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

No. of Hours/ Week	No. of Credits	Total Hours	Marks
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
I	**Invertebrate Zoology** (30 Hrs.)					
	1	Observation of live *Paramecium* – Hay culture.	4	Identify the *Paramecium* **(CO-1, 3)**	Demonstration & Observation	Continuous Performance based assessment. Internal Assessment.
	2	Observation of spicules – Sponge.	4	Identify spicules of sponges **(CO-1, 3)**	Demonstration & Observation	
	3	**Mounting**: 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	**Dissection**: Cockroach - Digestive system & Nervous system.	6	Dissect and display the Digestive system and Nervous system of Cockroach **(CO-2, 3, 4, 5)**	Demonstration & Observation	
	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	**Spotters:** *Amoeba, Euglena*, *Spongilla,* Sponge gemmule, *Obelia,* Coral (Fungia), Liver fluke, Tapeworm, *Ascaris* (Male and Female), Nereis, Leech, *Penaeus*, *Oryctesrhinoceros*, Pila, *Lamellidens*, *Pinctada*, Sepia, Octopus, Chiton, Starfish, Sea urchin, Sea Cucumber.**Larval forms:** Cercaria, Trochophore, Nauplius, Zoea, Bipinnaria.	6	Identify the specimens/ slides/ models and explains the structure/ function/ biological importance **(CO-1, 5)**	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
I	**Prochordata**(12 Hrs)					
	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: *Amphioxus* – external features Digestive system Excretory system	4	Describe the external and internal features of Amphioxus. **(CO-1,2)**	PPT, Video	
	3	External features and biological significance of the following: *Ascidian,* Balanoglossus, *Salpa.*	3	Discuss on the external features and biological significance prochordates. **(CO-1,2)**	PPT, Video	

	4	Agnatha: *Petromyzon* – Externalmorphology. Ammocoeteslarva.	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: *Scoliodon*- external characters, placoid scales.	2	State the general characters of *Scoliodon*. **(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, *Ichthyophis* 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: *Calotes* – 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. **(CO-2)**	Lecture, PPT	
IV	**Aves** (12 Hrs)					
	1	Aves: General characters and classification up to sub classes with names of the examples.	1	List the general characters and classification of birds. **(CO-1,4)**	Probing and interaction, Video lecture	Assignment: Class notes, Flow chart, mind map Open book test, MCQ, Class test, Formative Assessment II Quiz II Class note Submission
	2	Type study: *Columba livia* - external characters, exoskeleton flight muscles.	3	Explain the external characters and importance of flight muscles. **(CO-2)**	Observation of pigeon – PPT, Video	
	3	Digestive system, Respiratory system, Urino-genital system	4	Discuss the systems of *Columba livia.* **(CO-2)**	Interactive session, PPT, Video	
	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. **(CO-3)**	PPT, Video Lecture	
V	**Mammalia** (12 Hrs)					
	1	Mammalia: General characters and classification up to subclasses with names of the examples.	2	Identify the key taxonomic characters and classify mammals. **(CO-1,4)**	PPT, Video class using Google class.	Assignment: Class test, Flow chart, mind map MCQ, Formative Assessment II Quiz II Class note
	2	Type study: Rabbit - external morphology Structure of skin, dentition.	2	Describe the external morphology, skin and dentition of rabbit. **(CO-2)**	Lecture, PPT, discussion.	
	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. **(CO-2)**	PPT, Lecture and interactive session.	

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

instructors **Head of the Department**

Dr. S. PrakashShoba Dr. F.BriscaRenuga

Dr. Arockia Glory

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

Course						
		Ascidian, *Petromyzon*, Ammocoetes larva, *Narcine*, *Hippocampus*, *Anguilla*		significance.**(CO-2)**	Specimens	
	9	*Rhacophorus*, Axolotl larva, *Ichthyophis*, Salamander, Chamaeleon, *Draco*, *Chelone*, 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 **Head of the Department**

Dr. S. PrakashShoba Dr. F.BriscaRenuga

Dr. Arockia Glory

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 humanhealth.
2. To develop skills on disease management to form a healthysociety.

