**Deccan Education Society's**
**Fergusson College (Autonomous), Pune**

**Program Specific Outcomes (PSOs) and Course Outcomes (COs) 2019-20**
**Department of Zoology**
**Programme: M. Sc. Zoology**

| PSO No. | Program Specific Outcomes (PSOs)<br>Upon completion of this programme the student will be able to |
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| **PSO1** | **Academic Competence:**<br>(i) Describe fundamental concepts, principles and processes underlying the life science its different disciplines.<br>(ii) Understand the evolutionary, genetical, molecular, histological, and behavioural context of biological thought and research, and the contributions of physiological, anatomical, immunological and cellular studies of animals, to the resolution of medical, social and environmental issues even at molecular level.<br>(iii) Demonstrate a wide range of biochemical techniques, physiological processes, cellular activities, developmental and evolutionary processes, statistical methods and bioinformatics. |
| **PSO2** | **Personal and Professional competence:**<br>(i) Demonstrate the competence in fundamental zoological skills/techniques and experimentation using various methods in animal models and their behaviour, cell and molecular biology, biochemistry, developmental biology and immunology.<br>(ii) Illustrate methods in evolutionary biology, environmental science , biostatistics and bioinformatics and analyse biological data statistically.<br>(iii) Formulation of ideas, scientific writing and authentic reporting, effective presentation and communication skills . |
| **PSO3** | **Research Competence:**<br>(i) Analyse and interpret results obtained in cell biology, molecular biology, biochemistry, genetics, developmental biology, immunology, histology.<br>(ii) Create biological data and skills to explore and authenticate data for experimental and research purpose. |
| **PSO4** | **Entrepreneurial and Social competence:**<br>(i) Evaluate data of the societal relevance of biological systems and the processes and apply the knowledge of zoology in the different fields to address problems related to human kind.<br>(ii) Collaborate in various zoological services with demonstration of true values of leadership, co-operation, hard work, teamwork etc. during the field works, surveys and field visits. |

| . Semester I | | |
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| **Title of the Course and Course Code** | **Comparative Anatomy of Vertebrates ZOO4101** | **Number of Credits : 04** |
| **On completion of the course, the students will be able to:** | | **Bloom's Cognitive level** |
| CO1 | Describe development of kidney and the evolution of kidneys in vertebrate. Define meninges and write development and differentiations of various parts of brain of vertebrates. Define the hemopoiesis. | 1 |
| CO2 | Explain origin and types of cartilage, development of bones and types of joint. Compare skull bones of vertebrates. Discuss various types of vertebrae of vertebrates. Differentiate the girdles and appendicular bones of frog, Calotes, pigeon and human. | 2 |
| CO3 | Illustrate the origin and development of Alimentary canal. | 3 |
| CO4 | Compare the structure of integuments of vertebrate and list out the epidermal derivatives. Explain various types of epidermal glands and derivatives of vertebrates and explain the functions of epidermal gland and integument. Compare anatomical details of brain of shark, frog, Calotes, bird and rat. Explain the development of heart and compare heart of shark, frog, Calotes, pigeon and rat. | 4 |
| CO5 | Determine the development of gonads and explain the modification of genital ducts in vertebrates. | 5 |
| CO6 | Compile the knowledge of Evolution of Aortic arches of vertebrates, modification of oral cavity and sound producing organs of vertebrates. | 6 |
| **F. Y. M. Sc. Semester I** | | |
| **Title of the Course and Course Code** | **Cell Biology ZOO4102** | **Number of Credits : 04** |
| **On completion of the course, the students will be able to:** | | **Bloom's Cognitive level** |
| CO1 | Describe the concept of cell biology, protein sorting, cell -cell signalling, cell death, cell ageing. Identify and label components of the cells and describe their functions. | 1 |
| CO2 | Differentiate the concept and mechanism of programmed cell death and necrosis, cytoskeletal material and various transport processes across the cell membrane. | 2 |
| CO3 | Illustrate the biology of ageing, cancer and molecular approaches to cancer treatment. Outline intrinsic and extrinsic | 3 |

