

M.Sc. Zoology Syllabus

With effect from the academic year 2020 - 2021

Vision

Empower the students with Academic skills, Research aptitude and Social commitment through holistic education.

Mission

1. Foster knowledge and skills through innovative teaching and instill moral and ethical values.
2. Render opportunities for critical thinking, communication and collaboration.
3. Create research ambience to promote innovations and contemporary skills relevant to local and global needs.
4. Inspire to explore the natural resources and connect with nature.
5. Promote passion to serve the local community by creating empowered women of commitment and social consciousness through outreach and exposure programmes.
6. Facilitate life-long learning, participatory leadership and commitment to society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO - 1: The graduates use scientific and computational technology to solve socio-ecological issues and pursue research.

PEO - 2: The graduates will continue to learn and advance their career in industry both public and private sectors, government and academia.

PEO - 3: The graduates will apply their knowledge for developing innovative career oriented professional empowerment and leadership.

PROGRAMME OUTCOMES (POs)

PO	Upon completion of M.Sc. Zoology Degree Programme, the graduates will be able to:
PO - 1	carry out internship programmes and research projects to develop scientific skills and innovative ideas.
PO - 2	analyze complex problems, think independently, formulate and perform quality research.
PO - 3	develop a multidisciplinary perspective and contribute to the knowledge capital of the globe.
PO - 4	emerge as expressive, ethical and responsive citizens with proven expertise.

PO - 5	utilize the obtained scientific knowledge to create eco- friendly environment.
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PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO	Upon completion of M.Sc. Degree Programme, the graduates will be able to:	PO addressed
PSO - 1	explain the various aspects of life sciences including Biochemistry, Cell and Molecular Biology, Biosystematics, Genetics, Evolution, Physiology, Developmental Biology, Ecobiology, Immunology, Microbiology, Endocrinology, Bioinformatics, Biotechnology and Nanobiology.	PO - 1, 3, 5
PSO - 2	carry out experimental techniques and methods of statistical analysis appropriate for their course.	PO - 2, 4
PSO - 3	develop personal and key transferable skills and entrepreneurial skills.	PO - 2, 4
PSO - 4	independently assemble facts, summarize and draw conclusions from scientific text and develop competence in the design and execution of research.	PO - 1, 2, 4

**M.Sc. ZOOLOGY
ODD SEMESTER**

Semester I

Core I

Name of the course: Biochemistry

Course Code: PZ2011

No. of hours/ week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

1. To impart knowledge on chemical structure, functions and metabolic process of biomolecules in living system.
2. To develop analytical and communicative skills to conduct experiments and interpret the results.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	define structure and types of chemical bonds in biomolecules such as hydrogen ions, water, protein, carbohydrate, lipid, nucleotides, enzymes and vitamins.	PSO - 1	R
CO - 2	explain the fate of biomolecules in different metabolic pathways.	PSO - 1	U
CO - 3	apply cognitive, technical and creative skills to pursue higher studies and employability in industrial, biomedical and research laboratories.	PSO - 4	Ap
CO - 4	analyse biomolecules in biological systems and relate deficiency disorders.	PSO - 3	An
CO- 5	design biochemical experiments and publish the results through effective written and oral communication after drawing accurate conclusions.	PSO - 2	E

Semester I

Core II

Name of the course: Ecobiology

Course Code: PZ2012

No. of hours/ week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

1. To impart knowledge on ecosystem, population, community, environmental pollutions and natural resources.
2. To develop the skill to sensitize environmental issues and work productively within and beyond the academy for sustainable environment.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	define various laws of ecology, components of ecosystem, characteristics and dynamics of population and community, natural resources and environmental pollutants.	PSO - 1	R
CO - 2	classify different types of ecosystem, habitat, environmental factors and interpret the population processes, ecological succession, biological clock, biogeochemical cycles, biogeography, natural disasters and causes of pollution.	PSO - 1	U
CO - 3	develop cognitive, technical and creative skills which enable students for life-long learning and participate in environmental protection and conservation activities for sustainable environment and gain employability.	PSO - 3	Ap
CO - 4	analyse the nature of ecosystem, habitat, population, community, natural resources and environmental pollutions.	PSO - 2	An
CO - 5	assess the environmental issues like population explosion, urbanization, depletion of natural resources, pollution and waste managements.	PSO - 2	E
CO - 6	formulate hypotheses and test them by designing appropriate experiments, analyze, interpret the data and communicate the results through effective written and oral communication.	PSO - 4	C

Semester I

Core III

Name of the course: Structure and Function of Invertebrates

Course Code: PZ2013

No. of hours/ week	No. of credits	Total number of hours	Marks
5	3	75	100

Learning Objectives

1. To provide knowledge on the functional aspects of systems of invertebrates on a comparative basis.
2. To empower students with skills to comprehend the taxonomical and physiological functions of vital systems in invertebrates.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recognise the organisation of coelom, mode of locomotion, nutrition, respiration, excretion and significance of larval forms of invertebrates.	PSO - 1	R
CO - 2	comprehend the systematic position and physiological functions of vital systems in invertebrates.	PSO - 4	U
CO - 3	apply the cognitive skills to pursue higher studies and employability relevant fields.	PSO - 3	Ap
CO - 4	explore the structure and functions of vertebrates.	PSO - 2	An

