

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI 600034

PG and Research Department of Advanced Zoology and Biotechnology

UG Restructured CBCS curriculum with effect from June, 2016 and 2019

Program Outcomes (PO)

- PO1 : Acquire knowledge and skill about the basics of animal sciences.
- PO2 : Analyse complex interactions among the various animals of different phyla.
- PO3 : Apply the knowledge of structural organisation of cell and metabolic functions.
- PO4 : Realize the complex evolutionary processes and behaviour of animals.
- PO5 : Understand the physiological processes of animals and role of organ systems.
- PO6 : To involve in environmental conservation and protection of endangered species.
- PO7 : Apply the knowledge gained in sericulture, fish farming and vermicomposting preparation.
- PO8 : Understand the concepts of genetics and its importance in human health and empathise animal life and rights.

Program Specific Outcomes (PSO)

- PSO1 : Acquire knowledge about the basics animal sciences.
- PSO2 : Understand the diversity and distribution of animals and their interaction with the environment.
- PSO3 : Understand the structural and functional properties of cell and metabolic pathways.
- PSO4 : Realise the complexity of evolutionary processes and animal behaviour.
- PSO5 : Understand the physiological processes and organ systems of animals.
- PSO6 : To play integral role in protection of environment and conservation of endangered species.
- PSO7 : Perform laboratory procedures in Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, Clinical science, Toxicology, Sericulture, Biochemistry, Fish biology, Animal biotechnology, Immunology and
- PSO8 : Understand the concepts of genetics and its relevance to human welfare.
- PSO9 : Apply ethical principles in animal experiments and commit to professional ethics.
- PSO10 : To impart skills and necessary training to initiate start-ups in the realm of life sciences.

Sub. Code/ Semester	Title of the paper/Category	Cognitive Level	Course Objectives	Course Outcome
16UZO1MC01 Semester I	Invertebrata (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To study the diversity of invertebrate fauna. 2. To understand the origin and evolution of fauna. 3. To understand the phylogenetic tree of invertebrate fauna. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the emergence and diversity of invertebrate fauna.</p> <p>CO2 : interpret the gradual emergence of life on earth.</p> <p>CO3 : understand that life originated from the sea.</p> <p>CO4 : analyse the impact of terrestrialization.</p> <p>CO5 : know invertebrates that gave rise to the modern day vertebrates.</p>
16UZO1MC02 Semester I	Invertebrata lab course (Major Core Lab)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To dissect the organ systems of invertebrates. 2. To compare the structure and function of invertebrate groups. 3. To understand adaptations in invertebrates. 	<p>Upon completion students should be able to</p> <p>CO1 : have hands on experience of dissecting invertebrates.</p> <p>CO2 : able to understand the structural features of invertebrates.</p> <p>CO3 : able to assess the development of adaptive features of invertebrates.</p> <p>CO4 : able to compare the emergence of evolutionary traits in invertebrates.</p> <p>CO5 : correlate the divergence of characters from common ancestors.</p>
16UZO1MC03 Semester I	Economic Entomology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To study the diversity of Class Insecta. 2. To understand the economic importance of insect groups. 3. To understand the use of insects for sustainable growth. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the diversity of Arthropods.</p> <p>CO2 : analyse the economic importance of insects.</p> <p>CO3 : ascertain the use of insects in pest control.</p> <p>CO4 : distinguish harmful and beneficial insects.</p> <p>CO5 : explore the use of insects in economic growth.</p>

16UPB1AL01 Semester I	Basics of Plant Biology (Allied)	K1, K2, K3	<ol style="list-style-type: none"> 1. To understand the diversity of plants. 2. To apply and practice taxonomy and systematics. 3. To understand the internal and external organisation of plants. 	<p>Upon completion students should be able to</p> <p>CO1 : describe the structure and reproduction on different groups of plants. CO2 : identify and describe different taxonomy groups. CO3 : compare internal structure of leaf, stem and root. CO4 : understand developmental stages and endosperm types. CO5 : comprehend physiological processes in plants.</p>
16UPB1AL02 Semester I	Basics of Plant Biology Lab (Allied Lab)	K1, K2, K3	<ol style="list-style-type: none"> 1. To apply and practice classification through dissection. 2. To develop skills on identification of plants. 3. To study internal organisation and embryological features of plants. 	<p>Upon completions students should be able to</p> <p>CO1 : learn classification and internal and external structure of plants. CO2 : acquire skills on identification and description the higher plants. CO3 : describe the internal structure of leaf, stem and root. CO4 : compare different types of embryos and its stages. CO5 : explain the phenomenon of osmosis, photosynthesis, respiration.</p>
16UZO01AL01 Semester I	Animal Diversity (to Plant Biology and Biotechnology) (Allied)	K1, K2, K3	<ol style="list-style-type: none"> 1. To impart conceptual knowledge of vertebrates and their adaptations. 2. To learn the associations of vertebrates in relation to their environment. 3. To understand the complex vertebrate interactions. 	<p>Upon completion students should be able to</p> <p>CO1 : describe general taxonomic rules on animal classification. CO2 : classify phylum Protochordates to Mammalia CO3 : understand the distribution of fauna. CO4 : understand animal behaviour and its response to different instincts. CO5 : Understand various kinds of Animal adaptations.</p>
16UZO01AL02 Semester II	Animal Diversity Lab (to Plant Biology and Biotechnology) (Allied Lab)	K1, K2, K3	<ol style="list-style-type: none"> 1. To learn animal organisation through dissection. 2. To understand comparative anatomy of invertebrates and chordates. 3. To learn the cellular grade of organisation in animals. 	<p>Upon completion students should be able to</p> <p>CO1 : understand diversity of life. CO2 : appreciate interaction of animals with environment. CO3 : apply system of classification. CO4 : understand the role of evolution. CO5 : attribute reasons for divergent evolution.</p>