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 andprevention.	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. **(CO-3,4)**.	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. **(CO-3,4)**.	PPT, Video	
III	**(12 Hrs)**					
	1	Common cold, cough-treatment	3	Identify the treatment of common cold. **(CO-1)**.	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. **(CO-1,2)**.	PPT, Video	
	3	Asthma- causes, symptoms and treatment	4	Points out the causes and symptoms of Asthma. **(CO-3, 4)**.	Lecture, PPT	
	4	Headache - causes and types	2	Classify the types of headache. **(CO-1,5)**.	Lecture, PPT	
IV	**(12 Hrs)**					
	1	Dengue fever - causes, types, symptoms and treatment.	4	summarize the treatment of dengue fever. **(CO-4)**.	Lecture, PPT	Diagram test, MCQ, Formative Assessment I (1,2,3)
	2	Malaria - causes, types, symptoms and treatment	4	Recognize the symptoms of malaria. **(CO-4)**.	Lecture, Video	
	3	Filariasis (Elephantiasis) - causes, types, symptoms and treatment	4	Explores the causes and symptoms of Elephantiasis. **(CO-4)**.	Lecture, PPT, You tube links	
V	**(12 Hrs)**					Short test, Quiz, Assignment, Formative Assessment I (1) Formative Assessment II (2,3)
	1	Aging- old age related ailments, loss of memory, osteoporosis, Parkinson's disease, Alzheimer's disease.	4	Summarize old age related ailments. **(CO-5)**.	Lecture, Group discussion, PPT	
	2	Arthritis- causes, types, symptoms and treatments.	4	Interrelate various diseases. **(CO-5)**.	Lecture, PPT,Video tutorial	
	3	Fomentation	4	Point out the importance of fomentation. **(CO-5)**.	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	recallthe key concepts of heredity, population genetics, karyotyping and genetic counselling.	PSO - 1	R
CO - 2	describeMendelian, 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^{nd} 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^{th} ed.). Ludhiana: Kalyani Publishers.

5. Gardner, Simmons &Snustad (2006). *Principles of Genetics* (8th ed.). USA: John Wiley & Sons.
6. Ahluwalia, K.B. (2009). *Genetics* (2nd 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
I	**Mendelian inheritance** (12 Hrs.)					
	1	Monohybrid and dihybrid - back cross and test cross. Complete, incomplete and codominance.	3	Explain Monohybrid and dihybridcross, back cross, test cross, complete, incomplete and codominance.**(CO-1,2,3)**	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. **(CO-1,3,5)**	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 illustratePolygenic 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.	
II	**Chromosome mapping and Syndromes** (12 Hrs.)					
	1	Linkage – types, groups and theories. Crossing over - mechanism, theories, cytological evidence - Stern's experiment and Tetrad analysis, significance.	4	Describe linkage andcrossing over. **(CO-1,2,3)**	Lecture.	Internal TestI & 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 Drosophila.	2	Illustrate sex determination in man and Drosophila. **(CO-1,3,4)**	Lecture, PPT, Mind map	
	4	Nondisjunction - Primary and secondary nondisjunction in *Drosophila*. 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.	
III	**Cytoplasmic inheritance and Mutation** (12 Hrs.)					
	1	Cytoplasmic inheritance - Kappa particles in *Paramecium*, milk factor in mice, shell coiling in *Limnaea*.	4	Interpret cytoplasmic inheritance. **(CO-1,3,4)**	Lecture.	Internal TestI & Quiz I (1,2) Internal Test II &QuizII (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	
IV	**Human chromosomes and genetic diseases** (12 Hrs.)					

	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	**Population genetics** (12 Hrs.)					
	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	Comprehendinbreeding, 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	

CourseInstructorsHead of theDepartment

Dr. A. Punitha Dr. F. BriscaRenuga

Dr. S. Mary MettildaBai

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, *Drosophila*.	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	Hours	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 *Drosophila*.	4	Culture *Drosophila*	Demonstration	

			and identify the mutant forms of *Drosophila*.		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 **Head of the Department**

Dr. A. Punitha Dr. F. BriscaRenuga

Dr. J .VinoliyaJosphine Mary

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

	3	Autoanalyser, Centrifuge.	3	Recallthe 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'shaemoglobinometer.	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	

V	**Urine and Stool Analysis: (12 Hrs)**					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)**	Comparativ e Chart, Discussion	

Course In-charge: **Head of the Department:** Dr. C. Dr. Punitha Dr. F. BriscaRenuga
Dr. X. Venci Candida

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 theprinciples 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, *Entamoebahistolytica*, *Enterobiusvermicularis*, 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 byheat 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	**Spotters:** Water bath, Balance	3	Observe and identify.**CO-2)**	Observat ory learning	
8	Autoanalyser, Incubator	2	Observe and identify .**(CO-5)**	Observat ory learning	
9	Renal calculi	2	Observe and identify .**(CO-5)**	Observat ory learning	
10	*Entamoebahistolytica, Enterobiusvermicularis*	3	Observe and identify . **(CO-4)**	Observat ory learning	
11	Biomedical waste bags.	3	Observe and identify **(CO-6)**	Observat ory learning	

Course In-charge
Dr. C. Josephine Priyatharshini

Head of the Department
Dr. F. BriscaRenuga

B.Sc. Zoology Teaching Plan 2019-'20

Semester : VI **Major Core VIII**
Name of the Course : Biotechnology
Course code : ZC1761

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

Learning Objectives

1. To learn the basic concepts of biotechnology and understand the various techniques pertaining to biotechnology.
2. To get employability in biotech industries.

