

# 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
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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 - 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

**Teaching plan with Modules**

**Total Hours: 90 (Incl. Assignments & Test)**

Unit	Modules	Topics	Hours	Learning Outcome / CO addressed	Pedagogy	Assessment
<b>Basic concepts of biochemistry (18 Hrs.)</b>						
1	Scope. Atoms – Molecules – Chemical bonds – Primary bonds and secondary bonds.		4	Outlines the scope of Biochemistry. Recalls atoms, molecules and chemical bonds.	Seminar, PPT, Video, Classroomscreen	Formative Assessment I

			<b>(CO-1)</b>		& Quiz I
2	pH and Hydrogen ion concentration - Buffers - 'Henderson-HasselBalch' equation -	5	Demonstrates the importance of pH in biological system. Describes the derivation of pH as a measure of acidity in biological and chemical systems. <b>(CO-1,4)</b>	Seminar, PPT, Group Discussion	Seminar  Online assignment
3	Buffer systems in blood - Mechanism of buffer action - Acid base balance – Regulation of acid base balance – Acidosis and Alkalosis.	5	Illustrates the mechanism of buffer action Interpret the acid – base balance to diseases. <b>(CO-1,2,4)</b>	PPT, Video, Flow chart	Class test: Online Quiz (MCQ) using Google Forms
4	Water – Colligative properties - Water turnover and balance. Electrolyte balance – Dehydration and Water intoxication.	4	Explains the properties of water. Describes electrolyte balance. <b>(CO-1,2,4)</b>	PPT, Video, Mind Map	

### Carbohydrate (18 Hrs.)

1	Classification, structure, properties of mono, oligo and polysaccharides and biological role of carbohydrates.	2	Explains structure of carbohydrate. <b>(CO-1,2,4)</b>	Lecture using screen capture technique Seminar	Formative Assessment I& QuizI
2	Carbohydrate metabolism - glycogenesis, glycogenolysis, glycolysis.	4	Distinguish and describes catabolic and anabolic process. <b>(CO-1,2,3,4)</b>	Interactive PPT, Seminar Slido	
3	Krebs cycle, Electron transport and Oxidative phosphorylation, Energetics of glucose metabolism.	3	Summaries the ATP producing process in the biological system. <b>(CO-1,2,3,4)</b>	Interactive PPT, Video, Chart	Home assignment  Class test: Quizizz
4	Pasteur effect–HMP shunt - gluconeogenesis – glyoxylate pathway– Cori cycle.	4	Differentiate different pathways of metabolism. <b>(CO-1,2,3,4)</b>	Lecture with PPT, Mind map	Kahoot
5	Regulation and hormonal control of carbohydrate metabolism.	2	Correlate hormones to carbohydrate metabolism and diseases. <b>(CO-1,2,3,4)</b>	Lecture using jamboard tool, Discussion	
6	Glycogen storage diseases – blood sugar level – Glycosuria - Glucose tolerance test – Diabetes.	3	apply knowledge to glycogen storage diseases. <b>(CO-3,4)</b>	Lecture with video links	

<b>Proteins (18 Hrs.)</b>					
1	Classification, structure, Ramachandran plot, Properties and biological role.	3	Classify proteins. Describes the structure and discuss the role of proteins. <b>(CO-1,4)</b>	Seminar, PPT, Video	Formative Assessment II & Quiz II  Group Discussion  Seminar  Slip test (MCQ) using Google Forms
2	Amino acids - classification, structure and properties.	3	Describes the structure and properties of amino acids. <b>(CO-1,2)</b>	Seminar, PPT, Group Discussion	
3	Metabolism of proteins - deamination, transamination – transmethylation and decarboxylation of amino acids.	4	Differentiate different methods of metabolism of amino acids. <b>(CO-2,3,4)</b>	PPT, Video, E-Content	
4	Glycogenic and ketogenic amino acids. Formation and transport of ammonia - glucose-alanine cycle - Ornithine cycle.	4	Recalls and compare the metabolism of protein and carbohydrate. <b>(CO-2,3,4,5)</b>	PPT, Video, Google jamboard	
5	Metabolism of Phenylalanine, Tyrosine. Tryptophan. Porphyrins	4	Explains amino acids metabolism <b>(CO-3)</b>	Seminar, PPT, Video	
<b>Lipids (18 Hrs.)</b>					
1	Classification, structure and Biological role – Chylomicrons.	3	Describe structure and Define Chylomicrons. <b>(CO-1,2,4)</b>	Lecture with PPT, Seminar	Formative Assessment II & Quiz II  Online assignment through Google classroom    Seminar  Class test: Mind map
2	VLDL, LDL, HDL - Lipid metabolism. Theories of oxidation of fatty acids.	3	Define VLDL, LDL, HDL Describes oxidation theories. <b>(CO-1,2,3,4)</b>	Lecture, PPT, Classroom screen	
3	Oxidation of any one fatty acid and its bioenergetics (palmitic acid).	3	Explains beta oxidation. <b>(CO-1,2,3,4)</b>	Interactive PPT, Flow chart	
4	Ketogenesis - Biosynthesis of palmitic acid.	3	Identify different steps in the process of biosynthesis. <b>(CO-1,2,3,4)</b>	Video link, PPT	
5	Metabolism of cholesterol - lipid storage diseases – Role of liver in fat metabolism. Prostaglandins.	3	Describes and interpret role of liver. Explains role of Prostaglandins. <b>(CO-1,2,3,4)</b>	Lecture with PPT, Group discussion	
6	Integration of carbohydrate, protein and lipid metabolism.	3	Summarise the integration of metabolism. <b>(CO-1,2,4)</b>	Self-paced class –E-content, Mind map	
<b>Nucleotide metabolism, Enzymes, Vitamins (18 Hrs.)</b>					
1	Biosynthesis and degradation of purines and pyrimidines.	4	Describes the biosynthetic process of Purines & Pyrimidines. Recall DNA structure.	Video links and PPT, Classroom screen	Formative Assessment I & Quiz I (2,3,4)

			<b>(CO-1,2,4)</b>		
2	Enzymes: Classification, nomenclature, enzyme kinetics.	3	Recall and Identify the enzymes. <b>(CO-1,2,4)</b>	Lecture using PPT, Seminar	Formative Assessment II & QuizII (1,5)  Class test: Quiz through slido.com  Online assignments: Mind map  Seminar
3	Michaelis - Menten constant, enzyme inhibition, mechanism of enzyme action, factors affecting enzyme activity, isozymes, coenzymes.	4	Describes the role of enzymes and recall physiology of digestion. <b>(CO-1,2,3,4,5)</b>	Lecture using PPT, Seminar	
4	Classification of Vitamin (fat soluble and water soluble), occurrence and biochemical role.	3	Recall the nutrients and identify the sources and symptoms. <b>(CO-1,2,3,4,5)</b>	Thematic Discussion, Chart	
5	Mechanism of detoxification (oxidation, reduction, conjugation) - cytochrome P 450 system.	4	Explain and appreciate the detoxification process in the biological system. <b>(CO-1,2,3,4,5)</b>	Video lesson, Google jamboard, PPT	

### Course Instructors

J. Vinoliya Josephine Mary  
**Dr.S. Mary Mettilda Bai**

**Head of the Department**  
**Dr.S. Mary Mettilda Bai**

### Seminar & Assignment topics

#### UNIT I

1. Scope of Biochemistry.
2. Atoms - molecules - chemical bonds - primary bonds and secondary bonds.
3. Hydrogen ion concentration and buffers.
4. Colligative properties of water.

#### UNIT II

5. Carbohydrates: Classification and structure.
6. Properties of mono, oligo and polysaccharides.
7. Biological role of carbohydrates.
8. Glycogenesis and glycogenolysis.
9. Glycolysis
10. Krebs cycle
11. Electron transport and Oxidative phosphorylation

#### UNIT III

12. Proteins: Classification and structure
13. Properties and biological role of proteins
14. Amino acids – classification and structure
15. Properties of amino acids.

#### UNIT IV

16. Lipids: Classification, structure and biological role.
17. Chylomicrons, VLDL, LDL, HDL

18. Lipid metabolism – general
19. Theories of oxidation of fatty acids.

#### UNIT V

20. Enzymes: classification, nomenclature.
21. Enzyme kinetics and mechanism of enzyme action.
22. Factors affecting enzyme activity.
23. Classification of fat soluble vitamins.
24. Classification of water soluble vitamins.
25. Vitamins: occurrence and biochemical role.

**II. On line assignment** – Conducting test through Google form and submission of marks from the allotted seminar topics.

**Semester I**  
**Core II - 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	PSO - 3	Ap

	students for life-long learning and participate in environmental protection and conservation activities for sustainable environment and gain employability.		
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

**Teaching Plan with Modules**  
**Total Hours: 90(Incl. Seminar & Test)**

Unit	Modules	Topics	Hours	Learning outcome / CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Introduction to Ecology (18 Hrs)</b>					
	1	Scope of Ecobiology. Environmental concepts - laws and limiting factors. The environment - physical factors (climatic factors, topographic factors, edaphic factors),	3	Explain the advantages of being aware of ecobiology concepts, laws and factors. <b>(CO-1,2)</b>	Lecture, PPT, E-Content	Short test, MCQ, Seminar, Online assignment, Formative assessment I (1,2,3,4,5) Quiz I
	2	Biotic factors and their interactions (symbiosis, commensalism, parasitism and competition- prey-predator interactions - Scramble and contest competition).	3	Summarize ecosystem and its functions. <b>(CO-1,2)</b>	Lecture, PPT, YouTube links, Blended teaching, E-Contents	
3	Ecosystem: Concepts of ecosystem - structure and functions. Energy flow - single channel energy model, Y - shaped energy flow models.	3	Differentiate between the various models of energy flow. <b>(CO-1,2)</b>	Lecture, PPT, E-Contents, Mind map		

	4	Productivity - Primary production, secondary production, measurement of primary productivity. Homeostasis of the ecosystem	4	Summarize productivity and its types. (CO-1,2)	Lecture, PPT, Flow Chart, E-Contents	
	5	Habitat ecology: freshwater, marine, estuarine, mangrove and terrestrial.	5	Differentiate between the various ecological habitats. (CO-1,2)	Lecture, PPT, Youtube links, Flow charts.	
<b>II</b>	<b>Population and Community (18 Hrs)</b>					
	1	Population: Structure and regulation, growth form, population fluctuations, population processes.	4	Summarize the concept of population and various processes associated with it. (CO-3,4)	Lecture, PPT, E-Content	MCQ , Seminar, Online assignment, Formative assessment II (1,2,3,4,5) Quiz I Online assignment, Seminar
	2	life history strategies - diagrammatic and conventional life tables. Concept of Metapopulation.	3	Explain life table and life history strategies. (CO-3,4)	Lecture, PPT, Youtube links, Blended teaching, E-Contents	
	3	Community - basic terms, community structure, composition and stratification.	4	Describe community concept, structure etc. (CO-1,3,4)	Lecture, PPT, E-Contents, Mind map	
	4	Ecological niche, Ecotone and Edge effect, Ecotype.	3	Explain ecological niche and ecotype. (CO-1,3)	Lecture, PPT, Flow Chart, E-Contents	
	5	Ecological succession: types, general process, Concept of climax.	4	Summarize ecological succession. (CO-1,3)	Lecture, PPT, Youtube links, Flow charts.	
<b>Unit III</b>	<b>Biogeochemical cycles (18 Hrs)</b>					
	1	Water cycle, carbon cycle, nitrogen cycle	3	Summarize Gaseous cycle (CO-1,2)	Naitalism	



	2	Sulphur cycle and phosphorous cycle.	3	Summarize Sedimentary cycle (CO-1,2)	PPT , Web based	Short test, MCQ, Seminar, Online assignment, Formative assessment I (1,2,3,4,5,6, 7) Quiz I
	3	<b>Natural resource ecology:</b> Classification of resource, mineral resource	2	Classify Natural resources (CO-5,6)	PPT, You tube	
	4	Land resource, forest resource, water resource,	3	Describe different resources (CO-5,6)	PPT, Mind map	
	5	energy resource- conventional and non-conventional	2	Describe different energy resources (CO-5,6)	PPT, Group discussion	
	6	<b>Remote sensing:</b> Physical basis – information extraction – role in ecological research.	2	Summarize remote sensing (CO-5,6)	Group discussion, Web based	
	7	<b>Natural Disaster Management:</b> Floods, earthquakes, cyclones, landslides, Tsunami, Mitigation and Disaster Management.	3	Differentiate different types of disaster (CO-5,6)	You tube, Group discussion	
	<b>Biogeography (18 Hrs)</b>					
Unit IV	1	Patterns of distribution (continuous, discontinuous, endemic), descriptive zoogeography, zoogeographical regions of the world	3	Differentiate the patterns of distribution (CO-5,6)	PPT, Web based	Slido Short test, MCQ, Seminar, Online assignment, Formative assessment I (1,2,3) Quiz I Formative assessment II (3,4,5,6) Quiz II
	2	Dynamic biogeography (dispersal dynamics, dispersal pathways, migration, ecesis).	3	Summarize different biogeography( CO-5,6)	You tube, Group discussion	
	3	<b>Biodiversity:</b> Importance, Human impact on biodiversity,Endangered wildlife species - special projects in India - IUCN red list - hot spots.	3	Evaluate the importance of Biodiversity(CO-5,6)	Group discussion, Web based	
	4	Levels of diversity - species, genetic, ecosystem.GIS and satellite imaging in	3	Explain different levels of diversity(CO-	PPT, You tube	

	biodiversity assessment.		<b>5,6)</b>		
	5 Biodiversity indices: Shannon-Weiner index, Simpson index, Similarity and dissimilarity index, Association index.	3	Formulate hypothesis and test them by designing appropriate experiments (CO-4,5)	PPT, Group Discussion	
	6 Conservation of species: <i>In situ</i> and <i>Ex situ</i> Wildlife sanctuaries, national parks and biosphere reserves - Indian Board of Wild Life (IBWL) - National Board for Wild Life (NBWL) - Wild Life Conservation Laws and Trade Laws (CITES) in India.	3	Summarize national parks and biosphere reserves (CO-5,6)	Group discussion, Web based	
Unit V	<b>Pollution ecology (18 Hrs)</b>				
	1 Green House gas emission and Global warming. Impact of chemicals on biodiversity - Pesticides and fertilizers in agriculture	4	Describe the impact of chemicals on biodiversity (CO-3,6)	PPT, YouTube	Nearpod Short test, MCQ, Seminar, Online assignment, Formative assessment II (1,2,3,4,5) Quiz II
	2 Bio-indicator and biomarkers of environment. Carbon footprint, Carbon sink. Waste management: solid, liquid and gaseous wastes. e-wastes.	4	Evaluate the social and environmental issues (CO-3,6)	Group discussion, Web based	
	3 Toxicology: Biomagnification and bioaccumulation, toxicants, classification, toxicity (LC <sub>50</sub> and LD <sub>50</sub> ), OECD Test Guidelines for the Chemicals (420, 423), mode of action of toxicants	4	Formulate hypotheses and test them by designing appropriate experiments, analyze, interpret data (CO-4,5)	Group discussion, Web based	
	4 . <b>Urbanization:</b> Possible	3	Describe the	Group	

	advantages of urbanization – problems, solutions – satellite villages-biovillages.		advantagesproblems and solutions of urbanization <b>(CO-5,6)</b>	discussion, PPT
5	Environmental ethics. Central and State Pollution Control Boards. Environmental auditing, Environmental impact assessment, Legislations for environmental Protection.	3	Evaluate contemporary social and environmental issues <b>(CO-5,6)</b>	Group discussion, PPT

**Course Instructors**

Dr. Jeni Chander Padua  
C. Josephine Priyatharshini

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**Dr.S. Mary Mettilda Bai**

**Seminar (Three from each unit)**

1. Seminar : Scope of Ecobiology  
Assignment : Laws of environment
2. Seminar : Physical factors of environment  
Assignment : Biotic factors of environment
3. Seminar : Structure and functions of Ecosystem  
Assignment : Concepts of Ecosystem
4. Seminar : Energy flow – Single channel model  
Assignment : Y Shaped Energy Flow model
5. Seminar : Primary productivity  
Assignment : Secondary productivity
6. Seminar : Structure of population  
Assignment : Regulation, growth and population fluctuations in population
7. Seminar : Life history strategies - diagrammatic table  
Assignment : Life history strategies - conventional table
8. Seminar : Concept of metapopulation  
Assignment : Population processes
9. Seminar : Structure of community  
Assignment : Composition and stratification of community.
10. Seminar : Ecological niche, Ecotone and Edge effect  
Assignment : Ecological succession
11. Seminar : Water cycle  
Assignment : Floods and Tsunami
12. Seminar : Carbon cycle  
Assignment : Earthquakes and landslides
13. Seminar : Nitrogen cycle  
Assignment : Cyclones
14. Seminar : Sulphur cycle  
Assignment : Mitigation
15. Seminar : Phosphorous cycle  
Assignment : Mineral resources

16. Seminar : Biogeography – Patterns of distribution  
Assignment : Zoogeographical regions of the world
17. Seminar : Dynamic Biogeography  
Assignment : Importance of Biodiversity
18. Seminar : Endangered wildlife species - special projects in India  
Assignment : IUCN red list - hot spots.Levels
19. Seminar : Indian Board of Wild Life - IBWL  
Assignment : National Board for Wild Life - NBWL
20. Seminar : Wild Life Conservation Laws and Trade Laws (CITES) in India.  
Assignment : Conservation of species: *In situ* and *Ex situ*
21. Seminar : Green House gas emission and Global warming  
Assignment : Impact of chemicals on biodiversity
22. Seminar : Bio-indicator and biomarkers of environment  
Assignment : Carbon footprint, Carbon sink.
23. Seminar : Biomagnification and bioaccumulation, toxicants  
Assignment : Guidelines for the Chemicals (420, 423), mode of action of toxicants
24. Seminar : Environmental ethics.Central and State Pollution Control Boards.  
Assignment : Legislations for environmental Protection

### 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	C L
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

### Teaching Plan with Modules Total Hours: 75(Incl. Seminar & Test)

Unit	Modules	Topics	hrs	Learning Outcome	Pedagogy	Assessment
<b>I</b>	<b>Principle of Animal taxonomy (12 hrs)</b>					
	1	Species concept.	1	Demonstrate the knowledge of the concept of speciation.	PPT, Group discussion	Quiz through Google link, Test through Google classroom Assignment Formative Assessment - I
	2	International code of zoological nomenclature - Taxonomic procedures.	3	Discuss the principle of animal nomenclature. Identify species using taxonomical rules on animal classification.	PPT, Video, Identify and classify one invertebrate	
	3	New trends in taxonomy - Animal collection, handling and preservation.	4	Identify species using molecular taxonomy. Skill in collecting and preserving animals.	PPT, Video captured e-content.	

