B.SC. ZOOLOGY

PROGRAMME OUTCOMES OF B.SC. PROGRAMME

- Apply the broaden and in-depth knowledge of science and computing to analyse, think creatively and generate solutions to face the global challenges.
- Foster intellectual curiosity, critical thinking and logical reasoning.
- Adapt to different roles and responsibilities and develop leadership qualities in multicultural working environment by relating to diversity and ethical practices.
- Update the techniques and acquire skills to develop systems and methods to solve current problems.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSOs	Upon completion students of B.Sc. Zoology will be able to :
PSO - 1	Acquire knowledge on biosystematics and functional organization of animals.
PSO - 2	Undertake studies in a range of zoological disciplines including: Biochemistry, Cell Biology, Genetics, Physiology, Developmental Biology, Ecology, Evolution, Immunology, Microbiology, Biostatistics and Computer applications.
PSO - 3	Demonstrate practical skills and to interpret results obtained using the fundamental Zoological techniques.
PSO - 4	Develop entrepreneurship skills utilizing the knowledge gained from courses like Aquaculture, Sericulture, Apiculture, Poultry, Vermitechnology, Clinical lab technology and General health care.
PSO - 5	Plan their career goals and pursue higher studies to meet global challenges.

1.

2.

Semester : **III**

Name of the Course : **Cell Biology**
Course code : **ZC1731**

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

Learning Objectives

1. To enable the students to know about the diversified nature of cells and also the location, structure and functions of all cellular components.
2. To develop skill in micro- and molecular techniques. **Course Outcomes**

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	Recognize the cell organelles and discuss their functions.	PSO- 1	U
CO - 2	Explicate the structural organization of chromosomes and their significance.	PSO- 2	R
CO - 3	Outline the structure and functions of nucleic acids.	PSO- 2	R
CO - 4	Apply the knowledge of cell biology in cancer and stem cell research.	PSO -3	Ap
CO - 5	Demonstrate cytological techniques.	PSO- 3	Ap

Teaching Plan

Total Hours: 60 (Including Seminar & Test)

Unit	Module	Topics	Hours	Learning outcome	Pedagogy	Assessment
I	**Cell and micro techniques (9 hrs)**					
	1	Scope of cell Biology. Cell theory	1	Comprehend the scope of cell biology and cell theory	Lecture / Vocabulary drill	Jigsaw MCQ Short test Mind Map Formative Assessment I (1,2,4) Formative Assessment II (3)
	2	Microscopy: Compound, phase contrast and electron microscope.	3	Recognize different Microscopes and interpret its application	Lecture/ PPT	
	3	Cytological techniques: Fixation and fixatives – types of stains.	3	Develop skills to prepare permanent slides	Lecture / Demonstration	
	4	General organization of a prokaryotic (Bacteria) and Eukaryotic cell.	2	Differentiate prokaryotes and eukaryotes	Inquiry based learning/PPT/	
II	**Cell organelles (9 hrs)**					
	1	Ultrastructure and functions of Plasma membrane	2	Describe the structure of cell membranes and its functions	Lecture/PPT /video clippings on transport	Short test Objective test Formative Assessment I (1,2,) Formative Assessment II (1,2)
	2	Ultrastructure and functions of Mitochondria	2	Comprehend cellular respiration	Lecture/ PPT	
	3	Ultrastructure and functions of Ribosomes, Endoplasmic reticulum,	2	Explain the importance of endomembrane system in cellular function	Lecture/ Group discussion Concept map	
	4	Ultrastructure and functions of Golgi complex, Lysosomes, Centrosomes	3	Differentiate ER, Golgi, and lysosome	Lecture/ppt	
III	**Nucleus (9hrs)**					
	1	Ultrastructure and functions of Nucleus - Nuclear membrane, Nucleolus.	2	Describe the structure and function of the nucleus	Lecture / Group discussion/ppt	Short test MCQ

	2	Chromosomes – types, structure and functions.	1	Classify chromosomes and enumerate its functions	Lecture/ppt	Objective test Formative Assessment I (1,2,3) Formative Assessment II (4)
	3	Special types of chromosomes - Polytene and Lamp brush.	1	Trace special types of chromosomes.	Lecture/ PPT	
	4	Structure, functions and types of Nucleic acids (DNA & RNA).	4	Recognize the composition and roles of nucleic acids in the cell	Lecture / model	
IV	**Gene Expression and regulation (9hrs.)**					
	1	General characteristics of Genetic code	1	Explain the genetic code	Lecture/ Demonstration/ PPT	Open book test MCQ Formative Assessment II Formative Assessment III (5)
	2	Structure of gene - promoter sequence and coding sequence.	2	Comprehend the gene structure	Mind Map/Lecture	
	3	Protein synthesis – transcription and translation in prokaryotes.	3	Explain inter relation between transcription, translation, and protein synthesis	Lecture/ppt	
	4	Regulation of gene expression - Lac operon.	3	Explain the control of transcription by Lac operon	Lecture/ Videoclipping	
V	**Cell division and significance (9hrs.)**					
	1	Cell cycle –Mitosis Meiosis Mitotic apparatus, anaphase chromosomal movements and synaptonemal complex.	4	Describe and differentiate the major events of a cell	Mind map, Demonstration/Lecture/ mind map	Short test, Quiz, Formative Assessment III (1,2,3)
	2	Cancer – properties of cancer cells, types, causes, diagnosis and treatment	2	List the characteristics and treatment of cancer cells	Lecture/PPT	
	3	Oncogenes, Aging and Apoptosis.	3	Describe the of role oncogenes in cancer and cell death	Lecture/Discussion	

Course instructor
Dr. S. Mary Mettilda Bai

Head of the Department
Dr. S. Mary Mettilda Bai

Semester : **III** **Major Elective I (a)**
Name of the Course : **Biochemistry and Biophysics**
Course code : **ZC1732**

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

Learning Objectives

1. To enrich the knowledge of students on the structure, classification and metabolism of biomolecules and to learn the principle and functions of specified bio-instruments.
2. To develop practical skills on biochemical techniques and to use bioinstruments

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO – 1	Discuss the structure of an atom, molecule and their interactions.	PSO – 1	U
CO – 2	Evaluate the importance of buffer system and enzymes.	PSO – 2	R
CO – 3	Classify biological macromolecules and describe their structure and significance.	PSO – 2	R
CO – 4	Use methods and techniques of physics to study biological processes.	PSO – 3	Ap
CO – 5	Apply basic methods in the fields of biophysics, biochemistry.	PSO – 3	Ap