Semester I

Core IV

Name of the course: Comparative Anatomy of Chordates

Course Code: PZ2014

No. of hours/ week	No. of credits	Total number of hours	Marks
5	3	75	100

Learning Objectives

1. To provide the knowledge of origin, structure and function of different organ system of vertebrates.
2. To develop the skills to analyse the anatomy of vertebrates and its significance.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	identify the morphology and anatomy of major groups of vertebrates.	PSO - 1	R
CO - 2	interrelate the development of integuments, circulatory system, respiratory system, skeletal system, sense organs and nervous system.	PSO - 1	U
CO - 3	apply the cognitive skills to pursue higher studies and gain employability in academic and research institutions.	PSO - 3	Ap
CO - 4	analyse the anatomy of different groups of vertebrates.	PSO - 4	An

Semester I**Elective I (a)****Name of the course: Animal Husbandry****Course Code: PZ2015**

No. of hours/ week	No. of credits	Total number of hours	Marks
4	3	60	100

Learning Objectives

1. To gain knowledge on livestock management and construction of farms.
2. To develop skills on livestock farming and extend it to the society.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	acquire knowledge on Livestock resources, construction and management of Livestock farms.	PSO - 1	U
CO - 2	identify the breeds and stages of livestock.	PSO - 1	R
CO - 3	analyse the ethical laws formulated by the Animal Welfare Board.	PSO - 4	An
CO - 4	develop entrepreneurial skills and gain employability in animal farms and research laboratories.	PSO - 3	Ap

Semester II**Practical I****Name of the course: Biochemistry and Ecobiology****Course Code: PZ20P1**

No. of hours/week	No of credits	Total number of hours	Marks
4	4	60	100

Learning Objectives

1. To design and perform biochemical experiments.
2. To understand the interaction between abiotic and biotic environment.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	describe the knowledge necessary for professional or academic work in the field of biochemistry and ecology.	PSO - 1	U
CO - 2	analyse the biomolecules and physico-chemical parameters in samples.	PSO - 2	An
CO - 3	develop drawing and writing skills and design experiments.	PSO - 4	Ap
CO - 4	estimate the components of an ecosystem.	PSO - 2	E

Semester : II **Core**
VII

Name of the Course : Physiology
Course code : PZ1731

No. of hours, week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

1. To impart knowledge on the structure and functions of various organs, organ systems and also to know about the associated disorders.
2. To get job in diagnostic centers, research and academic institutions.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	describe the anatomy of different physiological systems at the tissue and cellular levels.	PSO - 1	U
CO - 2	evaluate the physiological functioning of different organs.	PSO - 2	E
CO - 3	analyze the physiological changes in relation to environmental conditions.	PSO - 7	Ap; An
CO - 4	identify different tissues related to anatomy and physiology from an evidence-based perspective.	PSO - 9	U

CO - 5	carry out physiological studies in the laboratory, interpret data and graphs and write a report.	PSO - 9	Ap; An
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Semester : III Core VIII
Name of the Course : Immunology
Course Code : PZ1732

No. of hours/ week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

1. To facilitate the students to understand and appreciate the defense functions of the immune system.
2. To develop the skill to determine the immunomodulatory strategies used to enhance or suppress the immune response.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	explain the importance of innate immune response in providing adaptive immunity.	PSO - 1	U
CO - 2	know the evolution of immune molecules in different groups of animals.	PSO - 1	U
CO - 3	differentiate the types of hypersensitive allergic reactions by seeing the symptoms and duration and suggest the remedies.	PSO - 2	R; An
CO - 4	discuss the role of immune molecules in different diseases and organ transplantation.	PSO - 6	Ap
CO - 5	demonstrate detailed knowledge and understanding of immunology and the way it is applied in diagnostic and therapeutic techniques and research.	PSO - 9	U; Ap

Semester : III Elective III
Name of the Course : General Endocrinology (a)
Course code : PZ1733

No. of hours/week	No. of credits	Total number of hours	Marks
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6	5	90	100
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Learning Objectives

1. To learn how the endocrine system functions under normal circumstances, as well as the pathologies that arise when homeostasis fails.
2. To get job in clinical laboratory and endocrine research institutes.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	discuss the principles of endocrine system, hormonal communication and neuroendocrine mechanism in animals.	PSO - 1	U
CO - 2	explain the secretion and transportation of hormones to maintain homeostasis.	PSO - 10	U
CO - 3	apply the knowledge of endocrinology to understand hormone-related disorders.	PSO - 8	Ap
CO - 4	explain women related physiological processes such as menstruation, gestation and lactation.	PSO - 3	Ap
CO - 5	correlate endocrine regulation of reproduction and metamorphosis in various invertebrates and vertebrates.	PSO - 5	Ap; An

Semester : IV

Practical III

Name of the Course: Physiology and Immunology

Course Code : PZ17P3

No. of hours/week	No of credits	Total number of hours	Marks
4	4	60	100

Learning Objectives

1. To design experiments and apply it in physiological research.
2. To understand the various immune-techniques and apply in immunological experiments.

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	gain knowledge on the functioning of organ and organ systems.	PSO - 1	U

CO - 2	demonstrate the effect of abiotic factors on the physiology of the systems through experiments.	PSO - 2	Ap; An
CO - 3	identify the immune cells in a blood smear.	PSO - 1	R
CO - 4	demonstrate immune-techniques on antigen-antibody interaction.	PSO - 10	Ap

Semester : IV Practical III

Name of the Course : Physiology and Immunology

Course Code : PZ17P3

No. of hours/week	No of credits	Total number of hours	Marks
4	4	60	100

Learning Objectives

- 1.To design experiments and apply it in physiological research.
2. To understand the various immune-techniques and apply in immunological experiments.