	4	Organization of coelom - Acoelomates - Pseudocoelomates - Coelomates.	3	Classify animals based on presence or absence of coelom.	Narrated PPT, Animation & Video	(1 - 5)
	5	Protostomia and Deuterostomia.	1	Differentiate protostomes and deuterostomes.	PPT, Online images, Video	
<b>II</b>	<b>Locomotion and Nutrition</b>					
	1	Pseudopodia – Flagella and ciliary movement in protozoa	2	Explain the movements in protozoa.	PPT, captured e-content	Quiz through Google link, Assignment Google classroom Formative Assessment - I (1 - 3) Formative Assessment - I (3-4)
	2	Hydrostatic movement in Coelenterate, Annelida and Echinodermata.	3	Contrast the movements in lower invertebrates.	PPT, Animation video	
	3	Nutrition and digestion Free Digestive organs in invertebrates	2	Contrast animal groups with regard to nutrition and digestion.	PPT, Discussion	
	4	Patterns of feeding and digestion in lower metazoan Filter feeding in polychaeta, Mollusca and Echinodermata.	5	Recall and contrast the patterns of feeding in lower invertebrates	PPT, Video and animation	
<b>III</b>	<b>Respiration and Excretion</b>					
	1	Organs of respiration - gills, lungs and trachea, respiratory pigments	2	Describe the organs of respiration and respiratory pigments.	PPT, E content video	Quiz through Google link, Assignment Google classroom Formative Assessment-II (1 - 4)
	2	Mechanism of respiration.	3	Explicate the mechanism of respiration in invertebrates	PPT, video (YouTube)	
	3	Excretion – organs of excretion- coelom, coelomoducts, nephridia and Malpighian tubules	4	Describe and relate excretion of invertebrates using different excretory organs.	PPT, images and animation	
	4	Mechanisms of excretion and osmoregulation	3	Describe how invertebrates solve the physiological and environmental challenges.	PPT, images and animation	
<b>IV</b>	<b>Nervous system</b>					
	1	Primitive nervous system - Coelenterata and Echinodermata	3	Narrate the organization of nervous system in Coelenterata& Echinodermata.	PPT, Online images, e content	Quiz and Assignment Google classroom Formative Assessment -II (1)
	2	Advance nervous system - Annelida, Arthropoda (crustacean and insects), Mollusca (Cephalopoda).	5	Narrate the organization of nervous system in higher invertebrates,	PPT, animation	

	3	Endocrine organs in Invertebrates.	4	Explain the structure and role of endocrine organs in invertebrates	PPT and video	Formative Assessment - III (2&3)
<b>V</b>	<b>Invertebrate larvae and Minor Phyla</b>					
	1	Larval forms of free-living invertebrates, Larval forms of parasites	4	Explain why invertebrates exhibit different larval forms.		Quiz and Assignment via Google classroom Formative Assessment - III (1-4)
	3	Strategies and evolutionary significance of larval forms.	2	Explicate the strategies and evolutionary relationship of different larval forms.	PPT, animation, discussion	
	4	Minor Phyla (structural features and affinity) – significance – organization and general characters.	4	Identify the major characters and organization of minor phyla.	PPT, animation, discussion	

**Course Instructor**  
**Dr. A. Shyla Suganthi**

**Head of the Department**  
**Dr. S. Mary Mettilda Bai**

**Semester I**  
**Core IV - 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

**Teaching Plan with Modules**  
**Total Hours 75 (Incl. Seminar & Test)**

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Protochordates (15 Hrs.)</b>					
	1	Origin of chordates, chordate characters	4	Identify the chordate characters(CO-1)	PPT	MCQ, Flow chart, Mind map, Short Answer Test, seminar  Formative assessment I (1-4) Quiz I Online assignment
	2	classification of protochordata-general characteristics	4	Classify prochordates(CO-1)	Interactive PPT	
	3	development and affinities of Hemichordata	3	Analyse the affinities of Hemichordates (CO-4)	Open Board class	
	4	Urochordata, Cephalochordata.	4	Interrelate the characters of Urochordates and Cephalochordates (CO-2)	Youtube videos, comparative tables, PPT	
<b>II</b>						
<b>Vertebrate Integument (15 Hrs.)</b>						
1	Origin and classification of vertebrates	3	Classify vertebrates (CO-1)	Interactive PPT	MCQ, Comparative table, Mind map, Diagram test, Short Answer Test, seminar  Formative assessment I (1)	
2	Vertebrate integument and its derivatives - development	4	Interrelate the development of integuments (CO-2)	Comparative pictures, Youtube videos		
3	general structure and functions of skin and its derivatives - glands	4	Analyse the anatomy of skin and its derivatives (CO-4)	Open board class		
4	scales, horns, claws, nail, hoofs, feathers and hairs	4	Compare the formation of scales,	PPT, Animation		



				horns, claws, nail, feathers and hairs <b>(CO-2)</b>	videos, Open board class	Quiz I Formative assessment II (2,3,4) Quiz II  Online assignment
<b>III</b>	<b>Circulation and Respiration (15 Hrs.)</b>					
	1	General plan of circulation in various groups - blood - evolution of heart	4	Identify the circulatory pathway and components of blood <b>(CO-1)</b>	Interactive PPT, open board	MCQ, Flow chart, Mind map, Short Answer Test, seminar  Formative assessment II (1,2,3,4) Quiz II, Online assignment
	2	evolution of aortic arches and portal systems	4	Analyze the evolution of aortic arches and portal systems <b>(CO-4)</b>	You tube video links, PPT	
	3	Respiratory system – characters of respiratory tissue - internal and external respiration	4	Describe the internal and external respiration <b>(CO-2)</b>	Open board, Animation videos	
	4	comparative account of respiratory organs.	3	Distinguish the various respiratory organs <b>(CO-4)</b>	PPT	
<b>IV</b>	<b>Skeletal and Urinogenital system (15 Hrs.)</b>					
	1	Skeletal system - form, function, body size and skeletal elements of the body	5	Explain the structure and function of skeletal system <b>(CO-2)</b>	Online diagrams and open board	MCQ, Comparative table, Mind map, Diagram test, Short Answer Test, seminar  Formative assessment I (1-4) Quiz I Online assignment
	2	comparative account of jaw suspensorium,	3	Compare jaw suspensorium of vertebrates <b>(CO-2)</b>	Interactive PPT	
	3	vertebral column - limbs and girdles.	3	Identify the bones of limbs and girdles <b>(CO-1)</b>	You tube videos	
	4	Evolution of urinogenital system in vertebrate series	4	Recognize the evolution of urinogenital system in vertebrates <b>(CO-2)</b>	PPT, open board	
<b>V</b>	<b>Sensory and Nervous system (15 Hrs.)</b>					
	1	Sense organs - simple receptors – organs of olfaction, taste and hearing	4	Explain the different sense organs <b>(CO-1)</b>	PPT	MCQ, Flow chart, Mind map,

	2	lateral line system – electroreception.	2	Describe lateral line system (CO-1)	Interactive powerpoint	Short Answer Test, seminar
	3	Nervous system – comparative anatomy of the brain in relation to its functions	4	Compare the functions of brain in vertebrates (CO-2)	Online videos, PPT	Formative assessment I (1) Quiz I
	4	comparative anatomy of spinal cord – nerves – cranial, peripheral and autonomous nervous system.	5	Interrelate the cranial, peripheral and autonomous nervous system (CO-2)	Comparative diagrams, Open board	Formative assessment II (2,3,4) Quiz II Online assignment

**Course Instructor**  
**Dr. X.Venci Candida**

**Head of the Department**  
**Dr. S. Mary Mettilda Bai**

### Assignments

1. Chordate characters.
2. General characteristics of prochordates.
3. Affinities of Hemichordata.
4. Affinities of Urochordata.
5. Affinities of Cephalochordata.
6. Origin of vertebrates.
7. Structure and function of Skin.
8. Derivatives of skin - scales, horns, claws.
9. Nail, hoofs, feathers and hairs.
10. Blood.
11. Characters of respiratory tissue.
12. Internal and external respiration.
13. Comparative account of respiratory organs.
14. Skeletal elements of the body.
15. Comparative account of jaw suspensorium.
16. Forelimbs and girdles.
17. Hindlimbs and girdles.
18. Urinogenital system in vertebrates.
19. Simple receptors.
20. Organs of olfaction, taste and hearing.
21. Lateral line system.
22. Electroreception.
23. Peripheral nervous system.
24. Autonomous nervous system.

**Semester I**  
**Elective I (a) - 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

**Teaching plan with Modules**

**Total Hours: 60 (Incl. Assignments & Test)**

Unit	Modul es	Topics	Hours	Learning Outcome	Pedagogy	Assessment
I	Livestock farming (Ruminants I): (12 hrs)					

	1	Prospects of livestock industry in India. Introduction and scope of cattle farming.	2	Explains the scope of livestock industry in India. (CO-1)	PPT, You tube links, Lecture	MCQ Online assignment, Seminar Formative Assessment I (1,2,3,4,5,6), Quiz.
	2	Housing systems- selection of site, layout and design.	2	Illustrate the Housing systems. (CO-1)	PPT, Video lesson, Lecture.	
	3	Selection of cattle - important exotic and indigenous breeds and their characteristics.	2	Identification of important exotic and indigenous breeds and their characteristics. (CO-2)	Flipped learning, Video, PPT	
	4	Fodder production and preservation of green fodder.	2	Explains the fodder production and preservation of green fodder. (CO-1)	PPT, Video, Lecture.	
	5	Management and feeding practices of calves, heifers, pregnant, lactating and dry animals, bulls and working animals.	2	Describes different stages of calves, heifers, pregnant, lactating and dry animals, bulls and working animals. (CO-2)	Discussion, PPT, Lecture.	
	6	Cattle diseases. Parasites – ecto and endo parasites.	2	Identifies different cattle diseases. (CO-1)	PPT, Flipped learning.	
II	Livestock farming (Ruminants II) (12 hrs)					
	1	Breeds of sheep and goat. Important economic traits for meat, milk and fibre.	2	Illustrate the breeds of sheep and goat. Important economic traits for meat, milk and fibre.(CO-2)	Video, Lecture, PPT.	Online assignment Seminar, Formative Assessment I, (1,2,3,4.5,6), Quiz.
	2	Management and feeding practices during different stages of growth and production (milk, meat and wool).	2	Explains management and feeding practices during different stages of growth and production. (CO-2)	Discussion, Lecture, PPT.	
	3	Breeding schedule and management of ram and buck.	2	Differentiates the ram and buck. (CO-2)	PPT, Lecture, flipped learning.	
	4	Weaning and fattening of lambs and kids.	2	Describes weaning and fattening of lambs and kids. (CO-2)	Video, PPT, Lecture.	
	5	Methods of	2	Explain methods of	Video, PPT,	

		milking and precautions.		milking and precautions. (CO-2)	Lecture.	
	6	Factors affecting quality and quantity of milk production and milk products.	2	Identification of factors affecting quality and quantity of milk production and milk products. (CO-2)	PPT, flipped learning.	
III	Livestock (Non ruminants) (12 hrs)					
	1	Scope of swine farming. Important exotic and indigenous breeds and their characteristics.	2	Describes swine farming and different breeds and their characteristics. (CO-2)	PPT, You tube links, Lecture.	Online assignment Seminar, Formative Assessment I, (1,2,3,4,5), Quiz. Formative Assessment II, (4,5)
	2	Housing and feeding of swine.	1	Illustrates the housing and feeding of swine. (CO-2)	PPT, Video, Lecture.	
	3	Management of different categories of swine: pregnant sows, pig-lets, growing stock, lactating sows.	4	Identify the management of different categories of swine. (CO-2)	Flipped learning, Video, PPT	
	4	Horses, donkeys and mules: feeding, Foaling and care of newborn.	3	Describes feeding, Foaling and care horses, donkeys and mules. (CO-2)	PPT, Video, Lecture.	
	5	Care of race horses and preparing horses for show.	2	Explains care of race horses and preparing horses for show. (CO-2)	Discussion, PPT, Lecture	
IV	Laboratory and Pet animal management (12 hrs)					
	1	Handling, weighing, sexing and weaning of laboratory animals (rat and rabbit).	3	Describes the handling, weighing, sexing of laboratory animals. (CO-4)	PPT, Video, Lecture.	Online assignment Seminar, Formative Assessment II, (1,2,3,4,5), Quiz.
	2	Marking for identification, Feeding schedule.	2	Marking for identification, Feeding schedule. (CO-4)	Flipped learning, Video, PPT	
	3	Prophylactic measures and Hygienic care.	2	Explains the prophylactic measures and Hygienic care. (CO-4)	PPT, Video, Lecture.	
	4	Handling of dogs and pet birds - Feeding practices and care of young ones.	3	Describes the handling and feeding practices of pet animals. (CO-4)	PPT, Video, Lecture.	
	5	Grooming and	2	Explains the methods of	Blended	

		bathing of dogs. Marketing.		Grooming, bathing and marketing of dogs. (CO- 4)	learning, Video, PPT, Lecture	
V	Animal welfare (12 hrs)					
	1	Animal welfare and ethics - role and current status of Animal Welfare Board of India and other welfare organizations.	4	Describes the role of Animal Welfare Board of India and other welfare organizations. (CO-3)	PPT, Video, Lecture.	Online assignment Seminar, Formative Assessment II, (1,2,3,4), Quiz.
	2	Common offences against animals - Prevention of Cruelty to Animals (PCA) Act, 1960.	4	Explains the common offences against animals. (CO-3)	Flipped learning, Video, PPT	
	3	Functions of Animal ethics committee (CPCSEA).	2	Explains the functions of Animal ethics committee (CPCSEA). (CO-3)	PPT, Video, Lecture.	
	4	Livestock Importation Act - Evidence, liability and insurance.	2	Describes the livestock Importation Act. (CO-3)	Blended learning, PPT, Lecture	

**Course Instructor**  
**Dr. Prakash Shoba**

**Head of the Department**  
**Dr. S. Mary Mettilda Bai**

**Practical I - 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

**Teaching Plan with Modules**  
**Total Hours 30**

S. No	Topics	Hours	Learning Outcome / CO addressed	Pedagogy	Assessment
1	Colorimetry- verification of Beer-Lambert's law.	2	Demonstrate the principle of Beer-Lambert's law in biological samples using colorimetry <b>CO 1</b>	Demonstration in lab, Virtual demonstration, Hands on training	Test Record Testing the skill in preparation of solutions
2	Preparation of Acid & Alkali solutions and acid-base titration applying Henderson-Hasselbalch' equation.	4	Prepare Acid & Alkali solutions and identify the pH of an unknown solution <b>CO 2</b>		
3	Preparation buffers of known pH and solutions of known molarity, normality, percentage, ppt, ppm.	4	Prepare solutions of different units and use in biochemical studies <b>CO 2</b>		
4	Chromatographic separation of amino acids.	2	Interpret the aminoacid composition of		

			biological samples <b>CO 2</b>		
5	Quantitative estimation of glucose (Blood/ Tissue).	3	Analyze the changes in glucose level of any sample <b>CO 3</b>		
6	Quantitative estimation of protein (standard graph).	3	Evaluate the protein level of any sample. <b>CO 3</b>		
7	Quantitative estimation of total lipid (Blood/ Tissue).	3	Analyze the changes in lipid level of any sample <b>CO 3</b>		
8	Quantitative estimation of ascorbic acid.	2	Explore the level of ascorbic acid <b>CO 3</b>		
9	Quantitative estimation of blood urea.	2	Analyse the changes in glucose level of any sample <b>CO 3</b>		
10	Determination of salivary amylase activity in relation to substrate applying Michaelis - Menten equation.	3	Interpret the role of salivary amylase activity on substrates <b>CO 2</b>		
11	<b>Instruments/Charts/ Models</b> Colorimeter, pH Meter, Centrifuge, Chromatogram, Electrophoretic unit	2	Identify the instruments and discuss its applications <b>CO1</b>	Video on the components of the instruments	

**Course Instructor**

**Dr. J. Josephine Vinoliya Mary**

**Head of the Department**

**Dr. S. Mary Mettilda Bai**

**Teaching plan with Modules**  
**Total Hours: 30 (Incl. Test)**  
**Ecobiology (30 Hours)**

<b>Unit</b>	<b>Modules</b>	<b>Topics</b>	<b>Hours</b>	<b>Learning outcome / CO addressed</b>	<b>Pedagogy</b>	<b>Assessment</b>
I	1	Measurement of primary	2	Recall primary productivity	Online Practical	



		productivity (O <sub>2</sub> measurement method).		and its measurement <b>(CO-2,3)</b>	Videos, You tube links, Record writing & submitting on Google Classroom	Self-assessment
	2	Sampling of animal population using quadrat method.	2	Identify various animal population of an area. <b>(CO-3)</b>	Online Practical Videos, Practical in the students house yard, Record writing & submitting on Google Classroom	Performance based Assessment.
	3	Observation of life table in an insect.	4	Recognise the stages in the life table of an insect. <b>(CO-3)</b>	Online Practical Videos, You tube links, Record writing & submission	Model examination
	4	Collection and identification of fresh water planktons.	4	Identify the different freshwater planktons of an area. <b>(CO-3)</b>	Field Visit in the students' neighbourhood/ You tube links, Record writing & submitting on Google Classroom	
	5	Measurement of turbidity using Secchi disc.	2	Spot the turbidity of any water body. <b>(CO-2)</b>	Videos, You tube links	
	6	Estimation of LC <sub>50</sub> of a pesticide.	4	Test the LC <sub>50</sub> of a pesticide. <b>(CO-2)</b>	Practical Videos, You tube links	
	7	Estimation of H <sub>2</sub> S in water sample.	2	Identify the H <sub>2</sub> S content in any water sample. <b>(CO-2)</b>	Online Practical Videos, You tube links, Record writing & submitting on Google Classroom	

8	Estimation of salinity in water sample.	2	Test the salinity of a water sample. <b>(CO-2)</b>	Online Practical Videos, You tube links, Record writing & submitting on Google Classroom
9	Estimation of CO <sub>2</sub> in water sample.	2	Identify the amount of CO <sub>2</sub> in water sample. <b>(CO-2)</b>	Online Practical Videos, You tube links, Record writing & submitting on Google Classroom
10	Study report of a pond ecosystem.	2	Document on a pond ecosystem that has been visited. <b>(CO-3)</b>	Field Visit in their neighbourhood/ You tube links, Record writing & submitting on Google Classroom
11	Commensalism (Shark and <i>Echeneis</i> ), Mutualism (Sea anemone and Hermit crab).	2	Discriminate between commensalism and mutualism. <b>(CO-3)</b>	e-Content on Spotters, PDF, Related Videos
12	Food chain, Food web, Conventional energy source (coal) and non-conventional energy source (wind mill).	2	Identify between conventional and non-conventional energy source. <b>(CO-3,5)</b>	e-Content on Spotters,PDF, Related Videos

**Course Instructor**  
**Dr. Jeni Chander Padua**

**Head of the Department**  
**Dr. S. Mary Mettilda Bai**

**Semester : III**

**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

### Teaching Plan with Modules

**Total Hours 90 (Incl. Seminar & Test)**

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Nutrition (18 Hrs.)</b>					
	1	Types of nutrition and feeding mechanisms in animals.	2	Compare the different types of feeding and nutrition in animals. (CO-1)	Lecture, Video	Short test MCQ Open book test

	2	Digestion - Functional anatomy of the digestive system (human) Movements of gastrointestinal tract Secretory functions of the alimentary tract and glands Digestion and absorption.	5	Describe the anatomy and physiology of digestive system. <b>(CO-1)</b>	Lecture, PPT	Formative assessment I (1-5) Quiz I Online assignment Seminar
	3	Metabolism of protein Metabolism of carbohydrate Metabolism of lipid.	6	Explain the metabolism of protein, fat and carbohydrate. <b>(CO-2)</b>	Lecture, Discussion	
	4	Balanced diet – Malnutrition - Energy balance – BMR.	2	Interpret the value of a healthy diet. <b>(CO-5)</b>	Lecture, PPT	
	5	Gastrointestinal disorders: Gall stones liver cirrhosis, gastritis, peptic ulcer and appendicitis.	3	Correlate different gastrointestinal disorders with the physiology of digestive system. <b>(CO-4)</b>	Video	
<b>II</b>	<b>Respiration and Homeostasis (18 Hrs.)</b>					
	1	Respiratory organs and respiratory pigment in animals.	2	Compare respiratory organs and pigment in different animals. <b>(CO-2)</b>	Lecture, PPT	MCQ through EDMODO Slip test Formative assessment I (1,2,3,4) Formative assessment II (5,6) Quiz II  Online assignment Seminar
	2	Physiological anatomy of the respiratory system (human) Transport of respiratory gases. Regulation of respiration.	4	Comprehend the structure and function of respiratory system. <b>(CO-1)</b>	Lecture, Video	
	3	Respiratory problems - bronchial asthma pneumonia and pulmonary tuberculosis.	2	Identify the symptoms of respiratory problems. <b>(CO-4)</b>	Lecture, PPT	
	4	Homeostasis Osmoregulation - types and mechanism Thermoregulation : Classification thermoregulatory mechanism in animals Aestivation and hibernation.	4	Outline the basics of homeostasis and adaptations. <b>(CO-3)</b>	Seminar Lecture	
	5	Deep sea physiology High altitude and space physiology Effects of exposure to cold and heat.	4	Explain the physiological changes at different altitude. <b>(CO-3)</b>	Lecture, Interactive session through MOODLE	
	6	Bioluminescence – physiology and functions.	2	Appreciate the biochemical changes during bioluminescence. <b>(CO-2)</b>	Lecture	

<b>III Circulation (18 Hrs.)</b>					
1	Components and functions of blood. Blood clotting.	3	Compare blood cells and its functions. <b>(CO-1)</b>	Seminar, Lecture	Mind map Short test
2	Haemopoiesis Myogenic and neurogenic heart.	2	Explain the formation and differentiation of blood cells. Differentiate heart. <b>(CO-1)</b>	Lecture	Online assignment Seminar
3	Functional anatomy of human heart.	2	Explain the structure of heart. <b>(CO-1)</b>	Seminar, ppt	Formative assessment – II (1-7) Quiz II
4	Cardiac cycle, pace maker, heart rate Bradycardia and tachycardia.	3	Discuss the cardiac cycle and cardiac problems. <b>(CO-2)</b>	Lecture	
5	Electrocardiogram (ECG).	2	Analyze the rhythmic pattern of heart beat. <b>(CO-5)</b>	Seminar	
6	Heart diseases (Atherosclerosis coronary thrombosis and angina pectoris).	3	Identify the causes of heart diseases. <b>(CO-4)</b>	Lecture, video	
7	Lymphatic system - organization, composition of lymph and functions.	3	Describe the lymphatic system. <b>(CO-1)</b>	Lecture	
<b>IV Neuro-muscular system (18 Hrs.)</b>					
1	Structure of brain and neuron.	4	Explain the structure of central nervous system. <b>(CO-1)</b>	Seminar	Formative assessment II (1,2) Quiz II
2	Neurotransmitters - Synapse- Nerve impulse conduction.	2	Differentiate transmission of nerve impulse. <b>(CO-2)</b>	Lecture, ppt, video Seminar	
3	Reflex activity Inborn and conditioned reflex actions.	2	Explain reflex activity. <b>(CO-3)</b>	Lecture, ppt	Formative assessment III (3,4,5,6) Memory matrix (Neuro-transmitters) Short test
4	Electroencephalogram. Neural disorders - Meningitis and epilepsy.	3	Comprehend and analyse the role of EEG in identifying neural disorders. <b>(CO-5)</b>	Lecture, video	
5	Types of muscle - structure and properties of skeletal muscle. Mechanism of muscle contraction. Neuromuscular junction.	5	Identify the types of muscle and the mechanism of contraction. <b>(CO-1)</b>	Lecture, ppt	Online assignment Seminar
6	Sense organs - Structure and functions of skin, eye, ear.	2	Differentiate the receptor organs, its structure and function. <b>(CO-1, 2)</b>	Lecture, model	

<b>V Excretion and Reproduction (18 Hrs.)</b>						
1	Excretory organs in different groups of animals.	3	Illustrate the excretory organs and types of excretion in animals. <b>(CO-2)</b>	Seminar	Formative assessment III (1-5)  Listing important terms Sliptest MCQ through Quizizz	
2	Patterns of excretion.					
3	Structure and function of kidney (human) Nephron- Formation of urine Micturition- Renal disorders – nephritis - renal calculi Dialysis.	6	Explain the structure and function of human kidney and associated disorders. <b>(CO-2, 4)</b>	Seminar, Lecture, Demonstration		
4	Structure of testis and ovary (human).	3	Differentiate male and female gonad. <b>(CO-1)</b>	Lecture, chart		
5	Oestrus and menstrual cycle Pregnancy parturition and lactation. Hormonal regulation of reproduction.	6	Explain the physiology of reproduction and apply the knowledge in day today life. <b>(CO-2)</b>	Lecture, PPT		

**Courseinstructor**  
**Dr. P.T. Arockya Glory**

**Head of theDepartment**  
**Dr. S. Mary MettildaBai**

**Seminar & Assignments Topics**

1. Seminar: Feeding mechanisms in animals.  
Assignment: Types of nutrition.
2. Seminar: Malnutrition - Energy balance – BMR.  
Assignment: Balanced diet.
3. Seminar: Anatomy of the respiratory system (human).  
Assignment: Regulation of respiration.
4. Seminar: High altitude and space physiology.  
Assignment: Effects of exposure to cold and heat.
5. Seminar: Components and functions of blood.  
Assignment: Blood clotting.
6. Seminar: Electrocardiogram (ECG).  
Assignment: Cardiac cycle.
7. Seminar: Electroencephalogram.  
Assignment: Neural disorders - Meningitis and epilepsy.
8. Seminar: Structure and functions of eye.  
Assignment: Structure and functions of ear.
9. Seminar: Oestrus and menstrual cycle.  
Assignment: Hormonal regulation of reproduction.