19UZO02AL01 Semester II	Agricultural Entomology (to Plant Biology and Biotechnology) (Allied)	K1, K2, K3	<ol style="list-style-type: none"> 1. To learn the importance of the insects in the ecosystems. 2. To understand insect classification and significance of Arthropods. 3. To understand the role of insects in agriculture. 	<p>Upon completion students should be able to</p> <p>CO1 : understand insect morphology, anatomy and behaviour.</p> <p>CO2 : understand the agro-forestry environment and management of insects.</p> <p>CO3 : apply principles of pest management.</p> <p>CO4 : understand the economic importance of insects.</p> <p>CO5 : understand the ecological importance of IPM and green pesticides.</p>
19UZO02AL02 Semester II	Agricultural Entomology Lab (to Plant Biology and Biotechnology) (Allied Lab)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To practice classification and taxonomy in insects. 2. To learn the importance of agro forest ecosystem. 3. To understand the integral role of insects in agriculture. 	<p>Upon completion students should be able to</p> <p>CO1 : understand Insect biodiversity.</p> <p>CO2 : understand the Population dynamics of insects.</p> <p>CO3 : apply biological and microbiological control.</p> <p>CO4 : understand mechanical, physical and agronomical control.</p> <p>CO5 : infer chemical control and side effects of pesticides.</p>
16UZO2MC01 Semester II	Chordata (Major Core)		<ol style="list-style-type: none"> 1. To study the diversity of chordates. 2. To understand the origin and evolution of prochordates. 3. To understand the phylogenetic significance of chordate groups. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the emergence and diversity of chordates.</p> <p>CO2 : interpret the gradual emergence of life on earth.</p> <p>CO3 : understand the relevance of prochordates in evolution.</p> <p>CO4 : analyse the impact of terrestrialization.</p> <p>CO5 : ascertain the connecting links between the modern day vertebrates.</p>
16UZO2MC02 Semester II	Chordata lab course (Major Core Lab)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To dissect the organ systems of chordates. 2. To compare the structure and function of chordate groups. 3. To understand the structural and functional adaptations of chordates. 	<p>Upon completion students should be able to</p> <p>CO1 : have hands on experience of dissecting chordates.</p> <p>CO2 : understand the structural modifications of chordates.</p> <p>CO3 : assess the development of adaptive features.</p> <p>CO4 : compare the gradual emergence of evolutionary traits in chordates.</p> <p>CO5 : correlate the divergence of characters from common ancestors.</p>

16UZ02MC03 Semester III	Fundamentals of Biotechnology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To study and understand the theoretical background of biotechnology. 2. To understand the applications of biotechnology in industries. 3. To learn the extensive application of biotechnology in human health. 	<p>Upon completion students should be able to</p> <p>CO1 : have basic understanding on principle and practices of biotechnology. CO2 : understand the role of biotechnology in agriculture. CO3 : assess the extensive application of biotechnology in disease control. CO4 : develop tools and techniques to support IPR. CO5 : create and find employment in biotechnology industries.</p>
16UPB2AL01 Semester III	Applied Microbiology (from Plant Biology and Biotechnology) (Allied)	K1, K2, K3	<ol style="list-style-type: none"> 1. To learn the historical events in microbiology 2. To understand the diversity in microbes. 3. To learn the taxonomic classification of microorganisms 	<p>Upon completion Upon completion students should be able to</p> <p>CO1: understand different types of microbes and its classification. CO2: compare the structure of microbes and their reproduction. CO3: explain the nutritional requirement of microorganism. CO4: understand the roles of microbes in food, pharmaceutical applications. CO5: comprehend the microbes' role in environmental protection.</p>
16UPB2AL02 Semester III	Applied Microbiology Lab (from Plant Biology and Biotechnology) (Allied Lab)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To learn various sterilization techniques. 2. To gather theoretical background of microbial cultivation. 3. To understand various specialized techniques such as pasteurization 	<p>Upon completion students should be able to</p> <p>CO1: prepare clay models to understand bacterial shapes. CO2: perform sterilization technique and media preparation. CO3: acquire skills on isolation of bacteria and staining techniques. CO4 : understand microbial evolution. CO5 : apply and practice microbial cultivation.</p>
16UZ03MC01 Semester III	Animal Physiology & Biochemistry (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To study the basic principles and functioning of physiological systems. 2. To understand more complex physiological functions. 3. To understand the role of cells, organelles and molecules in physiology. 	<p>Students should be able to</p> <p>CO1 : understand and appreciate mammalian physiology. CO2 : understand the functions of important physiological systems. CO3 : understand how these systems produce physiological responses. CO4 : perform, analyse and report on experiments in physiology. CO5 : recognise and identify principal tissue structures.</p>

16UZ03MC02 Semester III	Animal Physiology & Biochemistry Lab course (Major Core Lab)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To study the physiological systems of animals. 2. To analyse the responses of parameters against environmental stress. 3. To study the composition of macro and micro molecules and nutrients. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the role of organs and cells in major physiological systems. CO2 : illustrate the indicative parameters of environmental stress. CO3 : comprehend the interdependence of physiological processes. CO4 : understand the composition of major and minor nutrients. CO5 : assess biochemical parameters that regulate metabolism.</p>
16UZ03MC03 Semester III	Developmental Biology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To understand the role of genetics in defining biological processes. 2. To study the architecture, development and maturation of germ cells. 3. To understand the process of fertilization and development of embryo. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the biological process involved in the development. CO2 : describe the intricate process of fertilisation. CO3 : explain organogenesis. CO4 : describe the physiological aspects of growth and development. CO5 : understand the role of genes and environment in development.</p>
16UZ03MC04 Semester III	Organic Evolution (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To comprehend the primary processes of evolution. 2. To comprehend how evolutionary biology guides other biological fields. 3. To comprehend how evolutionary biologists work 	<p>Upon completion students should be able to</p> <p>CO1 : understand describe fundamental processes of evolutionary change. CO2 : understand how these processes are modified by extrinsic factors. CO3 : understand how these processes lead to patterns of change. CO4 : explain Darwin's contributions to evolution. CO5 : interpret phylogenetic trees.</p>
16UCH3AL03 Semester III	General Chemistry for Biology- I (from Chemistry Department) (Allied)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To learn the chemistry of macromolecules. 2. To identify and categorise chemicals. 3. To discuss characteristic elements. 	<p>Upon completion students should be able to</p> <p>CO1 : safely handle chemicals and eliminate errors in data analysis. CO2 : identify the chemical bonding and intramolecular interactions. CO3 : illustrate the principle of volumetric analysis . CO4 : explain the fundamentals of chemical kinetics CO5 : discuss the chemistry of fats, vitamins and hormones.</p>

