 1, 3 | PSO 4, 5 | Ap, C |

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| SEMESTER – IV | |
|---|---|
| **Course name** | **Elective paper (Entomology)** |
| **Course code** | **PGZOOEC 4.1A** |
| **Course type** | **Theory (Elective)** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Understand the application of insect biology in the field of agriculture, forest ecology, vector biology and forensic science |
| 2: | Demonstrate the application of insect apiculture, sericulture, and lac culture |
| 3: | Understand the global environmental impact on insects |
| 4: | Demonstrate the various aspect of Insect Ecology |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| CO 1: | Demonstrate, evaluate, analyse and apply the insect biology and its diversity in the field of agriculture, forest ecology, vector biology and forensic science | PO 1, 2, 3 | PSO 1, 2, 5 | U, E, An, Ap |
| CO 2: | Define, Demonstrate and apply the knowledge of insect biology in apiculture, sericulture, and lac culture | PO 1, 3 | PSO 1, 2, 5 | R, U, Ap |
| CO 3: | Demonstrate, access and apply the insect diversity in environment monitoring and the global environmental impact on insects | PO 1, 2, 3 | PSO 1, 2, 5 | U, E, Ap |
| CO 4: | Demonstrate, apply and discuss the various aspect of Insect Ecology | PO 1, 4 | PSO 1, 2, 5 | U, Ap, C |

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| SEMESTER – IV | |
|---|---|
| **Course name** | **Elective paper 2B (Cellular and Molecular Biology)** |
| **Course code** | **PGZOOEC 4.1B** |
| **Course type** | **Theory (Elective)** |

**Course Objectives:**

After completion of this course the student will be able to

| SL. No. | Course Objectives: |
|---|---|
| 1: | Remember and understand cellular metabolic disorders |
| 2: | Understand and evaluate the mendelian principles related to cell biology |
| 3: | Remember, understand and apply the gene transfer and gene manipulation methodologies |
| 4: | Understand, design and apply the tools and techniques in molecular biology viz. PCR, Cloning, |
| 5: | Understand, analyse and apply various nucleotide sequencing techniques |

**Course Outcomes:**

**After completion of this course the student will be able to**

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Demonstrate and analyse various cellular metabolic disorders | PO 1 | PSO 1 | U, An |
| CO 2: | Demonstrate and evaluate the mendelian principles related to gene interactions and construct pedigree | PO 1, 2 | PSO 4 | U, E, C |
| CO 3: | Define, demonstrate and discuss the gene transfer and gene manipulation methodologies in biotechnology | PO 1, 3 | PSO 4, 5 | R, U, C |
| CO 4: | Demonstrate, design and apply the tools and techniques in molecular biology viz. PCR, Cloning, | PO 1, 2, 3 | PSO 4, 5 | U, C, Ap |
| CO 5: | Demonstrate, evaluate and apply various nucleotide sequencing techniques | PO 1, 2, 3 | PSO 4, 5 | U, E, Ap |

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| SEMESTER – IV | |
|---|---|
| **Course name** | Phylogenetics, Biostatistics and Bioinformatics |
| **Course code** | **PGZOOCC 4.4** |
| **Course type** | **Practical** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Apply MEGA software to draw Phylogenetic tree |
| 2: | Demonstrate the molecular taxonomy and bar coding |
| 3: | Demonstrate and apply the Basics and operations of R, Data Visualization with R |
| 4: | Perform various data analysis tools and techniques |
| 5: | Apply the concept of facilitating the access from various Bioinformatics databases |
| 6: | Perform various in silico Experiments |
| 7: | Apply the python for bioinformatic analysis |

**Course Outcomes:**
**After completion of this course the student will be able to**

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Demonstrate and apply MEGA software to draw Phylogenetic tree | PO 1, 2 | PSO 3 | U, Ap |
| CO 2: | Demonstrate, analyse and evaluate the molecular taxonomy and bar coding | PO 1, 2 | PSO 3, 4 | U, An, E |
| CO 3: | Demonstrate and apply the Basics operations in R, data Visualization with R and construct graph | PO 1, 2 | PSO 3, 4 | U, Ap, C |
| CO 4: | Demonstrate and apply various data analysis tools and techniques | PO 1, 3 | PSO 3, 4, 5 | U, Ap |
| CO 5: | Demonstrate, evaluate and apply the concept of facilitating the access from various Bioinformatics databases | PO 1, 4 | PSO 3, 4, 5 | U, E, Ap |
| CO 6: | Examine various in silico Experiments | PO 1, 4 | PSO 4 | An |
| CO 7: | Demonstrate and apply the python for bioinformatic analysis | PO 1, 2 | PSO 3, 5 | U, Ap |