Modules with Teaching Plan

Credits: 4 **Total Hours: 60 (Incl. Seminar & Test)**

Unit	Mod	Description	Hours	Learning	Pedagogy	Assessment
I	**Bonds and Buffer**					
	1	Atoms – Chemical bonds Isotopes	2	Explain Atoms , Chemical bonds and isotopes	Lecture, Demonstration , PPT	Short test, Quiz, Formative Assessment I (1,2)
	2	Hydrogen ion concentration – pH Measurement of pH Acids and bases, Acidosis and alkalosis	4	Demonstrate pH and evaluate the importance of acids and bases	Lecture, PPT	
	3	Buffers – Mechanism of buffer action Hendersen-Hasselbalch equation Biological buffer systems Significance of buffers	3	Discuss the mechanism of buffer action	Demonstration , Lecture, Video class	Formative Assessment II (3)
II	**Proteins**					
	1	Amino acids – classification Structure and properties	2	Explain the structure and properties of amino acids	Lecture	Short test, Quiz,

	2	Proteins – classification Structure (primary, secondary, tertiary and quaternary) Haemoglobin, Silk Biological functions of proteins.	4	Compare the structure and biological functions of Proteins	Demonstration , Lecture	Formative Assessment I (1,2) Formative Assessment II (3, 4)
	3	Enzymes –Classification of enzymes, nomenclature Properties Mechanism of enzyme action	4	Discuss the classification, nomenclature and mechanism of enzyme action	Lecture , Demonstration, PPT	
III	**Carbohydrates and Lipids**					
	1	Carbohydrates – classification Monosaccharides(glucose and fructose) Disaccharides(sucrose and lactose) Polysaccharides(glycogen) Biological functions of carbohydrates	4	Discuss the carbohydrates – classification and biological functions	Lecture , Demonstration/ PPT	Short test, Quiz, Formative Assessment I (1) Formative Assessment II (2)
	2	Lipids – classification Simple lipids(triglycerides and waxes) Compound lipids (lecithin), Derived lipids(cholesterol) Biological functions of lipids	4	Discuss the properties of compound lipids and their biological functions	Lecture	
IV	**Thermodynamics and Light**					
	1	Laws of thermodynamics, enthalpy, entropy Free energy, Redox reactions and redox potential ATP bioenergetics	3	Recall the laws of thermodynamics, free energy, redox potential and bioenergetics	Lecture , PPT	Short test, Quiz, Formative Assessment I (1,2) Formative Assessment II (3)
	2	Membrane conductivity- diffusion, osmosis Active transport – mechanism, biological significance	2	Explain the membrane conductivity and biological significance	Lecture , PPT	
	3	Light –Nature and properties Electromagnetic spectrum- Absorption and Emission spectrum Fluorescence and Phosphorescence Bioluminescence	4	List the properties of light. Describe fluorescence , phosphorescence and bioluminescence	Lecture , PPT	
V	**Bioinstrumentation**					

	1	Centrifugation – principle and applications of differential and density gradient centrifugation Types of centrifuges	3	State the principles and applications of centrifugation	Lecture , PPT	Short test, Quiz, Formative Assessment III (1,2,3,4,5,)
	3	Colorimeter and spectrophotometer – principle, instrument and applications.	2	Demonstrate colorimetry and spectrophotometry	Lecture	
	4	Chromatography – principle and applications of paper, thin layer and column chromatography.	2	Differentiate thin layer and column chromatography	Lecture ,	
	5	Electrophoresis – principle and applications of Agarose and PAGE.	2	State the principles and applications of Agarose and PAGE.	Lecture	

Course instructor
Dr. S. Prakash Shoba

Head of the Department
Dr. S. Mary Mettilda Bai

Semester : **III** **Major Practical III**
Name of the Course : **Cell Biology, Biochemistry and Biophysics**
Course code : **ZC17P3**

No. of hours/week	No. of credits	Total number of hours	Marks
2	2	30	100

Learning Objectives

1. To develop skill in identifying cell types and cell division.
2. To apply working principles in basic bio instruments and to interpret the biological changes.

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO	CL
CO - 1	Prepare squash and smear of Biological samples and identify the cells.	PSO - 3	Ap
CO - 2	Develop skills in handling analytical instruments.	PSO - 3	Ap
CO - 3	Analyse biochemical constituents qualitatively and quantitatively.	PSO - 2	An
CO - 4	Use paper chromatography to separate biomolecules.	PSO - 3	Ap
CO - 5	Understand the structure of biomolecules and the Principles of biological processes.	PSO - 3	U

Teaching Plan

Credits: 2 **Total Hours: 30**

Module	Description	Hours	CO No.
1	Observation of mitosis in onion root tip.	2	1
2	Observation of giant chromosomes in *Chironomus* larva.	2	1

3	Preparation of Human blood smears.	2	1
4	Smear preparation of Squamous epithelium.	2	1
5	Qualitative test for carbohydrates, lipids and proteins.	2	3
6	Quantitative estimation of protein by Biuret method.	2	3
7	Determination of pH using pH meter.	2	2
8	Separation of amino acids using paper chromatography.	2	4
9	Verification of Beer's Law.	2	2
10	Demonstration of osmosis using grapes.	2	5
11	Compound microscope, Mitochondria, Golgi complex	2	2, 1
12	Endoplasmic reticulum, Ribosomes, Lysosomes (polymorphism)	2	1
13	Interphase Nucleus, DNA (Watson & Crick model), tRNA	2	1
14	Glucose, Amino acid, Cholesterol, ATP, EM spectrum	2	5
15	Centrifuge, Colorimeter, pH meter	2	2

Semester : III **Allied Zoology**
Name of the Course : General Zoology
Course code : ZA1731

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

Learning Objectives

1. To acquire a basic knowledge about animal diversity and general principles of Cell Biology, Genetics, Developmental Biology, Evolution and Physiology.
2. To seek employment in educational institutions and museums.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO	CL
CO- 1	Describe general principles of taxonomy on animal classification.	PSO -1	U
CO- 2	Explain the specific characteristics of invertebrates and vertebrates.	PSO -2	R
CO- 3	Explain the structure of cells, chromosomes and apply the knowledge of genetics in identifying genetic disorders.	PSO -2; PSO -3	R ; Ap
CO -4	Explain the development and evolution of animal life.	PSO -2	R
CO- 5	Recognize the major functions of organ systems in human body and the role played by animals in their environment.	PSO -2	R
CO -6	Apply diverse taxonomic resources for animal identification and simple experimental procedures pertaining to the course.	PSO -2 PSO -3	Ap

Teaching Plan
Total Hours: 60 (Including Seminar & Test)