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	C
CO - 1	gain knowledge on the functioning of organ and organ systems.	PSO - 1	U
CO - 2	demonstrate the effect of abiotic factors on the physiology of the systems through experiments.	PSO - 2	Ap; An
CO - 3	identify the immune cells in a blood smear.	PSO - 1	R
CO - 4	demonstrate immune-techniques on antigen-antibody interaction.	PSO - 10	Ap

Semester : III

Core VII Name of

Course code : PZ1731

No. of hours, week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

3. To impart knowledge on the structure and functions of various organs, organ systems and also to know about the associated disorders.
4. To get job in diagnostic centers, research and academic institutions.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	
CO - 1	describe the anatomy of different physiological systems at the tissue and cellular levels.	PSO - 1	
CO - 2	evaluate the physiological functioning of different organs.	PSO - 2	
CO - 3	analyze the physiological changes in relation to environmental conditions.	PSO - 7	Ap
CO - 4	identify different tissues related to anatomy and physiology from an evidence-based perspective.	PSO - 9	
CO - 5	carry out physiological studies in the laboratory, interpret data and graphs and write a report.	PSO - 9	Ap

Semester

: III

Core VIII Name of the

Course Code

: PZ1732

No. of hours/ week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

3. To facilitate the students to understand and appreciate the defense functions of the immune system.
4. To develop the skill to determine the immunomodulatory strategies used to enhance or suppress the immune response.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	
CO - 1	explain the importance of innate immune response in providing adaptive immunity.	PSO - 1	
CO - 2	know the evolution of immune molecules in different groups of animals.	PSO - 1	

CO - 3	differentiate the types of hypersensitive allergic reactions by seeing the symptoms and duration and suggest the remedies.	PSO - 2	R
CO - 4	discuss the role of immune molecules in different diseases and organ transplantation.	PSO - 6	
CO - 5	demonstrate detailed knowledge and understanding of immunology and the way it is applied in diagnostic and therapeutic techniques and research.	PSO - 9	U

1. Assignment:

Immunofluorescence.

2. Seminar: Flow cytometry.

Assignment: Transplantation: classification of grafts, graft versus host reaction.

Semester : III Elective III (a)
Name of the Course : General Endocrinology
Course code : PZ1733

No. of hours/week	No. of credits	Total number of hours	Marks
6	5	90	100

Learning Objectives

3. To learn how the endocrine system functions under normal circumstances, as well as the pathologies that arise when homeostasis fails.
4. To get job in clinical laboratory and endocrine research institutes.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed
CO - 1	discuss the principles of endocrine system, hormonal communication and neuroendocrine mechanism in animals.	PSO - 1
CO - 2	explain the secretion and transportation of hormones to maintain homeostasis.	PSO - 10
CO - 3	apply the knowledge of endocrinology to understand hormone-related disorders.	PSO - 8
CO - 4	explain women related physiological processes such as menstruation, gestation and lactation.	PSO - 3
CO - 5	correlate endocrine regulation of reproduction and metamorphosis in various invertebrates and vertebrates.	PSO - 5

Semester : IV
Course Code : PZ17P3

Practical III Name of

No. of hours/week	No of credits	Total number of hours	Marks
4	4	60	100

Learning Objectives

1. To design experiments and apply it in physiological research.
2. To understand the various immune-techniques and apply in immunological experiments.

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	gain knowledge on the functioning of organ and organ systems.	PSO - 1	U
CO - 2	demonstrate the effect of abiotic factors on the physiology of the systems through experiments.	PSO - 2	Ap; An
CO - 3	identify the immune cells in a blood smear.	PSO - 1	R
CO - 4	demonstrate immune-techniques on antigen-antibody interaction.	PSO - 10	Ap

M.Sc. Zoology EVEN SEMESTER

Semester : II

Core V

**Name of the Course: Biostatistics, Computer Applications and
Bioinformatics**

Course code : PZ2021

No. of hours/ week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

1. To enable the students to collect and use the data to derive inferences in various biological experiments.
2. To develop analytical skills of statistics and draw valid conclusions in research.

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	recall different biological data, methods of collection, processing and retrieval tools in sequence analysis.	PSO - 1	R
CO - 2	Explain measures of dispersion, significance of data and soft wares applied in biostatistics and biological databases.	PSO - 2	U
CO - 3	analyze the data and interpret the results manually or by using software.	PSO - 2	An
CO - 4	apply statistical and bioinformatics tools in research and gain employability in Research and Development organizations.	PSO - 3	Ap
CO - 5	evaluate biological data and critically analyse the research findings.	PSO - 4	E
CO - 6	formulate hypothesis, solve problems and present data to the scientific community.	PSO - 4	C

