

**Holy Cross College (Autonomous), Nagercoil**  
**Nationally Re-Accredited with A<sup>+</sup> (CGPA 3.35) by NAAC (IV Cycle)**

**Kanyakumari District, Tamilnadu, India.**

**Affiliated to**

**Manonmaniam Sundaranar University, Tirunelveli**



**Department of Zoology**



# **PLAN OF WORK**

**June to November**

**2021- 2021**

## DEPARTMENT OF ZOOLOGY



### 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 will apply appropriate theory and scientific knowledge to participate in activities that support humanity and economic development nationally and globally, developing as leaders in their fields of expertise.
PEO - 2	The graduates will pursue lifelong learning and continuous improvement of the knowledge and skills with the highest professional and ethical standards.
PEO - 3	The graduates will inculcate practical knowledge for developing professional empowerment and entrepreneurship and societal services.

### Programme Outcomes (POs)

PO	Upon completion of B.Sc. Degree Programme, the graduates will be able to:
PO - 1	utilize scientific knowledge to pursue higher studies in the relevant field.
PO - 2	create innovative ideas to enhance entrepreneurial skills for economic independence.
PO - 3	face challenging competitive examinations that offer rewarding careers.
PO - 4	reflect upon green initiatives and take responsible steps to build a sustainable environment.
PO - 5	handle ethical issues with social responsibility.
PO - 6	communicate effectively and collaborate successfully with peers to become competent professionals.

### Programme Specific Outcomes (PSOs)

PSO	Upon completion, B.Sc. Zoology graduates will be able to:	PO addressed
PSO - 1	gain knowledge on animal diversity and basic concepts of Taxonomy, Cell biology, Genetics, Physiology, Immunology, Microbiology, Biotechnology, Ecology, Evolution, Embryology and Applied Zoology.	PO - 1, 3
PSO - 2	perform experiments as per laboratory standards in the areas of Taxonomy, Physiology, Cell Biology, Genetics, Applied Zoology, Ecology and Toxicology, Biochemistry, Biophysics, Biostatistics, Biotechnology, Immunology, Microbiology and Evolution.	PO - 2, 3
PSO - 3	apply the biological method by formulating a hypothesis, gathering relevant data and analyzing the data to address the problem effectively.	PO - 4, 5
PSO - 4	plan their career goals and pursue higher studies in different Zoological disciplines and develop entrepreneurship skills by applying the knowledge gained from courses like Aquaculture, Sericulture, Apiculture, Poultry, Vermitechnology and Clinical Laboratory Technology.	PO - 2, 6

**Major Core I - Invertebrate Zoology**  
**Course Code: ZC2011**

No. of Hours/ Week	No. of Credits	Total Hours	Marks
4	4	60	100

**Objectives**

1. To know the difference between protozoa and metazoa, and to study the structure, functional organization, adaptations of invertebrates.
2. To develop the skill of identification of invertebrates and to promote employability in museum, consultancy firms and educational institutions.

**Course Outcomes**

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	identify the fundamental principles of systematics and classify according to their characters.	PSO - 1	R
CO - 2	compare functional organization and their relationship with the environment.	PSO - 2	U
CO - 3	apply and communicate the information about Invertebrates for life - long learning.	PSO - 4	Ap
CO - 4	analyse the ecological and economic importance of invertebrates.	PSO - 3	An
CO - 5	evaluate animal diversity and initiate their career opportunities.	PSO - 2	E
CO - 6	observe, draw and synthesize information about invertebrates in laboratory and field conditions to enhance research.	PSO - 4	C

**Teaching Plan with Modules**

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

Units	Modules	Topics	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Protozoa (12 Hrs.)</b>					
	1	Classification of Animal Kingdom.	2	Classifies each phylum. (CO-1, 4)	Flow Chart, PPT	MCQ, Short test, Open book test, Flow chart, Mind map, Diagram
	2	Levels of organization: Grades of organization, symmetry and coelom. Zoological nomenclature – Rules and regulations	2	Recognizes the grades, symmetry and coelom of various animals. (CO-1, 4)	PPT, Lecture	
	3	<b>Protozoa:</b> General characters and classification up to classes	2	Recalls the general characters and	Lecture	

		with names of examples only.		classification of protozoa with examples. <b>(CO-1, 4)</b>		Formative Assessment I (1,2,3,4,5,6,7)  Quiz I  Online assignment through Google classroom
	4	Type study: <i>Paramecium</i> – Structure.	1	Illustrates the structure of Paramecium. <b>(CO-1, 6)</b>	PPT, Lecture	
	5	Osmo-regulation and reproduction (binary fission and conjugation).	2	Relates the process of osmoregulation in protozoans. <b>(CO-1, 5)</b>	Lecture, PPT	
	6	Locomotion and Nutrition in Protozoa.	1	Explores the nutritional and locomotory activities of protozoans. <b>(CO-1)</b>	Brain storming, Lecture, YouTube video	
	7	Malaria and Amoebiasis (causes, symptoms, prevention and control).	2	Identify the causative organisms, causes and symptoms of Malaria and Amoebiasis. <b>(CO-3)</b>	PPT, Lecture	
<b>II</b>	<b>Porifera and Coelenterata (12 Hrs.)</b>					
	1	<b>Porifera:</b> General characters and classification up to classes with names of examples.	3	Recognizes the classification and characters of Porifera. <b>(CO-1)</b>	PPT, YouTube video	Slip test, MCQ  Formative Assessment I (1,2,3,4,5) Quiz I  Online assignment through Google classroom
	2	Type study: <i>Leucosolenia</i> – external morphology – body wall - reproduction. Canal system in sponges.	2	Explains the characters of <i>Leucosolenia</i> . <b>(CO-2)</b>	PPT, Lecture	
	3	<b>Coelenterata:</b> General characters and classification up to classes with names of examples only.	3	Relate the classification of Coelenterates with examples. <b>(CO-1)</b>	Lecture, Flow Chart	
	4	Type study: <i>Obelia</i> - Polymorphism and metagenesis.	2	Explores the characters of <i>Obelia</i> . <b>(CO-2)</b>	Lecture, PPT	
	5	Corals, Coral reefs and their significance.	2	Illustrates the significance of corals and reefs. <b>(CO-2, 4)</b>	PPT, YouTube video.	
<b>III</b>	<b>Platyhelminthes &amp; Aschelminthes (12 Hrs.)</b>					
	1	<b>Platyhelminthes:</b> General characters and classification up to classes with names of examples only.	2	Recalls the classification and characters of Platyhelminthes. <b>(CO-1, 4)</b>	PPT, lecture, YouTube video	Quiz, MCQ, Objective test Formative Assessment I (1,2) Quiz I Formative Assessment II
	2	Type study: Liver fluke (structure and life cycle), Tape worm (structure).	4	Explains the characters of Liver fluke. <b>(CO-1)</b>	Lecture, Video lesson.	
	3	Aschelminthes: General characters and classification up	2	Describe the general characters and	Lecture, PPT	

		to classes with names of examples only.		classification of Aschelminthes. (CO-1)		(3,4,5) Quiz II Online assignment through Google classroom
	4	Pathogenicity and control measures of <i>Ascaris lumbricoides</i> <i>Wuchereria bancrofti</i> , <i>Enterobius vermicularis</i> <i>Ancylostoma duodenale</i> and <i>Dracunculus medinensis</i> .	3	Analyse the pathogenicity of different parasites. (CO-1, 4)	Lecture, PPT	
	5	Parasitic adaptations of Helminthes.	1	Comprehend the different adaptations of parasites. (CO-1, 3)	Mind map, Lecture	
IV	Annelida & Arthropoda (12 Hrs.)					
	1	Annelida: General characters and classification up to classes with names of examples. Type study: Earthworm (structure and nephridia) Metamerism in Annelida.	4	Classify annelids and Identify metamerism in annelids. Explain the structure of earthworm and its excretory organ. (CO-1, 2)	Lecture, PPT	Online quiz, MCQ, Short test  Formative Assessment I (1,2) Quiz I  Formative Assessment II (3,4,5) Quiz II  Online assignment through Google classroom
	2	Arthropoda: General characters and classification up to classes with names of examples.	2	Identify arthropods based on its characters. (CO-1)	Mind Map, PPT	
	3	Type study: <i>Penaeus</i> - external characters, appendages. Compound eye. Reproductive system and life cycle.	3	Identify the different parts of <i>Penaeus</i> and its life cycle. (CO-1, 2)	Lecture, PPT	
	4	Mouth parts of insects.	1	Relate different mouth parts of insects and their feeding mode. (CO-3, 4)	Lecture, PPT	
	5	Pest of Paddy ( <i>Leptocorisavaricornis</i> ) Coconut ( <i>Oryctes rhinoceros</i> )	2	Compare the pests and their control measures. (CO-6)	Lecture, YouTube video	
V	Mollusca & Echinodermata (12 Hrs.)					
	1	Mollusca: General characters and classification up to classes with names of examples only.	2	Identify molluscs. (CO-1)	Group Discussion, Lecture	Short test, Quiz, Open book test, Flow chart, Mind map, Diagram,
	2	Type study: Pila - external characters – shell Pallial complex - Digestive system, Respiratory system.	3	Describe the anatomy and physiology of Pila (CO-1, 2)	Lecture, PPT	

	3	Cephalopods as advanced molluscs.	1	Evaluate the complexity of cephalopods. <b>(CO-3, 4)</b>	Lecture, Mind map	Labelling the diagram Formative Assessment II (1,2.3.4,5) Quiz II Online assignment through Google classroom
	4	Echinodermata: General characters and classification with names of examples.	2	Identify echinoderms based on the characters. <b>(CO-1)</b>	Lecture, PPT	
	5	Type study: Star fish – external characters. Water vascular system. Larval forms of Echinoderms and their phylogenetic significance.	4	Appreciate the structure and water vascular system. <b>(CO-2)</b> Identify larval forms of starfish. <b>(CO-6)</b>	Lecture, PPT, YouTube video	

**Course Instructors**  
**Dr. A.Punitha**  
**Dr. S.Mary Mettilda Bai**

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

**Semester I**  
**NMEC I - Public Health and Hygiene**  
**Course Code: ZNM201**

No. of Hours/ Week	No. of Credits	Total Hours	Marks
2	2	30	100

### Objectives

1. To understand the various aspects of health and hygiene and to practice a healthy life.
2. To develop skill for personal care and maternal health for the betterment of society.

### Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	describe personal health with respect to skin, hair, eye, ear and teeth.	PSO - 1	R
CO - 2	explain the concepts of health and nutrition in relation to physical, mental, social and spiritual fitness.	PSO - 1	U
CO - 3	analyse BMI and personal hygiene.	PSO - 3	An
CO - 4	evaluate food quality, housing standards and good sanitation.	PSO - 2	E
CO - 5	apply the knowledge of maternity, child health and Swachh Bharat Mission.	PSO - 4	Ap

### Teaching plan with Modules

**Total Hours: 30 (Incl. Assignments & Test)**

Unit	Modules	Topics	Hours	Learning Outcome	Pedagogy	Assessment
I	Nutrition and health (6hrs)					
	1	Concept of health. Foodpyramid.	1	Explains the Concept of health	PPT, Video lesson.	Formative Assessment I (1,2,3,4)  Quiz I Online Assignments
	2	Snacking and Fast food.	1	Define major problems associated with junk food.	Flipped learning, Video, PPT	
	3	BMI - obesity - malnutrition (Kwashiorkar and Marasmus).	2	Relate BMI, obesity and malnutrition.	PPT, Video.	
	4	Food hygiene, food toxicants and adulterants.	2	Relate Food hygiene, toxicant and adulterants.	PPT, You tube links	
II	Personal health care(6 hrs)					
	1	General care of skin and hair	2	Describes general skin and hair care	PPT, Video lesson.	Formative Assessment



	2	Care of teeth and eye	2	Explains common dental, eye and ear problems.	Flipped learning, Video, PPT	I (1) Quiz I Online Assignments Formative Assessment II (2,3,4) Quiz, Online assignments.
	3	General care of Ear.	1	Discuss on the ear problems and their care	PPT, Video.	
	4	Personal Hygiene	1	Describe the importance of hygiene		
III	Nutrition and health (6hrs)					
	1	Maternal and Child health: Motherhood - pregnancy confirmation	1	Recognise symptoms of pregnancy	PPT, Peer group discussion	Formative Assessment II (1,2) Quiz II Online Assignments Formative Assessment I (3,4) Quiz I Online Assignments
	2	common problems during pregnancy -	2	Illustrate the common problems occurring during pregnancy	Lecture, PPT, Discussion, Video	
	3	labour and delivery - postnatal care.	2	Recall the importance of postnatal care	Lecture, PPT	
	4	Vaccination schedule in India. Family planning.	1	Enumerate the vaccination schedule in India.	Google class room PPT, You tube	
IV	Nutrition and health (6hrs)					
	1	Environment and Health: Standards of housing.	1	Explore the standards of housing	PPT, You tube.	Formative Assessment I (1,2,3) Quiz I Online Assignment Formative Assessment II(4) Quiz II Online Assignment
	2	Sanitary health measures during fairs and festivals.	2	Enumerate the sanitary health measures to be adopted during functions	PPT, You tube.	
	3	Swachh Bharat Mission and Swachhata Hi Seva.	2	Differentiate between Swachh Bharat and Swachhata Hi Seva	PPT, Discussion	
	4	Precautions during pandemic situations.	1	Recall the precautions to be taken during pandemic outbreak.	PPT, You tube.	
V	Nutrition and health (6hrs)					

	1	<b>First aid:</b> First aid procedures for dehydration, heart attack,	2	Provide appropriate first aid for dehydration, heart attack	PPT, You tube.	Formative Assessment II (1,2,3,4) Quiz II Online Assignment
	2	poisoning, electric shocks,	1	Recognize and manage poisoning and electric shock	PPT, Flipped learning,	
	3	drowning, snake bite,	2	Administer first aid procedures for drowning, snake bite	PPT	
	4	road accidents and fire accidents.	1	Provide appropriate first aid for road and fire accidents.	PPT, You tube.	

**Course Instructors**  
**Dr. Jeni Padua**  
**Dr. A. Shyla Suganthi**

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

**Semester I**  
**Add on Course - Professional English for Life Sciences**  
**Course Code: ALS201**

<b>No. of Hours/ Week</b>	<b>No. of Credits</b>	<b>Total Hours</b>	<b>Marks</b>
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2	2	30	100
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### Objectives

1. To enhance the lexical, grammatical and socio-linguistic and communicative competence in an increasingly complex, interdependent world.
2. To develop intellectual flexibility, creativity and critical thinking skills of students by offering adequate practice in professional contexts.

### Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recognise the words used in life science and improve their competence in using the language.	1	R
CO - 2	Comprehend unfamiliar texts and describe biological processes.	2	U
CO - 3	apply language for speaking and writing with confidence in an intelligible and acceptable manner.	3	Ap
CO - 4	apply critical and theoretical approaches to the reading and analysis of various texts in life sciences.	3	Ap
CO - 4	analyze critically, negotiate and present without committing errors and develop entrepreneurship skills.	4	An

### Teaching Plan with Modules

**Total Hours: 30 (Incl. Test)**

Unit	Section	Topics	Hours	Learning outcome	Pedagogy	Assessment
	6 hrs					
I	1	Listening to instruction Small Group Work	2	Listen to instructions and respond (CO-1)	Lecture Video on instructions Group work	Questions to test listening skill Asked to identify the difference between facts and opinions Vocabulary
	2	Comprehension- Difference between facts & opinions	2	Differentiate facts and opinions (CO-2)	Model passages	
	3	Developing a short poem with pictures Vocabulary	2	Develop short poem (CO-3)	Students made to write short poem	
2	6 hrs.					
	1	Listening to Process Description - Cartographic Process	2	Develop descriptive and	Role play Video	Speaking skill

		Speaking–Role play–sample2		speaking skill (CO-3)		Reading Write
	2	ReadingPassageson Equipments&gadgets	2	Develop reading skill and understand gadgets (CO-4)	PPT on equipments and gadgets	sentences and paragraphs Internal Assessment
	3	Paragraph: Sentence Definition & Extended Definition, Free writing Vocabulary	2	Sentence making and free writing (CO-3)	Video Lecture	
3	6 hrs.					
	1	Listening to interviews of inventors in fields Small Group Discussion – Specific	3	Listen to interview and group discussion (CO-5)	Video Discuss in small groups	Test listening and group discussion Test Reading and writing skill
	2	Longer reading text – The Art of Loving Essay Writing – Solidarity Vocabulary	3	Read and write (CO-2)	Read passages and write essays	
4	6 hrs.					
	1	Listening to Lecture – 2 Short Talks – Poverty and the need to alleviate it	3	Listen to lecture and short talks (CO-5)	Listen and comprehend lectures	Test listening skill Interpret visuals
	2	Reading comprehension - passage 2 Interpreting Visual Inputs Vocabulary	3	Interpret visuals (CO-4)	Comprehension passages and visuals	
5	6 hrs.					
	1	Listening for Information Making Presentation task 3&4	2	Listen to information and make presentation (CO-3)	Video Presentation task	Presentation of textual matter Discussion on importance of professional ethics Give a Problem and ask for solution Internal Assessment
	2	Motivational Articles on Professional Competence, Professional Ethics & Life Skill	2	Implement professional competence, ethics and life skill (CO-3)	PPT and video	
	3	Problem & Solution Essays, Summary Writing Vocabulary	2	Solve problems and summarize text (CO-5)	Problem and solution	

**Course Instructors**  
**Dr. Vinoliya Josephine Mary**  
**Dr. Punitha**

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

**Semester II**  
**Major Practical I - Invertebrate Zoology & Chordate Zoology**  
**Course Code: ZC20P1**  
**(Conducted during Semester I & II)**

<b>No. of Hours/ Week</b>	<b>No. of Credits</b>	<b>Total Hours</b>	<b>Marks</b>
2 + 2	2	60	100

### Objectives

1. To impart practical knowledge on morphology and anatomy of invertebrates and chordates.
2. To reinforce the basic laboratory skills including microscopy, dissection and observation of animal diversity.

### Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	identify the systematic position of selected invertebrates and chordates through observation of live and preserved specimens.	PSO - 1	R
CO - 2	describe the external morphology and biological significance of invertebrates and chordates.	PSO - 4	U
CO - 3	apply technical and creative skills through teamwork.	PSO - 3	Ap
CO - 4	analyse the different taxonomic groups based on anatomy and structural arrangements.	PSO - 2	An

### Teaching plan with Modules

**Total Hours 30 (Incl. Demonstration, Observation & Test)**

Units	Modules	Topics	Hours	Learning Outcome/ CO Addressed	Pedagogy	Assessment
<b>I</b>	<b>Invertebrate Zoology (30 Hrs.)</b>					
	1	Observation of live <i>Paramecium</i> – Hay culture.	4	Identify the <i>Paramecium</i> (CO-1, 3)	Demonstration & Observation	Continuous Performance based assessment.
	2	Observation of spicules – Sponge.	4	Identify spicules of sponges (CO-1, 3)	Demonstration & Observation	
	3	<b>Mounting:</b> Cockroach – mouth parts, salivary gland apparatus, trachea; Mosquito & Honeybee – mouth parts Prawn - appendages	6	Dissect out and mount themouth parts, salivary gland and trachea of Cockroach on a slide and focus under microscope (CO-2, 3, 4, 5)	Demonstration & Observation	
	4	<b>Dissection:</b> Cockroach - Digestive system & Nervous system.	6	Dissect and display the Digestive system and Nervous system of Cockroach (CO-2, 3, 4, 5)	Demonstration & Observation	Internal Assessment.
	5	Grouping of given Invertebrates as per their systematic position.	2	Display the Grouping of given Invertebrates as per their systematic position.	Discussion	

6	Taxonomic study of insects upto class giving key identification, selecting any 5 locally available common examples and recording them.	2	Display the Taxonomic study of any 5 insects.	Discussion		
7	<b>Spotters:</b> <i>Amoeba</i> , <i>Euglena</i> , <i>Spongilla</i> , Sponge gemmule, <i>Obelia</i> , Coral (Fungia), Liver fluke, Tapeworm, <i>Ascaris</i> (Male and Female), Nereis, Leech, <i>Penaeus</i> , <i>Oryctesrhinoceros</i> , Pila, <i>Lamellidens</i> , <i>Pinctada</i> , Sepia, Octopus, Chiton, Starfish, Sea urchin, Sea Cucumber. <b>Larval forms:</b> Cercaria, Trochophore, Nauplius, Zoea, Bipinnaria.	6	Identify the specimens/ slides/ models and explains the structure/ function/ biological importance ( <b>CO-1, 5</b> )	Observation & Discussion		

**Course Instructors**  
**Dr.S. Mary Mettilda Bai**  
**Dr.A. Punitha**

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

## **B.Sc. Zoology**

**Semester : II** **Major Core II**  
**Name of the Course : Chordate Zoology**  
**Course code : ZC2021**

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

### **Learning Objectives**

1. To impart knowledge on the systematic position, structure, functional organization, adaptation and the economic importance of chordates.
2. To develop real time skills on identification of major groups of chordates to gain employment in academic and research institutions.

### Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	identify the systematic position and describe the biological significance of chordates.	PSO - 1	R
CO - 2	recognize different chordates based on their salient features.	PSO - 1	U
CO - 3	compare the morphology and anatomy of selected chordates.	PSO - 3	An
CO - 4	assess the structural, physiological, ecological and behavioural adaptations pertaining to their mode of life.	PSO - 2	E
CO - 5	design experiments to relate chordates with their environment.	PSO - 2	C
CO - 6	disseminate knowledge on chordates to excel in research and entrepreneurship initiatives.	PSO - 4	Ap

### Teaching Plan with Modules

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

Unit	Section	Description	Hours	Learning Outcome & CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Prochordata(12 Hrs)</b>					
	1	General characters of chordates and classification up to classes with names of examples, Prochordata: General characters and classification up to classes with examples.	3	Outline the general characters and classification of chordates and prochordates. (CO-1,4)	PPT, Video	MCQ, Class test,  Assignment: Class notes, Flow chart, mind map   Formative Assessment I  Quiz I
	2	Type study: <i>Amphioxus</i> – external features Digestive system Excretory system	4	Describe the external and internal features of <i>Amphioxus</i> . (CO-1,2)	PPT, Video	
	3	External features and biological significance of the following: <i>Ascidian</i> , <i>Balanoglossus</i> , <i>Salpa</i> .	3	Discuss on the external features and biological significance prochordates. (CO-1,2)	PPT, Video	



	4	Agnatha: <i>Petromyzon</i> – External morphology. Ammocoetes larva.	2	Explain the external features and biological significance of Agnatha. (CO-1,2)	PPT, Video	Class note Submission
II	Pisces (12 Hrs)					
	1	Pisces: General characters and classification up to sub classes with names of the examples.	2	List the general characters and classification of Pisces. (CO-1,4)	Interactive session, PPT, Video	Short test Mind map Objective test Formative Assessment I Quiz I Class note Submission
	2	Type study: <i>Scoliodon</i> - external characters, placoid scales.	2	State the general characters of <i>Scoliodon</i> . (CO-1,3)	PPT, Video	
	3	Digestive system, respiratory system Circulatory system Nervous system Receptor organs, urino-genital system.	4	Describe the physiology of the different systems of shark. (CO-1,2)	Interactive session, PPT, Video	
	4	Accessory respiratory organs in fishes Migration of fishes Lung fishes - Dipnoi.	4	Explain respiration and migration of fishes. (CO-1,3)	PPT	
III	Amphibia&Reptilia(12 Hrs)					
	1	Amphibia: General characters and classification up to orders with names of the examples only.	2	List the general characters and classification of amphibian. (CO-1,4)	PPT	Class test, MCQ, Assignment, Formative Assessment I (1,2,4), Quiz I Formative Assessment II (3,5), Quiz II Class note Submission
	2	Type study: Frog – External characters Endoskeleton: Skull, typical vertebra, atlas, girdles and limbs.	3	Recall the characteristics of frog. (CO-1,2)	PPT	
	3	Biological significance of Axolotl larva, <i>Ichthyophis</i> Parental care in Amphibia.	2	Discuss the biological significance and parental care in axolotl larva and ichthyophis. (CO-3)	Video, PPT	
	4	Reptilia: General characters and classification up to orders with names of the examples only.	2	Outline the general characters and classification of reptiles. (CO-1,4)	Lecture, PPT	

	5	Type study: <i>Calotes</i> – External characters, Circulatory system Excretory system. Identification and study of few poisonous snakes in India - first aid for snake bite and anti-venom.	3	Explains external characters of Calotes and functions of internal organs, Identify poisonous snakes. <b>(CO-2)</b>	Lecture, PPT	
<b>IV</b>	<b>Aves (12 Hrs)</b>					
	1	Aves: General characters and classification up to sub classes with names of the examples.	1	List the general characters and classification of birds. <b>(CO-1,4)</b>	Probing and interaction, Video lecture	Assignment: Class notes, Flow chart, mind map
	2	Type study: <i>Columba livia</i> - external characters, exoskeleton flight muscles.	3	Explain the external characters and importance of flight muscles. <b>(CO-2)</b>	Observation of pigeon – PPT, Video	Open book test, MCQ, Class test, Formative Assessment II
	3	Digestive system, Respiratory system, Urino-genital system	4	Discuss the systems of <i>Columba livia</i> . <b>(CO-2)</b>	Interactive session, PPT, Video	Quiz II
	4	Migration of birds, Flight adaptation in birds, Flightless birds (Ratitae): general characters and examples.	4	Compare the Flight adaptation in birds and their migratory behaviour. <b>(CO-3)</b>	PPT, Video Lecture	Class note Submission
<b>V</b>	<b>Mammalia (12 Hrs)</b>					
	1	Mammalia: General characters and classification up to subclasses with names of the examples.	2	Identify the key taxonomic characters and classify mammals. <b>(CO-1,4)</b>	PPT, Video class using Google class.	Assignment: Class test, Flow chart, mind map
	2	Type study: Rabbit - external morphology Structure of skin, dentition.	2	Describe the external morphology, skin and dentition of rabbit. <b>(CO-2)</b>	Lecture, PPT, discussion.	MCQ, Formative Assessment II
	3	Digestive system, Respiratory system Urinogenital system.  PPT, Video class using Google class.	3	Explain the structure of digestive, respiratory and urinogenital system of rabbit. <b>(CO-2)</b>	PPT, Lecture and interactive session.	Quiz II  Class note

<b>Course</b>	4	Structure of heart Structure of brain.	2	Describe the structure of heart and brain. <b>(CO-2)</b>	PPT, Video class using Google class.	Submission
	5	Egg laying mammals- Pouched mammals Adaptations of aquatic mammals.	3	Compare egg laying and pouched mammals. <b>(CO-3)</b>	Lecture, PPT.	

**instructors**

Dr. S. PrakashShoba

Dr. Arockia Glory

**Head of the Department**

Dr. F.BriscaRenuga

**Semester**

**: II**

**Major Practical II**

**Name of the Course**

**: Chordate Zoology**

**Course code**

**: ZC20P2**

No. of hours/week	No. of credits	Total number of hours	Marks
2	2	30	50

### Learning Objectives

1. To recognize and describe the morphology and anatomy of the chordates.
2. To create interest in chordate biodiversity through animal album and bird Watcher's diary.

### Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	identify the Systematic position of selected chordate specimens.	PSO - 2	R
CO - 2	describe the external morphology and biological significance of chordate specimens.	PSO - 1	U
CO - 3	acquire cognitive, technical and creative skills through team work.	PSO - 2	Ap
CO - 4	analyse the anatomy and structural arrangements in selected chordate animals.	PSO - 3	An

### Teaching Plan with Modules

**Total Hours: 30 (Incl. Test)**

Section	Description	Hrs	Learning outcome & CO addressed	Pedagogy	Assessment
1	Shark: Mounting of Placoid, Cycloid and Ctenoid scales.	2	Mount placoid scales. (CO-4)	Practical	Pre assessment
2	Fish: Digestive system.	2	Identify the parts of digestive system. (CO-4)	Practical	Performance assessment
3	Frog: Arterial system and Urinogenital system.	2	Recall the parts of arterial and Urinogenital system. (CO-4)	Demonstration – virtual lab	Model Practical Examination
4	Frog: Brain	2	Identify the parts of frog brain. (CO-4)		Observation Note
5	Reptiles: Key for Identification of poisonous and non-poisonous snakes.	2	Recollect the key points. (CO-3)	Charts	Identification of chordates
6	Pigeon: Identification of feathers, Digestive system, Respiratory system.	6	Identify different types of feathers and parts of internal organs. (CO-4)	Virtual lab	Album
7	Grouping of given chordate as per their systematic position.	2	Recall the classification of chordates. (CO-1)	Observation	Bird watcher's diary
8	<i>Amphioxus</i> , <i>Balanoglossus</i> ,	2	Identify and explain the biological	Observation of museum	

Course		Ascidian, <i>Petromyzon</i> , Ammocoetes larva, <i>Narcine</i> , <i>Hippocampus</i> , <i>Anguilla</i>		significance.(CO-2)	Specimens	
	9	<i>Rhacophorus</i> , Axolotl larva, <i>Ichthyophis</i> , Salamander, Chamaeleon, <i>Draco</i> , <i>Chelone</i> , Cobra	2			
	10	Wood pecker, Pelican, Penguin, Pangolin, Kangaroo, Bat, Loris, Whale	2			
	11	Endoskeleton of Frog: Typical vertebra, atlas, pectoral girdle, pelvic girdle, forelimb skeleton and hind limb skeleton.	2			
	12	Submission of an “Animal Album” containing photographs or paper cuttings of the locally available chordates of different taxa with brief writes up.	-	Familiarize the animals and documentation. (CO- 2)	Field visit	
	13	Maintenance of campus Bird-watcher’s Diary (group work).	-			
	14	Field visitto places of Zoological importance.	-			

**instructors**

Dr. S. PrakashShoba

Dr. Arockia Glory

**Head of the Department**

Dr. F.BriscaRenuga

**Semester : II**

**NMEC II**

**Name of the Course: Common Ailments and Simple Remedies**

**Course Code : ZNM202**

No. of Hours/Week	Credits	Total No. of Hours	Marks
4	2	60	100

### Learning Objectives

1. To create awareness on the changing life style and its impact on human health.
2. To develop skills on disease management to form a healthy society.