Unit	Module	Topics	Hours	Learning outcome	Pedagogy	Assessment
I	**Invertebrate Zoology (9 hrs)**					
	1	General characters of Invertebrates – Classification upto phylum with two examples for each.	2	State the principles of taxonomy on animal	Lecture, PPT	MCQ Short test Mind Map Formative Assessment I (1,2,4) Formative Assessment II (3)
	2	*Paramecium* – external features and Conjugation *Obelia* – external features Polymorphism	3	Recall the anatomy and physiology of	Lecture, Vocabulary drill	
	3	*Ascaris*- external features and Parasitic adaptations *Penaeus* – external features	2	Describe the anatomy and physiology of *Ascaris*	Lecture, Demonstration	
	4	Star fish – external features Water vascular system.	2	Discuss the anatomy and physiology of	Lecture, Group discussion	
II	**Chordate Zoology (9 hrs)**					
	1	General characters of chordates Outline classification up to classes with one example and characteristics of Chordates	2	Relate the general principles of taxonomy in animal	Brain Storming, Lecture	Short test Mind map Objective test Formative Assessment I (1,2) Formative Assessment II (3,4)
	2	Rabbit – external characters Migration of fishes	2	Identify the external features of rabbit and fish	Lecture, Video	
	3	Identification of poisonous snakes Identification of non-poisonous snakes Poison apparatus and First-aid for snake bite	3	migration Differentiate poisonous and non-poisonous	Lecture, Group discussion	
	4	Flight adaptations in birds Dentition in mammals	2	Identify the flight adaptations in birds and dentition in	Lecture, video	
III	**Cell Biology and Genetics (9hrs.)**					

	1	Structure of prokaryotic and eukaryotic cell Human chromosomes – structure – types and function	3	Differentiate prokaryotic and eukaryotic cell, and state the structure of human chromosomes	Lecture , PPT	Short test MCQ Objective test Formative Assessment I (1,2,3) Formative Assessment II (4)
	2	Simple Mendelian traits in man Genetics of blood groups in man,	2	Explain Mendelian traits in man and Genetics of blood	Lecture , Group discussion	
	3	Sex linked inheritance in man Colour blindness and haemophilia	2	Identify Sex linked inheritance in man	Lecture , PPT	
	4	Non-disjunction and syndromes in man: Klinefelter's syndrome Turner's syndrome and Down's syndrome	2	Recognize the syndromes in man	Lecture, PPT	
IV	**Developmental Zoology and Evolution (9hrs.)**					
	1	Early development in frog Structure of sperm and ovum	2	Recall the structure of sperm and egg of	Lecture , PPT	Diagram test Open book test MCQ Formative Assessment I (1,2,3,4) Formative Assessment III (5)
	2	Fertilization Cleavage	2	Describe Fertilization and Cleavage	Lecture, video	
	3	Blastulation Gastrulation	2	Explain Blastulation and Gastrulation	Lecture, video	
	4	Placenta – Types and functions	1	Differentiate the types of Placenta	Lecture , PPT	
	5	Urey Miller Experiment Modern synthetic theory of evolution.	2	Demonstrate the theory of evolution	Lecture	
V	**Physiology (9hrs.)**					
	1	Digestion – digestion of carbohydrates Digestion – digestion of proteins and fats	1	Discuss digestion in man	Lecture, PPT	Short test, Quiz (1,2) Formative Assessment
	2	Respiration – structure and functions of lungs in man.	1	Recall the mechanism of respiration in	Lecture	

	3	Excretion: structure and functions of kidney in man. Circulation: structure and function of human heart.	3	Describe the anatomy and physiology of kidney and heart of man	Lecture , PPT	III (1, 2, 3,4)
	4	Nervous system – central, peripheral, Sympathetic, parasympathetic Nervous system - Structure of a neuron.	4	Explain the nervous system of man	Lecture, video	

Course instructors
Dr. X. Venci Candida

Head of the Department
Dr. S. Mary Mettilda Bai

Semester : V **Major Core**

V Name of the Course: Physiology

Course code : ZC1751

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

Learning Objectives

1. To make students understand the functional significance of the different organs and organ systems of animals.
2. To provide job opportunities in academic institutions, National Health Service Centers.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	understand the basic anatomy of digestive, respiratory, excretory, homeostatic, neuromuscular, endocrine and reproductive system.	PSO - 1	U
CO - 2	describe the functional mechanism of internal regulation by different organ systems.	PSO - 1	U; R
CO - 3	compare various organ systems and discuss the adaptations exhibited by animals.	PSO - 1	U; E
CO - 4	analyze the reason for diseases in man and other organisms.	PSO - 8	U; An
CO - 5	use anatomical knowledge to predict physiological consequences.	PSO - 8	Ap; C; An

Teaching plan with Modules

Total Hours 90 (Incl. Assignments & Test)

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	**Nutrition, Digestion and Absorption** (18 Hrs.)					
	1	**Nutrition:** Types, composition of food - importance of nutrients**.**	3	Explain the composition of food and importance of nutrients. **(CO-1)**	Lecture, Chalk and talk, Video	Short test, MCQ, Online Assignment through Quizizz, Formative Assessment
	2	Balanced diet, Basal metabolic rate (BMR) and Body mass index (BMI).	3	Recognize the balanced diet, basal metabolic rate and Body mass index. **(CO-1,4)**	Lecture, PPT	
	3	Malnutrition (Marasmus, Kwashiorkor, Obesity, epidemic dropsy).	3	Discuss Malnutrition. **(CO-1,4)**	Lecture, PPT	

	4	Digestive system of man.	3	Illustrates the digestive system of man. **(CO-1,2)**	Lecture, PPT, You tube	I (1,2,3,4,5), Quiz I
	5	Digestion of carbohydrate, protein and fat. Absorption and assimilation of digested food materials.	4	Relates the Digestion of food materials. **(CO-1,2)**	Lecture, PPT	
	6	Physiology of ruminating stomach.	2	Recall the Physiology of ruminating stomach. **(CO-1,2)**	Lecture.	
II	**Respiration, Osmoregulation & Thermoregulation** (18 Hrs.)					
	1	Respiratory organs, Respiratory pigments.	3	Explain the Respiratory organs, and Respiratory pigments. **(CO-1,2)**	Lecture, PPT, Video	MCQ, **Respiratory system of man, transport of O_2 and CO_2.** Formative Assessment I (1,2,3), Quiz I, Formative Assessment II (4,5), Quiz II,
	2	Respiratory system of man, gaseous exchange - transport of O_2 and CO_2, Dissociation curve, Bohr's effect.	5	Discuss the Respiratory system of man. **(CO-1,2)**	Lecture, PPT, Team teaching	
	3	Chloride shift, Anaerobiosis, Respiratory Quotient.	3	Explores the process of Chloride shift, Anaerobiosis and Respiratory Quotient. **(CO-1,2)**	Lecture, PPT	
	4	Osmoregulation: Osmoconformers, Osmoregulators, Osmoregulation in crustaceans, fishes and mammals.	4	Recognize the Process of Osmoregulation. **(CO-1,2,3)**	Lecture, PPT, Chalk and talk, Virtual learning	
	5	Thermoregulation: Poikilotherms and Homeotherms, thermoregulatory Mechanism.	3	Recognize the Process of Thermoregulation. **(CO-1,2,3)**	Lecture, PPT	
III	**Circulation, Excretion** (18 Hrs.)					
	1	Blood Composition. Myogenic and neurogenic heart, structure of human heart.	4	Explain the Structure of human heart. **(CO-1,2)**	Lecture, Self learning	MCQ Short test, Online assignment through Edmodo,
	2	Heart beat - its origin and conduction, Pace maker, cardiac cycle, ECG, blood pressure.	4	Discuss the Heartbeat, Pace maker, cardiac cycle, ECG, blood pressure. **(CO-1,2)**	Lecture, Reflective teaching, PPT	