16UCH3AL04 Semester III	Chemistry Practical for Biology- I (from Chemistry Department) (Allied Lab)	K1, K2, K3	<ol style="list-style-type: none"> 1. To develop manuals to test chemical nature of organic substances. 2. To conduct confirmatory tests to confirm functional groups. 3. To educate students on laboratory safety. 	<p>Upon completion students should be able to</p> <p>CO1 : test and identify the chemical nature of the given organic substance.</p> <p>CO2 : classify the given organic substance as an aromatic or aliphatic. .</p> <p>CO3 : categorize the given organic substance as saturated or unsaturated.</p> <p>CO4 : identify the presence of characteristic elements nitrogen and sulphur.</p> <p>CO5 : tests and identify the functional group of given organic substance.</p>
16UZO4MC01 Semester IV	Environmental Biology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To describe, monitor and understand environmental systems. 2. To devise solutions to environmental problems. 3. To undertake wildlife survey and monitor ecological systems. 	<p>Upon completion students should be able to</p> <p>CO1 : use to assist in problem solving.</p> <p>CO2 : explain energy transformations across trophic levels.</p> <p>CO3 : illustrate abiotic/biotic interactions and symbiotic relationships.</p> <p>CO4 : identify various types of natural resources and human impact on them.</p> <p>CO5 : depict evolutionary trends and adaptations to environmental changes</p>
16UZO4MC02 Semester IV	Environmental Biology Lab (Major Core Lab)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To investigate questions and collect and analyze environmental data. 2. To make informed decisions in the laboratory through critical thinking. 3. To communicate effectively the results of scientific investigations. 	<p>Upon completion students should be able to</p> <p>CO1 : explain the structure and impact of biogeochemical cycles.</p> <p>CO2 : describe energy transformations across trophic levels</p> <p>CO3 : illustrate abiotic/biotic interactions and symbiotic relationships.</p> <p>CO4 : quantify and analyze the impact of lifestyle on the environment.</p> <p>CO5 : describe environmental hazards and social and economic ramifications.</p>
16UZO4ES01 Semester IV	Essentials of Marine Biology (Elective Subject)	K1, K2, K3	<ol style="list-style-type: none"> 1. To study the marine ecosystem. 2. To understand the ocean floor structure and movements. 3. To study the composition of ocean stratification and benthos. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the abiotic and biotic communities of the ocean.</p> <p>CO2 : assess the physical, chemical and biological characteristics of ocean.</p> <p>CO3 : to correlate the role of ocean currents to distribution of nutrients.</p> <p>CO4 : to understand the role of moon and sun in ocean water circulation.</p> <p>CO5 : appreciate the role of plankton in marine productivity.</p>

16UZO4ES02 Semester IV	Essentials of Marine Biology Lab (Elective Subject Lab)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To explain the structure and function of marine ecosystems. 2. To describe the chemical and physical features of seawater. 3. To describe organisms residing in the marine environment. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the marine diversity.</p> <p>CO2 : identify animals of different trophic levels.</p> <p>CO3 : quantify and characterise plankton.</p> <p>CO4 : determine the physicochemical parameters of sea water.</p> <p>CO5 : demonstrate the productivity of marine environment.</p>
16UZO4ES03 Semester IV	Biophysics and Biostatistics (Elective Subject)	K1, K2, K3	<ol style="list-style-type: none"> 1. To learn principles of biophysics. 2. To understand the properties of life and matter. 3. To To understand the applications of biostatistics. 	<p>Upon completion students should be able to</p> <p>CO1 : apply principles and properties of life.</p> <p>CO2 : understand the working principles of analytical instruments.</p> <p>CO3 : set standards for estimation techniques for biological experiments.</p> <p>CO4 : design statistical models and validate biological data.</p> <p>CO5 : test hypothesis through statistical software.</p>
16UZO4ES04 Semester IV	Biophysics and Biostatistics lab course (Elective Subject Lab)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To study the biophysical principles in biology. 2. To apply the principles of statistics in biological data analysis. 3. To know applications of analytical instruments in biology. 	<p>Upon completion students should be able to</p> <p>CO1 : apply biophysical principles in understanding properties of life.</p> <p>CO2 : understand the principles of analytical instruments in biology.</p> <p>CO3 : ascertain estimation techniques for biological experiments.</p> <p>CO4 : apply statistical methods to validate biological data.</p> <p>CO5 : authenticate biological data convincingly through statistical software.</p>
16UCH4AL03 Semester IV	General Chemistry for Biology -II (from Chemistry Department) (Allied)	K1, K2, K3	<ol style="list-style-type: none"> 1. To discuss the chemical structure of biomolecules. 2. To explain catabolic and anabolic reactions of molecules. 3. To discuss the types, synthesis and applications of fertilizers. 	<p>Upon completion students should be able to</p> <p>CO1 : discuss the chemistry of biomolecules and natural molecules.</p> <p>CO2 : outline the importance of lipids and steroids in the living system.</p> <p>CO3 : assess the biochemical concept of glycolysis.</p> <p>CO4 : evaluate the biological significance of alkaloids, terpenes , flavones.</p> <p>CO5 : explain the importance of fertilizers and pesticides.</p>