### Course Outcomes

COs	Upon completion of this course the students will be able to:	PSO Addressed	CL
CO - 1	enumerate the symptoms of common diseases.	PSO - 1	R
CO - 2	summarise common health problems like anaemia, heart diseases, diabetes, skin and dental problems and old age ailments.	PSO - 1	U
CO - 3	apply preventive strategies to develop healthy society.	PSO - 3	Ap
CO - 4	analyse the problems of changing life style and its impact on human health.	PSO - 3	An
CO - 5	evaluate the simple remedies for common ailments.	PSO - 3	E

### Teaching Plan with Modules Total Hours: 60 (Incl. Test)

Unit	Section	Topics	Hours	Learning outcome	Pedagogy	Assessment
I	(12 Hrs)					
	1	Anaemia and types of anaemia.	2	Summarize the details about anaemia. (CO-1).	Flipped learning	MCQ, Short test, Mind Map, Formative Assessment I  (1,2,3,4), Quiz I, Assignment
	2	Blood pressure-types, symptoms, treatments and prevention.	4	Identify the pros and cons of blood pressure. (CO-1).	Blended learning	
	3	Diabetes- causes, symptoms, diagnosis and treatment	3	Analyse the diagnosis and treatment of diabetes. (CO-2).	Flipped learning	
	4	Jaundice- causes, types, symptoms, treatment and prevention.	3	Analyze the symptoms and treatment of jaundice. (CO-2, 3).	Blended learning	
II	(12 Hrs)					
	1	Dental caries and Pyorrhoea-causes, symptoms, treatment and prevention	3	Memorizes the words related to the dental problems. (CO-3,4).	Flipped learning	Short test, Mind map,  Objective test, Assignment,
	2	Typhoid- causes, types, symptoms and treatment	4	Analyze the symptoms and treatment of typhoid. (CO-3,4).	PPT, Video	

	3	Digestive disorders: Diarrhoea - causes and treatment	3	Summarize the digestive disorders. <b>(CO-3,4)</b> .	PPT, Blended learning	Formative Assessment I (1), Formative Assessment II (2,3,4), Quiz II
	4	Chronic constipation- causes, prevention	2	Emphasizes the causes of chronic constipation. <b>(CO-3,4)</b> .	PPT, Video	
<b>III</b>	<b>(12 Hrs)</b>					
	1	Common cold, cough-treatment	3	Identify the treatment of common cold. <b>(CO-1)</b> .	Flipped learning	Short test, MCQ,  Objective test, Formative Assessment I (1,2), Formative Assessment II (3,4)
	2	Primary complex- causes and treatment	3	State the causes of primary complex. <b>(CO-1,2)</b> .	PPT, Video	
	3	Asthma- causes, symptoms and treatment	4	Points out the causes and symptoms of Asthma. <b>(CO-3, 4)</b> .	Lecture, PPT	
	4	Headache - causes and types	2	Classify the types of headache. <b>(CO-1,5)</b> .	Lecture, PPT	
<b>IV</b>	<b>(12 Hrs)</b>					
	1	Dengue fever - causes, types, symptoms and treatment.	4	summarize the treatment of dengue fever. <b>(CO-4)</b> .	Lecture, PPT	Diagram test, MCQ, Formative Assessment I (1,2,3)
	2	Malaria - causes, types, symptoms and treatment	4	Recognize the symptoms of malaria. <b>(CO-4)</b> .	Lecture, Video	
	3	Filariasis (Elephantiasis) - causes, types, symptoms and treatment	4	Explores the causes and symptoms of Elephantiasis. <b>(CO-4)</b> .	Lecture, PPT, You tube links	
<b>V</b>	<b>(12 Hrs)</b>					
	1	Aging- old age related ailments, loss of memory, osteoporosis, Parkinson's disease, Alzheimer's disease.	4	Summarize old age related ailments. <b>(CO-5)</b> .	Lecture, Group discussion, PPT	Short test, Quiz, Assignment, Formative Assessment I (1)  Formative Assessment II (2,3)
	2	Arthritis- causes, types, symptoms and treatments.	4	Interrelate various diseases. <b>(CO-5)</b> .	Lecture, PPT, Video tutorial	
	3	Fomentation	4	Point out the importance of fomentation. <b>(CO-5)</b> .	Lecture, PPT	

**Course instructors**

Dr. A.ShylaSuganthi

Dr. Josephine Priyadharshini

**Head of the Department**

Dr. F.BriscaRenuga

**Semester IV**  
**Major Core IV: Genetics**  
**Course Code: ZC2041**

No. of Hours/ Week	No. of Credits	Total Hours	Marks
4	4	60	100

**Objectives**

1. To enable the students to understand the basic principles of inheritance and population genetics.
2. To enhance skills to interpret hereditary, mutation and syndromes and extend genetic counseling to society.

**Course Outcomes**

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the key concepts of heredity, population genetics, karyotyping and genetic counselling.	PSO - 1	R
CO - 2	describe Mendelian, polygenic and cytoplasmic inheritance, chromosome mapping, nondisjunction, gene frequency and eugenics.	PSO - 1	U
CO - 3	apply the principles of heredity to real life situations.	PSO - 2	Ap
CO - 4	execute and analyze the results of genetic experimentation in animal and plant models.	PSO - 3	An
CO - 5	evaluate the genetic data of a population.	PSO - 4	E



## Unit I

(12 hrs.)

**Mendelian inheritance** - Monohybrid and dihybrid - back cross and test cross. Complete, incomplete and codominance. Interactions of genes: Complementary genes – flower colour in sweet pea, Supplementary genes – inheritance of comb in fowl, Epistasis – inheritance of colour pattern in poultry and coat colour in mice, Lethal genes – sickle cell anemia. Polygenic inheritance - Skin colour in man, Multiple alleles: ABO blood group in man, Rh factor in man, coat colour in rabbit.

## Unit II

(12 hrs.)

**Chromosome mapping and Syndromes:** Linkage – types, groups and theories. Crossing over - mechanism, theories, cytological evidence - Stern's experiment and Tetrad analysis, significance. Chromosome map - two point and three point cross, construction of chromosome map. Sex determination in man and *Drosophila*. Nondisjunction - Primary and secondary nondisjunction in *Drosophila*. Syndromes in man: Turner's, Klinefelter's and Down syndrome.

## Unit III

(12 hrs.)

**Cytoplasmic inheritance and Mutation:** Cytoplasmic inheritance - Kappa particles in *Paramecium*, milk factor in mice, shell coiling in *Limnaea*. DNA as genetic material - Bacterial transformation, conjugation, F-factor and transduction. Mutation: Chromosomal mutation - changes in structure and number, aneuploidy and euploidy, Gene mutation - mutagens. DNA repair mechanisms.

## Unit IV

(12 hrs.)

**Human chromosomes and genetic diseases:** autosomes and allosomes – Karyotype and idiogram. Simple Mendelian traits in man. Twins - types, development and application. Inborn errors of metabolism - Phenylketonuria, Alkaptonuria, Albinism. Sex-linked genes and their inheritance - X-linked genes - Colour blindness and Haemophilia, Y-linked genes - holandric genes.

## Unit V

(12 hrs.)

**Population genetics:** Hardy Weinberg equilibrium – calculation of gene frequency – factors affecting gene frequency – selection, mutation, genetic drift and migration. Inbreeding, out breeding and heterosis. Eugenics, Euthenics and Euphenics. Pedigree analysis. Genetic prognosis - Genetic counselling.

## Textbook

Meyyan, R. P. (2011). *Genetics*. Nagercoil: Saras Publications.

## Reference Books

1. Verma, P.S. & Agarwal, V.K. (2009). *Genetics*, Revised ed. New Delhi: S. Chand & Co.
2. Peter Snustad, D. & Michael J. Simmons (2010). *Principles of Genetics* (2<sup>nd</sup> ed.). USA: John Wiley and Sons.
3. Chatterjee, S. (2009). *Genetics*. New Delhi: APH Publishing Corporation.
4. Singh, B.D. (2008). *Fundamentals of Genetics* (4<sup>th</sup> ed.). Ludhiana: Kalyani Publishers.

5. Gardner, Simmons & Snustad (2006). *Principles of Genetics* (8<sup>th</sup> ed.). USA: John Wiley & Sons.
6. Ahluwalia, K.B. (2009). *Genetics* (2<sup>nd</sup> ed.). New Delhi: New Age International.

**Teaching Plan with Modules**  
**Total Hours 60 (Incl. Assignment & Test)**

Units	Modules	Topics	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Mendelian inheritance (12 Hrs.)</b>					
	1	Monohybrid and dihybrid - back cross and test cross. Complete, incomplete and codominance.	3	Explain Monohybrid and dihybrid cross, back cross, test cross, complete, incomplete and codominance. <b>(CO-1,2,3)</b>	Lecture	Class test 1 - MCQ (Google forms)
	2	Interactions of genes: Complementary genes – flower colour in sweet pea, Supplementary genes – inheritance of comb in fowl, Epistasis – inheritance of colour pattern in poultry and coat colour in mice.	5	Demonstrate the principles of gene interactions. <b>(CO-1,3,5)</b>	Lecture, PPT.	Internal Test I Quiz I  Online assignment

	3	Lethal genes – sickle cell anemia. Polygenic inheritance - Skin colour in man.	2	Define lethal genes and illustrate Polygenic inheritance. (CO-1,2,3)	Lecture, PPT, video, Mind map, Diagram	
	4	Multiple alleles: ABO blood group in man, Rh factor in man, coat colour in rabbit.	2	Illustrate multiple alleles. (CO-1,3,4)	Lecture, PPT.	
<b>II</b>	<b>Chromosome mapping and Syndromes (12 Hrs.)</b>					
	1	Linkage – types, groups and theories. Crossing over - mechanism, theories, cytological evidence - Stern’s experiment and Tetrad analysis, significance.	4	Describe linkage and crossing over. (CO-1,2,3)	Lecture.	Internal Test I & Quiz I  Class test 2  Assignment
	2	Chromosome map - two point and three point cross, construction of chromosome map.	3	Demonstrate chromosome map. (CO-1,2)	Lecture.	
	3	Sex determination in man and <i>Drosophila</i> .	2	Illustrate sex determination in man and <i>Drosophila</i> . (CO-1,3,4)	Lecture, PPT, Mind map	
	4	Nondisjunction - Primary and secondary nondisjunction in <i>Drosophila</i> . Syndromes in man: Turner’s, Klinefelter’s and Down syndrome.	3	Explain nondisjunction and identify syndromes in man. (CO-1,2,3,5)	Lecture, PPT.	
<b>III</b>	<b>Cytoplasmic inheritance and Mutation (12 Hrs.)</b>					
	1	Cytoplasmic inheritance - Kappa particles in <i>Paramecium</i> , milk factor in mice, shell coiling in <i>Limnaea</i> .	4	Interpret cytoplasmic inheritance. (CO-1,3,4)	Lecture.	Internal Test I & Quiz I (1,2)  Internal Test II & Quiz II (3,4)  Class test - Open book test  Assignment
	2	DNA as genetic material - Bacterial transformation, conjugation, F- factor and transduction.	3	Demonstrate DNA as genetic material. (CO-1,3,4)	Lecture, Interactive Class, video.	
	3	Mutation: Chromosomal mutation - changes in structure and number, aneuploidy and euploidy.	3	Define mutation and comprehend chromosomal mutation. (CO-1,3,5)	Lecture, PPT.	
	4	Gene mutation – mutagens. DNA repair mechanisms.	2	Define gene mutation, mutagens and explains the mechanism of DNA repair. (CO-1,3)	Lecture, PPT	
<b>IV</b>	<b>Human chromosomes and genetic diseases (12 Hrs.)</b>					

	1	Autosomes and allosomes – Karyotype and idiogram.	2	Define autosomes,allosomes, karyotype and idiogram.(CO-1,2,4)	Lecture, Chart, Table PPT	Open book test  Online Assignment Internal TestII Quiz II  Class test
	2	Simple Mendelian traits in man. Twins - types, development and application.	2	Interpret Simple Mendelian traits and explain the types of twins.(CO-1,2,5)	Lecture,	
	3	Inborn errors of metabolism - Phenylketonuria, Alkaptonuria, Albinism.	5	Explicate inborn errors of metabolism. (CO-1,3,5)	Lecture, PPT,	

	4	Sex-linked genes and their inheritance - X-linked genes - Colour blindness and Haemophilia, Y-linked genes - holandric genes.	3	Narrate the inheritance of sex-linked genes. (CO-1,3)	Lecture, Video	Formative Assessment II (3,4)
V	<b>Population genetics (12 Hrs.)</b>					
	1	Hardy Weinberg equilibrium – calculation of gene frequency.	3	Define Hardy Weinberg equilibrium and calculate gene frequency. (CO-1,4,5)	Lecture, PPT	Group Discussion Formative Assessment II Quiz II  Class test 4 Oral test
	2	Factors affecting gene frequency – selection, mutation, genetic drift and migration.	3	Identify the factors affecting gene frequency. (CO-1,2)	Lecture, Video lesson, PPT	
	3	Inbreeding, out breeding and heterosis. Eugenics, Euthenics and Euphenics.	3	Comprehend inbreeding, out breeding, heterosis, eugenics, euthenics and euphenics. (CO-1,2,4,5)	Lecture, PPT.	
	4	Pedigree analysis. Genetic prognosis - Genetic counselling.	3	Demonstrate Pedigree analysis. Interpret genetic prognosis and Genetic counselling. (CO-1,3,4,5)	Lecture, Flow chart	

**Course Instructors Head of the Department**

Dr. A. Punitha

Dr. S. Mary Mettilda Bai

Dr. F. Brisca Renuga

**Major Practical III**

**Semester**

**: IV**

Name of the course : Genetics, Biostatistics and Computer Applications

Sub. Code : ZC20P2

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

1. To

learn and practice the basic principles of inheritance in a firsthand manner.

2. To train the students learn and perform experiments, collect data, analyze the data, learn to interpret the data and draw conclusion from it.

### Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	Demonstrate Mendelian genetic principles in a controlled experimental set up.	PSO - 2	R
CO - 2	Identify the own Blood group.	PSO - 3	Ap
CO - 3	Perform experiments with the model organism, <i>Drosophila</i> .	PSO - 3	An
CO - 4	Design experiments, collect, analyze, interpret the data statistically and draw conclusion.	PSO - 3	Ap
CO - 5	Use computing skill for typing text.	PSO - 3; PSO - 5	Ap

### Genetics

1. Observation of simple Mendelian traits in man.
2. Verification of monohybrid and dihybrid ratio using beads.
3. Observation of mutant forms of *Drosophila*.
4. Observation of polygenic inheritance (length of shell/ height of students)
5. Blood group identification.

**Charts / Models / Bookplates:** Syndromes - Klinefelter's, Turner's and Down's, Sex- linked inheritance - Colour blindness, Haemophilia, Hypertrichosis.