Course Outcome

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	acquire knowledge of basic concepts of biotechnology and central dogma.	PSO - 3	U
CO - 2	discuss the rDNA technology, DNA library, hybridoma technology, animal cell and tissue culture and gene therapy.	PSO - 4	U
CO - 3	decide and apply appropriate tools and techniques in biotechnological manipulation.	PSO - 6	Ap; An
CO - 4	explain the general principles of generating transgenic plants, animals and application of microbes pharmaceutical products.	PSO - 6	Ap
CO - 5	undertake any responsibility as an individual and as a team in a multidisciplinary environment for landing in a job.	PSO - 8	Ap

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

Unit	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	**Plant and Animal cell culture** (18 Hrs.)					
	1	Introduction. Culture media - cell culture technique.	3	Explain the different types of culture media, their ingredients and cell culture technique. **(CO-2)**	Lecture, Discussion, Flow chart	MCQ, Formative assessment I, Quiz I, Online Assignment,
	2	Establishment of cell culture – primary and sub-culture - Explant culture, callus culture.	3	Demonstrate primary, Explant and callus culture. **(CO-2)**	Lecture, PPT	
	3	Somatic hybridization and micro-propagation.	5	Discuss Somatic hybridization and micro-propagation. **(CO-3)**	Lecture, mind map, PPT	
	4	Cell lines - large scale	4	Identify Cell lines and	Lecture,	

		culture of cell lines.		comprehend large scale culture of cell lines. **(CO-2)**	PPT	
	5	Organ culture - embryo culture.	3	Differentiate and discuss organ culture and embryo culture. **(CO-2)**	Lecture, video	
II	**Tissue engineering, Transgenic animal technology, Hybridoma technology** (18 Hrs.)					
	1	Artificial skin and cartilage. Stem cells: characteristics, types and applications.	4	Explain artificial skin and cartilage. Discuss characteristics, types and applications. **(CO-3)**	Group discussion, PPT, Chalk and talk	Slip test Assignment (Quizizz) Formative assessment I & Quiz I (1) Formative assessment II, Quiz 1I (2,3,4) Online Assignment
	2	Transgenic animal technology: Transgenesis – methods of transgenesis, applications of transgenic animals.	3	Outline transgenic animal technology. **(CO-4)**	Lecture, PPT, Discussion	
	3	Hybridoma technology: Production of Hybridoma, monoclonal antibodies: production and applications.	5	Identify the different steps involved in the production of monoclonal antibodies. **(CO-2)**	Lecture, Flow chart, Video	
	4	Bioreactors: stirred tank and air–lift bioreactor.	6	Discuss the common types of bioreactors. **(CO-3)**	Lecture , Chalk and talk, Model	
III	**Metabolite production, Bioremediation** (18 Hrs.)					
	1	Ethanol (primary metabolite), Penicillin (secondary metabolite). Immobilization of enzymes and their applications.	5	Demonstrate the production of ethanol and penicillin. **(CO-5)**	Lecture, PPT, Flow chart	MCQ Short test, Formative assessment II, Quiz II Online Assignment (Edmodo)
	2	Biosensors – types and applications. Bacterial SCP and its applications	4	Discuss biosensors and Comprehend SCP. **(CO-3)**	Lecture, PPT, mind map	
	3	Sewage and waste water treatment. Bioremediation: Types, Degradation of Xenobiotics (hydrocarbon, pesticide). Super bug – construction and application.	5	Narrate the steps involved in bioremediation. **(CO-4)**	Lecture, PPT, Flow chart	
	4	Biomining and bioleaching. Biocontrol – *Bacillus thuringiensis.*	4	Discuss biomining and biocontrol. **(CO-4)**	Lecture, PPT, mind map	
IV	**Genetic Engineering** (18 Hrs.)					
	1	Restriction enzymes, cloning	4	Explain the restriction	Chalk and	

		vectors: SV40, Ti plasmid.		enzymes and cloning vectors. **(CO-1, 2)**	talk, PPT	MCQ, Formative assessment I, Quiz I Online Assignment
	2	Preparation of desired gene - Isolation of plasmid vector - insertion of desired gene into the vector - Introduction of rDNA into host cell – Screening and identification of cloned gene.	6	Discuss the methods of rDNA technology. **(CO-2)**	Lecture, Video, Model	
	3	DNA library. Genome editing – CRISP, Next Generation sequencing techniques. Molecular markers (RAPD & RFLP).	4	Recall the DNA library, Genome editing – CRISP, Next Generation sequencing techniques. **(CO-3)**	Lecture, video	
	4	Polymerase chain reaction. Southern blotting. DNA sequencing: Sanger's method.	4	Recognize Polymerase chain reaction - Southern blotting and DNA sequencing: Sangers's method. **(CO-3)**	Lecture, PPT, Video, Mind Map	
V	**DNA applications, Bioethics**, **Nanotechnology** (18 Hrs)					
	1	Disease diagnosis – DNA probes, disease treatment – production of human insulin. Gene therapy – types and methods. SNP's for mutations.	4	Discuss DNA probes, production of human insulin and gene therapy. **(CO-5)**	Lecture, PPT, video	Slip test Assignment (Quizizz) Formative assessment I & Quiz I (1,2) Formative assessment II, Quiz 1I (3,4) Online Assignment
	2	Finger printing and its application in forensic medicine. Human Genome Project.	4	Illustrate finger printing technology and human genome project. **(CO-5)**	Lecture	
	3	Bioethics: Ethical implications of transgenic animals. Biosafety: Possible dangers of Genetically Engineered organisms (GEOs) and biohazards of rDNA technology.	6	Explain bioethics and biosafety. **(CO-5)**	Chalk and Talk	
	4	**Nanotechnology:** applications of nanotechnology in medicine, drug designing and cancer treatment.	4	Comprehend the applications of nanotechnology. **(CO-5)**	Lecture, PPT, video	