**Semester : IIICoreVIII**

**Name of the Course: Immunology**

**CourseCode : 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 immunosystem.
2. To develop the skill to determine the immunomodulatory strategies used to enhance or suppress the immuneresponse.

### 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 their 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

### Teaching plan with Modules

**Total Hours: 90 (Incl. Seminar & Test)**

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Immune system in invertebrates and vertebrates (18 Hrs.)</b>					
	1	Immunity- Innate and acquired Immunity-Types – natural and artificial, active and passive immunity, II, III and IV line of defense.	3	Differentiate innate and acquired Immunity. (CO-1)	Lecture, Partnering, Xenography Seminar.	MCQ Short test Memory matrix
	2	Lymphoid organs, Cells involved in immune response.	3	Describe lymphoid organs and cells involved in immune response. (CO-1, 2)	Lecture, Gamification Virtual class	Formative Assessment I

	3	Antigens, Immunoglobulins – characteristics Haptens and types.	3	Discuss the structure and functions of antigens and immunoglobulins. <b>(CO-1, 2)</b>	Seminar, Web based, Lecture, Video.	(1,2,3,4,5) Formative Assessment I (6) Schoolology
	4	Immune Response: Humoral immune response, Cell mediated immune response, primary immune response and secondary immune response.	5	Categorize immune response. <b>(CO-1, 2)</b>	Lecture, Video.	
	5	Importance of B cells in humoral immune response (antibody formation), Factors influencing antibody formation and Immunological memory (Anamnesis).	2	Illustrate the role of B cells in humoral immune response and immunological memory. <b>(CO-4)</b>	Lecture, Virtual classroom	
	6	Immunization: immunization schedule and vaccines.	2	Apply immunization schedule and vaccines. <b>(CO-1)</b>	Lecture, Team teaching Heutogogy	
<b>I</b>	<b>Major and minor histocompatibility complex (18 Hrs.)</b>					
<b>I</b>	1	MHC class I molecules, MHC class II molecules, Cellular distribution and regulation of MHC expression.	5	Differentiate the MHC class I and MHC class II molecules. <b>(CO-1)</b>	Lecture, Androgogy Suggesto- pedia	MCQ Short test Mind Map Formative Assessment I (1,2,3,) Formative Assessment II (4) Worksheet - Kahoot
	2	MHC in immune responsiveness, MHC and susceptibility to infectious diseases, Minor histocompatibility (H) antigens.	5	Explain the role of MHC in immune responsiveness and susceptibility to infectious diseases. <b>(CO-1)</b>	Lecture, Flip class	
	3	Immune effector mechanisms: Cytokines and their functions.	3	Appreciate cytokines and their functions. <b>(CO-1)</b>	Lecture, Reflective PPT	
	4	Complement system – classical pathways, alternate pathways and biological functions	5	Differentiate the classical and alternate pathways of complement system. <b>(CO-1)</b>	Lecture, Suggesto- pedia PPT	
<b>III</b>	<b>B and T cell (18 Hrs.)</b>					
	1	B cells – Maturation, B cells – activation, B cells –differentiation, B cell receptor (BCR) and B cell co-receptor complex. Signal transduction from B cell antigen receptor and Major pathways of BCR signaling.	6	Describe B cells and B cell co-receptor complex. <b>(CO-1)</b>	Lecture, Partnering PPT	MCQ Short test Mind Map Formative Assessment II



	2	T cells – maturation, T cells - activation and differentiation, T cell receptor (TCR). T cell co-receptor complex, Formation of T and B cell conjugates. Co-stimulation in T cell response and signal transduction, Clonal energy.	7	Illustrate T cells and signal transduction. <b>(CO-1)</b>	Lecture, Online Video	(1,2,3) Online assignment through Edmodo, Schoology
	3	Antigen processing and presentation – role of antigen presenting cells, cytosolic pathway and endocytic pathway	5	Recognize antigen processing and presentation. <b>(CO-1)</b>	Lecture, Team teaching Video.	
<b>IV</b>	<b>Immune system in health and diseases (18 Hrs.)</b>					
	1	Tumour immunology- properties of tumour cells and causes of tumours, tumour antigens, immune response to tumour and immune surveillance. Immunodiagnosis of tumour antigens and immuno therapy of tumour.	4	Acquire knowledge on the-properties of tumours and immuno therapy. <b>(CO-4)</b>	Lecture, Xenography PPT	Short test MCQ Formative Assessment II (1,2,3,4,5) Quiz II Formative Assessment III (6) Online worksheet through Edmodo
	2	Hypersensitivity: factors causing hypersensitivity, Type I, II, III, and IV reactions	4	Discuss the factors and types of hypersensitivity. <b>(CO-3)</b>	Seminar, Problem based, Lecture	
	3	Immunodeficiency – primary and secondary	2	Describe the immunodeficiency diseases. <b>(CO-4, 5)</b>	Lecture, Problem based PPT	
	4	Autoimmune diseases - characteristics, causes, classification	2	Acquire knowledge on autoimmune diseases. <b>(CO-4, 5)</b>	Lecture, Evaluative PPT	
	5	Autoimmune diseases - localized (Diabetes mellitus and Addison’s disease); systemic (lupus erythromatous and rheumatoid arthritis)	3	Recognize different types of autoimmune diseases. <b>(CO-4, 5)</b>	Seminar, Problem based Lecture	
	6	Immune response to infectious diseases and treatment - Protozoan disease (Malaria), Bacterial disease (Tuberculosis) and Viral disease (AIDS).	3	Discuss the immune response to infectious diseases and treatment. <b>(CO-4, 5)</b>	Lecture, Team teaching PPT	
<b>V</b>	<b>Antigen-antibody interaction (18 Hrs.)</b>					
	1	Antigen-antibody interaction: strength, affinity, avidity and cross reactivity.	2	Describe the antigen-antibody interaction. <b>(CO-2)</b>	Seminar, Demonstration.	Slip test Formative
	2	Complement fixation test-precipitation reaction in fluids and precipitin curve.	2	Discuss the complement fixation test. <b>(CO-2)</b>	Lecture, Role play, PPT	

3	Radial immunodiffusion and Double immunodiffusion.	2	Demonstrate immunodiffusion. (CO-2)	Heutogogy Lecture	Assessment III Seminar Assignment- Kahoot Quizizz
4	Immuno electrophoresis – counter electrophoresis and rocket electrophoresis. Agglutination reaction–hemagglutination and bacterial agglutination. Agglutination reaction- coated particle agglutination and agglutination inhibition.	3	Demonstrate immuno electrophoresis, hemagglutination and bacterial agglutination (CO-2)	Seminar, Lecture and Video	
7	Radio immuno assay, ELISA and Western blotting, Immunofluorescence.	4	Demonstrate radio immuno assay, ELISA, western blotting and Immunofluorescence. (CO-2)	Seminar, Technology based Lecture	
9	Flow cytometry.	2	Explain flowcytometry. (CO-2)	Seminar, Youtube Lecture	
10	Transplantation: classification of grafts, mechanism of graft rejection, graft versus host reaction, immuno suppressive therapy during transplantation.	3	Describes transplantation. (CO-2)	Lecture, Androgogy	

**Course Instructor**

**Head of the Department**

**Dr. Brisca Renuga**

**Dr.S Mary Mettilda Bai**

### **Seminar & Assignment Topics**

1. Seminar: Innate and acquired Immunity.  
Assignment: Types of Immunity.
2. Seminar: Immunoglobulins – characteristics.  
Assignment: Immunization schedule and vaccines.
3. Seminar: Cytokines and their functions.  
Assignment: MHC and susceptibility to infectious disease.
4. Seminar: Hypersensitivity: factors causing hypersensitivity, Type I and II.  
Assignment: Classical pathways, alternate pathways.
5. Seminar: Autoimmune diseases - localized (Diabetes mellitus and Addison's disease).  
Assignment: Autoimmune diseases- characteristics, causes, classification.
6. Seminar: Antigen-antibody interaction: strength, affinity, avidity and cross reactivity.  
Assignment: Properties of tumour cells and causes of tumours.
7. Seminar: Immuno electrophoresis – counter electrophoresis and rocket electrophoresis.  
Assignment: Radial immunodiffusion and Double immunodiffusion.
8. Seminar: Radio immuno assay, ELISA and Western blotting.  
Assignment: Immunofluorescence.
9. 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

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

### Teaching plan with Modules

Total Hours 90 (Incl. Seminar & Test)

Unit	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	<b>Introduction (18 Hrs.)</b>					
	1	Historical perspective and scope of endocrinology.	3	Explain the history and Scope of Endocrinology. (CO-1)	Seminar, and group discussion	MCQ Short test
	2	Endocrine methodologies - assay of hormones, surgical methods, radioisotope studies, pharmacological methods, and replacement therapy.	6	Differentiate the various methods of Hormonal assays. (CO-1)	Lecture, and group discussion	Formative Assessment I (1,2,3,4,5)

	3	Animal models for research.	3	Identify different animals used in Research. <b>(CO-1)</b>	Lecture Group discussion	Quiz I  Seminar  Assignment (Edmodo)
	4	Chemical messengers - neurocrine, paracrine, autocrine, endocrine.	4	Illustrate the action of hormones as Messengers. <b>(CO-2)</b>	Lecture / Video class	
	5	Pheromones and chalone.	2	Relate the hormone and behaviour. <b>(CO-2)</b>	Lecture	
<b>II</b>	<b>Neurosecretion and Neuroendocrine mechanisms (18 Hrs.)</b>					
	1	Neuroendocrine integration.	3	Relate the integration between the nervous system and the endocrine system. <b>(CO-2)</b>	Lecture, Mind map	Slip test Formative Assessment I (1,2,3,4) Quiz I  Formative Assessment II (5) Quiz II  Seminar  Assignment (Quizizz)
	2	Evolution of regulatory mechanisms.	3	Explore the evolution of regulatory mechanism. <b>(CO-1)</b>	Lecture, PPT	
	3	Endocrine control of neural function.	3	Appreciate the control of nervous system by endocrine organs. <b>(CO-1)</b>	Lecture, Video	
	4	Neuroendocrine mechanisms and functions in insects, crustaceans, non-arthropod invertebrates.	5	Identify the role of Neuroendocrine mechanisms in insects and non-arthropod invertebrates. <b>(CO-5)</b>	Seminar, Lecture	
	5	Analogous neurosecretory systems of invertebrates and vertebrates.	4	Recognize the analogy of endocrine glands and their function in vertebrates and invertebrates. <b>(CO-5)</b>	Seminar, Lecture, PPT	
<b>III</b>	<b>Endocrine glands and hormones (18 Hrs.)</b>					
	1	Organization of the endocrine system, Classification of hormones.	3	Describe the different types of hormones. <b>(CO-1)</b>	Lecture. Discussion	MCQ  Short test,  Online assignment (Edmodo)  Seminar,
	2	Structure, functions and pathophysiology of hypothalamus, pituitary.	4	Explain the structure and functions of hypothalamus and pituitary. Identify pathological conditions. <b>(CO-3)</b>	Seminar, Lecture, PPT	

3	Structure, functions and pathophysiology of thyroid and parathyroid.	4	Explain the structure and functions of thyroid and parathyroid. Identify pathological conditions. (CO-3)	Seminar, Lecture, PPT	Formative Assessment II (1,2,3,4,5)
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4	Structure, functions and pathophysiology of adrenal, pancreas and gonads.	4	Explain the adrenal gland and pancreas. Interpret pathological conditions of gonads. (CO-3)	Lecture, PPT	Quiz II
5	Gastro-intestinal hormones.	3	Describe Gastro-intestinal hormones. (CO-3)	Lecture, Video	
<b>IV</b>	<b>Hormone synthesis and mechanism of Hormone action (18 Hrs.)</b>				
1	Biosynthesis, storage and release of amine (catecholamines and thyroxine) protein (growth hormone and insulin) and steroid hormones (sex hormones).	5	Explain the synthesis of amine, protein and steroid hormones. (CO-2)	Lecture, Mind map	MCQ, Shorttest, Online assignment (Quizizz) Seminar, Formative Assessment II(1,2) QuizII, Formative Assessment III (3,4,5)
2	Mechanism of hormone action - receptors (membrane and cytosolic) - second messengers, signal transduction, termination of hormone activity.	4	Discuss hormone and cell communication. (CO-2)	Lecture, PPT	
3	Pathophysiological correlates of hormone action.	4	Analyse the importance of receptor number for proper functioning of hormone. (CO-3)	Lecture, Group discussion	
4	Endocrine disorders due to receptor number and function.	3	Outline the importance of receptor number. (CO-3)	Lecture, PPT	
5	Hormonal therapy.	2	Evaluate the therapeutic role of hormones. (CO-3)	Lecture, PPT	
<b>V</b>	<b>Endocrine Integration (18 Hrs)</b>				
1	Diffuse effect of hormones.	2	Interpret the varied role of one hormone on different organs. (CO-2)	Lecture, Flow Chart	MCQ Shorttest, Online
2	Hormonal regulation of growth, development and metabolism.	4	Appreciate the physiological regulation of hormones. (CO-2)	Lecture, Mind map	

3	Hormonal regulation of reproductive cycle and pregnancy, parturition and lactation.	4	Describe the role of hormones in reproduction. <b>(CO-4)</b>	Lecture, Videos	assignment (Edmodo)  Seminar,  Formative Assessment III (1,2,3,4,5)
4	Hormonal regulation of migration (birds and fishes).	3	Analyse the reason and changes in animals during migration. <b>(CO-5)</b>	Lecture, PPT	
5	Hormonal regulation of	5	Describe the	Lecture,	

**Course Instructor**  
**Dr. Punithaa**

**Head of the Department**  
**Dr. SMary Mettilda Bai**

Semester

: IV

Practical

III Name of the Course: Physiology and Immunology

CourseCode

: 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

Teaching plan with Modules

Total Hours 30 (Incl. Practicals & Test)

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Physiology (30 Hrs.)</b>					
	1	Effect of temperature on heartbeat of Freshwater Mussel and calculation of $Q_{10}$ .	2	Find out the effect of temperature on heartbeat of Freshwater Mussel and calculate $Q_{10}$ . (CO -2)	Demonstration & practical	Continuous performance based assessment  Internal assessment
	2	Effect of temperature on salivary amylase activity and calculation of $Q_{10}$ .	2	Find out the effect of temperature on salivary amylase activity and calculate $Q_{10}$ . (CO -2)	Demonstration & practical	
	3	Effect of pH on salivary amylase activity.	2	Find out the action of salivary amylase in relation to pH. (CO -2)	Demonstration & practical	
4	Salt loss and salt gain in a freshwater fish.	2	Demonstrate Salt loss and salt gain in a freshwater fish. (CO -2)	Demonstration & practical		

	5	Examination of excretory products of fish, bird and mammals.	2	Find out the type of nitrogenous waste eliminated by different animals. <b>(CO -1)</b>	Demonstration & practical	
	6	Survey of digestive enzymes in Cockroach.	2	Find out the digestive enzymes present in the different parts of the digestive system of Cockroach. <b>(CO -1)</b>	Demonstration & Observation	
	7	Counting of blood cells using haemocytometer.	2	Count blood cells using haemocytometer. <b>(CO -1)</b>	Demonstration & Observation	
	8	Haemolysis of blood – Demonstration.	2	Demonstrate hemolysis of blood. <b>(CO -1)</b>	Demonstration & Observation	
	9	Observation of haemin crystals in blood.	2	Mount haemin crystals in blood under microscope. <b>(CO -1)</b>	Demonstration & Observation	
	10	Estimation of haemoglobin (any method).	2	Estimate the amount of haemoglobin in vertebrate blood samples. <b>(CO -1)</b>	Demonstration & Observation	
	11	EEG, ECG, Conditional reflex, Skeletal muscle, Kymograph, Sphygmomanometer, Intestine, Nervous tissue, Liver, Lungs, Heart, Kidney.		Identify the apparatus/ equipments/ slides/ charts/ specimens/ models and comment on it. <b>(CO -1)</b>	Observation of apparatus/ equipments/ slides/ charts	
<b>II</b>	<b>Immunology (30 Hrs.)</b>					
	1	Dissection of Lymphoid organs of a vertebrate (Demonstration).	2	Identify lymphoid organs. <b>(CO -1)</b>	Demonstration	Continuous performance based assessment
	2	Histology of lymphoid organs (Chart / CD).	2	Identify cells and parts of lymphoid organs. <b>(CO -1)</b>	Chart / CD	
	3	Identification of various types of immune cells in peripheral blood smear.	2	Identify blood cells. <b>(CO -3)</b>	Practical	
	4	Separation and preparation of cellular antigen (RBC and bacteria).	2	Differentiate the RBCs and bacteria. <b>(CO -3)</b>	Practical	
	5	Methods of immunization- Intravenous, intraperitoneal and subcutaneous routes.	4	Differentiate intravenous and subcutaneous routes. <b>(CO -1)</b>	Virtual lab	
	6	Methods of blood collection and serum preparation.	4	Demonstrate different blood collection methods. <b>(CO -1)</b>	Virtual lab	
	7	Antigen antibody interaction: Blood typing and Hemagglutination.	2	Identify different blood groups. <b>(CO -4)</b>	Demonstration and observation	
	8	ELISA test (Demonstration).	2	Demonstrate ELISA. <b>(CO -4)</b>	Demonstration and	



				observation
9	Radial immunodiffusion,	4	Demonstrate immunodiffusion. (CO -4)	Demonstration and observation
10	Double immunodiffusion	2	Demonstrate immunodiffusion. (CO -4)	Demonstration and observation
11	Immunoelectrophoretic apparatus Semi dry blotting apparatus Counter current immunoelectrophoresis (chart), Rocket immunoelectrophoresis (chart).	4	Differentiate different Immuno electrophoretic apparatus. (CO -4)	Observation of apparatus/ charts

Courseinstructors

Dr. J. VinoliyaJosephineMary  
Dr. C. JosephinePriyatharshini

Head of theDepartment

Dr. S. Mary Mettilda Bai



	behavior and hibernation, neoplastic growth and colour change in vertebrates.	physiological and behavioural role of hormones in animals. (CO-5)	PPT, Videos	
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Course instructor

Dr. S. Mary Mettilda Bai

Head of the Department

Dr. S. Mary Mettilda Bai

### **Seminar & Assignment Topics**

2. Seminar: Animal models for research.  
Assignment: Endocrinology methodologies.
3. Seminar: Chemical messengers - neurocrine, paracrine, autocrine, endocrine.  
Assignment: Pheromones and chaperones.
4. Seminar: Neuroendocrine mechanisms and functions in insects.  
Assignment: Hormonal regulation of migration in birds.
5. Seminar: Neuroendocrine mechanisms and functions in crustaceans.  
Assignment: Hormonal regulation of migration in fishes.
6. Seminar: Neuroendocrine mechanisms and functions in non-arthropod invertebrates.  
Assignment: Hormonal regulation of behavior and hibernation.
7. Seminar: Structure, functions and pathophysiology of pituitary.  
Assignment: Structure, functions and pathophysiology of hypothalamus.
8. Seminar: Structure, functions and pathophysiology of thyroid.  
Assignment: Structure, functions and pathophysiology of parathyroid.
9. Seminar: Biosynthesis, storage and release of catecholamines.  
Assignment: Biosynthesis, storage and release of thyroxine.
10. Seminar: Biosynthesis, storage and release of growth hormone. Assignment: Biosynthesis, storage and release of insulin.