16UCH4AL04 Semester IV	Chemistry Practical for Biology -II (from Chemistry Department) (Allied Lab)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To learn volumetric analysis. 2. To quantitatively analyse samples. 3. To test the presence of major chemical compounds in food products. 	<p>Upon completion students should be able to</p> <p>CO1 : acquire basic principle of volumetric analysis. CO2 : utilize the titration skill for quantitative analysis. CO3 : estimate major chemical compounds in food products. CO4 : estimate the strength of an unknown solution. CO5 : compare the use of indicators in different types of titrations.</p>
19UZ04AL01 Semester IV	Bioinformatics (to Statistics Department) (Allied)	K1, K2, K3	<ol style="list-style-type: none"> 1. To learn basic concepts of biology, computer science and mathematics. 2. To learn advanced methods in computational biology. 3. To construct predictive mathematical models of biological systems. 	<p>Upon completion students should be able to</p> <p>CO1 : apply fundamental methods in probability and statistics. CO2 : understand chemical principles of molecular biology and genomics. CO3 : analyse the design and implementation of relational databases. CO4 : evaluate computational and experimental data. CO5 : retrieve relevant biological data from database.</p>
19UZ04AL02 Semester IV	Bioinformatics Lab (to Statistics Department) (Allied Lab)	K1, K2, K3	<ol style="list-style-type: none"> 1. To provide hands-on experience with bioinformatics tools. 2. To train in programs used for database searching. 3. To do sequence analysis, protein function and build phylogenetic trees. 	<p>Upon completion students should be able to</p> <p>CO1 : relate modern biology and informatics. CO2 : understand and describe basic biotechnology. CO3 : build query for retrieving scientific records and chemical structure. CO4 : understand homology using Multiple sequence alignment. CO5 : understanding evolutionary relationships.</p>
16UZ05MC01 Semester V	Molecular Cell Biology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To study the molecular basis of cells and organs. 2. To understand the cellular grade of organisation in animals. 3. To explain the pathways of cellular action. 	<p>Upon completion students should be able to</p> <p>CO1 : understand cells and organs that control biological systems. CO2 : origin, development and differentiation of different cells. CO3 : specify organ specific cells and molecules for malfunctioning. CO4 : understand the pathways of cellular function. CO5 : identify molecular markers that indicate abnormal functioning.</p>

16UZ05MC02 Semester V	Molecular Genetics (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To learn the principles of genetics. 2. To understand the genetic control of molecular action. 3. To understand the function and expression of genes. 	<p>Upon completion students should be able to</p> <p>CO1 : describe the fundamental molecular principles of genetics.</p> <p>CO2 : understand the structure and function of DNA, RNA and protein.</p> <p>CO3 : explain the way in which genes code for proteins.</p> <p>CO4 : understand the relationship between phenotype and genotype.</p> <p>CO5 : understand how gene expression is regulated.</p>
16UZ05MC03 Semester V	Animal Biotechnology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To study the role of biotechnology in animal propagation. 2. To explore the pros and cons of genetic modifications. 3. To develop tools and techniques for industrial applications. 	<p>Upon completion students should be able to</p> <p>CO1 : appreciate the role of biotechnology in disease eradication.</p> <p>CO2 : apply biotechnological tools in sustainable agriculture.</p> <p>CO3 : understand the role of biotechnology in mass vaccination programs.</p> <p>CO4 : better their understanding in addressing environmental issues.</p> <p>CO5 : specify biotechnological tools that could stabilise strong gene pool.</p>
16UZ05MC04 Semester V	Immunology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To provide a foundation in immunological processes 2. To provide knowledge on how the immune system works. 3. To compare and contrast the innate versus adaptive immune systems 	<p>Upon completion students should be able to</p> <p>CO1 : distinguish various cell types involved in immune responses.</p> <p>CO2 : characterize antibody isotypes, development, and functions.</p> <p>CO3 : understand the role of cytokines in immune cell activation.</p> <p>CO4 : understand the role of MHC in transplantation.</p> <p>CO5 : describe lymphocyte development and the expression.</p>
16UZ05MC05 Semester V	Molecular Biology, Genetics & Biotechnology lab course (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To study the expressions of biomolecules. 2. To test genetic principles. 3. To test and demonstrate separation techniques in biotechnology. 	<p>Upon completion students should be able to</p> <p>CO1 : determine the role of biomolecules in cellular function.</p> <p>CO2 : quantify and differentiate molecules qualitatively.</p> <p>CO3 : demonstrate the genetic principles.</p> <p>CO4 : evaluate the role biomolecules and identify potential targets.</p> <p>CO5 : prescribe appropriate separation techniques to quantify biomolecules.</p>