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

Head of the Department
Dr. S. Mary Mettilda Bai

Semester : VI Major Core IX
Name of the Course : Immunology and Microbiology
Course code : ZC1762

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

Learning Objectives

1. To enable the students to become aware of the microbes around us and also to know about the processes involved in the elimination of invading microbes by the defense system of our body.
2. To provide proficiency in basic microbiological and immunological skills.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	identify the major components of the immune system at organ and cellular level.	PSO - 1	R
CO - 2	discuss the types of immune response and mechanisms to eliminate antigens.	PSO - 1	U
CO - 3	culture and identify the microorganisms based on morphological and staining techniques.	PSO - 3	Ap
CO - 4	apply knowledge of microorganisms on common pathological diseases.	PSO - 5	R; Ap
CO - 5	develop skills to monitor and maintain food safety.	PSO - 4	Ap
CO - 6	design analytical and experimental tasks involving microbiology and immunology.	PSO - 3	Ap; An

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

Unit	Modules	Topics	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
I	**Immunity and Lymphoid organs** (18 Hrs.)					
	1	History and scope of immunology.	2	Order the history of immunology year wise. **(CO-1)**	Lecture, PPT	Short test, online Assignment (MCQ), Formative assessment I-1,2,3,4,5
	2	Types of immunity - Innate, acquired, passive and active.	3	Distinguish the types of immunity. **(CO-1)**	Lecture	
	3	Primary and Secondary lymphoid organs - Thymus, Bone marrow, Bursa of Fabricius.	4	Relate Primary and Secondary organs and their functions.**(CO-1)**	Flipped classroom	

	4	Spleen, Lymph node, Mucosa Associated Lymphoid Tissue.	4	Categorize Primary and Secondary organs and its functions. **(CO-1)**	Lecture, PPT	Quiz I
	5	Lymphoid and myeloid lineage. Cells of immune system (T cells and B cells, macrophages)		Construct lymphoid and myeloid lineage and summarize T cells, B cells and macrophages. **(CO-1)**	Video lesson, Lecture	
II	**Antigen and antibodies** (18 Hrs.)					
	1	Haemopoietic stem cells and haemopoiesis.	4	Identify Haemopoietic stem cells. **(CO-2)**	Lecture	MCQ, online Assignment (Antigens and Immunogens), Formative assessment I – 1,2,3,4 Quiz I
	2	Antigen. Immunogens, hapten and adjuvants.	4	Describe antigens, Immunogens, hapten and adjuvants. **(CO-2)**	Blended classroom	
	3	Immunoglobulin: Immunoglobulin classes, structure and functions of IgG.	5	Sketch the structure of Immunoglobulin. **(CO-2)**	Lecture, you tube video	
	4	Antigen – Antibody reactions. Secondary antibody, purification of antibody using protein A/G.	5	Explain antigen – antibody reactions and purification of antibody. **(CO-2)**	Lecture, PPT	
III	**Immune Response** (18 Hrs.)					
	1	Immune Response: Primary and secondary immune response.	3	Categorize immune response. **(CO-2)**	Lecture, PPT	Short test, Open book test, Formative assessment I – 1,2,3 Formative assessment II– 4,5 Quiz I, II
	2	Immunity to bacterial infections - Humoral immune response, Cell-mediated immune response.	5	Enumerate humoral response. Illustrate cell mediated response. **(CO-2)**	Lecture, video	
	3	Hypersensitivity: Allergens and types of hypersensitivity.	4	Summarize Allergens and types of hypersensitivity. **(CO-2)**	Lecture, PPT	
	4	Tumour immunology. Autoimmunity - Rheumatoid arthritis.	4	Identify the causes, symptoms and treatment of Rheumatoid arthritis. **(CO-2)**	Lecture, PPT	
	5	Vaccines and Immunization schedule.	2	Indicate Immunization schedule. **(CO-2)**	Jigsaw	
IV	**Microbiology** (18 Hrs.)					
	1	History and scope of microbiology. Whittaker's classification of microbes with two examples.	4	Enumerate the history of microbiology. **(CO-3)**	Lecture, Chalk and Talk	Mind map, online Assignment