	3	Heart diseases: arthrosclerosis, acute coronary occlusion, Myocardial infarction.	2	Discuss Heart diseases. **(CO-1,4,5)**	Lecture, PPT	Formative Assessment II (1,2,3,4,5,6) Quiz II, Quizizz.
	4	Excretion: Patterns of excretion, excretory organs in invertebrates.	3	Recall the process of Excretion. **(CO-3)**	Lecture, PPT,	
	5	Structure of kidney in man, nephron and Mechanism of urine formation.	3	Discuss the structure and functions of kidney in man. **(CO-1,2)**	Lecture, PPT, Web based class	
	6	Composition of urine. Nephritis and Dialysis.	2	Recall the Composition of urine. Nephritis and Dialysis. **(CO-1,3,5)**	Lecture, PPT	
IV	**Muscle physiology, Neurophysiology, Receptors** (18 Hrs.)					
	1	Types of muscles, Ultrastructure and properties of skeletal muscle.	3	Explain the types of muscles, ultrastructure and properties of skeletal muscle. **(CO-1,2)**	Lecture, PPT, Discussion.	MCQ, Short test, Formative Assessment II (1,2) Quiz II, Formative Assessment III (3,4,5,6),
	2	Mechanism of muscle contraction and Rigor mortis.	3	Discuss the mechanism of muscle contraction and Rigor mortis. **(CO-1,2)**	Lecture, PPT, Video lesson.	
	3	Structure and types of neurons, Neurotransmitters.	2	Explain Nervous system and Structure of a neuron. **(CO-1,2)**	Lecture, PPT, Discussion.	
	4	Conduction of nerve impulse through myelinated and non-myelinated nerve, Conduction of nerve impulse through synapse and euro muscular junction.	5	Recall the conduction of nerve impulse. **(CO-1,2)**	Lecture, PPT.	
	5	Reflex action.	1	Discuss the Reflex action. **(CO-1,2)**	Lecture, PPT	
	6	Receptors: Types, Physiology of photoreception and phonoreception.	4	Recognize receptors. **(CO-1,2,5)**	Lecture, PPT, Video	
V	**Endocrine Physiology, Reproductive Physiology** (18 Hrs.)					
	1	Hormones and Pheromones.	2	Discuss hormones and pheromones. **(CO-1,2)**	Lecture, PPT, Discussion	MCQ Short test, Formative Assessment III (1,2,3,4,5),
	2	Endocrine glands - Pituitary, Thyroid, Parathyroid, Adrenal, Islets of Langerhans.	5	Discuss the endocrine glands. **(CO-1,2,5)**	Lecture, PPT	
	3	Biological clock and biological rhythms.	2	Discuss the biological clock and biological	Lecture, PPT	

				rhythms. **(CO-1,2)**		
	4	Male reproductive system. Female reproductive system, structure of graffian follicle.	4	Recall the structure of reproductive system. **(CO-1,2,5)**	Lecture, PPT, Discussion, Video	**Assignment on Female reproductive system.**
	5	Sexual cycles: Oestrus cycle, menstrual cycle- Menopause.	3	Recognize sexual cycles. **(CO-1,2,5)**	Lecture, PPT, Discussion	
	6	Hormonal regulation of menstruation, pregnancy and lactation.	2	Explain the hormonal regulation of menstruation, pregnancy and lactation. **(CO-1,2,5)**	Lecture, PPT	

Course instructor **Head of the Department**

Dr. A. Punitha Dr. S. Mary Mettilda Bai

Semester : V **Major Core VI**

Name of the Course : **Developmental Zoology**

Course code : **ZC1752**

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

Learning Objectives

1. To understand the sequential changes from cellular grade of organization to organ grade of organization in the development of multicellular organisms.
2. To pursue a wide range of career related to women's health and also in fields concerned with maternal and reproductive medicine.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	explain gametogenesis, fertilization and parthenogenesis.	PSO - 2	U
CO - 2	describe cleavage, morphogenetic movements and gastrulation.	PSO - 2	R
CO - 3	acquire knowledge on Organizer, gradient system foetal membranes and placentation in mammals	PSO - 6	U
CO - 4	demonstrate metamorphosis and regeneration	PSO - 2	R
CO - 5	discuss Nuclear cytoplasmic interaction, assisted reproductive technology and birth control measures.	PSO - 8	R

Teaching plan with Modules

Total Hours 90 (Incl. Assignments & Test)

Units	Modules	Topics	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
I	**Gametogenesis, Fertilization, Asexual Reproduction & Parthenogenesis** (18 Hrs.)					
	1	Gametogenesis: Introduction, Spermatogenesis, Oogenesis.	4	Explains the process of spermatogenesis and oogenesis. **(CO-1)**	Flow Chart, PPT.	MCQ Short test Open book test Formative Assessment I (1,2,3,4), Quizizz.
	2	Types of sperm and egg, egg membranes. Structure of sperm and egg of frog, chick and human.	5	Differentiates the structure of sperm and egg of frog, chick and human. **(CO-1)**	Lecture, PPT.	
	3	Fertilization: significance, types, chemical and cytological factors involved	5	Identifies the cytological and physiological changes during fertilization.	Group discussion, Lecture.	