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| SEMESTER – IV | |
|---|---|
| **Course name** | **Submission of final dissertation and practical of elective paper - Entomology** |
| **Course code** | **PGZOOEC 4.2A** |
| **Course type** | **Dissertation Project and Practical (Elective)** |

**Course Objectives:**
After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Apply the knowledge of morphology of typical insects under different orders |
| 2: | Demonstrate the wing venations of insects under order Diptera, Coleoptera & Lepidoptera |
| 3: | Prepare a report on Apiary / Sericulture institute visit |
| 4: | Design and perform original research work in Entomology |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Demonstrate and evaluate the knowledge of morphology of typical insects under different orders | PO 1 | PSO 3 | U, E |
| CO 2: | Demonstrate, analyse and evaluate the wing venations of insects under order Diptera, Coleoptera & Lepidoptera | PO 1, 4 | PSO 2, 3 | U, Ap, E |
| CO 3: | Prepare a report on Apiary / Sericulture institute visit | PO 1, 3 | PSO 3, 5 | C |
| CO 4: | Design, examine and interpret original research work in Entomology | PO 1, 4 | PSO 3, 5 | C, |

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| SEMESTER – IV | |
|---|---|
| **Course name** | **Dissertation (Submission of final dissertation) and practical of elective paper - Cellular and Molecular Biology** |
| **Course code** | **PGZOOEC 4.2B** |
| **Course type** | **Dissertation Project and Practical (Elective)** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Apply the knowledge of PCR |
| 2: | Apply the knowledge of cloning and sequencing |
| 3: | Apply the knowledge of mitochondrial DNA barcoding |
| 4: | Design, examine and interpret original research work using molecular biology techniques |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Demonstrate, explain and apply the knowledge of PCR | PO 1, 2 | PSO 3, 4 | U, E, Ap |
| CO 2: | Demonstrate, perform and discuss cloning and sequencing | PO 1, 2, 3 | PSO 3, 4 | U, Ap, C |
| CO 3: | Demonstrate and apply the knowledge of DNA barcoding | PO 1, 2, 3 | PSO 3, 4 | U, Ap |
| CO 4: | Design, examine and interpret original research work using molecular biology techniques | PO 2, 4 | PSO 3, 5 | C, Ap, E |

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| SEMESTER – IV | |
|---|---|
| **Course name** | **Fundamentals of remote sensing and GIS** |
| **Course code** | **PGZOOSOC-4** |
| **Course type** | **Theory** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Learn the basics of GIS and remote sensing and its application |
| 2: | Demonstration and learn the basic Map preparation in ArcGIS |
| 3: | Learn how the handling satellite data download and visualization |

**Course Outcomes:**

After completion of this course the student will be able to

| CO No. | Course Outcomes: | POs Addressed | PSOs Addressed | Cognitive Level |
|---|---|---|---|---|
| CO 1: | Define, Demonstrate and evaluate the basics of GIS and remote sensing and its application | PO 1, 3 | PSO 3, 5 | R, U, E |
| CO 2: | Demonstrate and apply the basic Map preparation in ArcGIS | PO 1, 2 | PSO 3, 5 | U, Ap, C |
| CO 3: | Illustrate and analyses the handling of satellite data and visualization | PO 1, 2, 3 | PSO 3, 4 | U, An |

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# RAMAKRISHNA MISSION VIVEKANANDA CENTENARY COLLEGE

RAHARA, KOLKATA-700118

## DEPARTMENT OF ZOOLOGY

## SESSION 2020-21

**Programme Outcomes, Programme Specific Outcomes, Course Objectives and Course Outcomes of Ph. D. Zoology Syllabus**

Principal
Ramakrishna Mission
Vivekananda Centenary College
Rahara, Kolkata-700 118