Semester : II

Core VI

Name of the Course : Cell and Molecular Biology

Course code : PZ2022

No. of Hours/ week	No. of Credits	Total Number of Hours	Marks
6	4	90	100

Learning Objectives

1. To provide knowledge on the structure and functions of bio-membranes, cell organelles and signaling pathways.
2. To avail employment in educational institutions and research laboratories.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recognize the structural and functional organization of plasma membrane, cell organelles, cell receptors, protein synthesis and abnormal cell growth.	PSO - 1	R
CO - 2	illustrate cellular organization and changes occurring in cells.	PSO - 1	U
CO - 3	analyse the prokaryotic and eukaryotic cells, flow of genetic information from DNA to protein, cell signaling and regulation of cell cycle.	PSO - 2	An
CO - 4	evaluate the changes in the cells, cell cycle and proteins involved in the regulation and apoptosis.	PSO - 4	E
CO - 5	apply the principles and techniques of molecular biology for research and employment.	PSO - 3	Ap

Semester : II
Name of the Course : Developmental Biology
Course code : PZ2023

Core VII

No. of hours/ week	No. of credits	Total number of hours	Marks
5	4	75	100

Learning Objectives

1. To enable the students to gain knowledge on the process by which a zygote multiplies, differentiates and develops into an adult.
2. To gain employment at fertility centers, hospitals and health centers.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	discuss basic concepts and developmental processes of different organ systems and techniques in reproductive biology.	PSO - 1	R
CO - 2	distinguish the embryonic structures, origin and development of organ systems.	PSO - 1	U
CO - 3	analyse the regulating mechanisms of developmental processes and identify deformities.	PSO - 2	An
CO - 4	apply knowledge to pursue higher studies and gain employability in biological research laboratories.	PSO - 3	Ap

Semester : II
Name of the Course: Rsearch Methodology
Course code : PZ2024

Core IX

No. of hours/ week	No. of credits	Total number of hours	Marks
5	3	75	100

Learning Objectives

1. To enable the students to understand the working principles of bio-

instruments and methodologies used in biological investigations.

2. To enhance report writing skills and create self-employment opportunities.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	outline the principles and working mechanism of laboratory equipment and research techniques.	PSO - 1	R
CO - 2	explain laboratory or field procedures, methods, and instrumentation for biological studies.	PSO - 1	U
CO - 3	analyze scientific methods to develop hypotheses, design and execute experiments by selecting the appropriate research techniques.	PSO - 2	An
CO - 4	conceptualize research processes, data presentation, report writing and publication in journals.	PSO - 3	Ap
CO - 5	evaluate scientific ideas and design experiments to address medical, social and environmental problems.	PSO - 4	E

Semester : II Elective II (a)
Name of the Course : Animal Behaviour and Chronobiology
Course code : PZ2025

No. of hours/week	No. of credits	Total number of hours	Marks
4	3	60	100

Learning Objectives

1. To acquaint students with deep understanding of Animal behaviour and Chronobiology.
2. To develop skills of animal watching and procure jobs in sanctuaries.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	describe animal behaviour, reflexes, biological rhythms and Chronobiology.	PSO - 1	R
CO - 2	summarize the history of ethology, social behaviour in animals, organization of circadian system in multicellular animals.	PSO - 1	U

CO - 3	illustrate the developing compassion towards animals, group selection, altruism, predict biological clock system, circadian pacemaker system in vertebrates.	PSO - 1	Ap
CO - 4	analyse the patterns of animal behaviour and complexity of biological clock system in vertebrates.	PSO - 3	An
CO - 5	assess the relevance of biological clocks for human welfare and taking decisions.	PSO - 4	E

Semester : II Practical II
Name of the Course: Biostatistics, Computer applications and Bioinformatics & Cell and Molecular Biology
Course code : PZ20P2

No. of hours/week	No of credits	Total number of hours	Marks
4	4	60	100

Learning Objectives

1. To design an experimental problem and evaluate critically with inferential biostatistics and necessary computer skills.
2. To develop the skills involved in cell biology, histology and biomolecules separation techniques.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	analyze and interpret the collected data using statistical methods manually and soft wares.	PSO - 1	An
CO - 2	evaluate the biological samples applying research techniques.	PSO - 2	E
CO - 3	develop drawing and writing skills through record and design experiments.	PSO - 2	Ap
CO - 4	design biological experiments.	PSO - 2	C

Semester : IV Core IX
Name of the Course: Microbiology
Course code : PZ1741

No. of hours/ week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

1. To know about the microbes in and around us and recognize their role in industrial production of valuable products, environmental management, biomining and also about the diseases caused by them.
2. To provide careers in industries, clinical laboratories, agricultural establishments, research institutes and Universities.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	explain the structure, distribution, classification and life cycle of microorganisms.	PSO - 1	U
CO - 2	culture microbes by selecting appropriate culture media.	PSO - 2	R; Ap
CO - 3	explain the role of microbes in food industries and environmental cleaning.	PSO - 7	R
CO - 4	identify the microbial pathogen and preventive measures.	PSO - 9	Ap
CO - 5	develop microbiological laboratory skills applicable to clinical research.	PSO - 10	Ap

Semester : IV Core X
Name of the Course : Ecobiology
Subject code : PZ1742

No. of hours/ week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

1. To provide the opportunity for students to develop a deep understanding of various aspects of the environment and apply that knowledge to current environmental issues and for wise environmental management.
2. To work productively with those within and beyond the academy on interdisciplinary collaborative projects

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	Explain the interaction of organisms with the physical and biological environment.	PSO - 1	U