Semester : IV  
 Name of the Course: Physiology and Immunology  
 Course Code : PZ17P3

Practical III

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

### Teaching plan with Modules

**Total Hours 30 (Incl. Practicals & Test)**

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Physiology (30 Hrs.)</b>					
	1	Effect of temperature on heartbeat of Freshwater Mussel and calculation of $Q_{10}$ .	2	Find out the effect of temperature on heartbeat of Freshwater Mussel and calculate $Q_{10}$ . (CO -2)	Demonstration & practical	Continuous performance based assessment
	2	Effect of temperature on salivary amylase activity and calculation of $Q_{10}$ .	2	Find out the effect of temperature on salivary amylase activity and calculate $Q_{10}$ . (CO -2)	Demonstration & practical	
	3	Effect of pH on salivary amylase activity.	2	Find out the action of salivary amylase in relation to pH. (CO -2)	Demonstration & practical	Internal assessment
4	Salt loss and salt gain in a freshwater fish.	2	Demonstrate Salt loss and salt gain in a freshwater fish. (CO -2)	Demonstration & practical		

	5	Examination of excretory products of fish, bird and mammals.	2	Find out the type of nitrogenous waste eliminated by different animals. <b>(CO -1)</b>	Demonstration & practical	
	6	Survey of digestive enzymes in Cockroach.	2	Find out the digestive enzymes present in the different parts of the digestive system of Cockroach. <b>(CO -1)</b>	Demonstration & Observation	
	7	Counting of blood cells using haemocytometer.	2	Count blood cells using haemocytometer. <b>(CO -1)</b>	Demonstration & Observation	
	8	Haemolysis of blood – Demonstration.	2	Demonstrate hemolysis of blood. <b>(CO -1)</b>	Demonstration & Observation	
	9	Observation of haemin crystals in blood.	2	Mount haemin crystals in blood under microscope. <b>(CO -1)</b>	Demonstration & Observation	
	10	Estimation of haemoglobin (any method).	2	Estimate the amount of haemoglobin in vertebrate blood samples. <b>(CO -1)</b>	Demonstration & Observation	
	11	EEG, ECG, Conditional reflex, Skeletal muscle, Kymograph, Sphygmomanometer, Intestine, Nervous tissue, Liver, Lungs, Heart, Kidney.		Identify the apparatus/ equipments/ slides/ charts/ specimens/ models and comment on it. <b>(CO -1)</b>	Observation of apparatus/ equipments/ slides/ charts	
<b>II</b>	<b>Immunology (30 Hrs.)</b>					
	1	Dissection of Lymphoid organs of a vertebrate (Demonstration).	2	Identify lymphoid organs. <b>(CO -1)</b>	Demonstration	Continuous performance based assessment
	2	Histology of lymphoid organs (Chart / CD).	2	Identify cells and parts of lymphoid organs. <b>(CO -1)</b>	Chart / CD	
	3	Identification of various types of immune cells in peripheral blood smear.	2	Identify blood cells. <b>(CO -3)</b>	Practical	
	4	Separation and preparation of cellular antigen (RBC and bacteria).	2	Differentiate the RBCs and bacteria. <b>(CO -3)</b>	Practical	
	5	Methods of immunization- Intravenous, intraperitoneal and subcutaneous routes.	4	Differentiate intravenous and subcutaneous routes. <b>(CO -1)</b>	Virtual lab	
	6	Methods of blood collection and serum preparation.	4	Demonstrate different blood collection methods. <b>(CO -1)</b>	Virtual lab	
	7	Antigen antibody interaction: Blood typing and Hemagglutination.	2	Identify different blood groups. <b>(CO -4)</b>	Demonstration and observation	
	8	ELISA test (Demonstration).	2	Demonstrate ELISA. <b>(CO -4)</b>	Demonstration and	

					observation
9	Radial immunodiffusion,	4	Demonstrate immunodiffusion. (CO -4)	Demonstration and observation	
10	Double immunodiffusion	2	Demonstrate immunodiffusion. (CO -4)	Demonstration and observation	
11	Immuno electrophoretic apparatus Semi dry blotting apparatus Counter current immunoelectrophoresis (chart), Rocket immunoelectrophoresis (chart).	4	Differentiate different Immuno electrophoretic apparatus. (CO -4)	Observation of apparatus/ charts	

Courseinstructors

Dr. J. VinoliyaJosephineMary  
Dr. C. JosephinePriyatharshini

Head of theDepartment

Dr. S. Mary Mettilda Bai

Semester

: III

Core VII

Name oftheCourse

: Physiology

Coursecode

: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	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

## Teaching Plan with Modules

**Total Hours 90 (Incl. Seminar & Test)**

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Nutrition (18 Hrs.)</b>					
	1	Types of nutrition and feeding mechanisms in animals.	2	Compare the different types of feeding and nutrition in animals. <b>(CO-1)</b>	Lecture, Video	Short test MCQ Open book test

	2	Digestion - Functional anatomy of the digestive system (human) Movements of gastrointestinal tract Secretory functions of the alimentary tract and glands Digestion and absorption.	5	Describe the anatomy and physiology of digestive system. <b>(CO-1)</b>	Lecture, PPT	Formative assessment I (1-5) Quiz I Online assignment Seminar
	3	Metabolism of protein Metabolism of carbohydrate Metabolism of lipid.	6	Explain the metabolism of protein, fat and carbohydrate. <b>(CO-2)</b>	Lecture, Discussion	
	4	Balanced diet – Malnutrition - Energy balance – BMR.	2	Interpret the value of a healthy diet. <b>(CO-5)</b>	Lecture, PPT	
	5	Gastrointestinal disorders: Gall stones liver cirrhosis, gastritis, peptic ulcer and appendicitis.	3	Correlate different gastrointestinal disorders with the physiology of digestive system. <b>(CO-4)</b>	Video	
<b>II</b>	<b>Respiration and Homeostasis (18 Hrs.)</b>					
	1	Respiratory organs and respiratory pigment in animals.	2	Compare respiratory organs and pigment in different animals. <b>(CO-2)</b>	Lecture, PPT	MCQ through EDMODO Slip test Formative assessment I (1,2,3,4) Formative assessment II (5,6) Quiz II  Online assignment Seminar
	2	Physiological anatomy of the respiratory system (human) Transport of respiratory gases. Regulation of respiration.	4	Comprehend the structure and function of respiratory system. <b>(CO-1)</b>	Lecture, Video	
	3	Respiratory problems - bronchial asthma pneumonia and pulmonary tuberculosis.	2	Identify the symptoms of respiratory problems. <b>(CO-4)</b>	Lecture, PPT	
	4	Homeostasis Osmoregulation - types and mechanism Thermoregulation : Classification thermoregulatory mechanism in animals Aestivation and hibernation.	4	Outline the basics of homeostasis and adaptations. <b>(CO-3)</b>	Seminar Lecture	
	5	Deep sea physiology High altitude and space physiology Effects of exposure to cold and heat.	4	Explain the physiological changes at different altitude. <b>(CO-3)</b>	Lecture, Interactive session through MOODLE	
	6	Bioluminescence – physiology and functions.	2	Appreciate the biochemical changes during bioluminescence. <b>(CO-2)</b>	Lecture	



<b>III Circulation (18 Hrs.)</b>					
1	Components and functions of blood. Blood clotting.	3	Compare blood cells and its functions. <b>(CO-1)</b>	Seminar, Lecture	Mind map Short test
2	Haemopoiesis Myogenic and neurogenic heart.	2	Explain the formation and differentiation of blood cells. Differentiate heart. <b>(CO-1)</b>	Lecture	Online assignment Seminar
3	Functional anatomy of human heart.	2	Explain the structure of heart. <b>(CO-1)</b>	Seminar, ppt	Formative assessment – II (1-7) Quiz II
4	Cardiac cycle, pace maker, heart rate Bradycardia and tachycardia.	3	Discuss the cardiac cycle and cardiac problems. <b>(CO-2)</b>	Lecture	
5	Electrocardiogram (ECG).	2	Analyze the rhythmic pattern of heart beat. <b>(CO-5)</b>	Seminar	
6	Heart diseases (Atherosclerosis coronary thrombosis and angina pectoris).	3	Identify the causes of heart diseases. <b>(CO-4)</b>	Lecture, video	
7	Lymphatic system - organization, composition of lymph and functions.	3	Describe the lymphatic system. <b>(CO-1)</b>	Lecture	
<b>IV Neuro-muscular system (18 Hrs.)</b>					
1	Structure of brain and neuron.	4	Explain the structure of central nervous system. <b>(CO-1)</b>	Seminar	Formative assessment II (1,2) Quiz II
2	Neurotransmitters - Synapse- Nerve impulse conduction.	2	Differentiate transmission of nerve impulse. <b>(CO-2)</b>	Lecture, ppt, video Seminar	
3	Reflex activity Inborn and conditioned reflex actions.	2	Explain reflex activity. <b>(CO-3)</b>	Lecture, ppt	Formative assessment III (3,4,5,6) Memory matrix (Neuro-transmitters) Short test
4	Electroencephalogram. Neural disorders - Meningitis and epilepsy.	3	Comprehend and analyse the role of EEG in identifying neural disorders. <b>(CO-5)</b>	Lecture, video	
5	Types of muscle - structure and properties of skeletal muscle. Mechanism of muscle contraction. Neuromuscular junction.	5	Identify the types of muscle and the mechanism of contraction. <b>(CO-1)</b>	Lecture, ppt	Online assignment Seminar
6	Sense organs - Structure and functions of skin, eye, ear.	2	Differentiate the receptor organs, its structure and function. <b>(CO-1, 2)</b>	Lecture, model	

<b>V Excretion and Reproduction (18 Hrs.)</b>						
1	Excretory organs in different groups of animals.	3	Illustrate the excretory organs and types of excretion in animals. <b>(CO-2)</b>	Seminar	Formative assessment III (1-5)  Listing important terms Sliptest MCQ through Quizizz	
2	Patterns of excretion.					
3	Structure and function of kidney (human) Nephron- Formation of urine Micturition- Renal disorders – nephritis - renal calculi Dialysis.	6	Explain the structure and function of human kidney and associated disorders. <b>(CO-2, 4)</b>	Seminar, Lecture, Demonstration		
4	Structure of testis and ovary (human).	3	Differentiate male and female gonad. <b>(CO-1)</b>	Lecture, chart		
5	Oestrus and menstrual cycle Pregnancy parturition and lactation. Hormonal regulation of reproduction.	6	Explain the physiology of reproduction and apply the knowledge in day today life. <b>(CO-2)</b>	Lecture, PPT		

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### **Seminar & Assignments Topics**

10. Seminar: Feeding mechanisms in animals. Assignment: Types of nutrition.
11. Seminar: Malnutrition - Energy balance – BMR. Assignment: Balanced diet.
12. Seminar: Anatomy of the respiratory system (human). Assignment: Regulation of respiration.
13. Seminar: High altitude and space physiology. Assignment: Effects of exposure to cold and heat.
14. Seminar: Components and functions of blood. Assignment: Blood clotting.
15. Seminar: Electrocardiogram (ECG). Assignment: Cardiac cycle.
16. Seminar: Electroencephalogram. Assignment: Neural disorders - Meningitis and epilepsy.
17. Seminar: Structure and functions of eye. Assignment: Structure and functions of ear.
18. Seminar: Oestrus and menstrual cycle. Assignment: Hormonal regulation of reproduction.

Semester : III  
 Name of the Course: Immunology

Core VIII

CourseCode : PZ1732

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

### Learning Objectives

- To facilitate the students to understand and appreciate the defense functions of the immunosystem.
- To develop the skill to determine the immunomodulatory strategies used to enhance or suppress the immuneresponse.

### 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 their 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

### Teaching plan with Modules

Total Hours: 90 (Incl. Seminar & Test)

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	<b>Immune system in invertebrates and vertebrates (18 Hrs.)</b>					
	1	Immunity- Innate and acquired Immunity-Types – natural and artificial, active and passive immunity, II, III and IV line of defense.	3	Differentiate innate and acquired Immunity. (CO-1)	Lecture, Partnering, Xenography Seminar.	MCQ Short test Memory matrix
	2	Lymphoid organs, Cells involved in immune response.	3	Describe lymphoid organs and cells involved in immune response. (CO-1, 2)	Lecture, Gamification Virtual class	Formative Assessment I

	3	Antigens, Immunoglobulins – characteristics Haptens and types.	3	Discuss the structure and functions of antigens and immunoglobulins. <b>(CO-1, 2)</b>	Seminar, Web based, Lecture, Video.	(1,2,3,4,5) Formative Assessment I (6) Schoolology
	4	Immune Response: Humoral immune response, Cell mediated immune response, primary immune response and secondary immune response.	5	Categorize immune response. <b>(CO-1, 2)</b>	Lecture, Video.	
	5	Importance of B cells in humoral immune response (antibody formation), Factors influencing antibody formation and Immunological memory (Anamnesis).	2	Illustrate the role of B cells in humoral immune response and immunological memory. <b>(CO-4)</b>	Lecture, Virtual classroom	
	6	Immunization: immunization schedule and vaccines.	2	Apply immunization schedule and vaccines. <b>(CO-1)</b>	Lecture, Team teaching Heutogogy	
<b>II</b>	<b>Major and minor histocompatibility complex (18 Hrs.)</b>					
	1	MHC class I molecules, MHC class II molecules, Cellular distribution and regulation of MHC expression.	5	Differentiate the MHC class I and MHC class II molecules. <b>(CO-1)</b>	Lecture, Androgogy Suggesto- pedia	MCQ Short test Mind Map
	2	MHC in immune responsiveness, MHC and susceptibility to infectious diseases, Minor histocompatibility (H) antigens.	5	Explain the role of MHC in immune responsiveness and susceptibility to infectious diseases. <b>(CO-1)</b>	Lecture, Flip class	Formative Assessment I (1,2,3,)
	3	Immune effector mechanisms: Cytokines and their functions.	3	Appreciate cytokines and their functions. <b>(CO-1)</b>	Lecture, Reflective PPT	Formative Assessment II (4)
	4	Complement system – classical pathways, alternate pathways and biological functions	5	Differentiate the classical and alternate pathways of complement system. <b>(CO-1)</b>	Lecture, Suggesto- pedia PPT	Worksheet - Kahoot
<b>III</b>	<b>B and T cell (18 Hrs.)</b>					
	1	B cells – Maturation, B cells – activation, B cells – differentiation, B cell receptor (BCR) and B cell co-receptor complex. Signal transduction from B cell antigen receptor and Major pathways of BCR signaling.	6	Describe B cells and B cell co-receptor complex. <b>(CO-1)</b>	Lecture, Partnering PPT	MCQ Short test Mind Map Formative Assessment II

	2	T cells – maturation, T cells - activation and differentiation, T cell receptor (TCR). T cell co-receptor complex, Formation of T and B cell conjugates. Co-stimulation in T cell response and signal transduction, Clonal anergy.	7	Illustrate T cells and signal transduction. (CO-1)	Lecture, Online Video	(1,2,3) Online assignment through Edmodo, Schoology
	3	Antigen processing and presentation – role of antigen presenting cells, cytosolic pathway and endocytic pathway	5	Recognize antigen processing and presentation. (CO-1)	Lecture, Team teaching Video.	
<b>IV</b>	<b>Immune system in health and diseases (18 Hrs.)</b>					
	1	Tumour immunology- properties of tumour cells and causes of tumours, tumour antigens, immune response to tumour and immune surveillance. Immunodiagnosis of tumour antigens and immuno therapy of tumour.	4	Acquire knowledge on the-properties of tumours and immuno therapy. (CO-4)	Lecture, Xenography PPT	Short test MCQ Formative Assessment II (1,2,3,4,5) Quiz II Formative Assessment III (6) Online worksheet through Edmodo
	2	Hypersensitivity: factors causing hypersensitivity, Type I, II, III, and IV reactions	4	Discuss the factors and types of hypersensitivity. (CO-3)	Seminar, Problem based, Lecture	
	3	Immunodeficiency – primary and secondary	2	Describe the immunodeficiency diseases. (CO-4, 5)	Lecture, Problem based PPT	
	4	Autoimmune diseases - characteristics, causes, classification	2	Acquire knowledge on autoimmune diseases. (CO-4, 5)	Lecture, Evaluative PPT	
	5	Autoimmune diseases - localized (Diabetes mellitus and Addison’s disease); systemic (lupus erythromatous and rheumatoid arthritis)	3	Recognize different types of autoimmune diseases. (CO-4, 5)	Seminar, Problem based Lecture	
	6	Immune response to infectious diseases and treatment - Protozoan disease (Malaria), Bacterial disease (Tuberculosis) and Viral disease (AIDS).	3	Discuss the immune response to infectious diseases and treatment. (CO-4, 5)	Lecture, Team teaching PPT	
<b>V</b>	<b>Antigen-antibody interaction (18 Hrs.)</b>					
	1	Antigen-antibody interaction: strength, affinity, avidity and cross reactivity.	2	Describe the antigen-antibody interaction.(CO-2)	Seminar, Demonstration.	Slip test Formative
	2	Complement fixation test-precipitation reaction in fluids and precipitin curve.	2	Discuss the complement fixation test. (CO-2)	Lecture, Role play, PPT	

3	Radial immunodiffusion and Double immunodiffusion.	2	Demonstrate immunodiffusion. (CO-2)	Heutogogy Lecture	Assessment III Seminar Assignment- Kahoot Quizizz
4	Immuno electrophoresis – counter electrophoresis and rocket electrophoresis. Agglutination reaction–hemagglutination and bacterial agglutination. Agglutination reaction- coated particle agglutination and agglutination inhibition.	3	Demonstrate immuno electrophoresis, hemagglutination and bacterial agglutination (CO-2)	Seminar, Lecture and Video	
7	Radio immuno assay, ELISA and Western blotting, Immunofluorescence.	4	Demonstrate radio immuno assay, ELISA, western blotting and Immunofluorescence. (CO-2)	Seminar, Technology based Lecture	
9	Flow cytometry.	2	Explain flowcytometry. (CO-2)	Seminar, Youtube Lecture	
10	Transplantation: classification of grafts, mechanism of graft rejection, graft versus host reaction, immuno suppressive therapy during transplantation.	3	Describes transplantation. (CO-2)	Lecture, Androgogy	

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### **Seminar & Assignment Topics**

10. Seminar: Innate and acquiredImmunity. Assignment: Types of Immunity.
11. Seminar: Immunoglobulins – characteristics. Assignment: Immunization schedule andvaccines.
12. Seminar: Cytokines and their functions. Assignment: MHC and susceptibility to infectious disease.
13. Seminar: Hypersensitivity: factors causing hypersensitivity, Type I andII. Assignment: Classical pathways, alternatopathways.
14. Seminar: Autoimmune diseases - localized (Diabetes mellitus and Addison’s disease). Assignment: Autoimmune diseases- characteristics, causes,classification.
15. Seminar: Antigen-antibody interaction: strength, affinity, avidity and cross reactivity. Assignment: Properties of tumour cells and causes oftumours.
16. Seminar: Immuno electrophoresis – counter electrophoresis and rocket electrophoresis. Assignment: Radial immunodiffusion and Doubleimmunodiffusion.
17. Seminar: Radio immuno assay, ELISA and Westernblotting. Assignment:Immunofluorescence.
18. Seminar: Flowcytometry. 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

- To learn how the endocrine system functions under normal circumstances, as well as the pathologies that arise when homeostasis fails.
- 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

### Teaching plan with Modules

*Total Hours 90 (Incl. Seminar & Test)*

Unit	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Introduction (18 Hrs.)</b>					
	1	Historical perspective and scope of endocrinology.	3	Explain the history and Scope of Endocrinology. (CO-1)	Seminar, and group discussion	MCQ Short test
	2	Endocrine methodologies - assay of hormones, surgical methods, radioisotope studies, pharmacological methods, and replacement therapy.	6	Differentiate the various methods of Hormonal assays. (CO-1)	Lecture, and group discussion	Formative Assessment I (1,2,3,4,5)