		in fertilization - physiological changes in fertilization. Asexual reproduction.		**(CO-1)**		**Assignment on Partheno-genesis: types and significance.**
	4	Asexual reproduction. Parthenogenesis: types and significance.	4	Illustrates the process of parthenogenesis. **(CO-1)**	Lecture, video - you tube.	
II	**Cleavage & Organogenesis** (18 Hrs.)					
	1	Cleavage: Planes and patterns of cleavage, cleavage and blastulation in frog.	4	Relates the different planes and patterns of cleavage. **(CO-2)**	Lecture, pictographic method.	Quiz, Slip test Formative Assessment I (1,2,3) Formative Assessment II (4,5,6), Online assignments using Edmodo.
	2	Fate map of frog. Morphogenetic movements.	3	Relates the morphogenetic movements during blastulation. **(CO-2)**	Video lesson, Lecture, blended classroom.	
	3	Gastrulation in frog.	2	Explores the process involved in gastrulation. **(CO-2)**	PPT, Lecture.	
	4	Stem cells. Development of brain, eye, heart and digestive system in frog.	6	Records how the different organs are developed. **(CO-3)**	Lecture/ Video lesson.	
	5	Development of digestive system in frog.	2	Recognize the development of digestive system. **(CO-3)**	Lecture, flipped classroom.	
	6	Transplantation.	1	Identifies the process of transplantation. **(CO-3)**	Lecture.	
III	**Organizer, Gradient theory & Extra embryonic membranes** (18 Hrs.)					
	1	Organizer: **S**pemann's experiments- organizer in amphibian embryo.	4	Identifies organizer through experimental study. **(CO-3)**	Brain storming, Lecture.	Open book test Quiz, Slip test Formative Assessment II (1,2,3,4.5.6), Kahoot Quiz.
	2	Embryonic induction - neural induction. Competence.	2	Explains the embryonic and neural induction. **(CO-3)**	Group discussion, Lecture.	
	3	Gradient theory: gradient system - types, experimental evidences.	4	Differentiates the different types of gradient system. **(CO-3)**	Lecture, vocabulary drills.	
	4	Morphogenetic fields.	2	Identifies morphogenetic fields. **(CO-3)**	Lecture, video lesson.	
	5	Extra embryonic membranes: Development of foetal membranes.	3	Illustrates the development of foetal membranes. **(CO-3)**	Lecture, flash cards.	
	6	Placenta in mammals - classification, functions and development. Placental	3	Relates the different types of placenta. **(CO-3)**	Lecture, PPT using smart board.	

		preservation.				
IV	**Metamorphosis & Regeneration** (18 Hrs.)					
	1	Metamorphosis: Types, Insect and Amphibian metamorphosis.	5	Explores the process of metamorphosis. **(CO-4)**	Flow Chart, PPT.	MCQ Formative Assessment II (1) Formative Assessment III (2,3,4), **Assignment** through Edmodo: **Physiological changes involved in regeneration.**
	2	Hormonal control of metamorphosis in Insect and Amphibian.	3	Records how hormones control metamorphosis. **(CO-4)**	Lecture, PPT.	
	3	Regeneration: types, regeneration in Planaria, Amphibia and human liver.	5	Recognize the regeneration process in Planaria, amphibian and human. **(CO-4)**	Group discussion, Lecture	
	4	Factors influencing regeneration, physiological changes involved in regeneration.	5	Identifies the factors involved in regeneration.**(CO-4)**	Lecture, online video lesson	
V	**Nucleo-cytoplasmic interaction, In *vitro* fertilization & Birth Control** (18 Hrs.)					
	1	Nucleo-cytoplasmic interaction: Acetabularia.	2	Explains the Nucleo-cytoplasmic interaction. **(CO-5)**	Lecture, pictographic method.	Quiz, Slip test Formative Assessment III (1,2,3,4,5,6), Quizizz.
	2	In *vitro* fertilization: Infertility – causes and diagnostic parameters – hormonal imbalance.	4	Recalls the causes of infertility. **(CO-5)**	Video lesson, lecture.	
	3	Poly Cystic Ovarian Diseases (PCOD) - artificial insemination.	4	Identifies PCOD diseases. **(CO-5)**	PPT, lecture.	
	4	Cryopreservation of sperm and ovum - test tube babies – amniocentesis.	3	Illustrates the process of cryopreservation. **(CO-5)**	Lecture/ Video lesson.	
	5	Birth control: contraceptive devices - surgical method.	2	Relates the different contraceptive devices. **(CO-5)**	Lecture, flipped classroom.	
	6	Hormonal and therapeutic methods of birth control - physical barriers - IUCD.	3	Explores the hormonal and therapeutic methods of birth control. **(CO-5)**	Lecture, models and pictographic method.	

Course Instructor **Head of the Department**

Dr. X. Venci Candida Dr. S. Mary Mettilda Bai

Semester : V **Major Core VII**

Name of the Course : **Ecology and Toxicology**

Course code : **ZC1753**

No. of hours/ week	No. of credits	Total number of hours	Marks
5	5	75	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 seek employment in Food and Drug Administration agency and Environmental Protection Agency.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	discuss the abiotic and biotic factors of the natural ecosystem.	PSO - 1	U
CO - 2	identify the natural resources and its conservation.	PSO - 2	R
CO - 3	critically evaluate the environmental degradation and suggest measures for remediation.	PSO - 3	Ap; E
CO - 4	identify hazardous environmental factors and assess their effects.	PSO - 7	Ap; An
CO - 5	utilize scientific literature and database to effectively communicate aspects of toxicology.	PSO - 5	Ap

Teaching plan with Modules

Total Hours 75 (Incl. Assignments & Test)

Units	Modules	Topics	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
I	**Ecology, Biotic factors and Habitat ecology** (15 Hrs.)					
	1	Scope - Branches of ecology, Abiotic factors: Biological effects of temperature and light.	5	Explains the scope of ecology and biological effects of abiotic factors. **(CO-1)**	Lecture, PPT	MCQ Short test Open book test Formative
	2	Concept of limiting factors: Liebig's law of minimum,	2	Illustrate the concept of limiting factors. **(CO-1)**	Lecture, Video	

		Shelford's law of tolerance.			lesson	Assessment I (1,2,3,4), Quiz I Online assignment
	3	Biotic factors: mutualism – commensalism – antagonism (antibiosis, parasitism, predation and competition).	2	Identifies the species interaction. **(CO-1,2)**	Flipped learning, Lecture	
	4	Habitat ecology: Characteristics and communities of Aquatic – freshwater (pond) and marine – terrestrial (forest, grass land, Desert) and adaptations of organisms.	6	Relates the different organism living in different habitats. **(CO-1)**	Lecture, PPT, Experiential learning	
II	**Ecosystem, Biogeochemical cycle and Population ecology** (15 Hrs.)					
	1	Ecosystem: Structure (abiotic and biotic) - food chain and food web - Trophic levels - energy flow and ecological pyramids.	6	Describes the structure and function of ecosystem. **(CO-1)**	Lecture, PPT, Video class	Quiz, Formative Assessment I (1,2) Formative Assessment II (3), Online assignments through Edmodo
	2	Biogeochemical cycle: nitrogen and phosphorous cycle.	4	Explains the bio-geochemical cycle. **(CO-1,2)**	Video, Lecture	
	3	Population ecology: density, natality, mortality, age distribution, population growth, biotic potential, population dispersal and dispersion, regulation.	5	Describes the different characteristics of population. **(CO-1)**	PPT, Lecture blended classroom	
III	**Community & Ecological succession** (15 Hrs.)					
	1	Community: Community structure, composition and stratification.	4	Illustrate the community structure and stratification. **(CO-1)**	Lecture, PPT	Quiz MCQ Short test Formative Assessment II (1,2,3,4.), Quiz II
	2	Ecological niche, Ecotone and Edge effect, Ecotype.	3	Explains ecological niche, ecotone and edge effect. **(CO-1)**	Lecture, Discussion,	
	3	Ecological succession: types, general process, Concepts of climax, patterns of succession.	5	Differentiates the ecological succession and climax community. **(CO-1)**	Lecture, flipped learning	
	4	Animal distribution – continuous, discontinuous. Zoogeographical regions of world.	3	Describes the distribution of animals. **(CO-1)**	Lecture, PPT	
IV	**Wild life conservation & Urbanization** (15 Hrs.)					
	1	Wild life conservation: Necessity, causes, endangered species	3	Explain the wild life conservation, necessity and causes. **(CO-2,4)**	Flow Chart, PPT	Online assignment: **Urbanization - advantages,**
	2	Methods of conservation - in situ (sanctuaries and	2	Records conservation methods and gain	Lecture, PPT, Mind	