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| | pathways of cell death, mechanism of vesicular transport. | |
| CO4 | Identify and draw diagrams of cell membrane and cell organelles and analyse their functions. | 4 |
| CO5 | Review the process of cell renewal, applications of stem cells, pathways of signal transduction, signalling networks. | 5 |
| CO6 | Integrate the knowledge of cellular mechanism with research activities to understand and interpret the alterations happening in the cell structure and functions due to physical, chemical and ecological factors. | 6 |
| **F. Y. M. Sc. Semester I** | | |
| **Title of the Course and Course Code** | **Biochemistry ZOO4103** | **Number of Credits : 04** |
| **On completion of the course, the students will be able to:** | | **Bloom's Cognitive level** |
| CO1 | Outline concept of Biomolecules, its importance and explain types of biomolecules in biological system. Describe structure and properties of proteins, DNA and RNA. | 1 |
| CO2 | Classify types of enzymes and explain effect of various factors on enzymatic reaction. | 2 |
| CO3 | Illustrate the metabolism of carbohydrates and proteins. | 3 |
| CO4 | Explain Lipid metabolism and its importance. Compare mitochondrial and peroxisomal systems of fatty acid oxidation. | 4 |
| CO5 | Compare α, β and ώ oxidation of fatty acids. Review energetics of carbohydrates and lipid metabolism. | 5 |
| CO6 | Write about the role of enzymes with respect to metabolic reactions. | 6 |
| **F. Y. M. Sc. Semester I** | | |
| **Title of the Course and Course Code** | **Zoology Practical –I (Comparative Anatomy of Vertebrates and Cell Biology ZOO4104** | **Number of Credits : 04** |
| **On completion of the course, the students will be able to:** | | **Bloom's Cognitive level** |
| CO1 | Describe and demonstrate the experiment for preparation of mitotic and meiotic stages of chromosome and the effect of colchicine on mitosis. | 1 |
| CO2 | Clarify the method of determination of chiasma frequency and terminalization coefficient. Illustrate preparation of blood smear and differential count. | 2 |
| CO3 | Demonstrate and illustrate the mechanism of phagocytosis, pinocytosis and subcellular fraction. | 3 |
| CO4 | Differentiate the skin and integumentary glands, skull of vertebrate animals. | 4 |
| CO5 | Compare and apprise vertebrates of frog and human, pelvic and pectoral girdles of different groups of vertebrates. | 5 |
| CO6 | Compile the comparative anatomical data of Pisces, Amphibians, Reptiles, Aves and Mammals and prepare a | 6 |

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| | report. | |

| F. Y. M. Sc. Semester I | | |
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| **Title of the Course and Course Code** | **Zoology Practical-II<br>Biochemistry (P core 2) and any one Elective (Animal Behaviour OR Endocrinology) ZOO4105** | **Number of Credits : 04** |
| **On completion of the course, the students will be able to:** | | **Bloom's Cognitive level** |
| CO1 | Describe concept of standard Laboratory Practices and techniques of Sterilization and of equipments. | 1 |
| CO2 | Estimate different biomolecules by qualitative and quantitative methods. | 2 |
| CO3 | Carry out and examine enzyme reaction and compare the effect of temperature and pH on enzyme activity. | 3 |
| CO4 | Explain the geotaxis behaviour, orientation responses, feeding responses, orientation responses and observe animal behaviour. | 4 |
| CO5 | Determine blood glucose and liver glycogen levels using suitable model. | 5 |
| CO6 | Perform the calibrations of centrifuge, colorimeter/spectrophotometer, pH meter. Specify the standardization of different acid and bases. | 6 |
| **Elective - Animal Behaviour** | | |
| CO1 | Describe geotaxis behaviour of earthworm, and outline the orientational responses of 1stinstar noctuid larvae to photo stimuli. Identify the soil to which the earthworm are attracted. | 1 |
| CO2 | Differentiate changes in earthworm responsiveness. Identify and compare the effect of household and natural solutions on behaviour of ants. | 2 |
| CO3 | Demonstrate orientational responses of 1stinstar noctuid larvae to photo stimuli | 3 |
| CO4 | Categorize and classify animal behaviour, and explain Display Behaviour of Siamese Fighting Fish (Betta splendens) Analyse effect of household and natural solutions on behaviour of ant | 4 |
| CO5 | Determine the median threshold concentration of sucrose solution in eliciting feeding responses of housefly | 5 |
| CO6 | Design, and perform experiment by using a choice chamber to investigate animal responses to stimuli. | 6 |
| **Elective -Advanced Endocrinology** | | |
| CO1 | Recall the basic concepts of endocrinology and histological aspects of endocrine organs. | 1 |
| CO2 | Explain the basic theory of endocrinological processes with special reference to hormonal regulation | 2 |
| CO3 | Apply the principle and protocols for estimation and determination of endocrine components | 3 |
| CO4 | Analyse anatomical/histological features and interpret clinical conditions of hormones. | 4 |
| CO5 | Determine the hormonal levels of selected endocrine organs | 5 |