### Teaching Plan with Modules

Total Hours: 30 (Incl. Test)

Section	Description	Hou rs	Learning outcome	Pedagogy	Assessment
1	Observation of simple Mendelian traits in man.	2	Identify Mendelian traits in man.	Practical	Pre-assessment.
2	Verification of monohybrid and dihybrid ratio using beads.	4	Verify monohybrid and dihybrid cross.	Practical	Performance-based Assessment.
3	Observation of mutant forms of <i>Drosophila</i> .	4	Culture <i>Drosophila</i>	Demonstration	

			and identify the mutant forms of <i>Drosophila</i> .		Self-assessment Model examinations
4	Observation of polygenic inheritance (length of shell/ height of students)	2	Recollect the key points associated with polygenic inheritance.	Practical	
5	Blood group identification.	2	Identify different types of blood groups.	Practical	
9	Syndromes (Klinefelter's, syndrome, Turner's syndrome, Down syndrome)	2	Identify the characteristics of syndromes.	Charts	
10	Sex- linked inheritance (Colorblindness, Haemophilia, Hypertrichosis).	2	Identify sex-linked inheritance.	Charts	

**Course instructors**

Dr. A. Punitha                      Dr. F. BriscaRenuga  
Dr. J .VinoliyaJosphine Mary

**Head of the Department**

**Semester IV**  
**Major Elective II: (a) Clinical Laboratory Technology**  
**Course Code: ZC2042**

No. of Hours/ Week	No. of Credits	Total Hours	Marks
4	3	60	100

**Objectives**

1. To impart knowledge on the laboratory techniques adopted in clinical laboratories.
2. To develop skills for gaining employability in hospitals and research laboratories.

### Course outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	describe the laboratory principles applied in diagnosis of disease.	PSO - 1	R
CO - 2	classify the clinical specimens and use appropriate laboratory protocol.	PSO - 2	U
CO - 3	prepare reagents, handle instruments, perform clinical analysis and validate the results.	PSO - 3	Ap
CO - 4	develop skills necessary for higher studies or placement in clinical laboratories.	PSO - 4	An

### Teaching Plan with Modules Total Hours: 60 (Incl. Test)

Unit	Modules	Topics	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Essential pre-requisites of a Clinical Laboratory (12 Hrs)</b>					
	1	Safety measures and first aid in the laboratory.	2	Recall the Safety measures of the laboratory. <b>(CO-2)</b>	Xenography, Mind map, PPT	Short test, Open book test, MCQ
	2	Sterilization – physical and chemical methods.	4	Interpret the sterilization methods. <b>(CO-2)</b>	Androgogy, PPT	
	3	Preparation of Normal, Molar and Percentage solution.	4	Outline the preparation of reagrnts. <b>(CO-3)</b>	Lecture, PPT	Formative Assessment I (1, 2, 3,4)
	4	Biomedical waste management.	2	Explain the biomedical waste management. <b>(CO-2)</b>	Lecture, Video, PPT	Quiz I
<b>II</b>	<b>Laboratory Instruments and their applications: (12 Hrs)</b>					
	1	Microscope, Balance.	2	Explain the principle of microscope. <b>(CO-3)</b>	Demonstration,	Short test, Open book test, MCQ
	2	pH meter, Colorimeter.	2	Outline the working mechanism of colorimeter. <b>(CO-3)</b>	Techobased	



	3	Autoanalyser, Centrifuge.	3	Recall the handling protocol of autoanalyser and centrifuge. (CO-3)	Lecture, PPT	Formative Assessment I (1, 2) Quiz I  Formative Assessment II (3, 4, 5) Quiz II
	4	Incubator, Water bath.	2	Differentiate the functions of Incubator and Water bath. (CO-3)	Lecture, Video, PPT	
	5	Haemocytometer, Sahli's haemoglobinometer.	3	Apply the methodologies to count RBCs and WBCs. (CO-3)	Lecture, Mind map, PPT	
III	Clinical Haematology (12 Hrs)					
	1	Collection of blood - Venous and capillary, Blood grouping, Separation of plasma and serum.	3	Identify different blood groups, plasma and serum. (CO-3)	PPT, Video	Slip test, MCQ, Assignment Open book test  Formative Assessment I (1, 2, 3, 4) Quiz I
	2	Blood cell count – Total count and differential count, Haemoglobin estimation by Sahli's method, Erythrocyte sedimentation rate (ESR).	3	Apply Sahli's method to estimate haemoglobin. (CO-3)	PPT, Video, Flipped learning	
	3	Analysis of blood glucose, serum creatinine, alkaline phosphatase, cholesterol.	3	Analyse different components of blood. (CO-3)	PPT, Video, Blended learning	
	4	High density lipid (HDL) and low density lipid (LDL), Triglycerides.	3	Classify lipids. (CO-3)	PPT, Video, Collaborative learning	
IV	Examination of sputum and body fluids:(12 Hrs)					
	1	Collection, Physical, chemical examination of fluids.	4	Recall the collection and examination of fluids. (CO-1)	Chalk and board, lecture	Short test, Open book test, MCQ, online assignment  Formative Assessment I (1,2,3) Quiz I
	2	Microscopic examination of cerebrospinal fluid and sputum.	4	Outline the microscopic examination of cerebrospinal fluid and sputum. (CO-2)	PPT, Lecture	
	3	Serous fluid - pleural, pericardial and peritoneal, Synovial fluid.	4	Compare the various serous fluid. (CO-4)	Flipped classroom, Group discussion	

<b>V</b>	<b>Urine and Stool Analysis: (12 Hrs)</b>					Short test, MCQ, Assignment  Formative Assessment II (1, 2, 3, 4, 5) Quiz II
	1	Urine – collection, composition, volume, colour and transparency.	3	Explain the properties of Urine.(CO-2)	Lecture, Chalk and board	
	2	Analysis of urine for glucose, albumin, bilirubin, urobilinogen and ketone.	3	Analyse the various components of urine. (CO-4)	Lecture, PPT, experiential learning	
	3	Microscopic examination for bacteria, organized and unorganized deposits and blood. Pregnancy test.	2	Identify the different bacteria and deposits of blood.(CO-3)	You tube videos, blended learning	
	4	Stool - collection, types, microscopic examination -	2	Explain the collection and types of stool.(CO-2)	PPT, Video, Blended learning	
	5	identification of intestinal parasites using saline wet mount - faecal occult blood.	2	Analyse the intestinal parasites and identify them. (CO-4)	Comparative Chart, Discussion	

**Course In-charge:**

Punitha

Dr. X. Venci Candida

**Head of the Department:**

Dr. C. Dr.

Dr. F. BriscaRenuga

**Semester IV**  
**Major Practical II**  
**III & IV Semester Major Core & Electives**  
**Course Code: ZC20P2**  
**(Conducted during III & IV Semester)**

No. of Hours/ Week	No. of Credits	Total Hours	Marks
2 + 2	2	60	100

**Objectives**

1. To impart practical skills in selected fields of biology.
2. To develop skills to apply the principles of biological techniques.

**Course outcomes**

CO	Upon completion of this course the students will be able to:	PSO addressed	CL

CO - 1	Identify biomolecules, cells, chromosomes, genetic disorders and animals.	PSO - 1	R
CO - 2	illustrate cells and its structure, biomolecules and the principles of biotechniques.	PSO - 2	U
CO - 3	handle analytical instruments and biological samples.	PSO - 3	Ap
CO - 4	analyse biochemical constituents, biological sequences and disorders.	PSO - 4	An

## Genetics

1. Observation of simple Mendelian traits in man.
2. Verification of monohybrid and dihybrid ratio using beads.
3. Observation of mutant forms of *Drosophila*.
4. Observation of polygenic inheritance (length of shell/ height of students)
5. Blood group identification.

**Charts / Models / Bookplates:** Syndromes - Klinefelter's, Turner's and Down's, Sex- linked inheritance - Colour blindness, Haemophilia, Hypertrichosis.

## Clinical Laboratory Technology

1. Collection of blood and separation of serum and plasma
2. Estimation of blood glucose using glucometer.
3. Routine examination of urine: Urine sugar determination by Benedict's method.
4. Protein by heat and acetic method, Urobilinogen and Ketone bodies.
5. Microscopic examination of urine.
6. Pregnancy test (kit method).

**Spotters:** Water bath, Balance, Autoanalyser, Incubator, Renal calculi, *Entamoeba histolytica*, *Enterobius vermicularis*, Biomedical waste bags.

## Teaching Plan with Modules

**Total Hours: 30**

Modules		Topics	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
1	Collection of blood and separation of serum and plasma		3	Experiential learning (CO-1)	Practical	Practical Assessment, Model exam, Summative exam
2	Estimation of blood glucose using glucometer.		3	Experiential learning (CO-1)	Practical	
3	Routine examination of urine: Urine sugar determination by Benedict's method.		3	Experiential learning (CO-1)	Practical	

4	Protein by heat and acetic method, Urobilinogen and Ketone bodies.	3	Experiential learning (CO-2)	Practical	
5	Microscopic examination of urine.	2	Experiential learning (CO-2)	Practical	
6	Pregnancy test (kit method).	3	Experiential learning (CO-2)	Practical	
7	<b>Spotters:</b> Water bath, Balance	3	Observe and identify.(CO-2)	Observatory learning	
8	Autoanalyser, Incubator	2	Observe and identify (CO-5)	Observatory learning	
9	Renal calculi	2	Observe and identify (CO-5)	Observatory learning	
10	<i>Entamoeba histolytica</i> , <i>Enterobius vermicularis</i>	3	Observe and identify . (CO-4)	Observatory learning	
11	Biomedical waste bags.	3	Observe and identify (CO-6)	Observatory learning	

**Course In-charge**

Dr. C. Josephine Priyatharshini

**Head of the Department**

Dr. F. BriscaRenuga

**Semester V**  
**Name of the Course - Physiology**  
**Course Code: ZC2051**

**Major Core V**

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

### Learning Objectives

1. To enable the students to gain insight knowledge on the functional significance of the different organs and organ systems.
2. To develop skills to relate the normal and abnormal functions of vital organs.
3. To train future researchers academically and intellectually in the area of physiology.
4. Enable to perform, analyse and report on experiments and observations in physiology;

### Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the basic anatomy of digestive, respiratory, excretory, homeostatic, neuromuscular, endocrine and reproductive system.	PSO - 1	R
CO - 2	describe the important physiological systems and internal regulation.	PSO - 1	U
CO - 3	compare various organ systems and adaptations exhibited by animals.	PSO - 2	Ap
CO - 4	infer the integration of activities of different organ and organ system.	PSO - 3	An
CO - 5	interrelate different organ systems to diseases for a holistic approach to human health.	PSO - 2	E

### Teaching plan with Modules

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

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Nutrition and Digestion (18 Hrs.)</b>					
	1	<b>Nutrition:</b> Types, composition of food - importance of nutrients.	3	Explain the types of nutrition, composition of food and importance of nutrients.(CO-1,3,5)	Brainstorming Lecture, Video	Class Test: MCQ
	2	Balanced diet, Basal metabolic rate (BMR) and Body mass index (BMI).	3	Recognize the balanced diet, basal metabolic rate and Body mass index.(CO-1,5)	Inquiry based Lecture, PPT	Internal Test I Quiz I
	3	Malnutrition (Marasmus, Kwashiorkor, Obesity, epidemic dropsy).	3	Discuss Malnutrition.(CO-1,2,5)	Discussion, review of the diseases	Online Assignment:
	4	Mechanical & chemical digestion and absorption - Digestive system of man.	3	Illustrates the anatomy and physiology of digestive system of man.(CO-1,2,4)	Demonstrative Lecture, YouTube Videos	Physiology of ruminating stomach.

	5	Digestion of carbohydrate, protein and fat. Absorption and assimilation of digested food materials.	4	Relates the Digestion of food materials.(CO-2,4)	Collaborative Lecture, PPT	
	6	Physiology of ruminating stomach.	2	Recall the Physiology of ruminating stomach.(CO-1,3)	Panel/Expert Lecture, Video	
<b>II</b>	<b>Respiration,Osmo-&amp; thermoregulation(18 Hrs.)</b>					
	1	Respiration - Respiratory organs, Respiratory pigments.	3	Explain the Respiratory organs, and Respiratory pigments.(CO-1,2)	Blended learning, Brainstorming	Class Test: Slip Test
	2	Respiratory system of man-transport of O <sub>2</sub> and CO <sub>2</sub> , oxygen dissociation curve, Bohr's effect.	5	Discuss the anatomy and physiology of Respiratory system of man. (CO-1,2,4)	Demonstrative Lecture, PPT, Team teaching	Internal Test I (1,2) Quiz I (1,2)
	3	Chloride shift, Anaerobiosis, Respiratory Quotient.	3	Explore the process of Chloride shift, Anaerobiosis and Respiratory Quotient.(CO-2,3,5)	Chalk and Talk, Discussion, PPT	Assignment: Mind map - Respiratory organs & pigments.
	4	Osmoregulation:Osmoconformers, Osmoregulators, Osmoregulation in crustaceans, fishes and mammals.	4	Recognize the process of Osmoregulation.(CO-2,3)	Inquiry based Lecture	Internal Test II (3,4,5) Quiz II (3,4,5)
	5	Thermoregulation -poikilotherms and homeotherms, thermoregulatory Mechanisms.	3	Explain thermoregulatory mechanisms of Poikilotherms and homeotherms. (CO-2,3,4)	Interactive teaching, Jigsaw	
<b>III</b>	<b>Circulation and Excretion(18 Hrs.)</b>					
	1	Circulation - composition blood and lymph, myogenic and neurogenic heart, structure of human heart.	4	Differentiate myogenic and neurogenic heart. Explain the Structure of human heart (CO-1,2,3)	Lecture, Flipped learning, PPT, You tube	Internal Test I Quiz I
	2	Heart beat - origin and conduction, pace maker, cardiac cycle and ECG, blood pressure.	4	Discuss the Heartbeat, Pace maker, cardiac cycle, ECG, blood pressure.(CO-2,3,5)	Lecture, PPT, Blended learning	Assignment on Structure of heart
	3	Heart diseases: artherosclerosis, acute coronary occlusion, Myocardial infarction.	2	Explain the causes and symptoms of Heart diseases.(CO-2,5)	Lecture, You tube, PPT, Peer group teaching	Mind map on cardiac cycle
	4	Excretion - patterns of excretion, excretory organs in invertebrates.	3	Recall the process of Excretion.(CO- 1,3,4)	Lecture PPT, Inquiry learning	Class test:

	5	Structure of kidney in man, nephron, counter current mechanism of urine formation.	3	Discuss the structure and functions of kidney in man. (CO-1,2,3)	Lecture PPT, Video class	Excretion
	6	Composition of urine. Nephritis and Dialysis.	2	Recall the Composition of urine, Nephritis and Dialysis.(CO-2,5)	Lecture, PPT, You tube	
IV	Muscle andNeurophysiology(18 Hrs.)					
	1	Muscle physiology - types of muscles, ultrastructure and properties of skeletal muscle.	4	Explain the types of muscles, ultrastructure and properties of skeletal muscle.(CO- 1,2)	Lecture, PPT	Internal Test I&Quiz II (1, 2, 3)
	2	Mechanism of muscle contraction and Rigor mortis.	4	Discuss the mechanism of muscle contraction and Rigor mortis. (CO- 2,3,5)	Lecture, PPT, Group discussion.	
	3	Structure and types of neurons, neurotransmitters.	2	Explain Structure of Nervous system and a neuron. (CO-1,4)	Lecture, PPT, Video.	Internal Test II&Quiz II (4,5,6)
	4	Conduction of nerve impulse through myelinated and non-myelinated nerve and synapse.	3	Illustrate the conduction of nerve impulse through synapse and neuro muscular junction.(CO- 2,3,4)	Lecture, PPT, You tube.	
	5	Reflex action.	1	Explain Reflex action(CO-2,4)	Lecture, PPT	
	6	Receptors - types, physiology of phonoreception.	4	Describe the structure and function of eye and ear.(CO-1,2,4)	PPT, Peer group teaching	
V	Endocrine and Reproductive Physiology (18 Hrs.)					
	1	Endocrine physiology - hormones and pheromones.	2	Discuss hormones and pheromones.(CO-2,3,4)	Cooperative Lecture & Group discussion	Class Test: Open book test Assignment: Mind map – Endocrine glands.
	2	Hypothalamus and endocrine glands - pituitary, thyroid, parathyroid, adrenal, islets of Langerhans.	5	Explainendocrine glands.(CO-1,2,4,5)	Inquiry based Lecture, PPT	
	3	Biological clock and biological rhythms.	2	Discuss the biological clock and biological rhythms.(CO-2,3,4)	Interactive Lecture, Video	Internal Test II Quiz II  Assignment: Hormonal
	4	Reproductive physiology - male reproductive system. Female reproductive system,	4	Recall the structure of reproductive system.(CO-1,2,3,4)	Lecture, PPT, Discussion,	

		structure of graffian follicle.			Video	regulation of menstruation
	5	Menstrual cycles and menopause.	2	Recognize sexual cycles.(CO- 2,3,4)	Lecture, PPT, Discussion	
	6	Hormonal regulation of menstruation, pregnancy and lactation.	3	Explain the hormonal regulation of menstruation, pregnancy and lactation.(CO-2,3,4)	Lecture, PPT	
Course instructor					Head of the Department	
Dr. S. PrakashShoba			Dr. S. Mary MettildaBai		Dr. F. BriscaRenuga	



**Semester V**  
**Name of the course - Biotechnology**  
**Course Code: ZC2052**

**Major Core VI**

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

### Objectives

1. To inculcate the basic concepts and various techniques pertaining to biotechnology.
2. To provide interdisciplinary skills for research and employability in biotech industries.

### Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	explain the basic concepts of biotechnology and nanotechnology.	PSO - 1	R
CO - 2	recite DNA, hybridoma technology, tissue engineering and applications of nanotechnology.	PSO - 1	U
CO - 3	apply appropriate tools and techniques in biotechnological manipulation and problems ethically.	PSO - 2	Ap
CO - 4	examine the transgenic animals, microbial and biotechnological products.	PSO - 3	An
CO - 5	prioritize biotechnological techniques for the welfare of environment and society.	PSO - 4	E

### Teaching Plan with Modules

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

Unit	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>		<b>Genetic Engineering (18 Hrs.)</b>				
	1	Scope of biotechnology, Genetic Engineering- Enzymes for cutting and joining DNAs, cloning vectors - pBR322, SV40, Ti plasmid.	5	Explain the Genetic Engineering. (CO-1,2,3)	Chalk and talk, PPT, Peer teaching	MCQ, Mind Map, Class Test
	2	<i>In vitro</i> construction of rDNA, Introduction of rDNA into host cell - selection of recombinants. DNA library.	4	Discuss the methods of rDNA technology. (CO-1,2,3)	Lecture, PPT, Interaction	
	3	Molecular markers- RAPD and RFLP. Polymerase Chain Reaction (PCR). Southern blotting.	5	Recall the Molecular markers, PCR and sequencing techniques. (CO-1,3,5)	Lecture, PPT, Demonstration	Internal Test I (1, 2, 3 & 4)  Quiz I
		DNA sequencing - Maxam and Gilbert's	4	Recognize DNA sequencing: Sanger's	PPT, Video,	

	4	s method– Sanger’s.		method. (CO-3,5)	Group discussion	Assignment
	<b>Cell culture(18 Hrs.)</b>					
	1	Culture media - cell culture technique.	3	Explain the different types of culture media, their ingredients and cell culture technique. (CO-1,4,5)	Lecture, PPT, Demonstration	Flow chart, Mind map Internal Test I & Quiz I (1,2 & 3)
	2	Establishment of cell culture – primary and sub-culture - Explant culture, callus culture.	3	Demonstrate primary, Explant and callus culture. (CO-1,4,5)	Lecture, Demonstration	
	3	Somatic hybridization and micro-propagation.	5	Discuss Somatic hybridization and micro-propagation. (CO-1,4,5)	PPT, Peer teaching	
	4	Cell lines - large scale culture of cell lines.	4	Identify Cell lines and comprehend large scale culture of cell lines. (CO-1,3,5)	Interactive Lecture, Demonstration	Internal Test II & Quiz II (4& 5)
	5	Organ culture – artificial skin and cartilage - 3D culture – <i>In vitro</i> organ development - embryo culture. Stem cells - characteristics, types and applications.	3	Differentiate and discuss organ culture and embryo culture. (CO-1,2,5)	Lecture, PPT Video, Group discussion	Assignment
<b>III</b>	<b>Transgenic animal technology (18 Hrs.)</b>					
	1	Transgenesis–methods of transgenesis, knockout gene, applications of transgenic animals.	4	Explain method soft ransgenesis and applications of transgenic animals.(CO-1,3,5)	Lecture, Group discussion, PPT	Class Test , MCQ
	2	Bioethics – ethical implications of transgenic animals	5	Outline bioethics (CO-1,5)	Lecture, PPT, Videos Peer teaching	Internal Test II& Quiz II (1, 2 3 & 4)
	3	<b>Hybridoma technology:</b> Production of Hybridoma, monoclonal antibodies: production and applications.	5	Identify the different steps involved in the production of monoclonal antibodies. (CO-2,4,5)	Lecture, PPT, Video	Assignment

	4	<b>Bioreactors:</b> stirred tank and air–lift bioreactor.	4	Discuss the common types of bioreactors. <b>(CO-3,4,5)</b>	Lecture, Peer teaching, YouTube videos	
<b>IV</b>	<b>Metabolite production, Bioremediation (18 Hrs.)</b>					
	1	Production - primary metabolite –L. glutamic acid and L. glutamine, secondary metabolite – penicillin, Biofuel- ethanol. Immobilization of enzymes and their applications.	5	Demonstrate the production of ethanol and penicillin. <b>(CO-3,4,5)</b>	Lecture, Mind Map, Question and answer session	MCQ, Class test, Open book test, Mind Map
	2	Biosensors – types and applications. Bacterial SCP and its applications. Sewage and waste water treatment.	4	Discuss biosensors and Comprehend SCP. <b>(CO-3,4)</b>	Lecture, PPT, Group Discussion	Internal Test I (1, 2&3)
	3	<b>Bioremediation:</b> Types, Degradation of Xenobiotics (hydrocarbon, pesticide). Super bug – construction and application. Biomining and bioleaching	5	Narrate the steps involved in bioremediation. <b>(CO-4)</b>	Lecture, PPT, Brainstorming	Quiz I
	4	Biocontrol – <i>Bacillus thuringiensis</i> . Biosafety: Possible dangers of Genetically Engineered Organisms (GEOs) and biohazard of rDNA technology.	4	Discuss biomining and biocontrol. <b>(CO-4)</b>	Lecture, PPT, Jigsaw	Internal Test II (4) Quiz II Assignment
<b>V</b>	<b>DNA applications (18 Hrs)</b>					
	1	Disease diagnosis–DNA probes, disease treatment–production of human insulin.	5	Discuss DNA probes, production of human insulin and gene therapy. <b>(CO-4,5)</b>	Lecture, PPT, video	Class test Mind Map MCQ Internal Test II & Quiz II (1 & 2)
	2	Gene therapy – types and methods.	2	Recall Gene therapy – types and methods.		Internal Test II (3 & 4)
	3	Finger printing and its application in forensic medicine. Human Genome Project.	5	Illustrate finger printing technology and human genome project. <b>(CO-4, 5)</b>	Lecture, Group discussion	

	4	Nanobiotechnology–Nano drug, Drug delivery system, DNA microarray, gene chip, Diagnosis and screening.	6	Comprehend the applications of nanotechnology. (CO-1,4,5)	Lecture, PPT, Brain stroming	Quiz II Assignment
<b>Course instructors</b>					<b>Head of the Department</b>	
Dr. A. Punitha			Dr. P.T. Arokya Glory		Dr. F. Brisca Renuga	

**Semester V****Major Core VII****Name of the course - Ecology and Toxicology****Course Code: ZC2053**

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

**Objectives**

1. To develop a deep understanding on the interaction between the environment and the living organisms.
2. To develop skills to assess the toxicants and its impacts, environmental standards and apply that knowledge to current environmental issues for wise environmental management.

**Course Outcomes**

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	define abiotic, biotic and limiting factors, community structure, ecological succession, wild life conservation and toxicants.	PSO - 1	R
CO - 2	comprehend the physical and chemical properties of environment, biological effects, biogeochemical cycles, wild life conservation, environmental pollution and toxicology.	PSO - 1	U
CO - 3	identify the biotic factors, characteristics of communities, endangered species and causes for environmental problems.	PSO - 2	Ap
CO - 4	assess the structure and function of ecosystem, community, habitat for sustainable management of environmental system and for the remediation.	PSO - 3	An
CO - 5	evaluate the impact of environment changes on the biosphere.	PSO - 4	E
CO - 6	design and execute independent research in environmental science.	PSO - 4	C

**Teaching plan with Modules****Total Hours: 75 (Incl. Assignments & Test)**

Unit	Modules	Topics	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Introduction to ecology(15hrs)</b>					
	1	Scope - Branches of ecology, Autecology and synecology. Environment – atmosphere, lithosphere, hydrosphere and biosphere. Biological effects of temperature and light.	5	Explains the scope of ecology and biological effects of abiotic factors.(CO-1)	PPT, You tube links	MCQ, Short test, Online assignment
	2	Concept of limiting factors: Liebig's law of minimum, Shelford's law of tolerance.	2	Illustrate the concept of limiting factors.(CO-1)	PPT, Video	Internal Test I (1,2,3,4), Quiz I
	3	Inter specific relationship -	2	Identifies the species	Flipped learning,	

		mutualism, commensalism, antagonism - antibiosis, parasitism, predation and competition.		interaction.(CO-1)	PPT	
	4	Habitat ecology- adaptations of deep sea and desert living animals.	6	Relates the different organism living in different habitats. (CO-1)	PPT, Video	
<b>II</b>	<b>Ecosystem and Population ecology(15hrs)</b>					
	1	Ecosystem –Structure, abiotic and biotic factors. Functions - Detritus and grazing food chains, food web, trophic levels, energy flow, Linear and Y-shaped, ecological pyramids.	5	Describes the structure and function of ecosystem. (CO-1,4)	Video, PPT, mind map.	Quiz, Flow chart of biogeochemical cycles, Internal Test II (1,2,3) Quiz II Online assignments.
	2	Biogeochemical cycle – types, nitrogen and phosphorous cycle.	2	Explains the bio-geochemical cycle. (CO-1,2)	Video, PPT, Flow chart.	
	3	Population ecology - density, natality, mortality, age distribution, population growth, population equilibrium, population fluctuations, biotic potential, population dispersal and dispersion, regulation of population - density independent and density dependent factors, population interaction.	8	Describes the different characteristics of population. (CO-1,5)	PPT, Blended learning.	
<b>III</b>	<b>Community Ecology(15hrs)</b>					
	1	Concept of community, Community- structure, composition and stratification.	3	Illustrates the community structure and stratification. (CO-3,4)	Lecture, PPT, Inquiry based learning,	Internal TestII&QuizI Online Assignments Flow charts
	2	Ecological niche, Ecotone and Edge effect, Ecotype, Ecological indicators. Ecological succession - types, general process,	3	Differentiates ecological niche, ecotone and edge effect. (CO-4,5)	Flipped Classroom, PPT	
	3	Concepts of climax- theories of climax, patterns of succession. Ecological effects of dams, hydroelectric projects	3	Explains the ecological succession and climax community. (CO-4,5)	PPT, Video, Google jamboard, flow chart	
	4	Animal distribution – continuous and discontinuous. Parallelism, Endemism. Zoogeographical regions of world.	3	Describes the distribution of animals and outlines the Zoogeographical regions of world. (CO-3,5)	Video, PPT, mind map	
	5	Remote sensing and its applications in agriculture, fisheries, forest management and	3	Describes the applications of remote sensing in various fields(CO-5)	Video, Discussion, lecture with PPT	

		food management.				
IV	Toxicology(15 hrs)					
	1	Scope and sub-divisions of toxicology. Toxicants – classification, toxicity - lethal, sublethal, LC <sub>50</sub> , and LD <sub>50</sub> .	3	Classifies toxicants and explains their toxicity. (CO-2,6)	Video, PPT, Red List chart	Internal Test I & Quiz I (1,2,3).
	2	Toxic agents and their mode of action – toxico kinetics – toxico dynamics – toxic responses - ADME.	3	Explains the mode of action of toxic agents(CO-2,5)	Flipped classroom, Video, PPT	Class test: MCQ using Google forms
	3	Toxic effects of heavy metals, pesticides, carcinogens, food additives, cosmetics, micro plastics and radiations. Factors affecting toxicity.	3	Identifies environmental pollutants, toxicants and contaminants. (CO-4,5)	PPT, Video, Diagram	
	4	Dose-effect and dose-response relationship - acute toxicity, chronic toxicity reversible and irreversible effects	3	Illustrates the behaviour of toxicants. (CO-4,5)	PPT, Debate, Group discussion	
	5	Toxicity bioassay – <i>invivo</i> experiments – determination of LC <sub>50</sub> and LD <sub>50</sub> , <i>exvivo</i> experiments – haematological and biochemical parameters. Application of toxicology.	3	Explains various toxicity assays and experiments (CO-2,4,5)	PPT, Flow Chart	
V	Ecotoxicology(15hrs)					
	1	Types – measurement of ecotoxicological effects. Pollution - pollutants, xenobiotics,	4	Differentiates the types of pollutants (CO-2,3)	PPT, Video, Flash card	Internal Test I (2,3) & Quiz I (2,3)
	2	greenhouse effect, ozone depletion, acid rain, photochemical smog,Bhopal episode, Chernobyl disaster, BOD, Eutrophication, Red tide,	4	Identifies the effects of climate change on the environment. (CO-2,3)	Video, PPT, Mind map	Class test Formative Assessment II (1,4)& Quiz II(1,4)
	3	Minamata disease, bioaccumulation, biomagnifications, biotransformation, bio monitoring.	4	Elucidates the results of pollution and identifies the issues (CO-2,3)	PPT, Video, Group discussion	
	4	Waste water treatment and solid waste management. Environmental Auditing and Environmental Impact	3	Explains the problems and solutions of waste water management and elucidates the need for EIA. (CO-3,4)	PPT, Video, Flipped classroom	

		Assessment (EIA).				
<b>Course Instructors</b>					<b>Head of the Department</b>	
<b>Dr. Vinoliya Josephine Mary</b>			<b>Dr. Jeni Chandar Padua</b>		<b>Dr. F. Brisca Renuga</b>	



**Semester V****Major Practical III****Name of the course – Physiology and Biotechnology****Course Code: ZC20P3**

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

**Objectives**

1. To develop skills to perform physiological experiments and report the results.
2. To train the students to familiarize biotechnological experimental protocols.