CO - 2	Compare the differences in the structure and function of different types of ecosystems.	PSO - 1	U
CO - 3	Assess the human population increase with respect to anthropological activities and environmental impact.	PSO - 2	E
CO - 4	Formulate hypotheses and test them by designing appropriate experiments, analyze, interpret data and report	PSO - 3; PSO - 4	C; An; E
CO - 5	Use scientific knowledge of ecology to evaluate contemporary social and environmental issues.	PSO - 5	Ap; E
CO - 6	Participate in environmental protection and conservation.	PSO - 3	Ap

Semester : IV

Core XI

Name of the Course : Biotechnology & Nanobiology

Course code : PZ1743

No. of hours/ week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

1. To enable the students to understand the essence of biotechnology and become aware of the advances in Nanobiology.
2. To develop skill of technical proficiency in genetic manipulation to try to improve agricultural production, pharmaceutical products, medical treatment, or mitigation of Environment.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	Explain the basic concepts of gene cloning and the importance of DNA sequencing in biotechnological intervention.	PSO - 1	U
CO - 2	Demonstrate cell culture techniques and prepare protocol to perform experiments.	PSO - 2	U; Ap
CO - 3	Identify the progression of biotechnology in different areas like medicine, agriculture, environmental sustainability and forensics.	PSO - 2	R
CO - 4	Apply the knowledge of genetically modified organism in bioremediation.	PSO - 4	Ap; An; C
CO - 5	Outline the basic concepts of nanotechnology, its applications and threat to the environment.	PSO - 1; PSO - 2	U

CO - 6	Communicate the concepts of biotechnology and develop research skills.	PSO - 4; PSO - 5; PSO - 6	Ap
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Semester : IV Elective IV – (b)

Name of the Course: Practical IV Microbiology Ecobiology

Biotechnology and Nanobiology

Course code : PZ17P4

No. of hours/week	No of credits	Total number of hours	Marks
6	5	90	100

1. To acquire and demonstrate competency in laboratory safety and in routine microbiological and biotechnological techniques.
2. To recognize and apply methodological approaches of Ecobiology.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	Isolate, culture, stain and identify bacteria and perform antibiotic sensitivity test.	PSO - 1, 2	Ap
CO - 2	Estimate the physico-chemical parameters of water samples.	PSO - 1, 2, 4, 7	An; E
CO - 3	Identify the producers and consumers of a pond ecosystem and measure the primary productivity.	PSO - 1, 2, 7	R; Ap
CO - 4	Extract and quantify genomic DNA.	PSO - 1, 9	Ap
CO - 5	Prepare commercial products by using biotechnological methods.	PSO - 1, 9	C

Semester : VI

Elective IV – (b)

Name of the Course: Medical Entomology

Course code : PZ1745

No. of hours/week	No. of credits	Total number of hours	Marks
6	5	90	100

Learning Objectives

1. To identify medically important arthropods by their general morphology and important characteristics, to describe their biology, ecology and geographical distribution, their roles in

transmission of diseases and nuisance to public health and to describe and apply control methods for arthropod vectors.

2. To propose effective control measures to eradicate vector borne diseases and seek employment opportunities in health centers.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	identify the medically important arthropods by their general morphology and important characteristics.	PSO - 1	R ; U
CO - 2	describe the biology, ecology and geographical distribution of medically important pests and their role in transmission of diseases.	PSO - 2	U
CO - 3	outline the biology of tropical parasites and vectors and the relationship between parasites and their hosts.	PSO - 2	Ap
CO - 4	assess the immunological approaches in the control of parasitic infections.	PSO- 2	E
CO - 5	enumerate strategies for prevention and care of vector borne disease.	PSO - 1	Ap; E

M.Sc. Zoology Syllabus

With effect from the academic year 2020 - 2021

Vision

Empower the students with Academic skills, Research aptitude and Social commitment through holistic education.

Mission

1. Foster knowledge and skills through innovative teaching and instill moral and ethical values.
2. Render opportunities for critical thinking, communication and collaboration.
3. Create research ambience to promote innovations and contemporary skills relevant to local and global needs.
4. Inspire to explore the natural resources and connect with nature.
5. Promote passion to serve the local community by creating empowered women of commitment and social consciousness through outreach and exposure programmes.
6. Facilitate life-long learning, participatory leadership and commitment to society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO - 1: The graduates use scientific and computational technology to solve socio-ecological issues and pursue research.

PEO - 2: The graduates will continue to learn and advance their career in industry both public and private sectors, government and academia.

PEO - 3: The graduates will apply their knowledge for developing innovative career oriented professional empowerment and leadership.

PROGRAMME OUTCOMES (POs)

PO	Upon completion of M.Sc. Zoology Degree Programme, the graduates will be able to:
PO - 1	carry out internship programmes and research projects to develop scientific skills and innovative ideas.
PO - 2	analyze complex problems, think independently, formulate and perform quality research.
PO - 3	develop a multidisciplinary perspective and contribute to the knowledge capital of the globe.