## PROGRAM OUTCOMES

After completion of the Ph.D. Degree program, the students will be able to

| PO No. | Program Outcomes | Cognitive Level |
|---|---|---|
| PO 1 | Understands and apply theories, methodologies, and knowledge to address fundamental questions in their primary area of study. | U, Ap |
| PO 2 | Demonstrate the gained knowledge and skills in oral and written and hence communicate them to publish and present work in their field. | E, C |
| PO 3 | Develop a mastery of analysing skills and knowledge at a level required for college and university undergraduate teaching in their discipline and assessment of student learning. | An |
| PO 4 | Develop the intellectual independence that epitomizes true scholarship and Pursue research of significance in the discipline under the guidance of an advisor. | C |

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## PROGRAMME SPECIFIC OUTCOMES

After the successful completion of this course, the student will be able to:

| PSO No. | Program Specific Outcomes | Cognitive Level |
|---|---|---|
| PSO1 | Participate in research in the field of Zoology along with other fields of Life Sciences. | Ap |
| PSO2 | Understand, apply and evaluate advanced experimental and theoretical techniques in animal science. | U, Ap, E |
| PSO3 | Develop proficiency in research methodology, critical thinking skills and conduct cutting-edge research. | An, C |
| PSO4 | Ability to conduct independent research to get post-doctoral position aiming for an academic career or find employment in industrial R&D laboratories. | C |

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| Credit Distribution across the Course | | | |
|---|---|---|---|
| **Course Type** | **Total Papers** | **Credit** | **Total Credit** |
| Common | 3 | 3×4 | 12 |
| Special | 1 | 1x4 | 4 |
| | | Total | 16 |

| List of Common Courses | | |
|---|---|---|
| **Code** | Course | **Credit** |
| **PHDZOO 01** | **Research Methodology** | **4** |
| **PHDZOO 02** | **Computer Applications** | **4** |
| **PHDZOO 03** | **Literature review** | **4** |
| Special | | |
| **PHDZOO 04** | **Tools and techniques in molecular biology and biochemistry** | **4** |
| **PHDZOO 05** | **Pharmacology and Toxicology** | **4** |
| **PHDZOO 06** | **Anti-Microbial Defence** | **4** |
| **PHDZOO 07** | **Ecology, Environment and animal behaviour** | **4** |
| **PHDZOO 08** | **Bioinformatics and computational Biology** | **4** |

| SEMESTER – I | |
|---|---|
| **Course name** | **Research Methodology** |
| **Course code** | **PHDZOO 01** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | Develop the ability to choose methods appropriate to research aims and objectives. |
| 2: | Understand the advantages and disadvantages of particular research method. |
| 3: | Develop skill of critical thinking and the skill of qualitative and quantitative data analysis and presentation. |
| 4: | Prepare students for organizing and conducting research in a more appropriate manner |

## Course Outcomes (PHDZOO 01)

On successful completion of the course students will be able to:

| CO. No. | Course Outcome | Cognitive Level | POs Addressed | PSOs Addressed |
|---|---|---|---|---|
| CO1 | Understand the objectives, motivation and types of research | U | PO1 | PSO2 |
| CO2 | Define and formulate a research problem | R, C | PO4 | PSO1 |
| CO3 | Collect data (primary or secondary) based on the formulated problem and analyse the data. | An | PO2 | PSO3 |
| CO4 | Analyse the data with hypothesis testing, generalization and interpretation. | An, C | PO3 | PSO4 |
| CO5 | Discuss the application of results and write the thesis. | Ap, E | PO3 | PSO4 |

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| SEMESTER – I | |
|---|---|
| **Course name** | **Computer Applications** |
| **Course code** | **PHDZOO 02** |

**Course Objectives:**

After completion of this course the student will be able

| Sl. No. | Course Objectives: |
|---|---|
| 1: | To develop competency in technical writing. |
| 2: | To master the fundamentals of writing LaTeX and Python scripts. |
| 3: | To acquire Object Oriented Skills in Python. |
| 4: | To develop the skill of designing Graphical user Interfaces in Python and LaTeX. |
| 5: | To develop the ability to write database applications in Python. |

## Course Outcomes (PHDZOO 02)

On successful completion of the course students will be able to:

| CO. No. | Course Outcome | Cognitive Level | POs Addressed | PSOs Addressed |
|---|---|---|---|---|
| CO1 | Explain and use TeX and LaTeX. | An | PO2 | PSO1 |
| CO2 | Understand the advantages of LaTeX over other more traditional software's. | U | PO1 | PSO2 |
| CO3 | Prepare handouts and presentations using LaTeX. | C | PO4 | PSO3 |
| CO4 | Understand the core Python scripting elements such as variables and flow control structures. | U, Ap | PO1 | PSO3 |
| CO5 | Use Python to read, write, demonstrations files. | E, C | PO3 | PSO4 |