		national parks) and ex situ (zoo and germplasm bank).		knowledge on national parks. **(CO-2,3)**	map	**problems, solutions**
	3	Remote sensing and its applications in agriculture, fisheries, forest management and food management.	5	Gain knowledge on remote sensing application agriculture, fisheries, forest management and food management. **(CO-2,4)**	PPT, Lecture	Formative Assessment II (1,2) Formative Assessment III (3,4)
	4	Urbanization: Possible advantages of urbanization – problems, solutions.	5	Explains the advantages problems and solutions of urbanization. **(CO-2,4)**	Lecture, blended learning	
V	**Toxicology & Environmental toxicology** (15 Hrs.)					
	1	Toxicology: toxicants - classification - toxicity (LC_{50}, and LD_{50}), toxic agents and their mode of action.	4	Explains the toxicants and their classification and toxicity. **(CO-4,5)**	Lecture, Flow chart	Quiz, Formative Assessment III (1,2,3,4). **Online Assignment**: **Toxic effects of pesticides.**
	2	Toxic effects of metals, solvents, pesticides, carcinogens, food additives, drugs and poisons and radiations.	4	Records the toxic effects of metals, solvents, pesticides, carcinogens, food additives, drugs and poisons and radiations. **(CO-4,5)**	Video lesson, lecture, PPT	
	3	Environmental toxicology: environmental pollutants, toxicants and contaminants.	4	Identifies environmental pollutants, toxicants and contaminants. **(CO-4,5)**	PPT, lecture	
	4	Behaviour of toxicants in the environment – effect of xenobiotics.	3	Illustrates the behaviour of toxicants in the environment. **(CO-4,5)**	Lecture, Video lesson	

Course Instructor **Head of the Department**

Dr. S. Prakash Shoba Dr. S. Mary Mettilda Bai.

Semester : V **Major Elective III (b)**
Name of the Course : Sericulture
Course code : ZC1755

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

Learning Objectives

1. To develop skills in sericulture in order to enable the students to adopt it as a vocation after their graduation as it is rural based and welfare-oriented agro based industry.
2. To develop entrepreneurial way of thinking that will allow them to identify and create business opportunities that may be commercialized successfully.

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	Explain the cultivation and maintenance of mulberry plantation.	PSO - 5	U
CO - 2	Identify the diseases and pests of mulberry plant and silk worm.	PSO - 5	R
CO - 3	Rear silkworms and gain knowledge on silk reeling.	PSO - 9	Ap
CO - 4	Evaluate the quality of cocoon and marketing.	PSO - 9	An; E
CO - 5	Acquire skills necessary for self-employment in sericulture.	PSO - 8	Ap; C

Teaching plan with Modules

Total Hours 75 (Incl. Assignments & Test)

Units	Modules	Topic	Hours	Learning outcome/ CO Addressed	Pedagogy	Assessment
I	**Introduction to Sericulture and Moriculture** (15 Hrs.)					
	1	Importance to Sericulture. Silk Road.	2	Appreciate Sericulture. Recall Silk Road. **(CO-5)**	Lecture, Map	Short test, MCQ, Formative Assessment I (1-7), Quiz I Quizizz
	2	Sericulture industry in India. Sericulture as cottage industry.	2	Illustrate Sericulture as cottage Industry. **(CO-5)**	Lecture	
	3	Birth and role of CSB.	2	Recognize the role of CSB. **(CO-5)**	Flow chart	
	4	Important mulberry varieties. Optimum conditions for mulberry growth.	2	Discuss the Optimum conditions for mulberry growth. **(CO-1)**	PPT	
	5	Planting system. Methods of propagation - seedling, vegetative and new methods - irrigation.	3	Explain the Planting system of mulberry and the methods of propagation and irrigation. **(CO-1)**	Lecture, PPT	

	6	Biofertilizers - Green manuring, Triacontanol and Seriboost.	2	Appreciate green manuring. **(CO-1)**	Lecture	
	7	Pruning - harvesting of leaves. Preservation of leaves. Nutritive value of mulberry.	2	Explain pruning, harvesting and preservation of leaves. **(CO-1)**	Lecture, Demonstration	
II	**Diseases of Mulberry** (15 Hrs.)					
	1	Diseases: Fungal - white and violet root rot and Fusarium root rot.	3	Explain fungal root diseases of Mulberry. **(CO-2)**	Lecture, PPT, Discussion	Short test, MCQ, Open book test, Formative Assessment II (1-7), Quiz II Quizizz **Assignment on "Diseases of Mulberry".**
	2	Fungal stem rot and stem canker and wilt diseases.	2	Explain fungal stem diseases of Mulberry. **(CO-2)**		
	3	Leaf spot and powdery mildew diseases.	2	Explain fungal leaf diseases of Mulberry. **(CO-2)**		
	4	Bacterial - leaf blight and rot diseases	2	Explain bacterial diseases of Mulberry. **(CO-2)**		
	5	Viral - dwarf and leaf mosaic diseases	2	Explain viral diseases of Mulberry. **(CO-2)**		
	6	Nematode - root knot disease	2	Explain root knot disease of Mulberry. **(CO-2)**		
	7	Deficiency diseases - nitrogen, phosphorus, magnesium and potassium	2	Explain deficiency diseases of Mulberry. **(CO-2)**		
III	**Pests of Mulberry, Biology of silkworm, Diseases of silkworm** (15 Hrs.)					
	1	Leaf eating insect pests. Mulberry pyralid - Bihar hairy caterpillar.	3	Identify pests of mulberry and explain the control measures. **(CO-2)**	Lecture, PPT, Discussion	MCQ, Quiz, Open text book, Short test, Formative Assessment I (3-5), Formative Assessment III (1&2)
	2	Wasp moth and Almond leaf bore. Borer pest - Stem girdler beetle and stem borer.	3			
	3	Taxonomic position of Bombyx mori. Habit and habitat of silkworm. Classification of silkworms.	3	Outline the taxonomic position, habit and habitat of silk worm **(CO-3)**	Lecture & PPT	
	4	Life cycle of *B. mori.* Morphology of egg, larva, pupa and adult.	3	Explain the life history of *B. mori.* **(CO-3)**	Lecture & PPT	
	5	Diseases of silkworm: Pebrine, Grasserie, Flacherie, Nucleo Polyhedral Viral (NPV) Disease and Muscardine.	3	Differentiate and Describe bacterial and viral diseases. **(CO-3)**	Lecture & PPT	
IV	**Silkworm rearing, Cocoon marketing, Grainage technology** (15 Hrs.)					
	1	Rearing appliances.	2	Apply rearing appliances for silkworm rearing. **(CO-3)**	Lecture, PPT	MCQ, Quiz, Open text book, Short test, Formative Assessment I (1),
	2	Rearing operations - Maintenance of optimum conditions for rearing. Feeding, bed cleaning, spacing, care during moulting.	3	Outline the conditions for rearing silkworm. **(CO-3 & CO-5)**	Lecture, You tube	
	3	Rearing methods - Chawki, shelf, floor and shoot rearing. Sampoorna.	2	Explain rearing methods. **(CO-3)**	Lecture	
	4	Mounting - Methods of mounting	2	Summarise mounting methods.	Lecture,	