**Course Outcomes**

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	Select appropriate methods in physiology and biotechnology experiments.	PSO - 1	R
CO - 2	describe the principles of analytical instruments and its uses in physiology and biotechnology.	PSO - 2	U
CO - 3	demonstrate scientific experiments and interpret the biological data.	PSO - 3	Ap
CO - 4	estimate the effect of abiotic factors on physiological process and quantify genomic DNA.	PSO - 2	An
CO - 5	select appropriate physiological and biotechnological techniques to analyse the biological samples.	PSO - 4	E

**Teaching plan with Modules****Total Hours 30 (Incl. Demonstration, Observation & Test)**

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Physiology (30 Hrs.)</b>					
	1	Rate of oxygen consumption in a fish.	2	Design an experiment to find the rate of oxygen consumption of an aquatic organism. (CO – 3).	Hands on practical	Continuous Performance based assessment.  Internal Assessment
	2	Effect of temperature on the opercular movement of a fish and calculation of Q <sub>10</sub> .	2	Evaluate the effect of temperature on the rate of enzyme activity (CO – 1).	Hands on practical	
	3	Estimation of salt loss and salt gain in a fresh water fish	2	Assess salt loss and salt gain in a fresh water fish	Hands on practical	

	4	Identification of nitrogenous excretory products – ammonia, urea, uric acid	2	Identification of nitrogenous excretory products (CO – 1).	Hands on practical	
	5	Action of salivary amylase in relation to pH.	2	Assess the effect of pH on the rate of enzyme activity (CO – 1)	Hands on practical	
	6	Action of salivary amylase in relation to enzyme concentration.	2	Analyse the effect of enzyme concentration on the rate of activity (CO – 1).	Hands on practical	
	7	Estimation of haemoglobin-demonstration	2	Estimate the amount of hemoglobin in human blood sample (CO – 2).	Hands on practical	
	8	Counting of blood cells using haemocytometer (Demonstration).	2	Demonstrate blood cell counting using hemocytometer (CO-3)	Demonstration	
	9	Determination of blood clotting time (Demonstration).	2	Demonstrate blood clotting time (CO-3)	Demonstration	
	10	Determination of Body mass index of students.	2	Assess Body mass index of students. (CO-3)	Hands on practical	
		Haemoglobin, ECG, kwashiorkor disease, Obesity, Sphygmomanometer, Kymograph, Cardiac muscle, Striated and Non-striated muscle, Simple muscle curve.		Identify the apparatus/ Equipments and explain its application. Identify the slides/ charts and comment on it (CO-2)	Observation	
<b>Practical Incharge</b>					<b>Head of the Department</b>	
Dr. S. Prakash Shoba			Dr. S. Mary Mettilda Bai		Dr. F. Brisca Renuga	

### Teaching plan with Modules

**Total Hours 30 (Incl. Demonstration, Observation & Test)**

Unit	Section	Description	Hours	Learning Outcome /CO addressed	Pedagogy	Assessment
<b>II</b>	1	Isolation of genomic DNA from <i>E. coli</i> .	4	Isolate the genomic DNA from <i>E. coli</i> . (CO-1)	Practical	Continuous Performance based assessment.
	2	DNA–Agarose Gel Electrophoresis (Demonstration)	3	Separate DNA by Agarose gel Electrophoresis. (CO-1)		

3	Estimation of DNA by Diphenylamine (DPA) Method	2	Estimate the DNA estimated by DPA method	Practical	Internal Assessment
4	Measurement of degradation: Estimation of COD in sewage.	2	Estimate the COD of sewage	Practical	
5	Measurement of Bioremediation: Estimation of BOD in Sewage.	4	Estimate the BOD of sewage water	Practical	
6	Immobilization of enzyme (Amylase/Invertase/Protease) using sodium alginate.	2	Explain the Enzyme immobilization and its application	Practical	
7	Polymerase Chain Reaction– Demonstration.	2	Explains the principles of PCR	Demonstration	
8	Production of Hybridoma and Monoclonal antibodies– Flowchart.	2	Explain the Production of Hybridoma and Monoclonal antibodies	Demonstration	
9	Isolation of B and T lymphocytes using kits.	2	Demonstration isolation method of B and T lymphocytes	Demonstration	
10	Animal cell culture media preparation.	2	Explain the preparation method of Animal cell culture media	Demonstration	
	<b>Models/Charts/Photos</b> BR3 22, Recombinant DNA, Electroporation unit, Southern blotting, RFLP, Dolly, Fermenter, Human genome sequence, Penicillin, Bio – gas production.	5	Discriminate biotechnological methods and identify nano-products. <b>(CO-1,2,3,4)</b>	Flowcharts, instruments, Figures	
<b>Course instructor</b>					<b>Head of the Department</b>
Dr. A. Punitha		Dr. P.T.Arockia Glory		Dr. F. BriscaRenuga	

**Semester V& VI****Major Practical IV****Name of the course: Ecology and Toxicology & Organic Evolution****Course Code: ZC20P4 (Conducted during Semester V & VI)**

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

**Objectives**

1. To investigate the relationship between the organisms and their environment.
2. To develop skill to identify variation, speciation and phylogeny.

**Course Outcomes**

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the protocols to analyze water quality and variation in finger prints.	PSO - 1	R
CO - 2	identify the zooplankton, serial homology, mutant forms of <i>Drosophila</i> , mimicking animals and fossils.	PSO - 2	U
CO - 3	interpret the evolutionary concepts, natural selection, variations, gene frequency and prodigality of nature through experiments.	PSO - 3	Ap
CO - 4	analyze physical and chemical factors of natural ecosystem and lethal concentration of pesticide.	PSO - 4	An

**Teaching plan with Module****Total Hours 60 (Incl. Demonstration, Observation & Test)**

Units	Module	Topic	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Ecology and Toxicology (30 Hrs.) V semester</b>					
	1	Detection of transparency of water by Secchi disc.	3	Measure transparency of water. <b>(CO-1)</b>	Demonstration & Observation	Continuous Performance based assessment.
	2	Quantitative estimation of oxygen in water samples.	3	Estimate oxygen content in water samples. <b>(CO-1)</b>	Demonstration & Observation	
	3	Estimation of salinity of water samples.	3	Estimate salinity of water samples. <b>(CO-1)</b>	Demonstration & Observation	
	4	Estimation of CO <sub>2</sub> in water samples.		Estimate the CO <sub>2</sub> in water samples.. <b>(CO-1)</b>	Demonstration & Observation	
	5	Mounting of planktons	3	Identify planktons and prepare temporary	Demonstration & Observation	Internal Assessment.

				slides.(CO-2)		
6	Study of food chain and food web in a terrestrial ecosystem.	3	Identify the producers and consumers in an ecosystem and how they interact. (CO-4)	Field visit		
7	Estimate insect population using quadrat method.		Estimate insect population of a study area using quadrat method. (CO-4)	Field visit		
8	Preparation of different concentrations of toxicants (percentage, ppt, ppm).		Prepare different concentrations of toxicants (CO-4)	Demonstration & Observation		
9	Determination of LC <sub>50</sub> of a pesticide (toxicity curve method).	3	Determine LC <sub>50</sub> of a pesticide. (CO-4)	Demonstration & Observation		
10	Study of pond ecosystem and field report of the visit (compulsory).	3	Document the field trip. (CO-4)	Field Trip/ virtual visit		
11	<b>Museum specimens/ Slides/ Models/ Charts:</b> Water sampler, Water cycle, Ecological Pyramids, Energy Flow, Edge effect, Mutualism - Hermit crab and Sea anemone, Commensalism - <i>Echeneis</i> and Shark, Parasitism - Sacculina on Crab, Competition – prey and predator, Cyclomorphosis - <i>Daphnia</i> .	9	Identify and Explain water sampler, ecological pyramids, Mutualism, Commensalism, Competition, Cyclomorphosis. (CO-2,4)	Observation of the spotters and specimen		
<b>Course Instructor</b>				<b>Head of the Department</b>		
<b>Dr. Vinoliya Josephine Mary</b>			<b>Dr. JeniChandar Padua</b>		<b>Dr. F. BriscaRenuga</b>	

**Semester : VI** **Major Core VIII**  
**Name of the Course : Developmental Biology**  
**Course code : ZC2061**

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

### Objectives

1. To impart knowledge on the sequential changes during the embryonic development of animals and human reproductive health.
2. To develop skills on observation of developmental stages, regeneration and nuclear transplantation.

### Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	define the concepts of reproduction, embryonic development, nucleo-cytoplasmic interaction and birth control.	PSO – 1	R
CO - 2	outline the patterns of cleavage, morphogenetic movements, fate map, the reproductive disorders and treatment.	PSO - 1	U
CO - 3	execute the principles of embryology in applied sciences and birth control measures.	PSO – 3	Ap
CO - 4	analyze clinical implications of the development, gender based reproductive disorders and intervening mechanism.	PSO - 3	An

### Teaching Plan with Modules

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

Units	Modules	Topics	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Reproduction(18 Hrs.)</b>					
	1	Sexual reproduction Spermatogenesis, Structure and types of sperm.	4	Explains the process of spermatogenesis. (CO-1)	PPT, You tube videos	MCQ, Short test, labelling diagrams, preparing comparative charts, Quizziz,
	2	Oogenesis, types of egg, egg membranes, Structure of egg-frog, chick and human.	5	Differentiates the structure of sperm and egg of frog, chick and human. (CO-1)	Comparative images and charts, You tube links	

	3	Fertilization -types, chemical and cytological factors involved in fertilization, physiological changes in fertilization, significance, Prevention of polyspermy	5	Identifies the cytological and physiological changes during fertilization. <b>(CO-1)</b>	PPT, video Lecture	mind map
	4	Asexua reproduction. Parthenogenesis - types and significance.	4	Illustrates the process of parthenogenesis. <b>(CO-1)</b>	PPT, video Lecture	

## **II Cleavage and Gastrulation(18 Hrs.)**

	1	Cleavage: Planes and patterns of cleavage, factors controlling cleavage, cleavage and blastulation in frog.	4	Relates the different planes and patterns of cleavage. <b>(CO-2)</b>	Video links and PPT	Quiz through google classroom, Quiz through slido.com  Online assignments Mind map on development of organ systems Formative Assessment I
	2	Fate map of frog. Morphogenetic movements.	3	Relates the morphogenetic movements during blastulation. <b>(CO-2)</b>	Video lesson, Lecture, PPT	
	3	Gastrulation in frog.	2	Explores the process involved in gastrulation. <b>(CO-2)</b>	PPT.	
	4	Organizer –Spemann’s experiments - organizer in amphibian embryo, embryonic induction - neural induction.	6	Records how the different organs are developed. <b>(CO-3)</b>	PPT, Video on you tube.	
	5	Competence. Gradient theory - gradient system - types experimental evidences mechanism.	3	Recognize the development of digestive system. <b>(CO-3)</b>	Lecture using PPT	

## **III Organogenesis(18 Hrs.)**

	1	Development of eye, heart, digestive system in frog	4	Recognize the development of digestive system. <b>(CO-2)</b>	Video links and PPT, Lecture	MCQ, Flow chart, Mind map, Short Answer Test,  Formative assessment II Quiz II, Online assignment
	2	Extra embryonic membranes - development of fetal membranes.	3	Relates the development of fetal membranes. <b>(CO-2)</b>	Video lesson, Lecture using PPT	
	3	Placenta in mammals - classification, functions	2	Explores the process involved in gastrulation. <b>(CO-2)</b>	PPT.	
	4	Development Stemcells, Preservation of cord blood	6	Records the development of Stem cells, Preservation of	Narrative PPT –Screen	

		stem cells.		cord blood stem cells.. (CO-3)	capture using Camtasia tool, Develop and upload video on you tube.	
	5	Principles of collections of Umbilical cord, gametes and embryos.	3	Explore the collections of Umbilical cord. (CO-3)	Lecture using PPT	

**IV Metamorphosis and Regeneration (18 Hrs.)**

	1	Metamorphosis: Types, Insect and Amphibian metamorphosis.	3	Explores the process of metamorphosis. (CO-4)	Flow Chart using PPT, Seminar by student Video link	Quiz through quizziz, Quiz through mentee.com  Online assignments Flow chart of metamorphosis Formative Assessment II
	2	Hormonal control of metamorphosis in Insect and Amphibian.	4	Records how hormones control metamorphosis. (CO-4)	Lecture with PPT.	
	3	Regeneration: types, regeneration in Planaria, Amphibia and human liver.	3	Recognize the regeneration process in Planaria, amphibian and human. (CO-4)	Seminar by student Interactive PPT.	
	4	Factors influencing regeneration, physiological changes involved in regeneration.	3	Identifies the factors involved in regeneration. (CO-4)	Lecture with PPT online video lesson.	
	5	Nucleo - cytoplasmic interaction- Acetabularia. Ageing-concepts and theories	3	Explore the concepts and theories of ageing	Chalk and Talk. Lecture	
	6	Syntheticbiology–syntheticlife.	2	Explains synthetic biology–synthetic life.	Lecture, PPT	

**V Embryological Techniques(18 Hrs.)**

	1	Infertility–causesanddiagnosticparameters–hormonalimbalance,PolyCysticOvarianDiseases(PCOD).Rhfactorsandincompatibility	2	Explains infertility causes and diagnosis. (CO-3)	Open board, Animation videos	Quiz through google classroom, Flow Chart Formative
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	2	Invitrofertilization,artificialin semination,cryopreservationof sperm and ovum- test tube babies – amniocentesis.	4	Recalls the causes of infertility. (CO-3)	PPT	Assessment I Quiz I, Online assignment,
	3	Teratogenesis-agents and their effects.	4	Identifies teratogenesis-agents and their effects. (CO-3)	Online diagrams and open board	
	4	Cryopreservation of sperm and ovum - test tube babies – amniocentesis.	3	Illustrates the process of cryopreservation. (CO-4)	Lecture with PPT.	
	5	Birthcontrol- physical barriers-contraceptive devices- IUCD, surgicalmethod.	2	Relates the different contraceptive devices. (CO-4)	Video lesson	
	6	Hormonal and therapeutic methods of birth control	3	Explores the hormonal and therapeutic methods of birth control. (CO-4)	Lecture with PPT	
Course instructor					Head of the Department	
Dr. S. Prakash Shoba			Dr. A. Shyla Suganthi		Dr. C. Josephine Priyatharshini	

Semester : VI  
 Name of the Course : Immunology and Microbiology  
 Course code : ZC2062

Major Core IX

No.ofhours/week	No.ofcredits	Totalnumberof hours	Marks
6	6	90	100

#### Objectives

1. To enable the students to know about the immune system and the microbes around us.
2. To develop the analytical skill on invading microbes and immune response.

#### CourseOutcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO- 1	define the components of the immune system, mechanisms of immune response, microbial diversity, infectious diseases and microbial application.	PSO-1	R
CO- 2	Discuss the types of immune cells, immune response , taxonomic classification of microbes and their role in industries.	PSO-1	U
CO- 3	apply the concepts of Immunology and Microbiology for interdisciplinary research and life-long learning.	PSO-3	Ap
CO- 4	Analyze the role of microbes in food, air, water, soil and immune response to infection.	PSO-4	An

#### Teaching Plan with Modules paraphrase Total Hours: 90 ((Incl. Assignments & Test)

Units	Modules	Topics	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
I	Immunity and Lymphoid organs (18 Hrs.)					
	1	History and scope.	2	Paraphrase the history of immunology. (CO-1)	Interactive Lecture.	Class test, online Assignment,
	2	Types of immunity - Innate, acquired, passive and active.	3	Discriminate the types of immunity. (CO-1)	Lecture-with examples, Models.	