	2	Bacteria: structure of *E. coli*, bacterial growth curve.	3	Explain the structure of *E. coli.* **(CO-3)**	Lecture, Chalk and Talk	(Structure of TMV and T_4 Bacteriophage), Formative assessment II 1,2,3,4,5 Quiz II
	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/ PPT	
	4	Virus: structure (TMV and T_4 phage) – reproduction of phages (lysogenic and lytic).	4	Illustrate the structure of Virus and its reproduction. **(CO-3)**	Lecture/ Video	
	5	Synthetic Biology	2	Outline Synthetic Biology. **(CO-3)**	Group discussion	
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)**	Lecture, Chalk and Talk	Slip test, Formative assessment II - 1,2,3,4,5 Quiz II MCQ through Quizziz
	2	Industrial microbiology: Wine and vinegar production	4	Interpret Wine and vinegar production in the industries. **(CO-5)**	Lecture, Chalk and Talk	
	3	Medical microbiology: Bacterial diseases (Tuberculosis, Gonorrhea, Streptococcal dermal infection).	4	List bacterial diseases. **(CO-4)**	Poster, Flash cards	
	4	Viral diseases (AIDS, Chicken pox, Hepatitis B, Rabies).	4	Discuss viral diseases. **(CO-4)**	Lecture, PPT	
	5	Fungal diseases (Mycotoxicosis and Aspergillosis).	2	Categorize fungal diseases. **(CO-4)**	PPT	

Course instructor
Dr. X. Venci Candida

Head of the Department
Dr. S. Mary Mettilda Bai

Semester : VI **Major Core X**
Name of the Course: Evolutionary Biology
Course Code : ZC1763

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

Learning Objectives

1. To discern the evolutionary significance of animals and origin of species.
2. To provide methods of investigating animal evolution, construction of phylogenetic trees and to get job in educational institutions and paleontological departments.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	explain the concepts of evolution, origin of life, geological time scale and evidences of evolution.	PSO - 1	U
CO - 2	explain the theories of evolution, mechanism of speciation and extinction of organism.	PSO - 3	R
CO - 3	apply Hardy-Weinberg equilibrium in population genetics.	PSO -6	Ap; E
CO - 4	outline the major transitions in evolution, from the origin of life to hominid evolution.	PSO - 6	Ap
CO - 5	perform, analyse and report experimental observations in evolutionary biology.	PSO - 2	Ap; An

Teaching Plan with Modules

Total Hours 60 (Incl. Assignments & Test)

Unit	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	**Concepts and Evidences of Evolution** (15 Hrs.)					
	1	Concepts and Evidences of Evolution: Origin of life - Theories and experiments.	4	Explain Origin of life - Theories and experiments. **(CO-1)**.	Lecture, Flipped learning	Short test, MCQ, Formative assessment I (1,2,3,4) Quiz I Online assignment
	2	Evidences insupport of evolution – morphology and comparative anatomy, embryology,	7	Comparing the process of evolution – morphology and comparative anatomy, embryology. **(CO-1)**.	Lecture, Chalk and talk, Blended learning	
	3	Physiology and biochemistry, palaeontology.	2	Comparing the process of evolution – Physiology and biochemistry, palaeontology. **(CO-1)**.	Lecture , Chalk and talk	

	4	Geological time scale.	3	Summarize Geological time scale. **(CO-1)**	Lecture , Chalk and talk	
II	**Theories of Evolution** (15 Hrs.)					
	1	Theories of Evolution: Lamarckism, Neo-Lamarckism.	3	Explain the theory of Lamarckism, Neo-Lamarckism. **(CO-2)**.	Lecture, Chalk and talk, PPT	Short test, MCQ Formative assessment I (1,2,3,4,5). Quiz I
	2	Darwinism, Neo-Darwinism.	3	Explain the theory of Darwinism, Neo-Darwinism. **(CO-2)**.	Lecture, Chalk and talk, Video	
	3	Mutation theory of De Vries. Modern synthetic theory.	4	Describing the Mutation theory of De Vries and Modern synthetic theory. **(CO-2, 3)**.	Lecture, Chalk and talk	
	4	Variation – types, sources – mutation, combination, hybridization, genetic drift, Founder's principle, polyploidy.	3	Explain different types and sources of variation. **(CO-2)**.	Lecture, Chalk and talk, Cooperative teaching	
	5	Natural selection – Stabilizing, directional and disruptive selection.	2	Summarizing different types of natural selection. **(CO-2)**.	Lecture, PPT	
III	**Isolating mechanisms, Species Concept and Speciation** (15 Hrs.)					
	1	Isolating mechanisms: Types, origin and evolution of isolating mechanisms, role of isolation in speciation.	3	Summarize the types, origin and evolution of isolating mechanisms, role of isolation in speciation. **(CO-2)**.	Lecture, Chalk and talk, Flipped learning	Short test, MCQ, Formative assessment I (1,2,3) Quiz I Mind map Formative assessment II (4,5) Quiz II
	2	Species, sibling species, sub species, demes.	3	Explain the species, sibling species, sub species, demes. **(CO-2)**.	Lecture, Chalk and talk	
	3	Species concept - morphological, genetic and biological.	2	Summarize morphological, genetic and biological Species concept. **(CO-2)**.	Lecture, PPT, Peer group teaching	
	4	Speciation - Phyletic and true speciation, mechanism of speciation.	3	Describe phyletic and true speciation, mechanism of speciation. **(CO-2)**.	Lecture, Chalk and talk, Video	
	5	Patterns of speciation – allopatric, sympatric, quantum and parapatric.	4	Compare the different patterns of speciation. **(CO-2)**.	Lecture, PPT, Brain storming	
IV	**Phylogenetic analysis** (15 Hrs.)					