	3	Animal models for research.	3	Identify different animals used in Research. <b>(CO-1)</b>	Lecture Group discussion	Quiz I  Seminar  Assignment (Edmodo)
	4	Chemical messengers - neurocrine, paracrine, autocrine, endocrine.	4	Illustrate the action of hormones as Messengers. <b>(CO-2)</b>	Lecture / Video class	
	5	Pheromones and chalone.	2	Relate the hormone and behaviour. <b>(CO-2)</b>	Lecture	
<b>II</b>	<b>Neurosecretion and Neuroendocrine mechanisms (18 Hrs.)</b>					
	1	Neuroendocrine integration.	3	Relate the integration between the nervous system and the endocrine system. <b>(CO-2)</b>	Lecture, Mind map	Slip test Formative Assessment I  (1,2,3,4) Quiz I  Formative Assessment II (5) Quiz II  Seminar  Assignment (Quizizz)
	2	Evolution of regulatory mechanisms.	3	Explore the evolution of regulatory mechanism. <b>(CO-1)</b>	Lecture, PPT	
	3	Endocrine control of neural function.	3	Appreciate the control of nervous system by endocrine organs. <b>(CO-1)</b>	Lecture, Video	
	4	Neuroendocrine mechanisms and functions in insects, crustaceans, non-arthropod invertebrates.	5	Identify the role of Neuroendocrine mechanisms in insects and non-arthropod invertebrates. <b>(CO-5)</b>	Seminar, Lecture	
	5	Analogous neurosecretory systems of invertebrates and vertebrates.	4	Recognize the analogy of endocrine glands and their function in vertebrates and invertebrates. <b>(CO-5)</b>	Seminar, Lecture, PPT	
<b>III</b>	<b>Endocrine glands and hormones (18 Hrs.)</b>					
	1	Organization of the endocrine system, Classification of hormones.	3	Describe the different types of hormones. <b>(CO-1)</b>	Lecture. Discussion	MCQ  Short test,  Online assignment (Edmodo)  Seminar,  Formative Assessment II (1,2,3,4,5)
	2	Structure, functions and pathophysiology of hypothalamus, pituitary.	4	Explain the structure and functions of hypothalamus and pituitary. Identify pathological conditions. <b>(CO-3)</b>	Seminar, Lecture, PPT	
	3	Structure, functions and pathophysiology of thyroid and parathyroid.	4	Explain the structure and functions of thyroid and parathyroid. Identify pathological conditions. <b>(CO-3)</b>	Seminar, Lecture, PPT	



	4	Structure, functions and pathophysiology of adrenal, pancreas and gonads.	4	Explain the adrenal gland and pancreas. Interpret pathological conditions of gonads. (CO-3)	Lecture, PPT	Quiz II
	5	Gastro-intestinal hormones.	3	Describe Gastro-intestinal hormones. (CO-3)	Lecture, Video	
<b>IV</b>	<b>Hormone synthesis and mechanism of Hormone action (18 Hrs.)</b>					
	1	Biosynthesis, storage and release of amine (catecholamines and thyroxine) protein (growth hormone and insulin) and steroid hormones (sex hormones).	5	Explain the synthesis of amine, protein and steroid hormones. (CO-2)	Lecture, Mind map	MCQ, Shorttest, Online assignment (Quizizz) Seminar, Formative Assessment II(1,2) QuizII, Formative Assessment III (3,4,5)
	2	Mechanism of hormone action - receptors (membrane and cytosolic) - second messengers, signal transduction, termination of hormone activity.	4	Discuss hormone and cell communication. (CO-2)	Lecture, PPT	
	3	Pathophysiological correlates of hormone action.	4	Analyse the importance of receptor number for proper functioning of hormone. (CO-3)	Lecture, Group discussion	
	4	Endocrine disorders due to receptor number and function.	3	Outline the importance of receptor number. (CO-3)	Lecture, PPT	
	5	Hormonal therapy.	2	Evaluate the therapeutic role of hormones. (CO-3)	Lecture, PPT	
<b>V</b>	<b>Endocrine Integration (18 Hrs)</b>					
	1	Diffuse effect of hormones.	2	Interpret the varied role of one hormone on different organs. (CO-2)	Lecture, Flow Chart	MCQ Shorttest, Online assignment (Edmodo) Seminar, Formative Assessment III (1,2,3,4,5)
	2	Hormonal regulation of growth, development and metabolism.	4	Appreciate the physiological regulation of hormones. (CO-2)	Lecture, Mind map	
	3	Hormonal regulation of reproductive cycle and pregnancy, parturition and lactation.	4	Describe the role of hormones in reproduction. (CO-4)	Lecture, Videos	
	4	Hormonal regulation of migration (birds and fishes).	3	Analyse the reason and changes in animals during migration. (CO-5)	Lecture, PPT	
	5	Hormonal regulation of	5	Describe the	Lecture,	

		behavior and hibernation, neoplastic growth and colour change in vertebrates.		physiological and behavioural role of hormones in animals. (CO-5)	PPT, Videos	
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Course instructor

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Head of the Department

Dr. S. Mary Mettilda Bai

### **Seminar & Assignment Topics**

11. Seminar: Animal models for research. Assignment: Endocrinology methodologies.
12. Seminar: Chemical messengers - neurocrine, paracrine, autocrine, endocrine. Assignment: Pheromones and chaperones.
13. Seminar: Neuroendocrine mechanisms and functions in insects. Assignment: Hormonal regulation of migration in birds.
14. Seminar: Neuroendocrine mechanisms and functions in crustaceans. Assignment: Hormonal regulation of migration in fishes.
15. Seminar: Neuroendocrine mechanisms and functions in non-arthropod invertebrates. Assignment: Hormonal regulation of behavior and hibernation.
16. Seminar: Structure, functions and pathophysiology of pituitary. Assignment: Structure, functions and pathophysiology of hypothalamus.
17. Seminar: Structure, functions and pathophysiology of thyroid. Assignment: Structure, functions and pathophysiology of parathyroid.
18. Seminar: Biosynthesis, storage and release of catecholamines. Assignment: Biosynthesis, storage and release of thyroxine.
19. Seminar: Biosynthesis, storage and release of growth hormone. Assignment: Biosynthesis, storage and release of insulin.

**Semester : IV**  
**Name of the Course: Physiology and Immunology**  
**Course Code : PZ17P3**

**Practical III**

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

**Teaching plan with Modules**

**Total Hours 30 (Incl. Practicals & Test)**

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Physiology (30 Hrs.)</b>					
	1	Effect of temperature on heartbeat of Freshwater Mussel and calculation of $Q_{10}$ .	2	Find out the effect of temperature on heartbeat of Freshwater Mussel and calculate $Q_{10}$ . (CO -2)	Demonstration & practical	Continuous performance based assessment  Internal assessment
	2	Effect of temperature on salivary amylase activity and calculation of $Q_{10}$ .	2	Find out the effect of temperature on salivary amylase activity and calculate $Q_{10}$ . (CO -2)	Demonstration & practical	
	3	Effect of pH on salivary amylase activity.	2	Find out the action of salivary amylase in relation to pH. (CO -2)	Demonstration & practical	
4	Salt loss and salt gain in a freshwater fish.	2	Demonstrate Salt loss and salt gain in a freshwater fish. (CO -2)	Demonstration & practical		

	5	Examination of excretory products of fish, bird and mammals.	2	Find out the type of nitrogenous waste eliminated by different animals. <b>(CO -1)</b>	Demonstration & practical	
	6	Survey of digestive enzymes in Cockroach.	2	Find out the digestive enzymes present in the different parts of the digestive system of Cockroach. <b>(CO -1)</b>	Demonstration & Observation	
	7	Counting of blood cells using haemocytometer.	2	Count blood cells using haemocytometer. <b>(CO -1)</b>	Demonstration & Observation	
	8	Haemolysis of blood – Demonstration.	2	Demonstrate hemolysis of blood. <b>(CO -1)</b>	Demonstration & Observation	
	9	Observation of haemin crystals in blood.	2	Mount haemin crystals in blood under microscope. <b>(CO -1)</b>	Demonstration & Observation	
	10	Estimation of haemoglobin (any method).	2	Estimate the amount of haemoglobin in vertebrate blood samples. <b>(CO -1)</b>	Demonstration & Observation	
	11	EEG, ECG, Conditional reflex, Skeletal muscle, Kymograph, Sphygmomanometer, Intestine, Nervous tissue, Liver, Lungs, Heart, Kidney.		Identify the apparatus/ equipments/ slides/ charts/ specimens/ models and comment on it. <b>(CO -1)</b>	Observation of apparatus/ equipments/ slides/ charts	
<b>II</b>	<b>Immunology (30 Hrs.)</b>					
	1	Dissection of Lymphoid organs of a vertebrate (Demonstration).	2	Identify lymphoid organs. <b>(CO -1)</b>	Demonstration	Continuous performance based assessment
	2	Histology of lymphoid organs (Chart / CD).	2	Identify cells and parts of lymphoid organs. <b>(CO -1)</b>	Chart / CD	
	3	Identification of various types of immune cells in peripheral blood smear.	2	Identify blood cells. <b>(CO -3)</b>	Practical	
	4	Separation and preparation of cellular antigen (RBC and bacteria).	2	Differentiate the RBCs and bacteria. <b>(CO -3)</b>	Practical	
	5	Methods of immunization- Intravenous, intraperitoneal and subcutaneous routes.	4	Differentiate intravenous and subcutaneous routes. <b>(CO -1)</b>	Virtual lab	
	6	Methods of blood collection and serum preparation.	4	Demonstrate different blood collection methods. <b>(CO -1)</b>	Virtual lab	
	7	Antigen antibody interaction: Blood typing and Hemagglutination.	2	Identify different blood groups. <b>(CO -4)</b>	Demonstration and observation	
	8	ELISA test (Demonstration).	2	Demonstrate ELISA. <b>(CO -4)</b>	Demonstration and	

					observation
9	Radial immunodiffusion,	4	Demonstrate immunodiffusion. (CO -4)	Demonstration and observation	
10	Double immunodiffusion	2	Demonstrate immunodiffusion. (CO -4)	Demonstration and observation	
11	Immunoelectrophoretic apparatus Semi dry blotting apparatus Counter current immunoelectrophoresis (chart), Rocket immunoelectrophoresis (chart).	4	Differentiate different Immuno electrophoretic apparatus. (CO -4)	Observation of apparatus/ charts	

**Course instructor**

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**Head of the Department**

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## M.Sc. Zoology

**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

- To enable the students to collect and use the data to derive inferences in various biological experiments.
- 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	PSO - 3	Ap

	employability in Research and Development organizations.		
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

### Modules with Teaching Plan

**Total Hours: 90 (Incl. Seminar & Test)**

UNIT	Section	Description	Hours	Learning outcome / CO addressed	Pedagogy	Assessment
I	<b>Data collection and presentation (18 hrs)</b>					
	1	Population and sample in biological studies, variables and sampling methods	2	Classifies variables and constants. Differentiate population and sample. <b>(CO-1)</b>	PPT	Short test, MCQ, Seminar, Online Assignment Class test I Formative assessment I Quiz I
	2	Types of biological data.	2	Compares primary and secondary data <b>(CO-1)</b>	PPT	
	3	Measurement scales - ratio scale, interval scale, ordinal scale, nominal scale - parameters and statistics. Accuracy and precision.	4	Recognize different kinds of scales <b>(CO-2)</b>	PPT, Group discussion	
	4	Data collection and presentation - Tabulation	3	Recognize different methods of Classification and Tabulation. <b>(CO-3)</b>	PPT, Group discussion	
	5	Data collection and presentation – graphs and diagrams	3	Creates different types of diagrams and graphs <b>(CO-3)</b>	problem based learning	
	6	Measures of central tendency: types of mean, median, mode.	4	Distinguish measures of central tendency. <b>(CO-1)</b>	Problem solving	
II	<b>Measures of dispersion (18 hrs)</b>					
	1	Measures of dispersion: range – quartile and percentile.	2	Assess and construct Quartiles and Percentiles. <b>(CO-2)</b>	PPT	MCQ Mind map
	2	Mean deviation - standard deviation - coefficient of variation	2	Differentiates absolute and relative measures of dispersion. <b>(CO-2)</b>	Problem solving	Seminar, Online Assignment
	3	Skewness and kurtosis - standard error	2	Evaluates and interprets the skewness and	PPT, Problem solving	Formative assessment I ( 1)

			kurtosis. (CO-2)		Quiz I	
	4	Distribution: Binomial, Poisson and Normal.	2	Apply probability distributions to solve problems. (CO-3)	PPT, Problem solving. video clipping	Formative assessment II (2,3,4, 5,6,7) Quiz II
	5	Parametric and non parametric tests.	2	Apply parametric and non-parametric analysis. (CO-3)	PPT	
	6	Hypothesis testing – single and two population mean - types of error (Type I and Type II)	4	Relate Type I and Type II error and statistical significance. (CO-6)	Problem solving, Chalk and talk	
	7	Chi-square analysis – test for goodness of fit and homogeneity.	4	Elucidate goodness of fit using chi-square test. (CO-5)	Problem solving	
<b>III</b>	<b>Analysis of Data (18 hrs)</b>					
	1	Student's <i>t</i> -distribution	2	Perform t-tests to verify the level of significance. (CO-5)	Problem solving	Mind map, Short test,
	2	Analysis of variance (ANOVA) one way and two way classification (Factorial design).	3	Perform analysis of variance. (CO-5)	Problem solving	Seminar, Online Assignment
	3	Probability: Addition theorem, multiplication theorem and conditional theorem.	1	Solves problems on probabilities. (CO-4)	Exercise	Formative assessment I (1,2,3) Quiz I (1,2,3,4)
	4	Permutation and combination	2	Identifies the concept of permutation and combinations. (CO-4)	Problem solving	Formative assessment II (5-7)
	5	Correlation – types, methods of study and testing the significance.	3	test the significance of different statistics. (CO-1)	Problem solving	
	6	Regression: equations – regression lines – simple linear regression and testing its significance.	4	Estimate regression and find the significance of the slope. (CO-4)	brain storming, solve problems	
	7	Mathematical modeling in biology: types and applications	3	Examine problems using the appropriate mathematical	PPT	

				models. (CO-5)		
IV	<b>Computer applications</b> (18 hrs)					
	1	Computer applications. Microsoft office - M.S. Power point	3	Create document and power point slides in Microsoft word programs. (CO-1)	PPT, Practical	MCQ Seminar, Online Assignment Formative assessment I - (1- 4) Short test Formative assessment II (5-7)
	2	MS Excel	2	Generate charts and graphs. (CO-1)	PPT, Practical	
	3	MS Excel : statistical function - Descriptive statistics	3	Perform statistical analysis. (CO-1)	Solve problems using Excel	
	4	MS Excel : statistical function - <i>t</i> –test, ANOVA,	4	Solve problems using Excel. (CO-1)	Demonstrations, Problem solving	
	5	MS Excel : statistical function correlation, regression, Chi-square test.	2	Find significance using MS Excel. (CO-1)	Demonstration, exercises to solve problems	
	6	Viruses and worms.	1	Browse internet, sent emails and address viruses and worms. (CO-6)	Lecture and demonstration	
	7	Statistical Packages: SPSS, Minitab, Sigmaplot, Originpro	3	Explain the usage and applications of Statistical Packages. (CO-5)	PPT	
V	<b>Bioinformatics</b> (18 hrs)					
	1	Bioinformatics: Scope	1	Realizes the scope of bioinformatics. (CO-5)	mind storming	Listing out important terms, Slip test, Seminar, Online Assignment Formative
	2	Biological data bases – Data base retrieval tools (Locus link, ENTREZ, PubMed and SRS) – Nucleotide sequence data base (NCBI, EMBL) - Protein data base (SWISS-	4	Distinguish Biological databases and their uses. (CO-1)	demonstration using soft wares	



	PROT)				assessment I - (1, 2) Quiz I
3	Data base similarity search tools	3	Choose appropriate bioinformatics tools. (CO-1)	Video	Formative assessment II (3- 6) Quiz II
4	Biological sequence analysis (BLAST, FASTA Biological sequence analysis: sequence alignment, pair-wise alignment and multiple sequence alignment (CLUSTALW).	5	Perform pairwise and multiple sequence alignment using software. (CO-1)	PPT, Mind storming Jigsaw	
5	Protein structure visualizing tools (RasMol, Swiss PDB Viewer).	3	Analyze structure of proteins. (CO-4)	Chart, video	
6	Applications of bioinformatics tools.	2	Recall the applications of bioinformatics tools. (CO-4)	Discussion	

**Course instructor**

Dr. Josephine Vinoliya Mary  
Dr. F. Brisca Renuga

**Head of the Department**

Dr. S. Mary Mettilda Bai

**Seminar topics**

1. Population, sample in biological studies and parameters and statistics
2. Biological variables.
3. Types of biological data
4. Measurement scales - ratio scale, interval scale, ordinal scale, nominal scale
5. Data collection
6. Sampling methods
7. Presentation of data: Tabulation.
8. Presentation of data: Graphs and diagrams.
9. Frequency distribution - histogram - frequency curves and Ogives.
10. Measures of central tendency
11. Measures of dispersion

12. Hypothesis testing and Type I and II errors.
13. Microsoft office - M.S. Power point.
14. Microsoft office - MS Excel. table and charts.
15. Statistical function: Descriptive statistics –*t*-test, ANOVA,
16. Statistical function: Correlation and regression
17. Statistical function: Chi-square test.
18. Viruses and worms.
19. Scope of Bioinformatics, Biological data bases
20. Data base retrieval tools -Locus link, ENTREZ, Pubmed and SRS.
21. Nucleotide sequence data base –NCBI and EMBL.
22. Protein data base Protein data bank (PDB)
23. Data base similarity research tools – BLAST and MSA.
24. Protein structure visualizing tools - RasMol, Swiss PDB Viewer
25. Applications of bioinformatics tools.

**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

- To provide knowledge on the structure and functions of bio-membranes, cell organelles and signaling pathways.
- 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

### Teaching Plan with Modules

**Total Hours: 90 (Incl. Seminar & Test)**

Units	Modules	Topic	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Cell Structure &amp; Functions of cell organelles (18 Hrs.)</b>					
	1	prokaryotic and eukaryotic cells – structure.	2	Differentiate prokaryotic cells from eukaryotic cells. <b>(CO-3)</b>	Lecture, ppt, Group discussion	Short test, MCQ, Seminar, Online Assignment  Formative assessment - I (1,2,3,4,5,6) Quiz I
	2	Plasma membrane: Structure and function - active transport and pumps	4	Explain transport across membranes and the role of the proteins involved in it. <b>(CO-1)</b>	Lecture, video	
	3	Transport by transporter proteins – membrane potential.	3	Comprehend the mechanism of resting membrane potential <b>(CO-1)</b>	Lecture, ppt	