PO - 4	emerge as expressive, ethical and responsive citizens with proven expertise.
PO - 5	utilize the obtained scientific knowledge to create eco- friendly environment.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO	Upon completion of M.Sc. Degree Programme, the graduates will be able to:	PO addressed
PSO - 1	explain the various aspects of life sciences including Biochemistry, Cell and Molecular Biology, Biosystematics, Genetics, Evolution, Physiology, Developmental Biology, Ecobiology, Immunology, Microbiology, Endocrinology, Bioinformatics, Biotechnology and Nanobiology.	PO - 1, 3, 5
PSO - 2	carry out experimental techniques and methods of statistical analysis appropriate for their course.	PO - 2, 4
PSO - 3	develop personal and key transferable skills and entrepreneurial skills.	PO - 2, 4
PSO - 4	independently assemble facts, summarize and draw conclusions from scientific text and develop competence in the design and execution of research.	PO - 1, 2, 4

Semester I

Core I

Name of the course: Biochemistry

Course Code: PZ2011

No. of hours/ week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

1. To impart knowledge on chemical structure, functions and metabolic process of biomolecules in living system.
2. To develop analytical and communicative skills to conduct experiments and interpret the results.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	define structure and types of chemical bonds in biomolecules such as hydrogen ions, water, protein, carbohydrate, lipid, nucleotides, enzymes and vitamins.	PSO - 1	R
CO - 2	explain the fate of biomolecules in different metabolic pathways.	PSO - 1	U
CO - 3	apply cognitive, technical and creative skills to pursue higher studies and employability in industrial, biomedical and research laboratories.	PSO - 4	Ap
CO -	analyse biomolecules in biological systems and relate deficiency disorders.	PSO - 3	An

4			
CO-5	design biochemical experiments and publish the results through effective written and oral communication after drawing accurate conclusions.	PSO - 2	E

.Semester I

Core II

Name of the course: Ecobiology

Course Code: PZ2012

No. of hours/ week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

1. To impart knowledge on ecosystem, population, community, environmental pollutions and natural resources.
2. To develop the skill to sensitize environmental issues and work productively within and beyond the academy for sustainable environment.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	define various laws of ecology, components of ecosystem, characteristics and dynamics of population and community, natural resources and environmental pollutants.	PSO - 1	R
CO - 2	classify different types of ecosystem, habitat, environmental factors and interpret the population processes, ecological succession, biological clock, biogeochemical cycles, biogeography, natural disasters and causes of pollution.	PSO - 1	U
CO - 3	develop cognitive, technical and creative skills which enable students for life-long learning and participate in environmental protection and conservation activities for sustainable environment and gain employability.	PSO - 3	Ap
CO - 4	analyse the nature of ecosystem, habitat, population, community, natural resources and environmental pollutions.	PSO - 2	An
CO - 5	assess the environmental issues like population explosion, urbanization, depletion of natural resources, pollution and waste managements.	PSO - 2	E
CO - 6	formulate hypotheses and test them by designing appropriate experiments, analyze, interpret the data and communicate the results through effective written and oral communication.	PSO - 4	C

Semester I**Core III****Name of the course: Structure and Function of Invertebrates****Course Code: PZ2013**

No. of hours/ week	No. of credits	Total number of hours	Marks
5	3	75	100

Learning Objectives

3. To provide knowledge on the functional aspects of systems of invertebrates on a comparative basis.
4. To empower students with skills to comprehend the taxonomical and physiological functions of vital systems in invertebrates.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recognise the organisation of coelom, mode of locomotion, nutrition, respiration, excretion and significance of larval forms of invertebrates.	PSO - 1	R
CO - 2	comprehend the systematic position and physiological functions of vital systems in invertebrates.	PSO - 4	U
CO - 3	apply the cognitive skills to pursue higher studies and employability relevant fields.	PSO - 3	Ap
CO - 4	explore the structure and functions of vertebrates.	PSO - 2	An

Semester I**Core IV****Name of the course: Comparative Anatomy of Chordates****Course Code: PZ2014**

No. of hours/ week	No. of credits	Total number of hours	Marks
5	3	75	100

Learning Objectives

1. To provide the knowledge of origin, structure and function of different organ system of vertebrates.
2. To develop the skills to analyse the anatomy of vertebrates and its significance.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	identify the morphology and anatomy of major groups of vertebrates.	PSO - 1	R
CO - 2	interrelate the development of integuments, circulatory system, respiratory system, skeletal system, sense organs and nervous system.	PSO - 1	U
CO - 3	apply the cognitive skills to pursue higher studies and gain employability in academic and research institutions.	PSO - 3	Ap
CO - 4	analyse the anatomy of different groups of vertebrates.	PSO - 4	An

Semester I

Elective I (a)

Name of the course: - Animal Husbandry

Course Code: PZ2015

No. of hours/ week	No. of credits	Total number of hours	Marks
4	3	60	100

Learning Objectives

3. To gain knowledge on livestock management and construction of farms.
4. To develop skills on livestock farming and extend it to the society.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	acquire knowledge on Livestock resources, construction and management of Livestock farms.	PSO - 1	U
CO - 2	identify the breeds and stages of livestock.	PSO - 1	R
CO - 3	analyse the ethical laws formulated by the Animal Welfare	PSO - 4	

	Board.		An
CO - 4	develop entrepreneurial skills and gain employability in animal farms and research laboratories.	PSO - 3	Ap

Semester II

Practical I

Name of the course: Biochemistry and Ecobiology

Course Code: PZ20P1

No. of hours/week	No of credits	Total number of hours	Marks
4	4	60	100

Learning Objectives

1. To design and perform biochemical experiments.
2. To understand the interaction between abiotic and biotic environment.