16UZ05ES01 Semester V	Medical Laboratory Techniques (Elective Subject)	K1, K2, K3	<ol style="list-style-type: none"> 1. To learn techniques for analysing clinical samples. 2. To study the nature and composition of clinical samples. 3. To learn prognosis and diagnosis through clinical sample analysis. 	<p>Upon completion students should be able to</p> <p>CO1 : understand protocols and procedures to collect clinical samples. CO2 : explain the characteristics of clinical samples. CO3 : master handling clinical equipment. CO4 : evaluate the safety precautions while handling clinical samples. CO5 : advocate control measures to avoid contamination of clinical samples.</p>
16UZ05ES02 Semester V	Medical Laboratory Techniques Lab (Elective Subject Lab)	K1, K2, K3, K4, K5, K6	<ol style="list-style-type: none"> 1. To demonstrate procedures and protocols to analyse clinical samples. 2. To educate safety standards and maintain precision in analysis. 3. To learn screening techniques to diagnose disease expressions. 	<p>Upon completion students should be able to</p> <p>CO1 : master procedures related to handling clinical samples. CO2 : adhere to safety standards while handling clinical samples. CO3 : prescribe appropriate analytical tools to diagnose a disease. CO4 : read and interpret clinical parameters after estimation. CO5 : understand the importance of prognosis and diagnosis.</p>
16UZ05ES03 Semester V	Bioinstrumentation Science (Elective Subject)	K1, K2, K3	<ol style="list-style-type: none"> 1. To introduce the fundamentals of instrumentation techniques. 2. To understand the physical principles that measure biological variable. 3. To understand various measurement devices. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the scope of biomedical instrumentation. CO2 : understand the fundamental biosensing principles. CO3 : discuss, develop and apply electrical engineering concepts. CO4 : critically analyse simple biosensing and transduction problems. CO5 : clearly summarise and communicate findings from experiments.</p>
16UZ05ES04 Semester V	Bioinstrumentation Science Lab (Elective Subject Lab)	K1, K2, K3	<ol style="list-style-type: none"> 1. To study the application of established engineering methods. 2. To impart fluent application of engineering techniques and tools. 3. To understand the application of systematic engineering synthesis. 	<p>Upon completion students should be able to</p> <p>CO1 : learn several signals that can be measured from the human body. CO2 : understand how noise from physiologic systems can create artefacts. CO3 : understand theory and design on signal conditioning. CO4 : understand how signals are converted from analogue to digital. CO5 : study designs of instruments that acquire signals from living systems.</p>

16UZO5SK01 Semester V	Economic Zoology : Dairy Farming, Poultry Farming and Fishery Farming. (Skill Based)	K1, K2, K3	<ol style="list-style-type: none"> 1. To understand the concepts of animal farming. 2. To explore the cultivable breeds of animals for sustainable growth. 3. To develop entrepreneurial skills through animal farming. 	<p>Students should be able to</p> <p>CO1 : know the economic importance of animal farming. CO2 : disseminate information on economic aspects of zoology . CO3 : learn the modern techniques in animal husbandry. CO4 : pave way for alternative livelihood. CO5 : become entrepreneurs and create jobs.</p>
16UZO6MC01 Semester VI	Environmental Biotechnology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To study the role of biotechnology in environmental management. 2. To learn tools to assess environmental contamination. 3. To learn tools and techniques to screen pollutants. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the applications of biotechnology in combating pollution. CO2 : analyse tools meant to ascertain environmental quality. CO3 : apply appropriate estimation techniques to quantify contamination. CO4 : denote markers of environmental contamination. CO5 : prepare pollutant based indices for continuous monitoring.</p>
16UZO6MC02 Semester VI	Environmental Toxicology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To learn types and composition of environmental contaminants. 2. To study and understand environmental standards. 3. To learn environmental quality testing methods. 	<p>Students should be able to</p> <p>CO1 : classify hazardous contaminants. CO2 : explain the assimilation and expression of xenobiotics. CO3 : attribute reasons for the presence and expression of toxicants. CO4 : promote safe disposal and treatment of contaminants. CO5 : analyse the impact of contaminants on biological systems.</p>
16UZO6MC03 Semester VI	Environmental Biotechnology and Toxicology Lab course (Major Core Lab)	K1, K2, K3	<ol style="list-style-type: none"> 1. To learn applications of biotechnology in environmental safety. 2. To test tools and protocols to test environmental quality. 3. To study toxicological parameters of environmental concern. 	<p>Students should be able to</p> <p>CO1 : apply biotechnological tools to test environmental quality. CO2 : assess methods meant to quantify contaminant types. CO3 : infer implications of xenobiotics. CO4 : prescribe standards for contaminant testing. CO5 : handle analytical instruments.</p>

16UZO6MC04 Semester VI	Wildlife Conservation Biology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To learn the principles of conservation biology. 2. To impart skills of conservation of nature and natural resources. 3. To learn and understand conservation policies. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the principle behind wildlife conservation. CO2 : appreciate wildlife and understand the importance of conservation. CO3 : learn skills and techniques to conserve wildlife. CO4 : assess the role of animals in food chain and food web. CO5 : understand conservation policies, strategies and legislations.</p>
16UZO6MC05 Semester VI	Behaviour Biology and Wildlife Lab (Major Core Lab)	K1, K2, K3	<ol style="list-style-type: none"> 1. To learn and test behavioural patterns. 2. To develop skills for conservation. 3. To apply model tools for conservation. 	<p>Upon completion students should be able to</p> <p>CO1 : distinguish instinct and learnt behaviours. CO2 : understand complex social behaviours. CO3 : understand the role of evolution in behavioural expressions. CO4 : apply remote sensing for conservation strategies. CO5 : learn skills and procedures of census and survey.</p>
16UZO6MC06 Semester VI	Reproductive Biology and Endocrinology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To learn gametogenesis and control of reproduction. 2. To understand the reproductive function and hormonal regulation. 3. To understand reproductive technologies to circumvent infertility 	<p>Upon completion students should be able to</p> <p>CO1 : understand how hormones regulate reproductive function. CO2 : explain the integrated function of endocrine glands and reproduction. CO3 : understand the various causes of infertility. CO4 : understand factors determining the sex. CO5 : understand assisted reproductive technologies to circumvent infertility.</p>
16UZO6MS01 Semester VI	Bioinformatics (Major Special)	K1, K2, K3	<ol style="list-style-type: none"> 1. To introduce the historical perspective to the field of bioinformatics 2. To learn the key methods and tools used in bioinformatics 3. To learn learn about databases, data mining and exploration. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the basic concepts of biology and computer science. CO2 : handle software to extract information from large databases. CO3 : use sequence information in computer modelling CO4 : use problem-solving skills to develop new algorithms. CO5 : understand the intersection of life and information sciences.</p>

