

**Semester I**  
**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. <b>(CO-1, 4)</b>	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. <b>(CO-1, 4)</b>	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>Ascarislumbricoides</i> <i>Wuchereri abancrofti</i> , <i>Enterobiusvermicularis</i> <i>Ancylostomaduodenale</i> and <i>Dracunculusmedinensis</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		
<b>IV</b>	<b>Annelida &amp; Arthropoda (12 Hrs.)</b>						
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		
<b>V</b>	<b>Mollusca &amp; Echinodermata (12 Hrs.)</b>						
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
<b>I</b>	<b>Nutrition and health (6hrs)</b>					
	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	
<b>II</b>	<b>Personal health care(6 hrs)</b>					
	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		
<b>III</b>	<b>Nutrition and health (6hrs)</b>					
	1	<b>Maternal and Child health:</b> 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	
<b>IV</b>	<b>Nutrition and health (6hrs)</b>					
	1	<b>Environment and Health:</b> 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.	
<b>V</b>	<b>Nutrition and health (6hrs)</b>					

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**

No. of Hours/ Week	No. of Credits	Total Hours	Marks
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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
	<b>6 hrs</b>					
<b>I</b>	<b>1</b>	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
	<b>2</b>	Comprehension- Difference between facts & opinions	2	Differentiate facts and opinions (CO-2)	Model passages	
	<b>3</b>	Developing a short poem with pictures Vocabulary	2	Develop short poem (CO-3)	Students made to write short poem	
	<b>6 hrs.</b>					
<b>2</b>	<b>1</b>	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 sentences and paragraphs Internal Assessment
	2	ReadingPassageson Equipments&gadgets	2	Develop reading skill and understand gadgets (CO-4)	PPT on equipments and gadgets	
	3	Paragraph: Sentence Definitio n&Extended Definition, Free writing Vocabulary	2	Sentence making and free writing (CO-3)	Video Lecture	
3	<b>6 hrs.</b>					
	1	Listeningtointerviews ofinventorsinfields SmallGroupDiscussion – Specific	3	Listen to interview and group discussion(CO- 5)	Video Discuss in small groups	Test listening and group discussio n Test Reading and writing skill
	2	Longerreadingtext–TheArtof Loving EssayWriting– Solidarity Vocabulary	3	Read and write (CO-2)	Read passages and write essays	
4	<b>6 hrs.</b>					
	1	ListeningtoLecture– 2 ShortTalks –Povertyand theneedtoalleviate it	3	Listen to lecture and short talks (CO-5)	Listen and comprehend lectures	Test listening skill Interpret visuals
2	Readingcomprehension - passage2 InterpretingVisualInputs Vocabulary	3	Interpret visuals(CO-4)	Comprehensi on passages and visuals		
5	<b>6 hrs.</b>					
	1	ListeningforInformation MakingPresentationtask 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	MotivationalArticlesonProf essionalCompetence,Professi onalEthics &LifeSkill	2	Implement professional competence, ethics and life skill (CO-3)	PPT and video	
3	Problem&Solution Essays,SummaryWriting 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 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  Internal Test I (1,2) Quiz I (1,2)
	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	
	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.  Internal Test II (3,4,5) Quiz II (3,4,5)
	4	Osmoregulation:Osmoconformers, Osmoregulators, Osmoregulation in crustaceans, fishes and mammals.	4	Recognize the process of Osmoregulation.(CO-2,3)	Inquiry based Lecture	
	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 mygenic and neurogenic heart. Explain the Structure of human heart (CO-1,2,3)	Lecture, Flipped learning, PPT, You tube	Internal Test I Quiz I  Assignment on Structure of heart
	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	
	3	Heart diseases: arthrosclerosis, 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. <b>(CO-1,2,3)</b>	Lecture PPT, Video class	Excretion
	6	Composition of urine. Nephritis and Dialysis.	2	Recall the Composition of urine, Nephritis and Dialysis. <b>(CO-2,5)</b>	Lecture, PPT, You tube	
<b>IV</b>	<b>Muscle and Neurophysiology (18 Hrs.)</b>					
	1	Muscle physiology - types of muscles, ultrastructure and properties of skeletal muscle.	4	Explain the types of muscles, ultrastructure and properties of skeletal muscle. <b>(CO- 1,2)</b>	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. <b>(CO- 2,3,5)</b>	Lecture, PPT, Group discussion.	
	3	Structure and types of neurons, neurotransmitters.	2	Explain Structure of Nervous system and a neuron. <b>(CO-1,4)</b>	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. <b>(CO- 2,3,4)</b>	Lecture, PPT, You tube.	
	5	Reflex action.	1	Explain Reflex action <b>(CO-2,4)</b>	Lecture, PPT	
	6	Receptors - types, physiology of phonoreception.	4	Describe the structure and function of eye and ear. <b>(CO-1,2,4)</b>	PPT, Peer group teaching	
<b>V</b>	<b>Endocrine and Reproductive Physiology (18 Hrs.)</b>					
	1	Endocrine physiology - hormones and pheromones.	2	Discuss hormones and pheromones. <b>(CO-2,3,4)</b>	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	Explain endocrine glands. <b>(CO-1,2,4,5)</b>	Inquiry based Lecture, PPT	
	3	Biological clock and biological rhythms.	2	Discuss the biological clock and biological rhythms. <b>(CO-2,3,4)</b>	Interactive Lecture, Video	Internal Test II Quiz II
	4	Reproductive physiology - male reproductive system. Female reproductive system,	4	Recall the structure of reproductive system. <b>(CO-1,2,3,4)</b>	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		
<b>Course instructor</b>					<b>Head of the Department</b>	
Dr. S. PrakashShoba			Dr. S. Mary MettildaBai		Dr. F. BriscaRenuga	

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

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	reciterDNA, 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	priorities 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'	4	Recognize DNA sequencing: Sangers'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	Internal Test II & Quiz II (4& 5)
	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	Assignment
	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	
<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 I 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.				
<b>IV</b>	<b>Toxicology(15 hrs)</b>					
	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. <b>(CO-2,6)</b>	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 <b>(CO-2,5)</b>	Flipped classroom, Video, PPT	
	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. <b>(CO-4,5)</b>	PPT, Video, Diagram	
	4	Dose-effect and dose-response relationship - acute toxicity, chronic toxicity reversible and irreversible effects	3	Illustrates the behaviour of toxicants. <b>(CO-4,5)</b>	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 <b>(CO-2,4,5)</b>	PPT, Flow Chart	
<b>V</b>	<b>Ecotoxicology(15hrs)</b>					
	1	Types – measurement of ecotoxicological effects. Pollution - pollutants, xenobiotics,	4	Differentiates the types of pollutants <b>(CO-2,3)</b>	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. <b>(CO-2,3)</b>	Video, PPT, Mind map	
	3	Minamata disease, bioaccumulation, biomagnifications, biotransformation, bio monitoring.	4	Elucidates the results of pollution and identifies the issues <b>(CO-2,3)</b>	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. <b>(CO-3,4)</b>	PPT, Video, Flipped classroom	

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

**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. <b>(CO – 3).</b>	Hands on practical	Continuous Performance based assessment.  Internal Assessment
	2	Effect of temperature on the opercular movement of a fish and calculation of <b>Q10</b> .	2	Evaluate the effect of temperature on the rate of enzyme activity <b>(CO – 1).</b>	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 haemocytometer (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
II	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 - <i>Sacculina</i> 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. Jeni Chandar Padua</b>		<b>Dr. F. Brisca Renuga</b>