		– Precautions to be taken during mounting.		**(CO-3 & CO-5)**	PPT	Formative Assessment II (2-6), Quiz Formative Assessment III (7),
	5	Harvesting, Transport of cocoons. Physical characteristic of cocoons, Defective cocoons, cocoon markets.	2	Explain harvesting and transport of cocoons. Differentiate defective cocoons. **(CO- 4 & CO-5)**	Lecture, PPT	
	6	Grainages. Procedures in a grainage.	2	Illustrate grainage procedure. **(CO-3& CO-5)**	Lecture, PPT	
	7	Diapause and non – diapausing eggs. Transport of eggs.	2	Explain the transport of eggs **(CO-3& CO-5)**	Lecture, PPT	
V	**Silk reeling and Wild silkworm rearing** (15 Hrs.)					
	1	Stifling - sun drying – steam stifling – Hot air stifling.	2	Describe Stifling. **(CO-3)**	Lecture, Industrial visit	Industrial visit report, Formative Assessment III (1-7), Online assignment through Edmodo.
	2	Storage of cocoons - sorting of cocoons – deflossing - Cocoon riddling – cocoon mixing.	2	Explain Storage, sorting, deflossing, riddling and mixing of cocoons. **(CO-3)**		
	3	Cocoon cooking - open pan and three pan system. Brushing	3	Illustrates cocoon cooking. **(CO-3)**		
	4	Reeling - Country charka, cottage basin. Multi-end reeling.	3	Describe reeling of silk. **(CO-3)**		
	5	Re-reeling - lacing – skeining. Raw silk testing marketing.	2	Appreciate silk marketing. **(CO-4)**		
	6	By products of sericulture.	1	Recognise the Byproducts of sericulture. **(CO-5)**	Lecture, PPT	
	7	Wild silk worm rearing – Eri, Tasar and Muga	2	Recall wild silk worms. **(CO-3)**		

Course instructors

Dr. S. Mary Mettilda Bai
Dr. F. Brisca Renuga

Head of the Department

Dr. S. Mary Mettilda Bai

Semester : V **Skill Based Course**

Name of the Course : Vermitechnology

Course code : ZSK175

No. of hours/week	No. of credits	Total number of hours	Marks
2	2	30	100

Learning Objectives

1. To impart knowledge on the production of vermicompost, a nutrient rich fertilizer.
2. To enable the students to generate and promote employment and organic farming.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	discuss the classification and categories of earthworms.	PSO - 1	U
CO - 2	explain the biology of earthworms.	PSO - 1	U
CO - 3	assess the importance of earthworms in soil fertility, medicine and pharmaceutics.	PSO - 5	E
CO - 4	design the methodology for vermiculture and for the production of vermicompost and vermiwash.	PSO - 8	Ap
CO - 5	prepare and market the vermicompost.	PSO - 7	Ap

Teaching Plan with Modules

Total Hours 30 (Incl. Assignments & Test)

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	**Vermitechnology** (6 Hrs.)					
	1	Definition and importance. Earthworm–Systematic position and salient features.	2	Discuss the salient features and importance of earthworm. **(CO- 1)**	Lecture, Chalk and talk	MCQ Short test Memory matrix Quizizz Schoology
	2	Categories of earthworm – Anecic, Endogeic, Epigeic species.	1	Categorize the earthworm species. **(CO- 1)**	Lecture, PPT, Demonstration	
	3	Biology of *Eisenia fetida, Lumbricus terrestris, Eudrilus eugenia, Megascolex mauritii.*	3	Discuss the structure and biology of different earthworms. **(CO- 2)**	Seminar, Lecture, Video.	
II	**Role of earthworms** (6 Hrs.)					
	1	Soil fertility and productivity.	1	Appreciate the role of earthworm in soil fertility.	Lecture	MCQ

	2	Earthworm and microorganisms.	1	Explain the role of microorganism in earthworm. **(CO- 3)**	Lecture, Suggestopedia	Short test Mind Map Edmodo
	3	Pest and diseases of earthworm.	2	Differentiate the diseases of earthworm. **(CO- 3)**	Lecture, PPT	
	4	Economic and medicinal importance.	2	Explain the Medicinal importance of earthworm. **(CO- 3)**	Lecture, PPT	
III	**Vermiculture** (6 Hrs.)					
	1	Collection and preservation.	1	Describe the preservation of earthworm. **(CO- 4)**	Lecture, PPT Demonstration.	MCQ Short test Online assignment through Edmodo
	2	Vermiculture techniques -Types (monoculture and polyculture).	2	Illustrate types of vermitechniques. **(CO- 4)**	Lecture, Video	
	3	Vermicast - formation, shape, composition and importance.	1	Recognize vermicast. **(CO-4)**	Lecture, Video. Demonstration.	
	4	Vermiwash – preparation, composition and applications.	2	Demonstrate the preparation of vermiwash. **(CO- 4)**	Lecture, Video.	
IV	**Vermicomposting** (6 Hrs.)					
	1	Requirements–earthworm, site, bed, feed, moisture and oxygen.	1	Explain the dos and don'ts in vermitechnique. **(CO- 4)**	Lecture, PPT	Short test MCQ Online worksheet through Kahoot
	2	Steps of vermicomposting - selection of site, containers, species, food, preparation of vermibed, inoculation of worms, feeding, watering the wormbed.	3	Demonstrate the vermibed preparation. **(CO- 4)**	Seminar, Lecture Demonstration, Heutogogy	
	3	Methods of vermicomposting.	2	Describe the different methods of vermicomposting. **(CO- 4)**	Lecture, PPT	
V	**Harvesting and Marketing** (6 Hrs.)					
	1	Harvesting of earthworms and vermicompost	1	Describe the technique in harvesting. **(CO- 4)**	Demonstration.	Short test Quizizz Objective test Schoology
	2	Packaging, storing, and marketing of vermicompost. Economic viability of vermicomposting.	2	Discuss the economic viability of compost. **(CO-4, 5)**	Lecture, PPT Demonstration.	
	3	Vermi-remediation.	1	Explain vermi- remediation. **(CO- 4)**	Lecture	
	4	Financial Support by Government and Non-Government funding agencies.	2	Find out the financial support by Government. **(CO- 4, 5)**	Lecture	