Course Outcomes

CO	on completion of this course the students will be able to:	PSO addressed	CL
CO - 1	describe the knowledge necessary for professional or academic work in the field of biochemistry and ecology.	PSO - 1	U
CO - 2	analyse the biomolecules and physico-chemical parameters in samples.	PSO - 2	An
CO - 3	develop drawing and writing skills and design experiments.	PSO - 4	Ap
CO - 4	estimate the components of an ecosystem.	PSO - 2	

Semester III

Core IX

Name of the course: Physiology

Course Code: PZ2031

No. of hours/ week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

1. To impart knowledge on the structure and functions of various organs, organ systems and associated disorders.
2. To develop skills relevant for pursuing higher education and apply the knowledge in their life.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the structure and functions of organ systems.	PSO - 1	R
CO - 2	describe the anatomy of different physiological systems at the tissue and cellular levels.	PSO - 1	U
CO - 3	carry out physiological studies in the laboratory, interpret data and graphs and write a report.	PSO - 2	Ap
CO - 4	analyze the physiological changes in relation to environmental conditions.	PSO - 3	An
CO - 2	evaluate the physiological functioning of different organs.	PSO - 4	E

Semester III

Core X

Name of the course: Genetics and Evolution

Course Code: PZ2032

No. of hours/ week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

1. To enrich the knowledge on the principles of heredity at molecular level and to discern the evolutionary significance.
2. To develop skills for assessing heritability, identifying genetic disorders and constructing phylogenetic trees.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the principles of inheritance, mutation, genetic disorders, genetic equilibrium and patterns of evolution.	PSO - 1	R
CO - 2	describe Linkage and crossing over, Gene concept, Hardy Weinberg law and gene frequency, principles and methods of molecular evolutionary studies.	PSO - 1	U
CO - 3	interpret the heritability and its measurements, molecular and biochemical basis of genetic diseases, gene frequencies of population, Universal Tree of Life, cultural evolution of man.	PSO - 2	Ap

CO - 4	analyse the expressivity of genes, chromosome mapping, inheritance of particular character through Pedigree chart, Factors affecting Hardy Weinberg equilibrium and phylogenetic relationship.	PSO - 3	An
CO - 5	evaluate allelic and non-allelic interactions, effects of mutation, selection, migration, adaptation on Mendelian population.	PSO - 4	E

Semester III

Core XI

Name of the course: Culture and Capture Fisheries

Course Code: PZ2033

No. of hours/ week	No. of credits	Total number of hours	Mark s
6	4	90	100

Learning Objectives

- 1.To impart knowledge on the construction, maintenance and management of cultivable organisms in aqua farms.
- 2.To practice aqua farming and extend it to the society.

Course outcomes

CO	Upon completion of this course the students will be able to :	PSOs addressed	CL
CO - 1	recall the culture of finfish, shellfish and their management.	PSO - 1	R
CO - 2	describe different types of aquatic organisms, construction of ponds, nutrition and breeding in aquaculture.	PSO - 1	U
CO - 3	relate culture practices, breeding techniques, fish pathology, fishery genetics.	PSO - 2	Ap
CO - 4	analyse physico-chemical and nutritional factors for optimizing aquaculture, fish marketing and preservation.	PSO - 3	An
CO - 5	assess profitability of an established aqua farm.	PSO - 4	E

Semester III

Elective III (a)

Name of the course: General Endocrinology

Course Code: PZ2034

No. of hours/week	No. of credits	Total number of hours	Marks
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4	3	60	100
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Learning Objectives

1. To impart knowledge on the function and the pathology of the endocrine system.
2. To develop skills for analysing clinical problems of the endocrine system and pursue research.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	define the concepts of endocrine system, hormones, biosynthesis and pathology.	PSO - 1	R
CO - 2	associate the role of the endocrine system in relation to homeostasis, growth, development, behaviour and environmental factors.	PSO - 2	U
CO - 3	apply the knowledge of endocrine pathology to hormone- related disorders.	PSO - 4	Ap
CO - 4	envisage women related physiological processes related to endocrine glands and hormones.	PSO - 3	An
CO - 5	correlate endocrine regulation of growth, reproduction and metamorphosis in various invertebrates and vertebrates.	PSO - 4	E

Semester IV

Practical III

Name of the course: Physiology & Genetics and Evolution

Course code: PZ20P3 (Conducted during III Semester)

No. of hours/week	No of credits	Total number of hours	Marks
4	4	60	100

Learning Objectives

1. To equip the students to analyse the physiological processes and inheritance.
2. To develop the skill to trace the phylogenetic relationship of living organisms.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
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CO - 1	recall the functioning of organ and organ systems and Mendelian inheritance, population genetics, adaptive radiation and evidence of evolution.	PSO - 1	R
CO - 2	interpret the importance of factors in physiological activities and genes in inheritance, changes in gene and gene frequencies in a population.	PSO - 3	U
CO - 3	identify the sex and mutant forms in <i>Drosophila</i> , clinical features of disorders, gene frequencies in natural population.	PSO - 2	Ap
CO - 4	design experiments based on Hardy-Weinberg Law, enzyme activity and effect of physical factors on physiological activities.	PSO - 4	An