	4	Tight junction Gap junction.	2	Recall and relate the role of tight and gap junction. <b>(CO-1)</b>	Lecture, ppt	
	5	Cytoskeleton – Microfilaments, intermediate filaments and microtubules.	4	Describe the structure and role of cytoskeletons of the cell. <b>(CO-2)</b>	Lecture, video	
	6	Extracellular matrix – Collagen and non – collagen components.	3	Evaluate the function of extracellular matrix. <b>(CO-2)</b>	Lecture, ppt	
<b>II</b>	<b>Cell organelles and Nucleic acids (18 Hrs.)</b>					
	1	Structure and functions of Nucleus, mitochondria and Endoplasmic reticulum.	6	Illustrate and relate the coordination of Nucleus, mitochondria and ER. <b>(CO-2)</b>	Seminar, Lecture, video	Short test, Seminar, Online Assignment,
	2	Structure, functions of Golgi complex and lysosomes.	4	Identify and describe the structure of the Golgi complex and lysosomes and infer their relationship. <b>(CO-1)</b>	Lecture, Group discussion	Formative assessment – I (1,2,3)
	3	Ribosomes and translation of genetic information.	3	Discriminate the flow of information from DNA to a protein. <b>(CO-3)</b>	Lecture, ppt, video clipping	Quiz I
	4	Types, structure and functions of DNA.	3	Identify the main cytoskeletal components in diagrams and EM micrographs. <b>(CO-1)</b>	Seminar, ppt	Formative assessment – II (4,5)
	5	Types, structure and functions of RNA.	2	Recall the role of RNAs. <b>(CO-3)</b>	Seminar	Quiz II (4,5)
<b>III</b>	<b>Cell signaling (18 Hrs.)</b>					
	1	<b>Signaling pathways:</b> Cell adhesion molecules - Extra cellular signaling	3	Describe the structure and functions of the different families of cell adhesion receptor molecules. <b>(CO-3)</b>	Lecture, ppt	Short test, MCQ, Seminar, Online Assignment
	2	Signaling molecules and their receptors	2	Explain the types of signaling molecules and functions of the cell surface receptors. <b>(CO-3)</b>	Lecture, ppt	Formative assessment - I (1,2) Quiz I
	3	Pathways of intracellular signal transduction: G protein coupled receptors	3	Understand the intracellular signal transduction pathways and G protein coupled	Lecture, video, mind map	Formative assessment - II (3,4, 5, 6) Quiz II

				receptors. <b>(CO-3)</b>		
	4	Cyclic AMP pathways, Receptor Tyrosine Kinases (RTKs).	3	Explain the Cyclic AMP pathways and Receptor Tyrosine Kinases (RTKs). <b>(CO-3)</b>	Lecture, ppt	
	5	Ras, Raf and MAP kinase pathway	3	Relate the Ras, Raf and MAP kinase pathways. <b>(CO-3)</b>	Lecture, ppt, mind map	
	6	Second messengers, signaling from plasma membrane to nucleus.	4	Identify the role of second messengers in signal transduction pathways and mechanism of signaling from plasma membrane to the nucleus. <b>(CO-3)</b>	Lecture, video	
<b>IV</b>	<b>Protein synthesis and transport (18 Hrs.)</b>					
	1	Transcription – Translation in prokaryotes.	3	Describe the structure of Gene. <b>(CO-3)</b>	Seminar	Seminar,
	2	Transcription – Translation in eukaryotes.	5	Narrate stepwise the synthesis of proteins. <b>(CO-3)</b>	Lecture, ppt, Video, Seminar	Online Assignment,
	3	Protein trafficking - sorting - from ER to Golgi.	4	Describe protein sorting, its necessity and vesicle trafficking. <b>(CO-3)</b>	Lecture, ppt, video	Formative assessment - II
	4	Anterograde and retrograde transport – transport to lysosome – exocytosis – endocytosis.	3	Discuss how proteins are targeted and distributed to different compartments of a cell. <b>(CO-3)</b>	Lecture, ppt, video, Seminar	(1,2,3,4,5) Quiz II
	5	Membrane protein and secretory proteins.	3	Differentiate membrane and secretory proteins. <b>(CO-3)</b>	Lecture	
<b>V</b>	<b>Normal and abnormal cell growth (18 Hrs.)</b>					
	1	Cell cycle – Mitosis – Meiosis.	6	Identify the stages of the cell cycle and thereby Carry out a range of practical scientific skills. <b>(CO-5)</b>	Lecture and chart, Seminar	Listing out important terms, Slip test,
	2	Cyclin and Cyclin dependent kinases – Regulation of cyclin dependent kinases (cdk) – Cyclin activity.	4	Discuss the role of Cyclin and cyclin kinases in cell cycle. <b>(CO-4)</b>	Lecture and Video, Seminar	Seminar, Online Assignment, Quizizz
	3	Apoptosis– mechanism and significance.	3	Explain the mechanism and significance of Apoptosis. <b>(CO-4)</b>	Lecture, Ppt, mind map	Formative assessment -

	4	Molecular aspects of cancer, proto-oncogenes – oncogenes, tumour suppressor genes	5	Analyse the role of oncogenes and tumour suppressor genes. <b>(CO-4)</b>	Lecture, video,	II (1,2,3,4) Quiz - II
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**Course instructor**

Dr. C. Josephine Priyatharshini (In - charge)

Dr. P. T. Arokya Glory

**Head of the Department**

Dr. S. Mary Mettilda Bai

**Seminar and Online Assignment topics**

1. Seminar : Structure and functions of prokaryotic cell.  
Assignment : Structure and functions of prokaryotic cell.
2. Seminar : Structure and functions of eukaryotic cell.  
Assignment : Structure and functions of eukaryotic cell.
3. Seminar : Plasma membrane: Structure and function  
Assignment : Plasma membrane: Structure and function..
4. Seminar : Cell adhesion molecules: Selectin – Integrin – Cadherin.  
Assignment : Cell adhesion molecules: Selectin – Integrin – Cadherin.
5. Seminar : Tight junction and gap junction.  
Assignment : Tight junction and gap junction.
6. Seminar : Extracellular signaling – signaling molecules and their receptors. Assignment : Extracellular signaling – signaling molecules and their receptors.
7. Seminar : Pathways of intracellular signal transduction: G protein coupled receptors  
Assignment : Pathways of intracellular signal transduction: G protein coupled receptors
8. Seminar : Pathways of intracellular signal transduction: Ras pathway.  
Assignment : Pathways of intracellular signal transduction: Ras pathway.
9. Seminar : Pathways of intracellular signal transduction: Raf pathway.  
Assignment : Pathways of intracellular signal transduction: Raf pathway.
10. Seminar : Pathways of intracellular signal transduction: MAP kinase pathway.  
Assignment : Pathways of intracellular signal transduction: MAP kinase pathway.
11. Seminar : Structure and functions of Nucleus.  
Assignment : Structure and functions of Nucleus.
12. Seminar : Structure and functions of mitochondria.  
Assignment : Structure and functions of mitochondria.
13. Seminar : Structure and functions of Endoplasmic reticulum.  
Assignment : Structure and functions of Endoplasmic reticulum.
14. Seminar : Structure and functions of Golgi complex.  
Assignment : Structure and functions of Golgi complex.
15. Seminar : Structure and functions of RNA.  
Assignment : Structure and functions of RNA.

16. Seminar : DNA template  
Assignment : DNA template
17. Seminar : Transcription – Translation – Post translation  
Assignment : Transcription – Translation – Post translation
18. Seminar : Protein trafficking - sorting – Secretory pathway  
Assignment : Protein trafficking - sorting - Secretory pathway
19. Seminar : Protein trafficking - sorting – endocytic pathway  
Assignment : Protein trafficking - sorting – endocytic pathway
20. Seminar : Membrane protein and secretory proteins  
Assignment : Membrane protein and secretory proteins
21. Seminar : Cell cycle – Mitosis  
Assignment : Cell cycle – Mitosis
22. Seminar : Cell cycle – Meiosis  
Assignment : Cell cycle – Meiosis
23. Seminar : Cyclin activity  
Assignment : Cyclin activity
24. Seminar : Apoptosis – definition – mechanism and significance.  
Assignment : Apoptosis – definition – mechanism and significance.
25. Seminar : Neoplastic transformation: cancer – proto-oncogenes – tumour suppressor genes  
Assignment : Neoplastic transformation: cancer – proto-oncogenes – tumour suppressor genes

**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**

- To enable the students to gain knowledge on the process by which a zygote multiplies, differentiates and develops into an adult.
- 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

**Teaching plan with Modules**

**Total Hours 75 (Incl. Seminar & Test)**

Unit	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Introduction (15 Hrs.)</b>					
	1	Historical perspectives and theories of embryology.		Explain the theories of embryology. (CO-2)	PPT	Short test, Quizziz, Mind map, Formative
	2	Sexual and asexual		Differentiate the process	Lecture	



		reproduction - Parthenogenesis and types.		and types of reproduction (CO-3)	with Open board	assessment I (1,2,3,4) Quiz 1(1,2,3,4) Seminar, Online Assignment
	3	Male reproductive system of a mammal, spermatogenesis, structure and function of sperm, semen and seminal fluid.		Discuss the structure and function of male reproductive system and its function (CO-2)	PPT, Video lesson	
	4	Female reproductive system of a mammal, oogenesis, ovulation, vitellogenesis, types of eggs.		Explain the process of oogenesis and structure of female reproductive system Classify the types of eggs based on various factors (CO-3)	PPT, Flipped classroom	
<b>II</b>	<b>Fertilization and molecular aspects (15 Hrs.)</b>					
	1	Mechanism of fertilization, Theories of fertilization.		Analyze the theories of fertilization with the mechanism (CO-3)	PPT	MCQ Open book test Flow chart Formative assessment I (1) Quiz 1(1) Formative assessment II (2,3,4) Quiz II (2,3,4) Seminar, Online Assignment
	2	Cleavage: laws - planes – patterns – chemical changes during cleavage		Identify the planes and patterns of cleavage Summarize the chemical changes that takes place during cleavage (CO-4)	Video lesson, Lecture with open board	
	3	Cleavage and blastulation in chick and mammal.		Outline the concepts of cleavage and blastulation in chick and mammal (CO-2)	PPT, Video	
	4	Cell lineage, Fate map of chick and Mammal.		Explain the cell lineage and fate map of chick and mammal (CO-3)	PPT, Discussion	
<b>III</b>	<b>Morphogenetic movements&amp; Organogenesis (15 Hrs.)</b>					
	1	Morphogenetic movements and Gastrulation in chick and mammal. Germinal layers and their derivatives.	5	Differentiate the types of morphogenetic movements and the dermal derivatives Describe gastrulation in in chick and mammal. (CO-2)	PPT, Video	MCQ Short test, Quiz, Mind map Flow chart Formative assessment I Quiz 1 Seminar, Online Assignment
	2	Neurogenesis, Notogenesis, development of mesoderm and coelom.	2	Illustrate neurogenesis and notogenesis. Comprehend the development of mesoderm and coelom. (CO-1)	PPT, Video	
	3	Development of eye, skin	3	Explain the formation of	Flipped	

		and its derivatives in chick and mammal.		eye and skin. (CO-3)	Class: PPT	
	4	Development of heart, kidney, limbs, alimentary canal and its derivatives in chick and mammal.	5	Explain the development of heart, kidney, limbs, alimentary canal and its derivatives in chick and mammal. (CO-3)	PPT, Discussion	
<b>IV</b>	<b>Development of reproductive organs in man (15 Hrs.)</b>					
	1	Development and differentiation of testis.	3	Comprehend the development of male reproductive organ. (CO-3)	PPT, Video	MCQ, Short test, Seminar, Online Assignment Seminar, Formative assessment II Quiz II
	2	Development of male genital ducts and accessory glands.	2	Differentiate the development of testis and accessory glands. (CO-3)	PPT, Video	
	3	Development and differentiation of ovary, female genital ducts and accessory glands.	4	Differentiate the development of ovary and accessory glands. (CO-3)	PPT, Video	
	4	Teratogenesis and teratogens. Infertility – causes and treatment	3	Analyse the different causes of infertility and methods to solve. (CO-3,4)	PPT, Video	
	5	Development of extra embryonic membranes. Placentation in mammals.	3	Identify the extra embryonic membranes. Compare the placenta of mammals. (CO-3)	PPT, Video	
<b>V</b>	<b>Embryonic induction, Metamorphosis &amp; Regeneration (15 Hrs.)</b>					
	1	Embryonic induction in vertebrates – types – exogenous and endogenous. Theories of organizer or inductor, competence.	4	Explain the process of induction and competence. (CO-3)	PPT, Classroom screen	MCQ. Short test. Online Assignment. Formative assessment II (1,2,3,4) Quiz II (1,2,3,4). Seminar
	2	Differentiation - characteristics and types, selective action of genes in differentiation.	3	Explain the role of genes in differentiation. (CO-4)	PPT, Video	
	3	Metamorphosis in insects and amphibians. Neoteny.	3	Explain the process of metamorphosis and neoteny. (CO-1)	PPT, Video	
	4	Regeneration - Regenerative ability in animals and mechanism.	5	Analyse the regenerative ability of animals. (CO-3)	PPT, Video	

**Course instructor**  
Dr. X. Venci Candida  
Mettilda Bai

**Head of the Department**  
Dr. S. Mary Mettilda Bai Dr. S. Mary

## **Seminar & Assignment Topics**

1. Seminar: Theories of embryology  
Assignment: Historical perspectives of embryology.
2. Seminar: Parthenogenesis and types.  
Assignment: Different types of asexual reproduction in animals.
3. Seminar: Male reproductive system of a mammal.  
Assignment: Spermatogenesis & Factors influencing spermatogenesis.
4. Seminar: Female reproductive system of a mammal.  
Assignment: Oogenesis.
5. Seminar: Structure and function of sperm.  
Assignment: Semen and seminal fluid.
6. Seminar: Vitellogenesis and ovulation.  
Assignment: Types of eggs.
7. Seminar: Mechanism of fertilization.  
Assignment: Theories of fertilization.
8. Seminar: Cleavage and blastulation in chick.  
Assignment: Fate map of chick.
9. Seminar: Cleavage and blastulation in mammal.  
Assignment: Fate map of mammal.
10. Seminar: Cleavage: laws - planes - patterns  
Assignment: Chemical changes during cleavage.
11. Seminar: Teratogenesis and teratogens.  
Assignment: Cell lineage and numbering.
12. Seminar: Gastrulation in chick.  
Assignment: Morphogenetic movements in chick.
13. Seminar: Gastrulation in mammal.  
Assignment: Germinal layers and their derivatives in vertebrates.
14. Seminar: Neurogenesis.  
Assignment: Notogenesis.
15. Seminar: Development of eye.  
Assignment: Development of skin and its derivatives.
16. Seminar: Development of Heart.  
Assignment: Development of mesoderm and coelom.
17. Seminar: Development of kidney.  
Assignment: Development of limb.
18. Seminar: Development and differentiation of testis,  
Assignment: Development of male genital ducts and accessory glands.
19. Seminar: Development and differentiation of ovary,  
Assignment: Development of female genital ducts and accessory glands.
20. Seminar: Infertility – causes and treatment.

Assignment: Assisted Reproductive Technology (ART).  
21. Seminar: Development of extra embryonic membranes.  
Assignment: Extra embryonic membranes.  
22. Seminar: Placentation in mammals  
Assignment: Different types of placenta in mammals.  
23. Seminar: Metamorphosis in amphibians.  
Assignment: Neoteny.  
24. Seminar: Metamorphosis in insects.  
Assignment: Larval and pupal forms in insects.  
25. Seminar: Regeneration.  
Assignment: Regenerative ability in animals and mechanism.

**M.Sc. Zoology**  
Semester II

Core VIII

**Name of the Course:**  
**Research**  
**Methodology Coursecode**  
**: PZ2024**

No.ofhours/week	No.ofcredits	Totalnumberofhours	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

## Teaching Plan with Modules

**Total Hours: 75 (Incl. Seminar & Test)**

Unit	Section	Description	Hours	Learning outcome/CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Microscope (15 Hrs.)</b>					
	1	Principle-types-interference, fluorescence, confocal, electron microscopes-scanning tunneling microscope.	8	Explain the instrumentation of different types of microscope (CO-1,2).	PPT	MCQ Short test
	2	Atomic force microscope, Near field scanning optical microscope.	4	Discuss the principle and instrumentation of atomic force, near field scanning optical and Magnetic force microscope (CO-1,2).	Lecture, PPT	Formative Assessment, I,

	3	Magnetic force microscope. Photomicrography.	3	Apply the principle of photography in taking photos of micro and macro-organisms(CO-1,2).	Lecture, Video, PPT	Quiz I
<b>II</b>	<b>Centrifugation (15Hrs.)</b>					
	1	Principle-factors affecting sedimentation rate- Types and applications of centrifuges.	4	Operate the common centrifuges available in research/clinical labs. (CO-1,2).	Lecture, PPT	MCQ Open book test
	2	Cryotechniques - cryopreservation. Cryotechnique: Whole mounts.	2	Discuss the cryopreservation(CO-1,2).	Lecture, PPT	Short test Formative Assessment
	3	Microtome: Rotary and Freezing microtome. Microtomy: Fixation, Dehydration and Clearing, Microtomy: Embedding and Sectioning, Staining and Mounting.	9	Prepare whole and permanent mount of specimens/tissues(CO-1,2).	Lecture, PPT,	I(1, 2) Quiz I & II Formative Assessment II(3)
<b>III</b>	<b>Chromatography(15Hrs.)</b>					
	1	Chromatography: Principle	2	Discuss the principle of chromatography(CO-1,2).	Lecture, PPT	MCQ
	2	types - gas and liquid chromatography - High Performance Liquid Chromatography- Ion exchange- Affinity chromatography.	6	Explain the principle and applications of different types of chromatography(CO-1,2).	Lecture, PPT	Formative Assessment II (1,2) Quiz II
	3	<b>Electrophoresis:</b> Principles, types - gel - Polyacrylamide gel, agarose gel, blotting techniques, Iso-electric focusing-Immuno-electrophoresis.	5	Demonstrate principles, types of electrophoresis and blotting techniques(CO-1, 2).	Online video, PPT, Interactive class	Formative Assessment I (3,4) Quiz I
	4	Protein sequencing methods.	2	Develop phylogram using sequencing methods (CO-1,2).	PPT, Virtual demonstration	
<b>IV</b>	<b>Spectrophotometer(15Hrs.)</b>					
	1	Spectrophotometer: principle, design and applications. Spectroscopy: principle-design	3	Analyze samples using spectrophotometer and spectroscopy(CO-1,2).	PPT, video	MCQ, Class
	2	Types- Atomic Absorption Spectroscopy, Flame photometer,	3	Analyze the constituents of the samples using AAS and flame photometer(CO-1,2).	PPT, online video	

	3	Chemiluminometre	1	Examinechemiluminescence ofcompounds/samples(CO-	video, Interacti	testOnline
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			<b>1,2).</b>	veclass	Quiz,
4	NuclearMagneticResonancesp ectroscopy.  FTIR spectrometry andElectronSpinResonanc e.	4	Explain the principle andapplicationofNMR,FTI Rspectrometryand electron spin resonance ( <b>CO- 1,2).</b>	Seminar,P PT, Interactive class	OnlineAssi gnment  Formative Assessmen t -I
5	MagneticResonanceImagingandap plications.	2	Explain the principle andapplication of MRIs ( <b>CO-1,2).</b>	PPT, Interactiv eclass	(1,2,3)  Formative Assessmen t-II
6	Radioactivitycounters	2	Differentiatethetypesofradioacti vitycounters and its applications( <b>CO-1,2).</b>	Lecture,V ideo.	(4,5,6)
<b>V</b>	<b>ExperimentaldesignandReportwriting (15Hrs.)</b>				
1	Essential steps in researchLiterature collection and Reviewofliterature	3	reviewandcollectionoflit erature( <b>CO-3,4,5).</b>	PPT, Collection ofliteratur e	OnlineQuiz ,Openbook test,Online Assignmen t
2	Research anddiscriminative reading,Bibliography.	2	Comprehendliteratureand bibliography( <b>CO-3,4,5).</b>	Demonst ration,	
3	Indexcard,Literaturecitation,Pl agiarism, Alphabet numbersystem. Researchreport:TablesandFigure s,Formattingandtyping.	6	Identifyplagiarismandpr epare good Researchreport( <b>CO-3,4,5).</b>	Preparei ndexcar dDrawT ablesand figures	Formative Assessmen t-II  (1,2,3, 4,5)
4	Online literature collection, Openaccess journals, Impact factor andCopyRight	3	Publish articles in journalswithIF,Claimcopyrig htandpatent fortheirinnovation ( <b>CO-3,4,5).</b>	PPT, experienci allearning	
5	Laboratorysafety.	1	Followsafetyrulesinthelab oratory.( <b>CO-3,4,5).</b>	Interactiv e class,onli ne video	

**Courseinstructor**

Dr.ShylaSuganthi

Dr.A.Punitha

**HeadoftheDepartment**

Dr. MaryMettilda Bai



## **SeminarTopics**

1. Interferencemicroscope
2. Fluorescencemicroscope
3. Electronmicroscope
4. Confocalmicroscope
5. Magneticforcemicroscope
6. Types andapplicationsofcentrifuge
7. Cryotechnique
8. Cryopreservation
9. Fixation
10. Rotaryand Freezingmicrotome
11. Ion exchangechromatography
12. Gaschromatography
13. Polyacrylamidegelelectrophoresis
14. Immuno-electrophoresis.
15. Isoelectricfocusing
16. AtomicAbsorption Spectroscopy
17. Flamephotometer
18. FTIRspectrometry
19. ElectronSpinResonance
20. MagneticResonanceImaging
21. Researchreport
22. Onlineliteraturecollection
23. Bibliography
24. H-index
25. Patentandcopyrights

**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 insanctuaries.

### 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

### Teaching Plan with Modules

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

Unit	Modules	Topics	Hours	Learning outcome / CO addressed	Pedagogy	Assessment
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<b>I Introduction to Animal Behaviour (12 Hrs)</b>					
1	Principles of Animal Behaviour, Historical perspectives of ethology, Approaches to animal behaviour.	3	Explain the concepts and perspectives of animal behaviour <b>(CO-1,2)</b>	PPT, E-Content	MCQ, Online Assignment, Formative Assessment I (1,2,3) Quiz I
2	Ethogram - Methods and recording of a behaviour. Innate behavior	3	Summarize the methods of evaluating and recording behaviour. <b>(CO-1,2)</b>	PPT, Youtube links, Blended teaching, E-Contents	
3	Neurological basis of animal behaviour, hormonal control of behaviour.	3	Differentiate between the neurological and hormonal control of behaviour. <b>(CO-1,2)</b>	PPT, E-Contents, Mind map	
<b>II Patterns of Behaviour (12 Hrs)</b>					
1	Reflexes - types, reflex path, characteristics of reflexes.	4	Summarize the various processes involved in reflex action and its associated characteristics <b>(CO-3,4)</b>	PPT, E-Content	MCQ , Online Assignment, Formative assessment I (1,2,3) Quiz II
2	Orientation: Primary and secondary orientation, kinesis - orthokinesis, klinokinesis; taxis - tropotaxis, klinotaxis, menotaxis, mnemotaxis.	3	Differentiate primary and secondary orientation. <b>(CO-3,4)</b>	PPT, Youtube links, Blended teaching.	
<b>III Social and Sexual Behaviour (12 Hrs)</b>					