16UZO6MS01 Semester VI	Bioinformatics Lab (Major Special Lab)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To provide hands-on experience with bioinformatics tools. 2. To get trained in the basic theory and application of programs. 3. To develop basic competences in the use of bioinformatics tools. 	Upon completion students should be able to CO1 : apply software for database search. CO2 : understand sequence alignment techniques. CO3 : describe indices and matrices. CO4 : apply sequence visualising tools. CO5 : understand <i>in silico</i> analysis.
16UAZ6TP01 Semester VI	Internship (Training Programme)	K1, K2, K3, K4, K5, K6	<ol style="list-style-type: none"> 1. To get industry exposure 2. To understand the demands of industries. 3. To develop skill sets for industrial needs. 	Upon completion students should be able to CO1 : get industry exposure. CO2 : find applications for knowledge gained through class rooms. CO3 : understand the trend in industries. CO4 : matchup skills acquired for industrial needs. CO5 : keep phase with the ever growing demands of industries.

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI 600034

PG and Research Department of Advanced Zoology and Biotechnology

PG Restructured CBCS curriculum with effect from June, 2016 and 2019

Program Outcomes (PO)

- PO1 : understand the theory and practice of animal taxonomy.
- PO2 : correlate the diversity of animals and their interaction with the environment.
- PO3 : understand the molecular basis of life and metabolic pathways.
- PO4 : extensive role of natural selection and evolutionary processes.
- PO5 : understand the development of organ systems and physiological functions.
- PO6 : evaluate the role of environmental factors and conservation of natural resources.
- PO7 : apply the principles of computational biology and structural biology.
- PO8 : genetic basis of inheritance and expression of behaviour.
- PO9 : apply ethical principles and commit to professional ethics

Program Specific Outcomes (PSO)

- PSO1 : Understand and comprehend the organisation, diversity and evolution of invertebrates and chordates.
- PSO2 : Understand and apply the concepts of taxonomy, cytology, physiology, genetics, ecology and applied zoology.
- PSO3 : Understand the geological events on earth and appreciate the divergence of life.
- PSO4 : Perform laboratory procedures in Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, Toxicology, Sericulture, Biochemistry, Fish biology, Biotechnology, Immunology and Research methodology.
- PSO5 : Gain knowledge about research methodologies, bioethics, effective communication and skills of problem solving methods.

Sub. Code	Title of the paper	Cognitive Level	Course Objectives	Course Outcome
16PZO1MC01 Semester I	Phylogeny of Invertebrata and Chordata (Major Core)	K1, K2, K3	1. To learn the origin and evolution of invertebrates and chordates. 2. To understand the phylogenetic tree of the kingdom Animalia 3. To understand the diversity of life on earth.	Upon completion students should be able to CO1 : appreciate diversity of life around. CO2 : interpret factors that control diversity of life. CO3 : assess the origin and evolution of living creatures on the earth. CO4 : critically evaluate the ever changing environmental factors . CO5 : appreciate the role of human in conserving life around us.
16PZO1MC02 Semester I	Biosystematics (Major Core)	K1, K2, K3	1. To study the science of nomenclature. 2. To understand the character based classification of animals. 3. To study the pros and cons of hierarchical system of classification.	Upon completion students should be able to CO1 : understand the way in which classification system works. CO2 : interpret and discuss characters worth considering for nomenclature. CO3 : assess evolutionarily stable characters that make a species distinct. CO4 : learn the methodologies involved in assigning new names. CO5 : assign new species names as per established procedures.
16PZO1MC03 Semester I	Advanced Developmental Biology (Major Core)	K1, K2, K3	1. To understand the developmental processes of animals. 2. To study functional and structural properties of embryos. 3. To understand the development of organs and systems.	Upon completion students should be able to CO1 : understand the types and mechanism of reproduction in animals. CO2 : evaluate the types of cells that constitute the developmental process. CO3 : understand the genetic factors that control organ development. CO4 : evaluate the structural and functional similarities among animals. CO5 : correlate the evolutionary trends in the development of embryo.

16PZO1MC04 Semester I	Applied Entomology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To understand the general classification of Class Insecta. 2. To study the culture of insects of economic importance. 3. To explore the uses of insects for alternative livelihood. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the classification of Class Insecta. CO2 : distinguish harmful and beneficial insect types. CO3 : explore possibilities of utilising insect types as pest controlling agents. CO4 : assess use of for economic sustainability. CO5 : device control measures for pest causing insect groups.</p>
16PZO1MC05 Semester I	Animal Behavioural Biology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To study the pattern and types of animal behaviour. 2. To understand the genetic basis of complex behaviours. 3. To study the influence of environment upon animal behaviour. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the complex behaviour of animals. CO2 : able to map and correlate behavioural patterns of animals. CO3 : infer the genetic traits inherited generation after generation. CO4 : clarify genetic determinants that control behaviours. CO5 : identify commonality among behaviours of animal groups and types.</p>
16PZO1MC06 Semester I	Invertebrata, Chordata & Developmental Biology lab course (Major Core Lab)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To study the structural organisation of Invertebrates and chordates. 2. To compare the anatomical features of invertebrates and chordates. 3. To understand the role of evolution in speciation. 	<p>Upon completion students should be able to</p> <p>CO1 : have hands on experience on animal dissection. CO2 : compare and infer the system of functioning in different organs. CO3 : comprehend the factors that sustain diversity among animal groups. CO4 : trace back the origin, development and diversity of behavioural traits. CO5 : disseminate information on animal life and intelligence.</p>
16PZO2MC01 Semester II	Molecular cell Biology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To study the cells and organelles of animals and human. 2. To study the structural and functional organisation of animals. 3. To categorise animals based on cellular organisation. 	<p>Upon completion students should be able to</p> <p>CO1 : understand cellular grade of organisation. CO2 : assess the role of various cells in physiological functions. CO3 : correlate cells and physiological makeup of a particular organ. CO4 : understand the abnormal expression of a particular cell type. CO5 : specify cell types that pass on information to generations.</p>