	1	Phylogenetic analysis**:** Tools for sequence alignment–BLAST, FASTA.	4	Explain the various tools for sequence alignment–BLAST, FASTA. **(CO-4)**.	Lecture, PPT, Flipped learning, E-learning	Short test, MCQ, Formative assessment II (1,2,3,4), Quiz II Mind map
	2	Methods of phylogenetic analysis - phenetic and cladistic; phylogenetic trees.	4	Summarize the methods of phylogenetic analysis - phenetic and cladistic; phylogenetic trees. **(CO-4)**.	Lecture, Chalk and talk	
	3	Methods for determining evolutionary trees – maximum parsimony, distance and maximum likelihood.	7	Evaluating the methods for determining evolutionary trees – maximum parsimony, distance and maximum likelihood. **(CO-4)**.	Lecture, Chalk and talk, Peer group teaching	
V	**Trends in Evolution, Mimicry and Colouration** (15 Hrs.)					
	1	Trends in Evolution**:** Modes of evolution– micro, macro and megaevolution.	3	Describe the modes of evolution–micro, macro and megaevolution. **(CO-5)**	Lecture , Chalk and talk	Formative assessment II (1,2,3,4)
	2	Heterochrony - Paedomorphosis and Peramorphosis.	1	Define and explain Paedomorphosis and Peramorphosis. **(CO-2)**	Lecture, PPT, Flipped learning	
	3	Rate of evolution. Human Evolution – organic, cultural and future evolution.	6	Evaluating the Rate of evolution. Human Evolution – organic, cultural and future evolution. **(CO-5)**	Lecture, Chalk and talk, PPT, Video	
	4	Mimicry and colouration.	2	Describe the Mimicry and colouration. **(CO-5)**	Lecture, Chalk and talk, Models	
	5	Extinction - types, causes and significance.	3	Summarize the types, causes and significance of extinction. **(CO-5)**.	Lecture, Chalk and talk	

Course instructor
Dr. S. Prakash Shoba

Head of the Department
Dr. S. Mary Mettilda Bai

Semester : VI **Elective IV (a)**
Name of the Course : Applied Zoology
Course code : ZC1764

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

Learning Objectives

1. To deepen the knowledge of students in general and applied areas of Zoology.
2. To provide employment and job opportunities in the public, private and government sector

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	apply the knowledge of animal husbandry in economic development.	PSO - 5	U
CO - 2	identify the kinds of bees and the methods of bee keeping.	PSO - 8	U
CO - 3	rear silkworms, harvest and market the cocoons.	PSO - 9	Ap
CO - 4	apply skills and experience about the management of poultry and Dairy farming.	PSO - 9	Ap
CO - 5	culture of economically important finfish and shell fishes.	PSO - 8	Ap

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

Unit	Modules	Topics	Hours	Learning Outcome / CO addressed	Pedagogy	Assessment
I	**Apiculture** (15 Hrs)					
	1	Scope, Classification and kinds of bees, Bees and their society.	3	Categorize the kinds of bees and their features. **(CO-1, 2)**	Lecture, Chalk and Talk	MCQ, Slip test, Mind Map, Online Assignment (Honey bee products), Formative Assessment I, Quiz I
	2	Life cycle of *Apis indica* – food of honey bees - relationship between plants and bees.	4	Identify the various stages of bees. **(CO- 2)**	Lecture, Mind map	
	3	Methods of bee keeping (primitive and modern).	2	Explain the methods of bee keeping. **(CO-3)**	Lecture, Video	
	4	Honey Bee products: honey, bee wax, bee venom.	2	Analyse the various honey bee products. **(CO-3)**	PPT, Group Discussion	
	5	**Lac culture** – scope – lac insect *Laccifer lacca* and its life cycle – processing of lac – lac products and importance.	4	Explain the various stages of lac insect. **(CO-2, 3)**	Lecture, Video.	