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| | and estimate their hormonal levels | |
| CO6 | Perform experiments based on endocrine parameters and prepare a report of observations | 6 |
| **F. Y. M. Sc. Semester I** | | |
| **Title of the Course and Course Code** | **Animal Behaviour ZOO4106** | **Number of Credits : 04** |
| **On completion of the course, the students will be able to:** | | **Bloom's Cognitive level** |
| CO1 | Describe the behavioural Genetics and social behaviour of animals | 1 |
| CO2 | Explain and discuss how language evolved in primates and different modes of communication. | 2 |
| CO3 | Illustrate the role of nerves and hormones in controlling behaviour. | 3 |
| CO4 | Classify different behavioural patterns of animals to study and analyse animal psychology. | 4 |
| CO5 | Review reproductive behaviour and biological Rhythms. | 5 |
| CO6 | Write a report on application of Animal behaviour and outline different approaches and methods in study of behaviour. | 6 |
| **F. Y. M. Sc. Semester I** | | |
| **Title of the Course and Course Code** | **Advanced Endocrinology ZOO4108** | **Number of Credits : 04** |
| **On completion of the course, the students will be able to:** | | **Bloom's Cognitive level** |
| CO1 | Describe endocrine glands, their structural features, hormones secreted by endocrine glands /organs and hormone- Cell receptor mechanism. | 1 |
| CO2 | Explain role of pancreas as endocrine organ, hormones of pancreas and carbohydrate metabolism and related clinical aspects. | 2 |
| CO3 | Illustrate role of pancreas and thyroid gland, its physiological role and clinical implications. | 3 |
| CO4 | Classify different classes of hormones and their mechanism of action with special reference to receptor mechanisms and its processing through signal transduction. | 4 |
| CO5 | Review reproductive endocrine system and hormone disruptors Human Exposure to environmental factors, and its Clinical Implications | 5 |
| CO6 | Write a report on hormonal disruptors and associated disorders. | 6 |

| F. Y. M.Sc. Semester II | | |
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| **Title of the Course and Course Code** | **Comparative Physiology of Vertebrates ZOO4201** | **Number of Credits : 04** |
| **On completion of the course, the students will be able to:** | | **Bloom's Cognitive level** |
| CO1 | Describe the concepts of comparative physiology, its importance, functions of organs and organ systems of different groups of vertebrates. | 1 |
| CO2 | Discuss the structure of skeletal muscles and mechanism of muscular contraction. Articulate the conduction of impulses through the neurons and ultra- mechanism of osmoregulation in aquatic and terrestrial animals. | 2 |
| CO3 | Apply the knowledge of physiology to interpret effect of exercise on cardiovascular activities. Generalize the role of kidney in regulation of acid base balance, neurotransmitters and their role. | 3 |
| CO4 | Explain the physiology of reproductive activities in vertebrates and analyse the $O_2$ dissociation curve and its physiological and ecological importance. | 4 |
| CO5 | Compare the functioning of different systems of vertebrate animals. | 5 |
| CO6 | Compile the comparative data of physiological aspects related to digestive, respiratory, circulatory, excretory systems, reproductive and neuromuscular systems. | 6 |
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| **Title of the Course and Course Code** | **Genetics ZOO4202** | **Number of Credits : 04** |
| **On completion of the course, the students will be able to:** | | **Bloom's Cognitive level** |
| CO1 | Describe the different concepts and methods available to study classical genetics. | 1 |
| CO2 | Explain Non Mendelian Inheritance, chromosomal inheritance and variations. | 2 |
| CO3 | Apply the concepts and genetical processes for physical mapping of genes. | 3 |
| CO4 | Analyse variations in genetic and environmental factors in quantitative genetics. | 4 |
| CO5 | Determine probability and exercises for solving basic and population genetics problems. | 5 |
| CO6 | Write a report on Chromosomal Aberrations and genetic consequences. | 6 |