16PZO2MC02 Semester II	Radiation Biology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To understand biomolecules structure, organization and function. 2. To describe interactions between radiation and cells. 3. To describe the molecular basis of cellular radio sensitivity. 	<p>Upon completion students should be able to</p> <p>CO1 : explain cell cycle, repair, repopulation and radio sensitivity. CO2 : understand given clinical data, draw a cell survival curve. CO3 : identify the acute and late effects of radiation on living tissue. CO4 : explain the effects of radiation on the developing embryo and foetus. CO5 : explain the effects of time, dose and fractionation on treatment.</p>
16PZO2MC03 Semester II	Biochemistry (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To describe the chemistry of carbohydrates, lipids and proteins. 2. To describe the classification and structural organization of proteins. 3. To understand the mechanism of enzyme action. 	<p>Upon completion students should be able to</p> <p>CO1 : describe the metabolism of carbohydrates, lipids and its regulation. CO2 : identify the metabolic pathway of macro molecules. CO3 : describe the catabolic reactions of macromolecules. CO4 : identify the class and functions of secondary metabolites. CO5 : describe the classification and mechanism of enzyme action.</p>
16PZO2MC04 Semester II	Advanced Evolutionary Biology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To learn how natural selection controls all biological processes. 2. To learn how evolution has generated biological diversity. 3. To outline the major transitions in evolution. 	<p>Upon completion students should be able to</p> <p>CO1 : have enhanced knowledge evolutionary biology and behaviour. CO2 : develop cogent and critical arguments based on evolution. CO3 : perform, analyse and report on experiments and observations. CO4 : list and describe the evidence for evolution and its required corollaries. CO5 : describe the history and development of evolutionary thought.</p>
16PZO2MC05 Semester II	Molecular Cell biology lab course (Major Core Lab)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To build on the fundamental concepts of cell structure and function. 2. To relate the knowledge of cell structure and function. 3. To relate the sub-cellular components of a cell to heredity. 	<p>Upon completion students should be able to</p> <p>CO1 : understand chemical and molecular processes of cells. CO2 : describe and explain processes in living organisms. CO3 : perform, analyse and report on experiments and observations. CO4 : gain insight into the cell-based methods and understand biology. CO5 : Present hypotheses and conduct relevant experiments.</p>

16PZO2ES01 Semester II	Histochemical Technology (Elective Subject)	K1, K2, K3	<ol style="list-style-type: none"> 1. To identify the structure of cells, tissues and organs. 2. To explain histology and the pathogenesis of disease. 3. To interpret histological sections and microscopic images. 	<p>Upon completion students should be able to</p> <p>CO1 : identify and understand the principle components of microscopes. CO2 : operate and take sections in microtomes and cryostat. CO3 : understand different staining procedures used on tissue sections. CO4 : understand the structural features of biopsy and autopsy. CO5 : understand the principles of histochemistry.</p>
16PZO2ES02 Semester II	Clinical Lab Technology (Elective Subject)	K1, K2, K3	<ol style="list-style-type: none"> 1. To competently perform routine clinical laboratory tests. 2. To develop professional attitudes to serve healthcare industry. 3. To learn good laboratory practices and biosafety. 	<p>Upon completion students should be able to</p> <p>CO1 : perform laboratory test procedures accurately and efficiently. CO2 : choose an appropriate course of action to perform laboratory tests. CO3 : maintain the standards of the laboratory profession. CO4 : understand and interpret laboratory reports. CO5 : uphold efficiency in laboratory diagnosis..</p>
	Life Skill Training (LST)			
	LEAP			
	Summer Training Programme (STP)			
16PZO3MC01 Semester III	Environmental Biology and Management (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To translate environmental knowledge into action. 2. To introduce dominant environmental management models. 3. To evaluate contemporary thinking on environmental issues. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the major principles of sustainable development.. CO2 : translate generic concepts and methods into critical reviews. CO3 : assess theoretical and conceptual issues relating to environment. CO4 : effectively create environmental management analysis outputs. CO5 : address and approach issues of environment professionally .</p>

16PZO3MC02 Semester III	Research Methodology & Biostatistics (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To understand the concepts of research and its methodologies. 2. To select and define appropriate research problem and parameters. 3. To organize and conduct research in a more appropriate manner. 	<p>Upon completion students should be able to</p> <p>CO1 : conduct literature study, case study, structured surveys and interviews. CO2 : apply participatory and narrative analysis, cost-benefit analysis. CO3 : assess scenario methodology and technology foresight. CO4 : assess research methods pertinent to technology innovation research. CO5 : apply modern tools to compile and comprehend literature survey.</p>
16PZO3MC03 Semester III	Animal Physiology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To understand the physiology of animals of different environments. 2. To study the basic processes and effects of animal cell signalling 3. To understand the different energy requirements of animals. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the functioning of the oxygen transporting systems. CO2 : clarify control processes of the nervous and endocrine systems. CO3 : compare the formation of excretory products. CO4 : to relate the structure and function of animal tissues. CO5 : understand the complexity of reproduction in animals.</p>
16PZO3MC04 Semester III	Eco - Physiology Lab course (Major Core Lab)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To understand the relation between environment and functioning. 2. To show how life processes depend on the environment. 3. To understand life processes in the context of homeostasis. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the functioning of the oxygen transporting systems. CO2 : clarify control processes of the nervous and endocrine systems. CO3 : compare the formation of excretory products. CO4 : to relate the structure and function of animal tissues. CO5 : understand the complexity of reproduction in animals.</p>
16PZO3ES01 Semester III	Bioinformatics (Elective Subject)	K1, K2, K3	<ol style="list-style-type: none"> 1. To introduce the significance in Biological data analysis. 2. To characterise and manage the different types of Biological data. 3. To introduce the basics of sequence alignment and analysis 	<p>Upon completion students should be able to</p> <p>CO1 : access that databases that provide information on biomolecules. CO2 : apply database search tools. CO3 : explain about primary and secondary structures of proteins. CO4 : describe about protein folding and its significance. CO5 : describe structural and biological properties of macromolecules.</p>