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| SEMESTER – I | |
|---|---|
| **Course name** | **Literature review** |
| **Course code** | **PHDZOO 03** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | To learn to review and assess scientific literature critically. |
| 2: | To write and present an overview of the relevant literature for a specific research topic. |
| 3: | To develop knowledge, insight, and academic skills. |
| 4: | To develop transferable skills & interpersonal skills. |

## Course Outcomes (PHDZOO 03)

On successful completion of the course students will be able to:

| CO. No. | Course Outcome | Cognitive Level | POs Addressed | PSOs Addressed |
|---|---|---|---|---|
| CO1 | Identify and retrieve relevant publications within a field of research and write a literature review by searching the literature systematically. | An, E | PO2 | PSO1 |
| CO2 | Select representative scientific sources from several perspectives relevant to the assignment. | E | PO2 | PSO2 |
| CO3 | Write a research proposal for obtaining Financial assistance from national funding agencies. | C | PO4 | PSO4 |
| CO4 | Draw conclusions related to the research problem and give recommendations towards new research opportunities. | C | PO4 | PSO3 |

| | | | | |
|---|---|---|---|---|
| CO 5 | Represent and systematically structure a discussion on the theories and experimental results and define, design and write a literature review independently | An, C | PO3 | PSO3 |

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| SEMESTER – I | |
|---|---|
| **Course name** | **Tools and techniques in molecular biology and biochemistry** |
| **Course code** | **PHDZOO 04** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | To develop competency in molecular biology techniques |
| 2: | To apply techniques in biomolecules purification and characterisation |
| 3: | To acquire knowledge in microscopic and histochemistry techniques |
| 4: | To develop the ability in designing and conducting molecular biology and genetic engineering experiments. |

## Course Outcomes (PHDZOO 04)

On successful completion of the course students will be able to:

| CO. No. | Course Outcome | Cognitive Level | POs Addressed | PSOs Addressed |
|---|---|---|---|---|
| CO1 | Develop competency in molecular biology techniques | Ap | PO1 | PSO1, 3 |
| CO2 | Demonstrate and apply techniques in biomolecules purification and characterisation | U | PO2 | PSO2 |
| CO3 | Apply and analyse microscopic and histochemistry techniques | Ap, E | PO3 | PSO3 |
| CO4 | Design research experiments in molecular biology and genetic engineering. | C | PO4 | PSO3 |
| CO5 | Conducting molecular biology and genetic engineering experiments. | C | PO4 | PSO4 |

| SEMESTER – I | |
|---|---|
| **Course name** | **Pharmacology and Toxicology** |
| **Course code** | **PHDZOO 05** |

**Course Objectives:**

After completion of this course the student will be able

| Sl. No. | Course Objectives: |
|---|---|
| 1: | To understand the scopes and techniques in Pharmacology and Toxicology. |
| 2: | To demonstrate and evaluate the mechanism of Drug actions. |

| | |
|---|---|
| 3: | To acquire knowledge on Pharmacogenomics. |
| 4: | To develop the skill of designing experiments in Pharmacology and Toxicology. |
| 5: | To develop the ability to conduct experiments in Pharmacology and Toxicology. |

**Course Outcomes (PHDZOO 05)**

On successful completion of the course students will be able to:

| CO. No. | Course Outcome | Cognitive Level | POs Addressed | PSOs Addressed |
|---|---|---|---|---|
| CO1 | Demonstrate and apply the scopes and techniques in Pharmacology and Toxicology. | U, Ap | PO1 | PSO1, 2 |
| CO2 | Evaluate the mechanism of Drug actions. | E | PO2 | PSO2 |
| CO3 | Demonstrate and analyse the pharmacogenomics. | U, An | PO3 | PSO3 |
| CO 4 | Develop the skill of designing experiments in Pharmacology and Toxicology. | C | PO4 | PSO4 |
| CO 5 | conduct experiments in Pharmacology and Toxicology. | C | PO4 | PSO4 |

| SEMESTER – I | |
|---|---|
| **Course name** | **Anti-Microbial Defence** |
| **Course code** | **PHDZOO 06** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | To understand about the microbial pathogens and Anti-microbial defence. |
| 2: | To demonstrate and evaluate the role of natural compounds against microbes. |
| 3: | To acquire knowledge about the Chemotherapeutic agents. |
| 4: | To develop the skill of designing experiments to evaluate the impact of antimicrobial compounds. |
| 5: | To develop the ability to conduct experiments to evaluate the impact of antimicrobial compounds. |