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Semester: IV

Major Core XII

Name of the Course : Microbiology

Subject code : PZ2041

Hours/ Week	Credits	Total Hours	Marks
6	4	90	100

Objectives

1. To facilitate the students to understand the microbes and their significance.
2. To develop skills in microbial techniques relevant to industries, environment and disease management.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	describe the structure, distribution and life cycle of microorganisms and their role in human welfare.	PSO - 1	R
CO - 2	explain culture techniques, growth, fermentation and microbial products.	PSO - 2	U
CO - 3	Apply the microbiological laboratory skills in clinical research, food industries and environmental management.	PSO - 3	Ap
CO - 4	analyze beneficial and harmful microbes	PSO - 3	An
CO - 5	evaluate the microbial importance and applications in various fields.	PSO - 4	E

Semester IV

Major Core XIII

Name of the course: Biotechnology and Nanobiology

Course Code: PZ2042

Hours/ Week	Credits	Total Hours	Marks
6	4	90	100

Objectives

1. To enable the students to understand the essence of biotechnology and become aware of the advances in Nanobiology.

2. To develop skills to apply biotechnological principles in research related to genetic manipulations, industrial and environmental biotechnology.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	explain the various techniques used in modern biotechnology.	PSO - 1	U
CO - 2	outline the basic concepts of Biotechnology and Nanobiology, its application and threat to the society.	PSO - 2	R
CO - 3	apply the biotechnological principles in research and judicial use of bio- and nanotechnology to solve societal problems.	PSO - 2	Ap
CO - 4	analyze the impact of biotechnological products and genetically modified organisms in bioremediation.	PSO - 3	An
CO - 5	evaluate the function, gene modulation and their effects on improvement of crops and animals after the applications of cloned genes.	PSO - 4	E
CO - 6	design simple experiments on biotechnology and communicate the results through publication.	PSO - 3	C

Semester : IV Major Core XI
Name of the Course : Biotechnology and Nanobiology
Course code : PZ2042

No. of hours/ week	No. of credits	Total number of hours	Marks
6	4	90	100

Learning Objectives

1. To enable the students to understand the essence of biotechnology and become aware of the advances in Nanobiology.
2. To develop skill of technical proficiency in genetic manipulation to try to improve agricultural production, pharmaceutical products, medical treatment, or mitigation of environmental pollution.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
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CO - 1	explain the various techniques used in modern biotechnology.	PSO - 1	U
CO - 2	outline the basic concepts of Biotechnology and Nanobiology, its application and threat to the society.	PSO - 2	R
CO - 3	apply the biotechnological principles in research and judicial use of bio- and nanotechnology to solve societal problems.	PSO - 2	Ap
CO - 4	analyze the impact of biotechnological products and genetically modified organisms in bioremediation.	PSO - 3	An
CO - 5	evaluate the function, gene modulation and their effects on improvement of crops and animals after the applications of cloned genes.	PSO - 4	E
CO - 6	design simple experiments on biotechnology and communicate the results through publication.	PSO - 3	C

Semester : IV Core XIV
Name of the Course: Immunology
Course Code : PZ2043

No. of hours/ week	No. of credits	Total number of hours	Marks
5	4	90	100

Learning Objectives

1. To facilitate the students to appreciate the defense functions of the immune system.
2. To develop the skill to determine the immunomodulatory strategies used to enhance or suppress the immune response.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the importance of immunity, immune response, MHC, BCR and TCR, antigen –antibody interaction.	PSO - 1	U
CO - 2	relate the evolution of immune molecules in different groups of animals, immunodeficiency diseases and immunotechniques.	PSO - 2	Ap
CO - 3	make use of immunization schedules, differentiate the types of hypersensitive allergic reactions and symptoms.	PSO - 3	An
CO - 4	analyse the immune response in relation to toxicants, vaccines, tumour, and infectious diseases.	PSO - 3	E
CO - 5	evaluate the role of immune cells and humoral factors in immune response	PSO - 4	C

CO - 6	predictimmuno-nano materials for immunodiagnostic, therapeutic techniques and research.	PSO - 1	U
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Semester IV

Elective IV (a)

Name of the course: Parasitology

Course Code: PZ2045

Hours/ Week	Credits	Total Hours	Marks
4	3	60	100

Objectives

1. To enable the students to be aware of the cosmopolitan distribution of parasites, vectors and their control measures.
2. To develop skills for employment in clinical laboratories and health departments.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	define the basic biology and life cycle of parasites including epidemiology, diagnosis and treatment.	PSO - 1	R
CO - 2	explain morphological characters of parasites, developmental stages and their infestation.	PSO - 1	U
CO - 3	identify appropriate techniques and develop basic skills for detection of parasites.	PSO - 3	Ap
CO - 4	analyse the medical and public health aspects of human parasitic infections.	PSO - 2	An
CO - 5	compare the diagnostic methods of parasitic infestation in veterinary hospitals, clinics and research laboratories.	PSO - 4	E

Semester: IV

Practical IV

Name of the Course: Microbiology & Biotechnology and Nanobiology

Course Code: PZ20P4

Hours/ Week	Credits	Total Hours	Marks
4	4	60	100

Learning Objectives

1. To demonstrate competency in routine microbiological and biotechnological techniques.
2. To develop skills in cell culture and analytical techniques for procuring employability in research laboratories.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall microbiological and biotechnological experiment protocols.	PSO - 1	R
CO - 2	identify tools and techniques relevant to microbiology and bio-nanotechnology.	PSO - 2	U
CO - 3	perform microbiological and biotechnological experiments pertinent for the welfare of the environment and society.	PSO - 4	Ap
CO - 4	analyse the impact of microbiological, biotechnological products and genetically modified organisms in bioremediation.	PSO - 3	An