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| **Title of the Course and Course Code** | **Developmental biology ZOO4203** | **Number of Credits : 04** |
| **On completion of the course, the students will be able to:** | | **Bloom's Cognitive level** |
| CO1 | Define Axis formation. Describe stages of Animal Development, Embryonic Homologies, Malformations and Teratology, the cleavage and Gastrulation in chick. State the outline of developmental Biology. | 1 |
| CO2 | Discuss the patterns of developments in metazoans and unicellular eukaryotes, the post-embryonic development. Explain the segment formation and anterior-posterior body plan, the role of homeotic selector genes. | 2 |
| CO3 | Demonstrate the role of environment on animal development. Illustrate the process of fertilization, cleavage, gastrulation in Drosophila. | 3 |
| CO4 | Explain Hox Genes and Descent with Modification. Distinguish the process of primitive streak formation. | 4 |
| CO5 | Review the Principles of teratogenesis. Determine the Function of Genes during Development. | 5 |
| CO6 | Specify the process of teratogenesis. Compile teratogenic agents. Write the homologous Pathways of Development. Compile knowledge of neural tube formation. Design role of genes in axis specification in Drosophila. Write the process and types of Fertilization | 6 |
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| **Title of the Course and Course Code** | **Zoology Practical – III (Comparative Physiology of Vertebrates and Genetics) ZOO4204** | **Number of Credits : 04** |
| **On completion of the course, the students will be able to:** | | **Bloom's Cognitive level** |
| CO1 | Describe the pattern of sex linked inheritance with the help of mutants of Drosophila. Identify and detect the blood group. | 1 |
| CO2 | Estimate the gene frequencies in human population and analyse the data. | 2 |
| CO3 | Demonstrate preparation of Drosophila culture and Mendelian laws of inheritance with the help of Drosophila mutants. | 3 |
| CO4 | Explain and demonstrate the reflex action and various cellular changes during the oestrous cycle with the help of vaginal smear. | 4 |
| CO5 | Test the urine for its constituents. Determine the bleeding time and clotting time. | 5 |
| CO6 | Perform the experiments to estimate total plasma proteins, serum uric acid, oxygen consumption, compile the data and write the report. | 6 |

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| **Title of the Course and Course Code** | **Zoology Practical-IV**<br>**Subject- Developmental biology and any one elective (Immunology OR Environmental biology) ZOO4205** | **Number of Credits : 04** |
| **On completion of the course, the students will be able to:** | | **Bloom's Cognitive level** |
| **Developmental biology** | | |
| CO1 | Describe larval stages of *Drosophila*. | 1 |
| CO2 | Illustrate of different stages in Chick embryo (13 -72 hr). | 2 |
| CO3 | Examine a temporary mounting of 72 and 96 hours chick embryo. | 3 |
| CO4 | Explain angiogenesis in chick embryo. | 4 |
| CO5 | Evaluate the effects of teratogen on chick embryo development. | 5 |
| CO6 | Prepare a temporary slide of imaginal disc in *Drosophila.* | 6 |
| **Elective - Immunology** | | |
| CO1 | Identify the blood cells of immune system. | 1 |
| CO2 | Explain the basic process in Immunoelectrophoresis. | 2 |
| CO3 | Apply the technique for detection of antigen (ELISA). | 3 |
| CO4 | Analyse the antigen – antibody reaction while cross matching. | 4 |
| CO5 | Compare the histological structure of lymphoid organs. | 5 |
| CO6 | Specify the mechanism of antigen antibody interaction. | 6 |
| **Elective - Environmental biology** | | |
| CO1 | Describe different instruments/equipment which are used in environmental studies. | 1 |
| CO2 | Estimate population size & distribution. | 2 |
| CO3 | Calculate correlation coefficient and simple linear regression in a set of data. | 3 |
| CO4 | Analyze water quality to assess different physical and chemical parameters. Explain, identify communities and determine percentage frequency, density and abundance. | 4 |
| CO5 | Determine the biomass of a particular area., | 5 |
| CO6 | Write a report on landscape ecology. | 6 |

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| **Title of the Course and Course Code** | **Immunology ZOO4206** | **Number of Credits : 04** |
| **On completion of the course, the students will be able to:** | | **Bloom's Cognitive level** |
| CO1 | Recall the basic concepts of Immunology and describe which cell types and organs are involved in the immune response. | 1 |
| CO2 | Exemplify the adverse effect of immune system. including Allergy, hypersensitivity and autoimmunity | 2 |
| CO3 | Apply basic techniques for identifying antigen-antibody interactions. | 3 |
| CO4 | Explain the importance of phagocytosis and natural killer cells in innate body defence. | 4 |
| CO5 | Compare and contrast innate and adaptive immunity. | 5 |
| CO6 | Write various mechanisms that regulate immune responses and maintain tolerance. | 6 |
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| **Title of the Course and Course Code** | **Environmental biology ZOO4208** | **Number of Credits : 04** |
| **On completion of the course, the students will be able to:** | | **Bloom's Cognitive level** |
| CO1 | Describe basic concepts of ecology, different types of ecosystems, outline community organization and its structure. | 1 |
| CO2 | Interpret and explain interaction between environment and biota. | 2 |
| CO3 | Illustrate and demonstrate the characteristics/patterns of population and its dynamics with the help of case studies. | 3 |
| CO4 | Differentiate between Geometric and Exponential population grow. Analyze the limits of population growth and its case studies. | 4 |
| CO5 | Compare, evaluate and then evolve strategies of population study related to dispersal and growth, compile the data of case studies. | 5 |
| CO6 | Develop an in-depth knowledge of the large-scale ecology. Write a report on global and landscape ecology and human influence on atmospheric composition. | 6 |