	3	Cells of immune system (T cells and B cells, macrophages).	4	Construct lymphoid and myeloid lineage and summarize T cells, B cells and macrophages.	Lecture-discussion, PPT, video	Quizzes, Internaltest1 & Quiz I
	4	Primary and Secondary lymphoid organs - Thymus, Bone marrow, Bursa of Fabricius.	4	(CO-1)Relate Primary and Secondary organs and their functions. (CO-1)	PPT, Demonstration (mice), video	
	5	Spleen, Lymph node, Mucosa Associated Lymphoid Tissue. Lymphoid and myeloid lineage.	5	Categorize Primary and Secondary organs and its functions. (CO-1)	PPT, Video Blended classroom	
II	Antigen and antibodies (18 Hrs.)					
	1	Haemopoietic stem cells and haemopoiesis	4	Identify Haemopoietic stem cells. (CO-2)	Lecture-Chalk and Talk, PPT.	Internal test I – 3,4 Quiz I  Internal test II – 1,2 Quiz II
	2	Antigen. Immunogens, hapten and adjuvants	4	Describe antigens, Immunogens, hapten and adjuvants. (CO-2)	Blended classroom, Video	
	3	Immunoglobulin: Immunoglobulin classes, structure and functions of IgG.	5	Sketch the structure ofImmunoglobulins. (CO-2)	Formal Lecture, PPT, Peer group discussion, models.	
	4	Antigen – Antibody reactions. Secondary antibody, purification of antibody.	5	Explain antigen – antibody reactions and purification of antibody. (CO-2)	Interactive classroom, PPT	
III	Immune Response (18 Hrs.)					
	1	Immune Response: Primary and secondary immune response.	3	Categorize immune response. (CO-2)	Storytelling Lecture, PPT, videos	Short test, Open book test, Class
	2	Immunity to bacterial	5	Enumerate humoral	Formal	

		infections - Humoral immune response, Cell-mediated immune response.		response. Illustrate cell mediated response. (CO-2)	Lecture, Group discussion	test, Internal test II – Quiz II
	3	Hypersensitivity: Allergens and types of hypersensitivity.	4	Summarize Allergens and types of hypersensitivity. (CO-2)	Interactive classroom	
	4	Autoimmunity - Rheumatoid arthritis.Immunobiotics– definition,respiratoryanddi gestiveailments.	4	Identify the causes, symptoms and treatment of Rheumatoid arthritis. (CO-2)	video, interactive classroom	
	5	Vaccines and Immunization schedule.	2	Indicate Immunization schedule. (CO-2)	PPT, Chart, Blended classroom	
IV	Microbiology (18 Hrs.)					
	1	History and scope of microbiology. Whittaker’s and Bergy’s classification of microbes.	4	Enumerate the history of microbiology. (CO-3)	PPT, Chart, Storytelling Lecture	Mind map, online Assignment Open book test, Internal test I, Quiz I
	2	Bacteria: structure of <i>E. coli</i> , bacterial growth kinetics.	3	Explain the structure of <i>E. coli</i> and bacterial kinetics.(CO-3)	Interactive Lecture, PPT, Video	
	3	Culture media. Culture techniques - batch culture and continuous culture (chemostat and turbidostat).	5	Differentiate and apply culture media. Describe different culture technique. (CO-3)	Lecture- Demonstrati on, Group discussion, Video	
	4	Virus: structure (SARS and T4phage) – reproduction of T4phage (lysogenic and lytic).	4	Illustrate the structure of Virus and its reproduction. (CO-3)	Lecture, Video, PPT	
	5	Synthetic Biology	2	Outline Synthetic Biology. (CO-3)	Interactive Lecture, PPT	
V	Food Microbiology, Industrial Microbiology and Medical Microbiology (18 Hrs.)					
	1	Food Microbiology - Food poisoning, food spoilage and preservation.	4	Explain food poisoning and spoilage. (CO-5)	Formal Lecture, PPT, Peer group discussion.	Short test, Class test, Internal test II Quiz II

	2	Industrial microbiology: Scope and applications– Fermentation process– Fermenter-Wine and vinegar production	4	Interpret Wine and vinegar production in the industries. (CO-5)	Storytelling Lecture, Models, PPT, videos	
	3	Medical microbiology: Bacterial diseases- Leptospirosis, Syphilis, Pneumonia,	4	List bacterial diseases. (CO-4)	Interactive classroom, PPT	
	4	Viral diseases -COVID - 19, Herpes, Hepatitis B, Rabies	4	Discuss viral diseases. (CO-4)	Inquiry based Lecture, Group discussion	
	5	Fungal diseases Tineacorporis, Mucormycosis Mycotoxycosis and Aspergillosis.	2	Categorize fungal diseases (CO-4)	Interactive Lecture, PPT, Peer group discussion.	
Course instructor					Head of the Department	
Dr. A. Punitha			Dr. S. Mary Mettilda Bai		Dr. F. BriscaRenuga	

**Semester : VI**  
**Name of the Course: Organic Evolution**

**Major Core X**

**Course Code: ZC2063**

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

### Objectives

1. To discern the evolutionary significance of animals and origin of species.
2. To provide skills for tracing fossil records, interpreting animal evolution and analysing phylogenetic tree.

### Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the concepts of evolution, origin of life, geological time scale, natural selection, speciation and evidences of evolution.	PSO - 1	R
CO - 2	discuss on the theories of evolution, isolation, variation, speciation, fossils and phylogram.	PSO - 2	U
CO - 3	generalise experimental and natural evidences in support of evolution, genetic equilibrium, speciation and rate of evolution..	PSO -3	Ap
CO - 4	analyse the major transitions in evolution and phylogeny of animals.	PSO - 3	An
CO - 5	assess and report the evidences in support of natural selection, speciation and evolution.	PSO - 4	E

### Teaching Plan with Modules

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

Unit	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Concepts and Evidences of Evolution (15 Hrs.)</b>					
	1	Origin of life - Theories and experiments.	4	Explain the theories and experiments related to origin of life. <b>(CO-1)</b> .	Flipped learning	Short test, Mind map MCQ, Class Test  Formative assessment I Quiz I (1&2)  Assignment
	2	Evidences insupport of evolution – morphology and comparative anatomy, embryology.	7	Comparing the process of evolution based on morphology, comparative anatomy and embryology. <b>(CO-2)</b> .	Blended learning	
	3	Evidences insupport of evolution – Physiology and biochemistry,	2	Summarize the process of evolution based on Physiology and	PPT, You Tube Videos	

		palaeontology.		biochemistry, palaeontology. (CO-4).		Formative assessment II Quiz II (3 & 4)
	4	Geological time scale.	2	Correlate the age of earth and the diversity of animals at each age. (CO-4)	Peer group teaching	
II	Theories of Evolution (15 Hrs.)					
	1	Evolution:Lamarckism, Neo-Lamarckism.	3	Explain the theory of Lamarckism, Neo- Lamarckism. (CO-1).	Debate	Short test, MCQ, Flow chart  Internal test I Quiz I (1, 2, 3, & 5)  Assignment Internal test II Quiz II (4)
	2	Darwinism, Neo- Darwinism.	3	Describe the theory of Darwinism, Neo- Darwinism. (CO-2).	Peer group teaching	
	3	Mutationtheory of De Vries. Modern synthetic theory. Variation – types, sources	4	Categorize mutation based on its occurrence (CO-3).	KWL Know , Want to Know, Learned	
	4	Hardy-Weinberg law and elemental forces of evolution - mutation, combination, hybridization, genetic drift, Founder’s principle, polyploidy.	3	Solving the problem and identify the gene frequency. (CO-4).	Discussion	
	5	Natural selection – Stabilizing, directional and disruptive selection.	2	Summarizing the role of natural selection and the mechanism. (CO-4).	Jigsaw	
III Isolating mechanisms, Species Concept and Speciation (15 Hrs.)						
	1	Isolating mechanisms:Types, origin and evolution of isolating mechanisms, role of isolation inspeciation.	3	Explain the role of isolation inspeciation. (CO-2).	Flipped learning	Short test, Mind map, MCQ  Formative assessment I Quiz I (1, 2, 3, 4 & 5)  Assignment
	2	Species concept - morphological, genetic and biological. Salient features of species,	3	Distinguish species, sibling species, sub species and demes. (CO- 2).	Group discussion	
	3	Sibling species, sub species, demes. Speciation - Phyletic and	2	Comprehend morphological, genetic and biological Species concept. (CO-2).	Peer group	

	4	True speciation, mechanism of speciation.	3	Illustrate the mechanism of speciation. <b>(CO-4).</b>	Blended learning	
	5	Adaptive radiation (Darwin finches) - Convergent and divergent evolution.	4	Compare the different patterns of speciation. <b>(CO-3).</b>	Q& A method	
<b>IV</b>	<b>Phylogenetic analysis (15 Hrs.)</b>					
	1	Phylogenetic analysis: Tools for sequence alignment–BLAST, FASTA.	4	Explain the various tools for sequence alignment . <b>(CO-1).</b>	Blended learning	Short test, MCQ Internal test II Quiz II (1, 2,3 )  Assignment
	2	Methods of phylogenetic analysis - phenetic and cladistic; phylogenetic trees.	4	Summarize the methods of phylogenetic analysis. Explain phylogenetic trees. <b>(CO-3).</b>	Blended learning,	
	3	Methods for determining evolutionary trees – maximum parsimony, distance and maximum likelihood.	7	Evaluating the methods for determining evolutionary trees <b>(CO-4).</b>	Flipped learning	
<b>V</b>	<b>Trends in Evolution, Mimicry and Colouration (15 Hrs.)</b>					
	1	Trends in Evolution: Modes of evolution–micro, macro and megaevolution.	3	Classify the modes of evolution–micro, macro and megaevolution. <b>(CO-5)</b>	Group discussion	Short test, MCQ  Internal test II Quiz II (1, 2, 3, 4 & 5)  Assignment
	2	Heterochrony - Paedomorphosis and Peramorphosis.	1	Define and explain Paedomorphosis and Peramorphosis. <b>(CO-2)</b>	Flipped learning	
	3	Rate of evolution. Human Evolution – organic, cultural and future evolution.	6	Evaluate the rate of evolution. Explain the organic, cultural and future evolution of man. <b>(CO-5)</b>	Peer group teaching	
	4	Mimicry and colouration.	2	Explain the significance of mimicry and colouration in evolution. <b>(CO-5)</b>	Group discussion	



	5	Extinction - types, causes and significance.	3	Summarize the types, causes and significance of extinction. <b>(CO-2)</b> .		
<b>Course instructors</b>					<b>Head of the Department</b>	
Dr. Jeni Chandar Padua		Dr. P.T. Arokya Glory		Dr. F. Brisca Renuga	Dr. F. Brisca Renuga	

**Semester : VI Major Elective III–(a)**  
**Name of the Course: Economic Zoology**  
**Course code : ZC2064**

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

**Objectives**

1. To acquaint the students with the applied aspects of Zoology.
2. To develop entrepreneurial skills in the area of applied zoological sciences.

**Course Outcome**

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO-1	Recall the importance of applied area of biological sciences.	PSO-3	R
CO-2	Explain the rearing techniques of economically important animals.	PSO-3	U
CO-3	apply the different strategies adopted in rearing of honey bee, lac insect, silkworm, fishes, fowls and dairy animals.	PSO-4	Ap
CO-4	Choose the profitable culture practices.	PSO-4	An
CO-5	Evaluate the profitability of animal farms.	PSO-4	E
CO-6	Extend the entrepreneurial skills in establishing animal farms.	PSO-4	C

**Teaching Plan with Modules**

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

Unit	Modules	Topics	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
<b>I</b>	<b>Apiculture and Lac culture(12 Hrs)</b>					
	1	Apiculture - scope, varieties of honey bees, bees and their society, communication in honeybees.	2	Describe the classification of honeybees and their society and communication of bees. <b>(CO-1)</b>	Jigsaw	Short test, Open book test, MCQ, Assignment
	2	Bee pasturage, food of honeybees, relationship between plants and bees. Methods of beekeeping-	2	Understand the food of and relationship between plants and bees, methods of bee	mind map, Inquiry based	Formative Assessment I (1, 2, 3, 4)

		primitive and modern.		keeping.(CO-2)		Quiz I Formative Assessment II (5)
	3	Economic importance of honeybee products-honey, bee wax, bee venom, pollen, royal jelly, and propolis. Enemies and diseases of honeybees. Honey extraction and processing.	3	Discuss the diseases of honey bees and evaluate honey bee products. (CO-2)	Flipped classroom, discussion	
	4	Steps involved in starting apiary. Funding sources for beekeeping projects	2	Explain the funding sources and the steps in starting apiary. (CO-5)	mind map, ppt	
	5	Lac culture - life history of lac insect- host plants-rearing of lac insect-processing of lac, composition of lac. Economic importance of lac.	3	Explain the Life history of lac insect, rearing, processing and composition of lac and their economic importance.(CO-2)	Integrated learning	
<b>II</b>	<b>Sericulture (12 Hrs)</b>					
	1	Scope, Silk Road, CSB. Moriculture -varieties of mulberry, methods of propagation, harvesting of leaves.	3	Discuss the role of Central Silk Board. Explain Moriculture.(CO-2)	PPT, Lecture	Short test, Open book test, MCQ  Formative Assessment I (1, 2,3, 4, 5)  Quiz I
	2	Types of silk and silkworms. <i>Bombyxmori</i> -life cycle	2	Differentiate the common species of silkworm and identify the stages of mulberry silkworm.(CO-4)	Reflective method	
	3	Rearing, mounting, spinning, harvesting of cocoons	2	Describe the rearing operations in Sericulture.(CO-5)	Peer group learning	
	4	Silk reeling techniques, and marketing.	2	Explain silk reeling and marketing.(CO-2)	video, PPT	