Course Instructors **Head of the Department** Dr. C. Josephine Priyatharshini Dr. S. Mary Mettilda Bai Dr. C. Anitha

Semester : V Major Practical V
Name of the Course : Physiology and Developmental Zoology
Course code : ZC17P5

No. of hours/week	No. of credits	Total number of hours	Marks
4	2	60	100

Learning Objectives

1. To understand the basic principles of animal physiology and report experimental data.
2. To identify the stages of embryonic development and the structures in the temporary and permanent preparations.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	explain the effect of abiotic factors on physiological process.	PSO - 3	Ap
CO - 2	analyse major nutrients qualitatively and describe the principles of analytical instruments and its uses in physiology.	PSO - 4	An; Ap
CO - 3	perform scientific mode of thinking; planning experiments, analysing and evaluating data skills as scientific laboratory reports.	PSO - 6	Ap; An
CO - 4	develop methodological approach to embryonic development.	PSO - 7	An
CO - 5	identify instruments, tissues, embryonic structures in preparations, photographs and diagrams.	PSO - 8	R; An

Teaching plan with Modules

Total Hours 60 (Incl. Demonstration, Observation & Test)

Units	Modules	Topics	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
I	**Physiology** (30 Hrs.)					
	1	Rate of oxygen consumption in a fish.	4	Find out the rate of oxygen consumption. **(CO-1)**	Demonstration & practical	Continuous Performance based assessment. Internal Assessment.
	2	Effect of temperature in the opercular movement of a fish and calculation of Q_{10}.	4	Find out the effect of temperature in the opercular movement of a fish and calculate Q_{10}. **(CO-1,3)**	Demonstration & practical	
	3	Effect of temperature on the ciliary movement of a bivalve.	4	Find out the effect of temperature on the ciliary movement of a bivalve. **(CO-1)**	Demonstration & practical	
	4	Action of salivary amylase in relation to pH.	4	Find out the action of salivary amylase in	Demonstration & practical	

				relation to pH. **(CO-1)**		
	5	Action of salivary amylase in relation to enzyme concentration.	4	Find out the action of salivary amylase in relation to enzyme concentration. **(CO-1)**	Demonstration & practical	
	6	Estimation of haemoglobin-demonstration	2	Estimate haemoglobin content of blood. **(CO-2,3)**	Demonstration & Observation	
	7	Counting of blood cells using haemocytometer (Demonstration).	4	Count blood cells using haemocytometer. **(CO-2,3)**	Demonstration & Observation	
	8	Haemoglobin, ECG, Sphygmomanometer, Kymograph, Cardiac muscle, Striated muscle, Non-striated muscle, Simple muscle curve.	4	Identify the apparatus/ equipments/ slides/ charts and comment on it. **(CO-2)**	Observation of apparatus/ equipments/ slides/ charts	
II	**Developmental Zoology** (30 Hrs.)					
	1	Observation of sperm and egg of Frog.	4	Explain the structure of sperm and egg of Frog. **(CO-4)**	Observation of slides	Continuous Performance based assessment.
	2	Temporary mounting and observation of Chick embryo.	4	Prepare temporary slides of chick embryo and identify the developmental stage. **(CO-4)**	Demonstration & practical	
	3	Induced ovulation in frog (demonstration only).	4	Induce ovulation in frog. **(CO-4)**	Demonstration & Observation	
	4	Effect of thyroxin on Amphibian metamorphosis (demonstration only).	4	Explain the impact of thyroxin on Amphibian metamorphosis. **(CO-5)**	Demonstration & Observation	Internal Assessment.
	5	Observation of developmental stages in an insect.	4	Recognize the developmental stages of the insects. **(CO-5)**	Observation	
	6	Sperm and egg of Human.	2	Identify the spotters and explains the structure of the specimens and the models. **(CO-5)**	Observation of slides, specimen	
	7	Egg of insect, frog and bird.	2			
	8	Chick embryos of 24, 48, 72 and 96 hours.	2			
	9	Cleavage (2, 4, 8 and 16 cell stage), blastula and gastrula of frog.	2			
	10	Placenta – Diffuse, Discoidal, Zonary and Cotyledonary.	2			

Course Instructors **Head of the Department**

Dr. A. Punitha
Dr. X. Venci Candida

Dr. S. Mary Mettilda Bai

Semester : V Major Practical VI

Name of the Course : Ecology and Toxicology

Course code : ZC17P6

Learning Objectives

To investigate the relationship between the organisms and their environment

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	analyse the water quality of an aquatic ecosystem.	PSO - 3	Ap ; An
CO - 2	examine and identify the zooplanktons.	PSO - 1	Ap

Teaching plan with Module

Total Hours 60 (Incl. Demonstration, Observation & Test)

Units	Module	Topic	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
I	**Ecology and Toxicology** (30 Hrs.)					
	1	Detection of transparency of water by Secchi disc.	3	Measure transparency of water. **(CO-1)**	Experiment	Continuous Performance based assessment. Internal Assessment.
	2	Estimation of oxygen content of water samples.	3	Estimate oxygen content in water samples. **(CO-1)**	Experiment	
	3	Estimation of salinity of water samples.	3	Estimate salinity of water samples. **(CO-1)**	Experiment	
	4	Mounting of freshwater and marine planktons	3	Identify planktons and prepare temporary slides. **(CO-2)**	Demonstration & Observation	
	5	Analysis of producers and consumers in grass land.	3	Identify the producers and consumers in an ecosystem. **(CO-1)**	Field visit	
	6	Determination of 48 hours LC_{50} of a pesticide.	3	Determine LC_{50} of a pesticide. **(CO-1)**	Experiment	

	7	Study of natural ecosystem and field report of the visit (compulsory).	3	Document the field trip. **(CO-4)**	Field Trip	
	8	**Museum Specimens**: Secchi disc, Mutualism (Hermit crab and Sea anemone), Commensalism (Echeneis and Shark), Parasitism (Sacculina on Crab), Cyclomorphosis (Daphnia).	9	Identify and Explain Secchi disc, Mutualism, Commensalism, Parasitism, Cyclomorphosis.**(CO-3)**	Observation of the spotters and specimen	

Course Instructor

Dr. S. Prakash Shoba

Head of the Department

Dr. S. Mary Mettilda Bai