16PZO3ES02 Semester III	Aquaculture (Elective Subject)	K1, K2, K3	<ol style="list-style-type: none"> 1. To acquire skills necessary for work in aquaculture and fisheries. 2. To create solutions to challenges in aquaculture and fisheries. 3. To describe basic culture methodologies for cultivable species. 	<p>Upon completion students should be able to</p> <p>CO1 : describe different types of aquaculture systems.</p> <p>CO2 : understand conditioning factors and how they can be manipulated.</p> <p>CO3 : describe basic culture methodologies, common problems and solutions.</p> <p>CO4 : prescribe economically important species for culture.</p> <p>CO5 : understand the environmental impacts of aquaculture.</p>
16PCO3ID01 Semester III	Bio-products and Marketing (for Commerce Department) (Interdisciplinary)	K1, K2, K3	<ol style="list-style-type: none"> 1. To create awareness on a variety of biologically derived products. 2. To learn various bio-products and their marketing. 2. To encourage students to explore entrepreneurship in bio products. 	<p>Upon completion students should be able to</p> <p>CO1 : gain insights on a wide range of bio products.</p> <p>CO2 : understand the therapeutic and nutritional importance of bio products.</p> <p>CO3 : analyse and perceive green entrepreneurship and bio product market.</p> <p>CO4 : design small scale industry setup.</p> <p>CO5 : analyze bio products market trend.</p>
16PZO3ID01 Semester III	Entrepreneurship and Farm Management (from Commerce Department) (Interdisciplinary)	K1, K2, K3	<ol style="list-style-type: none"> 1. To provide a general overview of entrepreneurship. 2. To learn relevant measures to make a business plan. 3. To conduct a market survey and make a market plan. 	<p>Upon completion students should be able to</p> <p>CO1 : define entrepreneurship, innovation and economic terminologies.</p> <p>CO2 : understand the society's need for creating new businesses.</p> <p>CO3 : evaluate the barriers for entrepreneurship.</p> <p>CO4 : design and innovate business models.</p> <p>CO5 : suggest measures to improve the business plan.</p>
Semester IV	Self-study (SSP) (outside class hours) (Self-Study Paper)	K1, K2, K3	<ol style="list-style-type: none"> 1. To promote independent learning. 2. To develop skills for course designing. 3. To understand and approach newer trends in biology. 	<p>Upon completion students should be able to</p> <p>CO1 : learn independently.</p> <p>CO2 : understand skill measurement and independent decision making.</p> <p>CO3 : design course content and prescribe standards.</p> <p>CO4 : produce innovate models for learning.</p> <p>CO5 : suggest measures to improve quality learning.</p>

16PZO4PJ01 Semester IV	Project and Dissertation (Project)	K1, K2, K3, K4, K5, K6	<ol style="list-style-type: none"> 1. To promote independent research. 2. To develop skills to pursue application oriented research. 3. To address and investigate relevant issues and problems. 	<p>Upon completion students should be able to</p> <p>CO1 : demonstrate a sound technical knowledge on selected project topic. CO2 : undertake problem identification, formulation and solution. CO3 : design solutions to complex problems utilising a systems approach. CO4 : communicate research outcomes in written and oral forms. CO5 : undertake research as a profession.</p>
16PZO4MC01 Semester IV	Microbiology and Immunology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To learn the diversity and isolation methods of microbes. 2. To learn culture and purification techniques of microbes. 3. To study the facets of immune system and function. 	<p>Upon completion students should be able to</p> <p>CO1 : master aseptic techniques to perform routine culture handling. CO2 : comprehend the various methods for identification of microorganisms . CO3 : describe basic culture methodologies, common problems and solutions. CO4 : understand the microbial transport systems. CO5 : understand types and functioning of immune system.</p>
16PZO4MC02 Semester IV	Biotechnology (Major Core)	K1, K2, K3	<ol style="list-style-type: none"> 1. To comprehend about the introduction and history of biotechnology. 2. To study application of biotechnology. 2. To learn the pros and cons of gene manipulation. 	<p>Upon completion students should be able to</p> <p>CO1 : understand the principles and practices of biotechnology. CO2 : explain the steps involved in the production of bio products. CO3 : demonstrate skills related to biotechnology. CO4 : pursue research related to animal cell and tissue culture. CO5 : critically analyze the biochemical characteristics of the bio products.</p>
16PZO4MC03 Semester IV	Microbiology and Biotechnology Lab course (Major Core Lab)	K1, K2, K3, K4, K5	<ol style="list-style-type: none"> 1. To design, conduct experiments, analyze problems in Biotechnology. 2. To understand bio analytical tools and techniques. 3. To learn functional and structural organization of nucleic acid. 	<p>Upon completion students should be able to</p> <p>CO1 : determine appropriate tool for measuring specific volumes or masses. CO2 : describe the structure and function of DNA and RNA in the cell. CO3 : explain the structure of antibodies. CO4 : demonstrate PAGE and blotting techniques. CO5 : explain amplification of DNA.</p>