	5	Diseases of silkworm – pebrine, grasserie, Flacherie, sotto diseases, muscardine. Insect pest of silkworm –uzifly. Economic Importance of sericulture.	3	Identify the diseases and pests of silkworm.(CO-3)	video, PPT	
<b>III</b>	<b>Poultry Keeping(12 Hrs)</b>					
	1	Scope, Poultry industry in India, commercial layers and broilers. Poultry housing-types.	2	Explain the scope of commercial and broilers rearing. Design the poultry houses.(CO-5)	PPT,youtu be videos	Slip test, MCQ, Assignment Open book test  Formative Assessment I (1, 2, 3)  Quiz I Formative Assessment II (4,5)
	2	Management of chick, growers, layers and broilers. Sexing in chicks, debeaking	2	Explain the management of chick, growers, layers and broilers. Describe debeaking and sexing. (CO-2)	Jigsaw	
	3	Diseases of poultry – Ranikhet, Fowl pox, Coryza, Coccidiosis, Polyneuritis, vaccination.	3	Differentiate the causative organism and diseases of poultry. (CO-4)	PPT Group Discussion	
	4	Duck farming- introduction- duck breeds – housing - feed management	3	Evaluate the duck breeds and management of feed. (CO-5)	PPT, Peer group teaching,	
	5	breeding –disease management –marketing .Economic importanceof poultry farming.	2	Analyse the economic importance of poultry farming, disease management and marketing (CO-4)	Mind map, PPT	
<b>IV</b>	<b>Dairy Farming(12 Hrs)</b>					
	1	Scope, indigenous and exotic breeds, establishment of a typical dairy farm.	2	Explain the scope of rearing dairy animals. Recall the rules and	Chalk and Board, Lecture	Short test, Open book test, MCQ

				regulations applicable for the construction of dairy farm. <b>(CO-5)</b>		Formative Assessment II (1,2, 3,4,5) Quiz II
	2	Management of cow-Newborn, calf, Heifer, milking cow.	2	Explain the management of cows dairy farm. <b>(CO-2)</b>		
	3	Diseases-Mastitis, Rinder Pest, FMD	2	Categorize the diseases of dairy animals. Identify the causative organism. <b>(CO-4)</b>	PPT	
	4	Nutritive value of milk, dairy products - standard milk, skimmed milk, toned milk and fermented milk-curd, ghee, cheese. Dairy Farming: Pasteurization	3	Evaluate the nutritive value of milk and milk products. Explain pasteurization. <b>(CO-5)</b>	PPT, Group Discussion.	
	5	Goat farming–common breeds – construction and maintenance of shed. Economic importance of dairy farming.	3	Analyse the process involved in goat farming. <b>(CO-4)</b>	PPT video	
<b>V</b>	<b>Aquaculture (12 Hrs)</b>					Short test, MCQ  Formative Assessment II(1, 2, 3, 4, 5)  Quiz II
	1	Aquaculture in India, important cultivable organisms and their qualities.	2	Knowledge on aquaculture in India and cultivable organisms. <b>(CO-1)</b>	PPT, Peer group teaching	
	2	Culture –types, Indian major carps, marine prawn and pearl oyster.	2	Understand the culture of different types of fish. <b>(CO-2)</b>	Video, Inquiry based learning	
	3	Diseases of fishes – bacterial gill rot, viral hemorrhagic septicemia,	3	Analyse the different types of fish diseases. <b>(CO-4)</b>	PPT, blended classroom	

		saprolegniasis. Fish parasites–Argulus and <i>Ichthyophthirius</i>				
	4	Integrated fish culture - paddy cum fish culture (Pokkali), fish cum poultry farming, fish cum dairy farming, fish cum pig farming.	3	Compare the different types of integrated fish culture.(CO-4)	Group Discussion, Video	
	5	Ornamental fish culture – setting an aquarium, aquarium fishes. Economic importance of aquaculture.	2	Discuss the process of ornamental fish culture and economic importance of aquaculture. (CO – 2)	Experientia l learning, you tube videos	
<b>Course instructors</b>					<b>Head of the Department</b>	
Dr. X. Venci Candida		Dr. C. Josephine Priyatharshini	Dr. C. Anitha		Dr. F. BriscaRenuga	

**Semester : V & VI Major Practical VI**  
**Name of the Course : Ecology and Toxicology & Evolutionary Biology**  
**Course code : ZC20P6**

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

### Learning Objectives

1. To investigate the relationship between the organisms and their environment.
2. To know the phylogenetic relations of the animal phyla and their traits in understanding the evolutionary relationship.

### Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	analyse the water quality of an aquatic ecosystem.	PSO - 3	Ap ; An
CO - 2	Examine and identify the zooplanktons.	PSO - 1	Ap
CO - 3	assess the evolutionary concepts through experiments.	PSO - 4	E
CO - 4	study the natural ecosystem and report.	PSO - 7	C; Ap

### Teaching plan with Module

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

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

		and field report of the visit (compulsory).		(CO-4)		
	8	<b>Museum Specimens:</b> Secchi disc, Mutualism (Hermit crab and Sea anemone), Commensalism (Echeneis and Shark), Parasitism (Sacculina on Crab), Cyclomorphosis (Daphnia).	9	Identify and Explain Secchi disc, Mutualism, Commensalism, Parasitism, Cyclomorphosis. (CO-3)	Observation of the spotters and specimen	
<b>II</b>	<b>Evolutionary Biology (30 Hrs.) VI Semester</b>					
	1	Serial homology in prawn.	2	Identify Serial homology in prawn. (CO-3)	Practical	Peer-assessment.  Performance-based Assessment.  Self-assessment  Model examinations  Record submission
	2	Prodigality of nature - Frog.	2	Identify the prodigality of nature – Frog and explain the concept of over-production. (CO-3)	Practical	
	3	Mutant forms in <i>Drosophila</i> .	4	Culture <i>Drosophila</i> and identify Mutant forms in <i>Drosophila</i> . (CO-3)	Demonstration	
	4	Observation of variation in finger prints.	2	Identify the various patterns of finger prints and prove the theory “variation is universal.” (CO-3)	Practical	
	5	Variations in the markings of Umbonium shells.	2	Observe the markings of Umbonium shells and prove the theory “No two individuals are alike.” (CO-3)	Practical	
	6	Demonstration of Natural selection on gene frequency using beads.	2	Analyse the impact of Natural selection on gene frequency using beads. (CO-3)	Demonstration	
	7	Demonstration of Genetic drift on gene frequency using beads.	2	Test the role of Genetic drift on gene frequency using beads. (CO-3)	Practical	
	8	Demonstration of DNA sequence alignment by BLAST and construction of cladogram.	4	Demonstrate DNA sequence alignment by BLAST and construction of cladogram. (CO-3)	Demonstration	
	9	Homology- fore limbs of vertebrates, Analogy - wings of animals.	2	Identify Homology and Analogy in animals and prove organic evolution. (CO-3)	Charts	



	10	Vestigial organs, Nautiloid fossil, Limulus, Peripatus, Archaeopteryx		Identify the evolutionary significance of vestigial organs and fossils. <b>(CO-3)</b>	Specimens and chart	
	11	Darwin finches, Industrial melanism, Ancon sheep.	2	Prove the concepts of adaptive radiation, natural selection and mutation and explain Darwinism and DeVrism of Evolution. <b>(CO-3)</b>	Charts	
	12	Monarch and Viceroy butterfly, Stick insect, Krait and Lycodon.	3	Identify mimicry and colouration and explain their role in evolution. <b>(CO-3)</b>	Charts	
<b>Course Instructor</b>					<b>Head of the Department</b>	
Dr. P.T. Arokya Glory			Dr. S. Prakash Shoba		Dr. F. Brisca Renuga	

**Semester : V & VI Major Practical VI**  
**Name of the Course : Ecology and Toxicology & Evolutionary Biology**  
**Course code : ZC20P6**

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

### Learning Objectives

1. To investigate the relationship between the organisms and their environment.
2. To know the phylogenetic relations of the animal phyla and their traits in understanding the evolutionary relationship.

### Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	analyse the water quality of an aquatic ecosystem.	PSO - 3	Ap ; An
CO - 2	examine and identify the zooplanktons.	PSO - 1	Ap
CO - 3	assess the evolutionary concepts through experiments.	PSO - 4	E
CO - 4	study the natural ecosystem and report.	PSO - 7	C; Ap

### Teaching plan with Module

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

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

		and field report of the visit (compulsory).		(CO-4)		
	8	<b>Museum Specimens:</b> Secchi disc, Mutualism (Hermit crab and Sea anemone), Commensalism (Echeneis and Shark), Parasitism (Sacculina on Crab), Cyclomorphosis (Daphnia).	9	Identify and Explain Secchi disc, Mutualism, Commensalism, Parasitism, Cyclomorphosis. (CO-3)	Observation of the spotters and specimen	
II	<b>Evolutionary Biology (30 Hrs.) VI Semester</b>					
	1	Serial homology in prawn.	2	Identify Serial homology in prawn. (CO-3)	Practical	Peer-assessment.
	2	Prodigality of nature - Frog.	2	Identify the prodigality of nature – Frog and explain the concept of over-production. (CO-3)	Practical	
	3	Mutant forms in Drosophila.	4	Culture <i>Drosophila</i> and identify Mutant forms in Drosophila. (CO-3)	Demonstration	
	4	Observation of variation in finger prints.	2	Identify the various patterns of finger prints and prove the theory “variation is universal.” (CO-3)	Practical	
	5	Variations in the markings of Umbonium shells.	2	Observe the markings of Umbonium shells and prove the theory “No two individuals are alike.” (CO-3)	Practical	Performance-based Assessment.
	6	Demonstration of Natural selection on gene frequency using beads.	2	Analyse the impact of Natural selection on gene frequency using beads. (CO-3)	Demonstration	Self-assessment
	7	Demonstration of Genetic drift on gene frequency using beads.	2	Test the role of Genetic drift on gene frequency using beads. (CO-3)	Practical	Model examinations
	8	Demonstration of DNA sequence alignment by BLAST and construction of cladogram.	4	Demonstrate DNA sequence alignment by BLAST and construction of cladogram. (CO-3)	Demonstration	Record submission
	9	Homology- fore limbs of vertebrates, Analogy - wings of animals.	2	Identify Homology and Analogy in animals and prove organic evolution. (CO-3)	Charts	

	10	Vestigial organs, Nautiloid fossil, Limulus, Peripatus, Archaeopteryx		Identify the evolutionary significance of vestigial organs and fossils. <b>(CO-3)</b>	Specimens and chart	
	11	Darwin finches, Industrial melanism, Ancon sheep.	2	Prove the concepts of adaptive radiation, natural selection and mutation and explain Darwinism and DeVrism of Evolution. <b>(CO-3)</b>	Charts	
	12	Monarch and Viceroy butterfly, Stick insect, Krait and Lycodon.	3	Identify mimicry and colouration and explain their role in evolution. <b>(CO-3)</b>	Charts	
<b>Course Instructor</b>					<b>Head of the Department</b>	
Dr. Jeni Chandar Padua			Dr. P.T. Arockya Glory		Dr. F. Brisca Renuga	

**Semester : VI Major Practical V**  
**Name of the Course : Developmental Zoology & Immunology and Microbiology**  
**Course code : ZC20P5**

No.ofhours/week	No.ofcredits	Totalnumberof hours	Marks
4	2	60	100

#### Objectives

1. To familiarize the student with various immunological and microbiological techniques.
2. To implement experimental protocols and adapt them to carry out using biological techniques.

#### Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO- 1	Identify developmental stages, immune cells, lymphoid organs and microorganisms	PSO-3	R
CO- 2	Explain immunological and microbiological protocols.	PSO-2	U
CO- 3	Develop skills needed for future research in developmental Zoology, immunology and microbiology and biotechnology.	PSO-1	Ap
CO- 4	Differentiate the types of eggs, placenta, parts of immune system, Gram positive and negative bacteria and microbial and Immunological assay applicable to clinical research.	PSO-4	An

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
<b>II</b>	<b>Developmental Zoology (30 Hrs.)</b>					
	1	Temporary mounting of Frog egg and sperm.	2	Explain the structure of sperm and egg of Frog. <b>(CO-1)</b>	Observation of slides	Continuous Performance based assessment
	2	Temporary mounting and observation of Chick embryo.	2	Prepare temporary slides of chick embryo and identify the developmental stage. <b>(CO-1)</b>	Demonstration & practical	
	3	Demonstration of induced ovulation in frog (demonstration only).	2	Induce ovulation in frog. <b>(CO-1)</b>	Demonstration & Observation	Internal Assessment.
	4	Effect of thyroxine on Amphibian metamorphosis	2	Explain the impact of thyroxine on Amphibian metamorphosis. <b>(CO-1)</b>	Demonstration & Observation	

		(demonstration only).				
	5	Observation of developmental stages in an insect.	2	Recognize the developmental stages of the insects. (CO-1)	Observation	
	6	Observation of frog's sperm motility.	2	Record the sperm motility in frog. (CO-2)	Demonstration & Observation	
	7	Observation of regeneration in earthworm (demonstration).	2	Observe the of regeneration in earthworm. (CO-2)	Demonstration & Observation	
	8	Submission of report on chick embryo development.	2	Observation and writing of chick embryo development. (CO-2)	Observation	
	9	Identification of types of egg based on shell and yolk.	2	Identification of different types of egg. (CO-2)	Observation	
	10	Embryonic development of egg of Zebra fish (demonstration).	2	Demonstration of egg of Zebra fish. (CO-2)	Demonstration	
	11	Sperm and egg of Human.	5	Identify the spotters and explains the structure of the specimens and the models. (CO-3)	Observation of slides, specimen	
	12	Cleavage (2, 4, 8 and 16 cell stage)				
	13	Blastula and gastrula of frog.				
	14	Placenta – Diffuse, Discoidal, Zonary and Cotyledonary.	5			
	8	Condoms, copper T, <i>Invitro</i> fertilization,				
	9	Budding in hydra				
<b>Practical Incharge</b>						<b>Head of the Department</b>
Dr. S. Prakash Shoba			Dr.A. Shyla Suganthi		Dr. F.BriscaRenuga	

### Immunology and Microbiology

Units	Modules	Topic	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	Immunology and Microbiology (30 Hrs.)					

	1	Dissection of Lymphoid organs of Rat - (Virtual demonstration).	2	Identify immune organs and its role. <b>(CO-4, 5)</b>	Demonstration through virtual lab	Pre-assessment.
	2	Radial immuno diffusion, Demonstration of Hemagglutination.	2	Recall antigen antibody reactions. <b>(CO-2, 5)</b>	Practical	Performance-based Assessment.
	4	Observation of immune cells– Blood smear preparation.	2	Identify immune cells and its role. <b>(CO-1,3,4,)</b>	Practical	Self-assessment, Model examination
	5	Preparation of culture media for bacteria and fungi.	2	Point out steps in sterilization and preparation of media. <b>(CO- 2, 5)</b>	Practical	
	6	Serial dilution technique.	2	Recall serial dilution. <b>(CO-2, 5)</b>	Practical	
	7	Examination of bacterial motility by Hanging drop technique.	2	Devise the hanging drop technique. <b>(CO-2, 3, 5)</b>	Practical	
	8	Staining of bacteria – simple staining and gram staining.	3	Identify bacilli and coccus, positive and negative bacteria. <b>(CO-2, 3, 5)</b>	Practical	
	9	Study of the effect of pH on growth of bacteria based on turbidity.	3	Recall the growth of bacteria based on turbidity. <b>(CO-3, 5)</b>	Practical	
	10	<i>Escherichia coli</i> , TMV, T <sub>4</sub> phage.	2	Relate the structure of bacteria and virus. <b>(CO-3, 5)</b>	Charts	
	11	Bacterial growth curve, Chemostat.	2	Recall the growth curve and chemostat. <b>(CO-3, 5)</b>		
	12	Autoclave, Hot air oven, Inoculation loop.	2	Apply the culture technique of bacteria. <b>(CO-3, 5)</b>		
	13	Haemocytometer, Stage and Ocular micrometer.	2	Recall the application of haemocytometer and ocular micrometer. <b>(CO-5)</b>	Demonstration (virtual)	

<b>Course instructor</b>		<b>Head of the Department</b>
Dr. A. Punitha	Dr. S. Mary Mettilda Bai	Dr. F. Brisca Renuga