II	**Sericulture** (15 Hrs)					
	1	Scope – Silk Road - CSB - Moriculture: varieties of mulberry.	2	Knowledge on the methods in Moriculture. **(CO-1, 2)**	Lecture, Chalk and Talk	Open book test, Objective test, Formative Assessment I Quiz I
	2	Methods of propagation, harvesting of leaves.	2	Remember the methods of propagation and leaf harvesting. **(CO-2, 3)**	PPT, Lecture.	
	3	Common species of Silkworm, Life cycle of mulberry silkworm.	4	Compare the different stages of Silkworm. **(CO-2, 3)**	Lecture, Video.	
	4	Diseases of silkworm: pebrine, grasserie, sotto diseases, muscardine – pest of silkworm: uzifly.	3	Identify the different diseases of silkworm. **(CO-3)**	Lecture, Visit	
	5	Rearing of silkworm – mounting – spinning - harvesting of cocoons – silk reeling and marketing.	4	Explain the process of silk reeling and Marketing. **(CO-3)**	Lecture, Video	
III	**Poultry Keeping** (15 Hrs)					
	1	Scope, commercial layers and broilers.	3	Characterize the layers and broilers. **(CO-1, 2)**	Lecture, PPT	Slip test, MCQ, Objective test, Quiz I, Formative Assessment I (1,2,3)
	2	Poultry housing, types of poultry houses.	2	Design the poultry houses. **(CO-4)**	Lecture, PPT	
	3	Management of chick, growers, layers and broilers.	4	Explain the management of chick, growers, layers and broilers. **(CO-4)**	Lecture, blended classroom,	
	4	Debeaking, Sexing in chicks, Nutritive value of egg.	3	Critique the nutritive value of egg. **(CO-3)**	Lecture, Chalk and talk	Short test, Formative Assessment II (4, 5), Quiz II
	5	Diseases of poultry – Ranikhet, Fowl pox, Coryza, Coccidiosis, Polyneuritis – vaccination.	3	Analyse the diseases of poultry. **(CO-3)**	Lecture, Group Discussion, PPT	
IV	**Dairy Farming** (15 Hrs)					
	1	Scope, Breeds of Dairy animals, Establishment of a typical Dairy farm.	3	Knowledge on dairy animals and construct the dairy farm. **(CO-1, 3)**	Lecture, Chalk and talk	Diagram test, Short test, Open book test MCQ Formative
	2	Management of cow (New born, calf, Heifer, milking cow)	3	Understand the management of cows. **(CO-3)**	Lecture, video	
	3	Diseases (Mastitis, Rinder Pest, FMD).	2	Categorize the diseases of dairy animals. **(CO-3)**	Lecture, PPT	

	4	Nutritive value of milk- Dairy products (Standard milk, skimmed milk, toned milk and fermented milk - curd, ghee, cheese). Pasteurization.	4	Formulate dairy products and describe pasteurization. **(CO-4, 5)**	Lecture, PPT, Group Discussion.	Assessment II Quiz II
	5	Leather industry – scope – processing of skin**.**	3	Analyse the process involved in leather preparation. **(CO-1, 3)**	Lecture, video	
V	**Integrated Farming** (15 Hrs)					
	1	Definition and Scope, Agri-based fish farming, paddy cum fish culture, horticulture-cum fish culture.	4	Knowledge on integrated fish farming. **(CO-1, 3)**	Lecture, Chalk and Talk, PPT	Short test, Online Assignment (Integrated fish culture), Formative Assessment II, Quiz II
	2	Integrated bee keeping – Live-stock fish farming, Duck cum fish culture.	3	Understand the integrated bee keeping. **(CO-1)**	Lecture, Video	
	3	Fish cum poultry farming, fish cum dairy farming, goat cum fish integration.	4	Compare the different types of fish farming. **(CO-2)**	Lecture PPT	
	4	Fish cum pig farming – multi-trophic aquaculture- Livestock –poultry – fish - Horticulture.	4	Describe the multi-trophic aquaculture. **(CO-3, 5)**	Lecture, Group Discussion, Video	

Course instructor
Dr. C. Anitha

Head of the Department
Dr. S. Mary Mettilda Bai

Semester : V & VI Major Practical VI
Name of the Course : Ecology and Toxicology & Evolutionary Biology
Course code : ZC17P6

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

	7	Study of natural ecosystem and field report of the visit (compulsory).	3	Document the field trip. **(CO-4)**	Field Trip	
	8	**Museum Specimens**: Secchi disc, Mutualism (Hermit crab and Sea anemone), Commensalism (Echeneis and Shark), Parasitism (Sacculina on Crab), Cyclomorphosis (Daphnia).	9	Identify and Explain Secchi disc, Mutualism, Commensalism, Parasitism, Cyclomorphosis. **(CO-3)**	Observation of the spotters and specimen	
II	**Evolutionary Biology** (30 Hrs.) VI Semester					
	1	Serial homology in prawn.	2	Identify Serial homology in prawn. (**CO-4)**	Practical	Peer-assessment. Performance-based Assessment. Self-assessment Model examinations
	2	Prodigality of nature - Frog.	2	Identify the prodigality of nature – Frog and explain the concept of over-production. **(CO-4)**	Practical	
	3	Mutant forms in Drosophila.	4	Culture *Drosophila* and identify Mutant forms in Drosophila. **(CO-4)**	Demonstration	
	4	Observation of variation in finger prints.	2	Identify the various patterns of finger prints and prove the theory "variation is universal." **(CO-4)**	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-4)**	Practical	
	6	Demonstration of Natural selection on gene frequency using beads.	2	Analyse the impact of Natural selection on gene frequency using beads. **(CO-4)**	Demonstration	
	7	Demonstration of Genetic drift on gene frequency using beads.	2	Test the role of Genetic drift on gene frequency using beads. **(CO-4)**	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-4)**	Demonstration	
	9	Homology- fore limbs of vertebrates, Analogy - wings of animals.	2	Identify Homology and Analogy in animals and prove organic evolution. **(CO-4)**.	Charts	