1	Social Behaviour: Concept of Society; various modes of animal communication. Altruism; Insect's society with Honey bee as example	3	Summarize the concept of a society (CO-2,3)	PPT, Discussion, Lecture	Short test, MCQ, Seminar, Online assignment, Formative assessment I (1,2) Quiz I  Formative assessment II (3) Quiz II
2	Foraging in honey bee and bee communication. Nesting behaviour in birds.	3	Summarize the foraging and nesting behaviour in animals (CO-2,4)	PPT, Videos	
3	Sexual Behaviour: Mate choice, intra-sexual selection (male rivalry), inter-sexual selection (female choice), sexual conflict in parental care.	2	Classify the various strategies of sexual behaviour in animals (CO-3,4)	PPT, YouTube	
<b>IV Introduction to Chronobiology (12 Hrs)</b>					
1	Historical developments in chronobiology; Biological oscillation: the concept of average, amplitude, phase and period.	3	Explain the historical perspectives and concepts of chronobiology (CO-3,4)	PPT, Web based tutorials, Videos	Short test, MCQ, Seminar, Online assignment, Formative assessment
2	Biological clocks: central and peripheral biological clock, adaptive significance of biological clocks,	3	Summarize central and peripheral biological clocks (CO-3,4)	YouTube, Lecture, PPT	
3	Chronopharmacology, Chronomedicine, Chronotherapy.	3	Evaluate the importance of Chronomedicine and Chronotherapy (CO-4,5)	Group discussion, Web based	

					II (1,2,3) Quiz II
<b>V</b>	<b>Biological Rhythm (12 Hrs)</b>				
1	types of biological rhythms: short- and long- term rhythms, Circadian rhythms	4	Describe short and long term biological rhythms <b>(CO-3,5)</b>	PPT, YouTube videos	Short test, MCQ, Seminar, Online assignment, Formative assessment II (1,2,3) Quiz II
2	molecular biology of the circadian pacemaker system, Tidal rhythms and Lunar rhythms.	4	Evaluate the various circadian pacemaker systems <b>(CO-4,5)</b>	Group discussion, PPT, YouTube links	
3	Circannual rhythms, Photoperiod and regulation of seasonal reproduction of vertebrates, Role of melatonin.	4	Formulate, Analyse and Interpret the role and effect of melatonin in circannual rhythms <b>(CO-4,5)</b>	Group discussion, PPT	

**Course instructor**

Dr. Jeni Chandar Padua

**Head of the Department**

Dr. S. Mary Mettilda Bai

**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

### Teaching Plan with Modules

**Total Hours: 60 (Including Demonstration, Observation & Test)**

## Biostatistics, Computer applications and Bioinformatics (30 Hrs.)

UNIT	Section	Description	Hrs.	Learning outcome & CO addressed	Pedagogy	Assessment
I	1	Collection of biological data (Primary and Secondary).	4	Perform data collection. <b>(CO-1)</b>	Field visit and direct application	Pre-assessment.
	2	Classification and representation (Graphical and Diagrammatic) of collected data.	3	Analyse the data collected and apply graphical representation. <b>(CO-2)</b>	Practical	Performance-based Assessment.
	3	Measures of dispersion- Standard deviation and standard error	2	Recalls and apply the distribution. <b>(CO-1)</b>	Practical	Model examination
	4	Estimation of population by Mark and Recapture method using beads.	2	Estimate any population by mark and recapture method. <b>(CO-4)</b>	Practical	Self-assessment
	5	Correlation co-efficient – length and width of molluscan shells.	2	Recalls and analyse the relation between two variables. <b>(CO-2)</b>	Practical	
	6	Study of probability using coin tossing with 2 and 3 coins and chi square test	2	Recalls and apply the theory. <b>(CO-1)</b>	Practical	
	7	Regression Analysis	2	Apply the theory and analyse the relation between two variables. <b>(CO-4)</b>	Practical	
	8	Test of significance (student's <i>t</i> -test).	2	Recalls and apply the theory. <b>(CO-3)</b>	Practical	
	9	Preparation of graph using M.S. Excel.	2	Apply the theory and Perform the same. <b>(CO-3)</b>	Practical	
	10	Retrieval of DNA and protein sequence from NCBI.	4	Retrieve protein and DNA sequence of biological data. <b>(CO-1)</b>	Practical	

	11	Visualizing protein structure using RasMol.	3	Identify and interpret protein structures.(CO-1)	Practical	
	<b>Charts / Models</b>	NCBI, SWISS-PROT and PubMed	2	Distinguish Biological databases and their uses.(CO-1)	Practical	

**Course instructor**

Dr. Josephine Vinoliya Mary

Dr. F. Brisca Renuga

**Head of the Department**

Dr. S. Mary Mettilda Bai

### Cell and Molecular Biology (30 Hrs.)

Units	Modules	Topic	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Cell and Molecular Biology (30 Hrs.)</b>					
	1	Isolation and observation of sub cellular organelles.	3	Isolate and identify the sub-cellular organelles. (CO-4)	Practical	Continuous performance – based assessment, Record, Internal assessment
	2	Observation of mitosis - onion root tip	1	Identify the different stages of mitosis in cells. (CO-4)	Practical	
	3	Observation of meiosis - grasshopper testis	3	Identify the different stages of mitosis in cells. (CO-4)	Practical	
	4	Observation of polytene chromosome - salivary gland of Chironomus larva	3	Identify the different stages of mitosis in cells. (CO-4)	Practical	
	5	Barr-body identification	2	Identify the different stages of mitosis in cells. (CO-4)	Practical	
	6	Observation of striated muscle fibre - coxal muscle of cockroach	2	Discriminate the striated and non-striated muscles. (CO-2)	Practical	
	7	Observation of adipocytes - fat body of cockroach	2	Identify the adipocytes. (CO-2)	Practical	
8	Haemolymph smear (Cockroach).	2	Recognize and classify the haemocytes. (CO-2)	Practical		



9	Whole mount preparation of a specimen	6	Demonstrate the principles of permanent slide preparation. <b>(CO-4)</b>	Practical	
10	Sectioning and staining of a tissue	3	Demonstrate staining techniques. <b>(CO-4)</b>	Practical	
	<b>Spotters/ Slides</b> Fluid mosaic model, Golgi complex, Cancer cell, Cadherins, Karyotype, Haemocytometer	3	Identify and narrate the structure and functions of cell organelles. <b>(CO-3)</b>	Observation	

**Course instructor**

Dr. C. Josephine Priyatharshini  
Dr. P.T. Arokya Glory

**Head of the Department**

Dr. S. Mary Mettilda Bai

**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**

**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	PSO - 10	Ap

clinical research.		
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**Teaching plan with Modules**  
**Total Hours: 90 (Incl. Seminar & Test)**

UN IT	Modul e	Topics	Hour s	Learning outcome/ CO addressed	Pedagogy	Assessme nt
<b>I</b>	<b>Classification of microorganisms &amp; Virus (18 hrs)</b>					
	1	History and Scope of Microbiology. Classification of microorganisms - Whittaker's five kingdom classification. Three domain classification.	4	Classify and identify the microorganisms. <b>(CO – 1)</b>	PPT, Screen captured e- content	MCQ,  Mind Map,  Flow chart,  Short answer test, Seminar,  Group discussio n. Formativ e Assessm ent I (1- 6), Quiz I, Online assignmen t
	2	Viruses - General properties. Structure of viruses. Viral taxonomy.	3	Identify the taxonomical status of a virus and its properties. <b>(CO – 1)</b>	PPT, Online video, Discussion.	
	3	Bacteriophages: Reproduction of DNA and RNA phages. Temperate bacteriophages and lysogeny.	5	Describe the bacteriophage reproduction. <b>(CO – 1)</b>	Screen captured e- content PPT, Video - animation	
	4	Cytocidal infections and cell damage, persistent, latent and slow virus infections.	3	Elucidate viral infections. <b>(CO – 1)</b>	PPT, Online video,	
	5	Cultivation of viruses and purification assays.	2	Cultivate and purify the virus using different assays. <b>(CO – 1)</b>	Video lesson, PPT, E- content	
	6	Viruses and cancer. Viroids and Prions.	1	Explain the relationship of cancer and virus. <b>(CO – 1)</b>	Recorded PPT, scree captured e content	
<b>II</b>	<b>Bacteria (18 hrs)</b>					
	1	Classification, Bergey's system of bacterial classification	2	Classify bacteria. <b>(CO – 1)</b>	Recorded PPT, Online lesson	Seminar,  Group discussio n,
	2	Bacterial morphology and fine structure of <i>Escherichia coli</i> .	2	Recite the structure of <i>E. coli</i> . <b>(CO – 1)</b>	PPT, Online video	
	3	Bacterial nutrition - Common	3	Apply the types of	Online	

		nutrient requirements. Nutritional classes. Uptake of nutrients.		nutrient to culture bacteria. (CO – 2)	video, screen captured e content, PPT	MCQ,
	4	Bacterial growth and measurement of growth. Influence of environmental factors on growth. Synchronous growth.	3	Culture & assess the growth of bacteria. (CO – 2 & 5)	PPT, Online video, E-content	Mind Map, Flow chart,
	5	Continuous culture – Chemostat and turbidostat.	2	Culture bacteria using chemostat and turbidostat. (CO – 2)	PPT, Video lesson	Short answer test,
	6	Types of culture media.	3	Select the appropriate culture media. (CO – 2 & 5)	Recorded PPT, Online video	Formative
	7	Pure culture and methods of isolating pure cultures (streak plate technique and Pour-plate technique).	3	Culture and isolate bacteria using different methods. (CO - 2 & 5)	PPT Online Video, screen captured e content.	Assessment II (1-7), Quiz II, Online assignment.

<b>III</b>	<b>Industrial Microbiology (18 hrs)</b>					
	1	Fermentation and microbes - fermenter and types of fermenters (air-lift fermenter and stirred tank fermenter).	3	Explain the process of fermentation. List different types of fermenter. Differentiate stirred tank and airlift fermenter. (CO-3)	Google classroom, PPT. Summarization,	Quiz through google forms,
	2	Production of microbial products - alcohol (ethanol), antibiotics (penicillin),	4	Recall the production of ethanol and antibiotics by microbes. (CO-3)	Google classroom, PPT. Summarization,	Formative assessment I (1- 5)
		Production of microbial products - vitamin B <sub>2</sub> and Vitamin B <sub>12</sub> .	2	Describe the industrial production of vitamin B <sub>2</sub> and Vitamin B <sub>12</sub> . (CO-3)	Google classroom, PPT. Peer group	
	3	Biofertilizers - steps for preparing bacterial biofertilizers, mass cultivation of Cyanobacteria	2	Illustrates the production of biofertilizers. Explain the mass	Google classroom, PPT.	

			production technique of Cyanobacteria. (CO-3)		Quiz I (1- 5)
	Mass cultivation of <i>Azolla</i> , production of mycorrhizal fungi and VAM fungi.	3	Describe the mass production of <i>Azolla</i> , mycorrhizal and VAM fungi and its application. (CO-3)	Google classroom, PPT.	Seminar
	4 Bacterial insecticides – <i>Pseudomonas</i> species and <i>Bacillus</i> species.	2	Recall the application of bacterial insecticides. (CO-3)	Google classroom, PPT. Flipped classroom .Listing out important terms,	Short test
	5 Food spoilage and food preservation.	3	Explain the food spoilage by microbes and food preservation. (CO-4)	Google classroom, PPT. padlet, Peer group teaching Listing out important terms.	
<b>IV</b>	<b>Environmental Microbiology (18hrs)</b>				
	1 Drinking water and microbiological analysis of water purity - Coliform test, Most Probable Number (MPN) test, and Membrane Filter (MF) test.	4	Recall different techniques to check the water quality. Summarize the protocol of coliform test, Most Probable Number (MPN) test, and Membrane Filter (MF) test. (CO-5)	PPT. Lecture Video Summarization, Problem based	Quiz through google forms, Short test.
	2 Purification of water. Sewage treatment – small scale, large scale (primary, secondary and tertiary) treatment.	3	Appraise the application of small scale, large scale treatment. (CO-5)	PPT. Lecture, Video	Formative assessment I
	3 Biogas production – solubilization, acetogenesis and methanogenesis	4	Discuss the production of biogas. Differentiate acetogenesis and methanogenesis. (CO-3)	PPT. Lecture Peer group teaching.	(1- 2) Quiz I
	4 Microbial leaching – copper and uranium leaching.	4	Define leaching. Explain the effect of copper and uranium leaching. (CO-3)	PPT. Lecture	

	5	Biodegradation of petroleum and xenobiotics.	4	Explain the role of microbes in environmental cleaning. (CO-3)	PPT, Padlet, Lecture	Formative assessment II (3&5) Quiz II Seminar
V	<b>Antimicrobial agents (18 hrs)</b>					
	1	Classification, Drug administration, determination of antimicrobial activity, mechanism of antimicrobial agents	4	Classify methods of drug administration. Explain the methods of antibacterial activity determination. Discuss the mechanism of antibacterial activity of different agents. (CO-5)	Padlet. Lecture PPT and Peer group teaching.	Quiz through google forms,  Seminar,
	2	Effectiveness of antimicrobial drugs, drug resistance, drug dosage, antibacterial drug (penicillin), antifungal drug (nystatin), antiviral drug (amantadine).	4	Discuss the process of drug resistance. Interpret the drug dosage and drug resistance. Describe the effect of penicillin, nystatin, amantadine. (CO-5)	PPT, Lecture Peer group teaching.	Short test,  Formative assessment II (1-6)
	3	Current problems of antibiotic resistance in man. Microbes and diseases -Gnotobiotic animals,	3	Discuss the current problems of antibiotic resistance in man. (CO-5)	Group discussion. Peer group teaching	Quiz II (1-6)
		Distribution of normal micro biota of the human body. Mechanism of microbial pathogenesis, Nosocomial infections.	3	Recall the beneficial micro biota of the human body. Discuss the mechanism of pathogenesis of Nosocomial infections. (CO-5)	Group discussion. Peer group teaching	
	4	Protozoan diseases - Malaria and Amoebiasis. Fungal diseases- Mycotoxicosis and Aspergillosis.	4	Describe Protozoan and Fungal diseases. (CO-5)	Seminar, Group discussion.	
		Bacterial diseases - Air borne diseases – Meningitis and Streptococcal pneumonia.	2	Describe Air borne diseases – Meningitis and Streptococcal pneumonia. (CO-5)	Seminar, Peer group teaching	
	5	Food and water borne diseases -	2	Discuss water borne and	Seminar,	

		Cholera and Typhoid. Soil borne diseases - Tetanus and Anthrax.		Soil borne diseases. (CO-5)	Group discussion. Peer group teaching
	6	Sexually transmitted and contact diseases – Gonorrhoea and Syphilis. Viral diseases - Ebola, Hepatitis-B, Rabies and AIDS	2	Describe Sexually transmitted and Viral diseases. (CO-5)	Seminar, Group discussion. Peer group teaching

**Course instructor**

Dr. F. Brisca Renuga  
Dr. C. Anitha

**Head of the Department**

Dr. S. Mary Mettilda Bai

**Seminar Topics**

1. History and Scope of Microbiology.
2. Viruses - General properties. Structure of viruses.
3. Viruses and cancer.
4. Viroids and Prions.
5. Bergey's system of bacterial classification.
6. Fine structure of *Escherichia coli*.
7. Bacterial nutrition - Common nutrient requirements.
8. Factors which causes food spoilage
9. Food preservation techniques.
10. Protozoan diseases - Malaria and Amoebiasis.
11. Fungaldiseases-Mycotoxicosis and Aspergillosis.
12. Bacterial diseases - Air borne diseases – Meningitis and Streptococcal pneumonia.
13. Food and water borne diseases - Cholera and Typhoid.
14. Soil borne diseases - Tetanus and Anthrax.
15. Sexually transmitted and contact diseases – Gonorrhoea and Syphilis.
16. Viral diseases - Ebola, Hepatitis-B,
17. Viral diseases - Rabies and AIDS.
18. Biodegradation of petroleum
19. Biogas production

## **ONLINE ASSIGNMENT**

Development of Padlet for symptoms, causes and treatment of diseases.

**Semester** : IV  
**Name of the Course** : Ecobiology  
**Subject code** : PZ1742

**Core X**

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

### Teaching Plan with Modules

**Total Hours: 90 (Incl. Seminar & Test)**

Unit	Section	Description	Hou rs	Learning outcome	Pedagogy	Assessment
<b>I</b>	<b>Introduction (18 Hrs)</b>					
	1	Scope of Ecobiology and need for public awareness.	3	Explain the advantages of being aware of ecobiology concepts <b>(CO -1 )</b>	Lecture, PPT	Short test, MCQ, Mind map Seminar, Online assignment, Formative assessment I (1,2,3,4,5) Quiz I
	2	Ecosystem: Concepts of ecosystem – structure and functions.	3	Summarize ecosystem and its functions. <b>(CO - 2)</b>	Lecture, PPT	
	3	Energy flows – single channel energy model, Y - shaped energy flow models.	3	Differentiate between the various models of energy flow. <b>(CO -1 )</b>	Lecture, PPT, Video	
	4	Productivity - Primary production, secondary production, measurement of primary productivity.	4	Summarize productivity and its types. <b>(CO - 2)</b>	Lecture, PPT	
5	Habitat ecology: freshwater,	5	Differentiate	Lecture,		



		marine, estuarine, mangrove and terrestrial.		between the various ecological habitats.(CO - 2)	PPT	
<b>II</b>	<b>Population (18 Hrs)</b>					
	1	Structure and regulation, growth form, population fluctuations, population processes.	4	Summarize the concept of population and various processes associated with it. (CO -3 )	Lecture, Video, PPT	MCQ , Seminar, Online assignment, Formative assessment I (1,2,3), Quiz I, Formative assessment II (4,5) Quiz II,
	2	Life table - diagrammatic and conventional life tables, Life history strategies.	3	Explain life table and life history strategies. (CO - 3)	Lecture, Video, PPT	
	3	Community: Concept, basic terms, community structure, composition and stratification.	4	Describe community concept, structure etc. (CO -4)	Lecture, PPT	
	4	Ecological niche, Ecotone and Edge effect, Ecotype.	3	Explain ecological niche and ecotype.(CO -3 )	Lecture, Flipped learning	
	5	Ecological succession: types, general process, Concept of climax.	4	Summarize ecological succession. (CO -3 )	Lecture, PPT	
<b>III</b>	<b>Environment in action (18 Hrs)</b>					
	1	Climatic factors (climate, precipitation, temperature, light, oxygen, carbon dioxide and pH), topographic factors, edaphic factors (soil formation, soil profile, soil organisms).	6	Summarize the various environmental factors. (CO -3 )	Lecture , PPT, Blended learning	Short test, MCQ, Mind map Online assignment, Seminar Formative assessment II (1,2,3,4) Quiz II Formative Assessment I (3,4) Quiz I (3,4)
	2	Biotic factors (symbiosis, commensalism, parasitism and competition).	4	Compare various biotic factors. (CO - 2 )	PPT	
	3	Biological clock: biological rhythms and mechanism of biological clock.	3	Explain biological clock. (CO-2)	PPT, Video	
	4	Natural resource ecology: Concept and classification of resource, mineral resource, land resource, forest resource, water resource, energy resource (conventional and non-conventional).	5	Describe, differentiate and classify natural resources.(CO-5)	PPT, Open board	

<b>IV</b>	<b>Biogeochemical cycles (18 Hrs)</b>					
	1	Water cycle, carbon cycle, nitrogen cycle, sulphur cycle and phosphorous cycle.	6	Summaries biogeochemical cycles and differentiate them. (CO-3)	PPT, flow chart, video lesson	Short test, MCQ, Mind map Online assignment, Seminar  Formative assessment I (1,2,3,4) Quiz I (1,2,3,4) Formative assessment II (5) Quiz II (5)
	2	Biogeography: patterns of distribution (continuous, discontinuous, endemic), descriptive zoogeography, zoogeographical regions of the world. Dynamic biogeography (dispersal dynamics, dispersal pathways, migration, ecesis).	5	Explain the patterns of distribution and zoogeography. (CO-3)	Interactive PPT	
	3	Natural Disasters: Floods, earthquakes, cyclones, landslides, Tsunami, Mitigation and Disaster Management.	5	Evaluating the causes, effects and mitigation strategies for natural disasters. (CO-5)	Video lesson, group discussion	
	4	Urbanization: Possible advantages of urbanization – problems, solutions.	1	Summarize the advantages, problems and solutions for urbanization. (CO-6)	PPT	
	5	Remote sensing and its applications.	1	Describe the applications of remote sensing. (CO-5)	PPT, open board	
<b>V</b>	<b>Pollution ecology (18 Hrs)</b>					
	1	Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution, nuclear hazards.	7	Describe the causes, effects and control of pollution (CO-5)	Presentatio n of group reviews	MCQ, Short test ,  Online assignment, Seminar  Formative assessment II (1,2,3,4)
	2	Green House Gas emission and climate change.	3	Evaluating climate change and possible intervention strategies. (CO-5)	Video lesson	
	3	Waste management: solid, liquid and gaseous wastes. E-wastes.	3	Describe the management of wastes. (CO-6)	PPT, open board	