**Course Outcomes (PHDZOO 06)**

On successful completion of the course students will be able to:

| CO. No. | Course Outcome | Cognitive Level | POs Addressed | PSOs Addressed |
|---|---|---|---|---|
| CO1 | Demonstrate the microbial pathogens and Anti-microbial defence. | U | PO1 | PSO2 |
| CO2 | Analyse and evaluate the role of natural compounds against microbes. | An, E | PO3, 2 | PSO3, 2 |
| CO3 | Demonstrate and apply the acquire knowledge about the Chemotherapeutic agents. | U, Ap | PO1 | PSO1, 2 |

| | | | | |
|---|---|---|---|---|
| CO 4 | Develop the skill of designing experiments to evaluate the impact of antimicrobial compounds. | C | PO4 | PSO4 |
| CO 5 | Ddevelop the ability to conduct experiments to evaluate the impact of antimicrobial compounds. | C | PO4 | PSO4 |

| SEMESTER – I | |
|---|---|
| **Course name** | **Ecology, Environment and animal behaviour** |
| **Course code** | **PHDZOO 07** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | To understand about the biodiversity and genetic diversity. |
| 2: | To demonstrate and evaluate the biodiversity through molecular and computational approach. |
| 3: | To acquire knowledge about the field studies and to apply various tools and techniques in biodiversity study. |
| 4: | To develop the skill of designing field-based experiments to evaluate the environmental impact on biodiversity. |
| 5: | To develop the ability to conduct experiments to evaluate the ecological and environmental impact on biodiversity. |

**Course Outcomes (PHDZOO 07)**

On successful completion of the course students will be able to:

| CO. No. | Course Outcome | Cognitive Level | POs Addressed | PSOs Addressed |
|---|---|---|---|---|
| CO1 | Demonstrate the biodiversity and genetic diversity. | U | PO1 | PSO2 |
| CO2 | Demonstrate and analyse the biodiversity through molecular and computational approach. | U, E | PO2, 3 | PSO2, 3 |
| CO3 | Apply the acquired knowledge about the field studies and evaluate various tools and techniques in biodiversity study. | Ap, E | PO1, 2 | PSO1 |
| CO 4 | Develop the skill of designing field-based experiments to evaluate the environmental impact on biodiversity. | C | PO4 | PSO4 |
| CO 5 | Develop the ability to conduct experiments to evaluate the ecological and environmental impact on biodiversity. | C | PO4 | PSO4 |

| SEMESTER – I | |
|---|---|
| **Course name** | **Bioinformatics and computational Biology** |
| **Course code** | **PHDZOO 08** |

**Course Objectives:**

After completion of this course the student will be able to

| Sl. No. | Course Objectives: |
|---|---|
| 1: | To understand about the bioinformatics and its applications. |
| 2: | To demonstrate and evaluate various tools in bioinformatics. |
| 3: | To acquire knowledge about the genome analysis, gene mapping, gene identification, prediction and protein structure prediction. |
| 4: | To develop the skill of designing computational-based experiments. |
| 5: | To develop the ability to conduct computational-based experiments. |

**Course Outcomes (PHDZOO 08)**

On successful completion of the course students will be able to:

| CO. No. | Course Outcome | Cognitive Level | POs Addressed | PSOs Addressed |
|---|---|---|---|---|
| CO1 | Demonstrate the bioinformatics and its applications. | U | PO1 | PSO2 |
| CO2 | Demonstrate and evaluate various tools in bioinformatics. | U, E | PO1, 2 | PSO2 |
| CO3 | Apply and analyse the genome sequence, gene mapping, gene identification, prediction and protein structure prediction. | Ap, An | PO1, 3 | PSO1, 3 |
| CO 4 | To develop the skill of designing computational-based experiments. | C | PO4 | PSO4 |
| CO 5 | To develop the ability to conduct computational-based experiments. | C | PO4 | PSO4 |