	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. **(CO-4)**	Charts	
	12	Monarch and Viceroy butterfly, Stick insect, Krait and Lycodon.	3	Identify mimicry and colouration and explain their role in evolution. **(CO-4)**	Charts	

Course Instructor
Dr. S. Prakash Shoba

Head of the Department
Dr. S. Mary Mettilda Bai

Semester : VI Major Practical VII
Name of the Course : Biotechnology & Immunology and Microbiology
Course code : ZC17P7

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

Learning Objectives

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

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	isolate genomic DNA.	PSO - 3	Ap
CO - 2	perform quantitative, immunological and microbiological analysis.	PSO - 6	Ap
CO - 3	differentiate Gram positive and negative bacteria.	PSO - 3	An; Ap
CO - 4	identify lymphoid organs in a vertebrate model.	PSO - 4	R
CO - 5	develop skills needed for future research in immunology, microbiology and biotechnology.	PSO - 6	Ap

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

Units	Modules	Topic	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	**Biotechnology** (30 Hrs.)					
	1.	Isolation of genomic DNA.	4	Isolate DNA from biological samples.	Practical	Performance based assessment
	2.	Estimation of DNA by Diphenylamine (DPA) Method.	4	Estimate the quantity of DNA.	Practical	
	3.	Estimation of BOD in Sewage.	2	Estimate and analyse the oxygen content in sewage.	Practical	
	4.	Estimation of COD in sewage.	2	Analyse the CO_2 content in sewage.	Practical	
	5.	Immobilization of enzyme (Amylase/ Invertase/ Protease) using sodium alginate - Demonstration.	2	Recall the techniques and Immobilize enzyme.	Practical	
	6.	Polymerase Chain Reaction –	2	Recall DNA	Practical	

		Demonstration.		amplification.		Internal assessment Model examination
	7.	Production of Hybridoma and Monoclonal antibodies – Flow chart.	2	Recall hybridoma technique.	Practical	
	8	Isolation of B and T lymphocytes using kits.	4	Isolate B and T lymphocytes	Practical	
	9.	**Model/ Charts / Photo** pBR 322, λ phage, SV40, Recombinant DNA, Electroporation unit, Southern blotting, RFLP, organ culture (Plasma clot method), Knockout mice, Dolly, Sanger's method of DNA sequencing,	4	Identify different vectors and its role in hybridization techniques. Recall different molecular techniques.	Observation	
	10	Biosensor, Callus, Explant, Micropropagation, Fermenter, rDNA, Human genome sequence, Penicillin, Biogas production.	4	Identify and explains the biotechnological importance of the Model/ Charts / Photo	Observation	
II	**Immunology and Microbiology (**30 Hrs.)					
	1	Dissection of Lymphoid organs of Rat - (Virtual demonstration).	2	Identify immune organs and its role. **(CO-4, 5)**	Demonstration through virtual lab	Pre-assessment. Performance-based Assessment. Self-assessment, Model examination
	2	Cleaning and sterilization of glass wares and Preparation of culture media for microbes.	4	Point out steps in sterilization and preparation of media. **(CO- 2, 5)**	Practical	
	3	Serial dilution technique.	2	Recall serial dilution. **(CO-2, 5)**	Practical	
	4	Examination of bacterial motility by Hanging drop technique.	2	Devise the hanging drop technique. **(CO-2, 3, 5)**	Practical	
	5	Staining of bacteria – simple staining and gram staining.	4	Identify bacilli and coccus, positive and negative bacteria. **(CO-2, 3, 5)**	Practical	
	6	Radial immuno diffusion	4	Recall antigen antibody reactions. **(CO-2, 5)**	Practical	
	7	*Escherichia coli*, TMV, T_4 phage.	2	Relate the structure of bacteria and virus. **(CO-3, 5)**	Charts	
	8	Bacterial growth curve, Chemostat.	2	Recall the growth curve and chemostat. **(CO-3, 5)**		

	9	Autoclave, Hot air oven, Inoculation loop.	4	Apply the culture technique of bacteria. **(CO-3, 5)**		
	10	Haemocytometer, Stage and Ocular micrometer.	4	Recall the application of haemocytometer and ocular micrometer. **(CO-5)**	Demonstration	

Course instructor
Dr. F. Brisca Renuga
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