	4	Toxicology: Biomagnification and bioaccumulation, toxicants, classification, toxicity (LC <sub>50</sub> and LD <sub>50</sub> ), mode of action.	5	Identify toxicants, classify them and describe their mode of action. (CO-6)	PPT, Flow Chart, open board	Quiz II (1,2,3,4)
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**Course instructor**

Dr. S. Prakash Shoba

Dr. X. Venci Candida

**Head of the Department**

Dr. S. Mary Mettilda Bai

**Seminar & Assignment Topics**

1. Seminar: Fresh water ecology  
Assignment: primary production
2. Seminar: Marine ecology  
Assignment: secondary production
3. Seminar: Estuarine ecology  
Assignment: structure of community
4. Seminar: Mangroove ecology  
Assignment: community stratification
5. Seminar: Terrestrial ecology  
Assignment: competition
6. Seminar: Types of Ecological succession  
Assignment: parasitism
7. Seminar: Ecotype  
Assignment: commensalism
8. Seminar: Ecotone and edge effect  
Assignment: symbiosis
9. Seminar: Ecological niche  
Assignment: water cycle
10. Seminar: community structure  
Assignment: remote sensing
11. Seminar: non-conventional energy resource  
Assignment:
12. Seminar: conventional energy resource  
Assignment: flood
13. Seminar: water resource  
Assignment: earth quake
14. Seminar: forest resource  
Assignment: landslide
15. Seminar: land resource  
Assignment: Noise pollution
16. Seminar: Tsunami  
Assignment: Thermal pollution

17. Seminar: Cyclone  
Assignment: greenhouse effect
18. Seminar: Air pollution  
Assignment: Biomagnification
19. Seminar: water pollution  
Assignment: Bioaccumulation

**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	PSO - 2	R

	areas like medicine, agriculture, environmental sustainability and forensics.		
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

**Teaching Plan with Modules**  
**Total Hours: 90 (Incl. Seminar & Test)**

Unit	Section	Topics	Hou rs	Learning outcome	Pedagogy	Assessment
<b>I</b>	<b>Gene cloning(18 hrs)</b>					
	1	Basic steps of gene cloning, restriction and modifying enzymes, linkers and adaptors.	4	Explain gene cloning, restriction and modifying enzymes (CO 1).	Lecture, Video class	MCQ,  Short test,  Seminar,  Online Assignment,  Formative Assessment I  Quiz I
	2	Cloning and expression vectors, construction of chimeric DNA	4	Analyse construction of chimeric DNA.(CO 1).	Lecture PPT	
	3	Nucleic acid probes, DNA libraries.	3	Gain knowledge on DNA libraries.(CO 1).	PPT	
	4	Polymerase chain reaction, molecular markers.	3	Discuss the Polymerase chain reaction and molecular markers.(CO 1).	Lecture, Video class	
5	DNA sequencing, synthesis of oligonucleotides. Human Genome Project.	4	Appreciate human genome project.(CO 1).	Lecture, PPT		
<b>II</b>	<b>Animal Biotechnology(18 hrs)</b>					
	1	Primary culture and cell lines; pluripotent stem cell lines; tissue engineering.	4	Appreciate the advances in tissue engineering.(CO, 2).	Lecture, Video class	Short test,  mind map,  Objective test,  Formative Assessment
	2	<i>In vitro</i> fertilization and embryo transfer in animals; gene transfer methods.	4	Apply gene transfer methods in producing transgenic species.(CO, 2).	Lecture, Video class	

	3	Primary explantation techniques – organ and embryo culture.	3	Explain organ and embryo culture.(CO, 2).	PPT, discussion	I (1, 2, 3) Quiz I Class test -1  Formative Assessment II (4,5) Quiz II	
	4	Transgenic animals and the knock outs.	3	Discuss transgenic animals. (CO, 2).	Lecture, video		
	5	Biotechnology and aquaculture: ploidy induction, gynogenesis and androgenesis.	4	Describe ploidy induction, gynogenesis and androgenesis.(CO, 2).	PPT		
<b>III</b>	<b>Medical Biotechnology (18 hrs.)</b>						
	1	Hybridoma technology and Monoclonal antibodies.	4	Prepare monoclonal antibodies.(CO, 3).	Lecture, PPT	Short test,  MCQ,  Objective test,  Seminar,  Online Assignment,  Formative Assessment II  Quiz II	
	2	Applications of biotechnology in medicine, Vaccines, diagnostics and forensics.	4	Apply biotechnology in medicine, Vaccines, diagnostics and forensics.(CO, 3).	Lecture, PPT		
	3	Enzyme biotechnology: Isolation and purification of enzymes, uses of enzymes in industries, immobilization of enzymes and their uses.	5	Demonstrate immobilization of enzymes and their uses. (CO, 3).	Lecture, PPT		
	4	Biosensors. Terminator and traitor technology.	3	Describe the types and applications of biosensors.(CO, 3).	PPT		
	5	Intellectual Property Rights.	2	Gain knowledge on Intellectual Property Rights.(CO, 3).	PPT		
<b>IV</b>	<b>Industrial and Environmental Biotechnology (18 hrs.)</b>						
	1	Production of metabolites - Downstream processing and <i>in situ</i> recovery of products.	4	Demonstrate down stream processing. (CO, 3,4).	Lecture, PPT	MCQ,  Formative Assessment I  Quiz I  Class test II	
	2	Microbial biotransformation, microbial biomass production (SCP).	3	Discuss microbial biotransformation, microbial biomass production. (CO, 3,4).	Lecture, PPT		
	3	Bioremediation and Phytoremediation.	3	Explain the process of bioremediation. (CO, 3,4).	Lecture, Video class		
	4	Genetically engineered microorganisms (GEMs) - treating	5	Summarizes the importance of	Lecture, PPT		

		oil spills, detection of pesticide in soil and their degradation, sequestering heavy metals.		GEMs (CO, 3,4).			
	5	Biomining and Biofuels.	3	Explain the production of biomining and biofuels.(CO, 3,4).	Lecture, seminar		
<b>V</b>	<b>Nanomaterials (18hrs.)</b>						Short test, Seminar, Online Assignment, Formative Assessment II Quiz II
	1	Types and properties, DNA and protein nanoarrays	3	Explain the basics of nanotechnology(CO, 5).	Lecture, PPT		
	2	Biosystems (microbes) as nanofactories.	3	Summarize biosystems as nanofactories.(CO, 5).	Lecture, Video class		
	3	Application of nanotechnology - medical diagnostics, imaging and drug delivery, agro-practices and food related nanoproducts, cosmetics, contact lenses and dental implants.	5	Discuss the applications of nanotechnology (CO, 5).	Lecture, Video class		
	4	Nanotechnological approaches for environmental remediation, prevention of contamination, environment maintenance and quality enhancement.	4	Illustrate Nanotechnological approaches for environmental remediation. (CO, 5).	Lecture, PPT		
	5	Risks and threats of nanoparticles in environment.	3	Describe Risks and threats of nanoparticles in environment.(CO, 5).	PPT, discussion		

**Course instructor**

Dr. J. Vinoliya Josephine Mary  
Dr. A. Punitha

**Head of the Department**

Dr. S. Mary Mettilda Bai

**Seminar**

1. Cloning and expression vectors
2. Construction of chimeric DNA
3. Polymerase chain reaction,
4. Human Genome Project.

5. *In vitro* fertilization and embryo transfer in animals
6. Gynogenesis and androgenesis.
7. Hybridoma technology
8. Biosensors.
9. Immobilization of enzymes and their uses.
10. Intellectual Property Rights.
11. Microbial biotransformation
12. Bioremediation
13. Phytoremediation
14. Biomining
15. Biofuels.
16. Agro-practices and food related nanoproducts,
17. Cosmetics, contact lenses and dental implants
18. Environment maintenance and quality enhancement.
19. Risks and threats of nanoparticles in environment.

**Semester : IV Elective IV – (b)**

**Name of the Course: Medical Entomology**

**Course code : PZ1745**

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

**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

### Teaching plan with Modules Total Hours: 90 (Incl. Seminar & Test)

UNIT	Section	Description	Hours	Learning outcome	Pedagogy	Assessment
<b>I</b>	<b>Medical importance of insects (18 Hrs.)</b>					
	1	Fundamentals and scope of medical entomology	3	Explain the meaning of terms of entomology. (CO – 2)	Group discussion, Lecture, Seminar	Short test, MCQ, Online Assignment, Seminar, Formative Assessment I (1,2,3,4,5), Quiz I
	2	Insects of medical importance: filth breeding insects.	3	Identify the filth breeding insects. (CO-1)	Lecture, PPT, Seminar	
	3	Insects of medical importance: venomous insects	4	Recall venomous insects. (CO-1)	Lecture, PPT, Seminar	
	4	Insects of medical importance: blood sucking insects	4	Discuss on the blood sucking insects. (CO-1)	Lecture, PPT	
	5	Insects affecting physiology.	4	Explain the mechanism of insect physiology. (CO-1)	Lecture, PPT	
<b>II</b>	<b>Life cycle of human parasitic insects(18 Hrs.)</b>					
	1	Lice, fleas, mosquitoes, house flies and tsetse fly.	5	Describe the life cycle of human parasitic insects. (CO-3)	Lecture, PPT, You tube learning, Seminar	MCQ, Memory matrix, Online assignment, Seminar, Formative Assessment I (1,2,3,4), Quiz I,
	2	Immunity to human parasites	5	Explain the mechanism of immunity to human parasites. (CO-4)	Lecture, PPT	
	3	Host-parasitic relationships	5	Discuss the host- parasite relationship. (CO-2)	Lecture, PPT	
	4	Ecological adaptive features among human parasites	3	Discuss different adaptive mechanism of human parasites. (CO-3)	Lecture, PPT, You tube learning	
<b>III</b>						
<b>Vector entomology (18 Hrs.)</b>						
1	Scope of vector entomology	2	Discuss the importance of entomology. (CO-3)	Lecture, Xenography	MCQ Short test, Online assignment, Seminar, Formative Assessment I (1,2) Quiz II Memory matrix Formative Assessment II	
2	Vector borne diseases	3	Recall vector borne diseases. (CO-3)	Lecture, Seminar		
3	Mechanism of transmission in human beings - mechanical	3	Explain the transmission of vector borne diseases. (CO-5)	Lecture, PPT		
4	Mechanism of transmission in human beings – biological - myiasis	3	Differentiate the biological and mechanical mode of transmission. (CO-5)	Lecture, PPT		
5	Common vector insects and their identification: mosquitoes, sand flies, black	6	Recall the common vector insects, Seminar (CO-3)	Lecture, PPT, Xenography		

		flies, house fly, tsetse fly, human flea and human louse.			y	(3,4,5,6)
	6	Hard and soft tick, trombiculid mite, itch mite and Cyclops.	1	Identify different types of ticks. (CO-1)	Lecture, PPT	
<b>IV</b>	<b>Medical importance and management (18 Hrs.)</b>					
	1	Lice - body, head and pubic louse.	3	Differentiate different louse of human, Seminar (CO-2)	Lecture, PPT	MCQ, Short test, Online assignment,  Seminar,  Formative Assessment II (1,2,3,4,5)  Quiz II
	2	Fleas- flea nuisance, plague, flea-borne endemic typhus.	3	Discuss flea related diseases, Seminar (CO-2)	Lecture, PPT, Team teaching	
	3	Mosquitoes- nuisance, malaria, filariasis, yellow fever, dengue	4	Recall different mosquito related diseases, Seminar (CO-2)	Lecture, PPT	
	4	House flies- common and greater house fly- typhoid, dysentery, diarrhea, cholera, amoebiasis, gastroenteritis	4	Differentiate dysentery, diarrhea, cholera and amoebiasis. (CO-2)	Lecture, PPT, Team teaching	
	5	Tsetse fly- Gambian and Rhodesian sleeping sickness.	4	Discuss the symptoms and treatment for sleeping sickness. (CO-2)	Lecture, PPT	
<b>V</b>	<b>Vector control (18 Hrs.)</b>					
	1	Insecticides - use and consequences	4	Discuss different insecticides. (CO-5)	Lecture, PPT	MCQ  Short test,  Online assignment,  Seminar,  Formative Assessment II (1,2,3,4,5) Quiz II
	2	Use of bio-control agents and bio-pesticides	4	Differentiate bio-pesticides and insecticides. (CO-5)	Lecture, PPT	
	3	Use of bio-control agents - bacillus and predatory fishes	3	Identify predatory fishes. (CO-5)	Lecture, PPT, Virtual learning	
	4	National programmes related to vector borne diseases- malaria- N.M.E.P., N.M.C.P-	3	Explain different National programmes related to vector borne diseases. (CO-5)	Lecture, PPT, Self learning	
	5	National programmes related to vector borne diseases- filarial- N.F.C.P., N.F.E.P	4	Explain different National programmes related to vector borne diseases. (CO-5)	Lecture, PPT, Self learning	

**Course instructor**

Dr. C. Josephine Priyatharshini  
Dr. A. Shyla Suganthi

**Head of the Department**

Dr. S. Mary Mettilda Bai

**Seminar and Online Assignment topics**

1. Seminar : Scope of medical Entomology.  
Assignment : Scope of medical Entomology.
2. Seminar : Insects of medical importance: filth breeding insects.  
Assignment : Insects of medical importance: filth breeding insects.
3. Seminar : Insects of medical importance: blood sucking insects.  
Assignment : Insects of medical importance: blood sucking insects.
4. Seminar : Insects of medical importance: venomous insects.  
Assignment : Insects of medical importance: venomous insects.
5. Seminar : Parasites of vertebrates  
Assignment : Parasites of vertebrates
6. Seminar : Life cycle of human parasitic insects - Lice  
Assignment : Life cycle of human parasitic insects - Lice
7. Seminar : Life cycle of human parasitic insects - Flea  
Assignment : Life cycle of human parasitic insects - Flea
8. Seminar : Life cycle of human parasitic insects - Mosquito  
Assignment : Life cycle of human parasitic insects - Mosquito
9. Seminar : Life cycle of human parasitic insects – House flies  
Assignment : Life cycle of human parasitic insects – House flies
10. Seminar : Life cycle of human parasitic insects – Tsetse fly  
Assignment : Life cycle of human parasitic insects – Tsetse fly
11. Seminar : Common vector insects and their identification: trombiculid mite, itch mite.  
Assignment : Common vector insects and their identification: cyclops.
12. Seminar : Common vector insects and their identification: Hard and soft tick.  
Assignment : Common vector insects and their identification: sand flies.
13. Seminar : Common vector insects and their identification: human louse.  
Assignment : Common vector insects and their identification: black flies.
14. Seminar : Common vector insects and their identification: house fly.  
Assignment : Common vector insects and their identification: house fly.
15. Seminar : Common vector insects and their identification: human flea.  
Assignment : Common vector insects and their identification:
16. Seminar : Plague, flea-borne endemic typhus  
Assignment : Plague, flea-borne endemic typhus
17. Seminar : Malaria  
Assignment : Malaria
18. Seminar : Filariasis  
Assignment : Filariasis
19. Seminar : Dengue  
Assignment : Yellow fever

**Semester : IV Elective IV – (b)**

**Name of the Course: Practical IV**

**Course code :**  
**PZ17P4**

No.ofhours/week	Noofcredits	Totalnumberofhours	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
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**Teaching plan with Modules Total Hours: 90 (Incl. Test)**

## **Microbiology (30 Hours)**

UNIT	Section	Description	Hours	Learning outcome/CO addressed	Pedagogy	Assessment
I	1	Sterilization of glassware.	2	Recall the importance of sterilization of glassware. <b>(CO-1)</b>	Practical	Pre-assessment.
	2	Preparation of culture media	2	Prepare and select the appropriate culture media. <b>(CO-1)</b>	Practical	Performance

	3	Isolation of bacteria from soil, air and water.	2	Isolate the bacteria from different samples (CO-1)	Practical	based Assessment.
	4	Serial dilution – pure culture of bacteria.	4	Recall serial dilution (CO-1)	Practical	Self-assessment
	5	Observation of bacterial motility – hanging drop method.	2	Identify motility of bacteria (CO-1)	Practical	
	6	Simple staining of bacteria.	2	Identify bacteria by simple staining (CO-1)	Demonstration Practical	
	7	Gram staining of bacteria.	2	Differentiate positive and negative bacteria (CO-1)	Practical	
	8	Negative staining of bacteria.	2	Differentiate positive and negative bacteria. (CO-1)	Practical	
	9	Methylene blue reductase test for testing the quality of milk.	4	Test the quality of milk. (CO-1)	Demonstration Practical	
	10	Test for antibiotic sensitivity.	4	Analyze the resistance and sensitivity of the bacteria (CO-1)	Demonstration Practical	
	<b>Charts /Models</b>	<i>Streptococcus, Salmonella, Corynebacterium, Clostridium, Influenza virus, Rabies virus, Hepatitis –B, HIV, Entamoeba, Aspergillus, root nodules, Azolla, ocular and stage micrometer, Autoclave, Laminar flow</i>	4	Discriminate different micro-organism and explain the apparatus used for microbiological studies (CO-1)	Observation	

**Course instructors**  
**Course Instructors**

**Head of the Department**  
**Head of the Department**

Dr.F.BriscaRenuga  
Dr.C.Anitha

Dr. S. MaryMettildaBai



## Ecobiology(30Hours)

Unit	Section	Description	Hrs.	Learning outcome/ CO addressed	Pedagogy	Assessment
	1	Measurement of primary productivity (O <sub>2</sub> measurement method).	2	Recall primary productivity and its measurement (CO-2,3)	Practical	Self-assessment
	2	Sampling of animal population using quadrat method.	2	Identify various animal population of an area. (CO-2,3)	Practical	Performance-based
	3	Observation of life table in an insect.	4	Recognise the stages in the life table of an insect. (CO-2,3)	Video lesson	Assessment
	4	Collection and identification of freshwater planktons.	4	Identify the different freshwater plankton of an area. (CO-2,3)	Practical	Model examination
	5	Measurement of turbidity using Secchi disc.	2	Spot the turbidity of any water body. (CO-2,3)	Practical	
	6	Determination of LC <sub>50</sub> of a pesticide.	4	Test the LC <sub>50</sub> of a pesticide. (CO-2,3)	Demonstration	
	7	Estimation of H <sub>2</sub> S in water sample.	2	Identify the H <sub>2</sub> S content in any water sample. (CO-2,3)	Practical	
	8	Estimation of salinity in water sample.	2	Test the salinity of a water sample. (CO-2,3)	Practical	
	9	Estimation of CO <sub>2</sub> in water sample.	2	Identify the amount of CO <sub>2</sub> in water sample. (CO-2,3)	Practical	
	10	Study report of a pond ecosystem.	2	Document on a pond ecosystem that has been visited. (CO-2,3)	visit	
	11	Commensalism (Shark and <i>Echinoids</i> ), Mutualism (Sea anemone and Hermit crab).	2	Discriminate between commensalism and mutualism. (CO-2,3)	Spotters	
	12	Food chain, Food web, Conventional energy source (coal) and non-conventional energy source (windmill).	2	Identify between conventional and non-conventional energy source. (CO-2,3)	Spotters	

**Course instructors**  
Dr. X. Venci Candida

**Head of the Department**

Dr. S. Mary Metilda Bai D

r.S. Prakash Shoba

## Biotechnology and Nanobiology (30 Hours)

Unit	Section	Description	Hours	Learning Outcome /CO addressed	Pedagogy	Assessment
III	1	Extraction of genomic DNA.	4	Isolate the genomic DNA from animal tissue. (CO-4)	Practical	Self-assessment
	2	Estimation of DNA (DPA method).	3	Estimate the DNA. (CO-4)		
	3	Agarose gel electrophoresis in separation of DNA.	2	Separation of DNA by Agarose gel electrophoresis. (CO-4)		
	4	Polymerase Chain reaction.	2	Demonstrate PCR. (CO-4)	Demonstration	Performance-based Assessment.
	5	Bacterial culture and antibiotic selection media.	4	Analyze the resistance and sensitivity of the bacteria. (CO-5)	Practical	
	6	Immobilization of yeast cells.	2	Prepare Immobilization of yeast cells. (CO-5)		
	7	Preparation of wine.	2	Prepare wine from grape fruits. (CO-4)		
	8	Estimation of ethanol content in wine.	2	Estimate ethanol. (CO-5)		
	9	Production of amylase by bacteria.	4	Isolate bacteria from soil and produce amylase enzyme. (CO-5)		
	10	Plasmid DNA isolation, Insulin production by rDNA Technology, Hybridoma production, Synthesis of DNA nanoarray, Southern blotting, Biosensor (glucometer), Air-lift bioreactor, Buckyballs, Dendrimers.	5	Discriminate molecular technology and bioreactors. (CO-4,5)	Flowcharts, instruments, Figures	Observation Note

**Course instructor**

Dr.A. Punitha

**Course instructors**

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