

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 <i>Paramecium</i> – Hay culture.	4	Identify the <i>Paramecium</i> (CO-1, 3)	Demonstration & Observation	Continuous Performance based assessment.
	2	Observation of spicules – Sponge.	4	Identify spicules of sponges (CO-1, 3)	Demonstration & Observation	
	3	Mounting: Cockroach – mouth parts, salivary gland apparatus, trachea;	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	
Mosquito & Honeybee – mouth parts Prawn - appendages						

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	Internal Assessment.
5	Grouping of given Invertebrates as per their systematic position.	2	Display the Grouping of given Invertebrates as per their systematic position.	Discussion	
6	Taxonomic study of insects upto class giving key identification, selecting any 5 locally available common examples and recording them.	2	Display the Taxonomic study of any 5 insects.	Discussion	
7	Spotters: <i>Amoeba</i> , <i>Euglena</i> , <i>Spongilla</i> , Sponge gemmule, <i>Obelia</i> , Coral (Fungia), Liver fluke, Tapeworm, <i>Ascaris</i> (Male and Female), Nereis, Leech, <i>Penaeus</i> , <i>Oryctesrhinoceros</i> , Pila, <i>Lamellidens</i> , <i>Pinctada</i> , Sepia, Octopus, Chiton, Starfish, Sea urchin, Sea Cucumber. 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
	2	Type study: <i>Amphioxus</i> – external features Digestive system Excretory system	4	Describe the external and internal features of <i>Amphioxus</i> . (CO-1,2)	PPT, Video	Formative Assessment I
	3	External features and biological significance of the following: <i>Ascidian</i> , <i>Balanoglossus</i> , <i>Salpa</i> .	3	Discuss on the external features and biological significance prochordates. (CO-1,2)	PPT, Video	Quiz I

	4	Agnatha: <i>Petromyzon</i> – External morphology. Ammocoetes larva.	2	Explain the external features and biological significance of Agnatha. (CO-1,2)	PPT, Video	Class note Submission
II	Pisces (12 Hrs)					
	1	Pisces: General characters and classification up to sub classes with names of the examples.	2	List the general characters and classification of Pisces. (CO-1,4)	Interactive session, PPT, Video	Short test Mind map
	2	Type study: <i>Scoliodon</i> - external characters, placoid scales.	2	State the general characters of <i>Scoliodon</i> . (CO-1,3)	PPT, Video	Objective test Formative Assessment I
	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	Quiz I Class note Submission
	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,
	2	Type study: Frog – External characters Endoskeleton: Skull, typical vertebra, atlas, girdles and limbs.	3	Recall the characteristics of frog. (CO-1,2)	PPT	Assignment, Formative Assessment I (1,2,4), Quiz I
	3	Biological significance of Axolotl larva, <i>Ichthyophis</i> Parental care in Amphibia.	2	Discuss the biological significance and parental care in axolotl larva and ichthyophis. (CO-3)	Video, PPT	Formative Assessment II (3,5), Quiz II
	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	Class note Submission

	5	Type study: <i>Calotes</i> – External characters, Circulatory system Excretory system. Identification and study of few poisonous snakes in India - first aid for snake bite and anti-venom.	3	Explains external characters of Calotes and functions of internal organs, Identify poisonous snakes. (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
	2	Type study: <i>Columba livia</i> - external characters, exoskeleton flight muscles.	3	Explain the external characters and importance of flight muscles. (CO-2)	Observation of pigeon – PPT, Video	Open book test, MCQ, Class test,
	3	Digestive system, Respiratory system, Urino-genital system	4	Discuss the systems of <i>Columba livia</i> . (CO-2)	Interactive session, PPT, Video	Formative Assessment II
	4	Migration of birds, Flight adaptation in birds, Flightless birds (Ratitae): general characters and examples.	4	Compare the Flight adaptation in birds and their migratory behaviour. (CO-3)	PPT, Video Lecture	Quiz II Class note Submission
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
	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.	MCQ,
	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.	Formative Assessment II Quiz II Class note

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

Dr. S. PrakashShoba

Dr. Arockia Glory

Head of the Department

Dr. F.BriscaRenuga

Semester

: II

Major Practical II

Name of the Course

: Chordate Zoology

Course code

: ZC20P2

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

Learning Objectives

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

Course Outcome

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

Teaching Plan with Modules

Total Hours: 30 (Incl. Test)

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

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

instructors
Dr. S. Prakash Shoba
Dr. Arockia Glory

Head of the Department
Dr. F. Brisca Renuga

Semester : II NMEC II
Name of the Course: Common Ailments and Simple Remedies
Course Code : ZNM202

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

Learning Objectives

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

Course Outcomes

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

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

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

	3	Digestive disorders: Diarrhoea - causes and treatment	3	Summarize the digestive disorders. (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)					
	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	Short test, Quiz, Assignment, Formative Assessment I (1) Formative Assessment II (2,3)
	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	recall the key concepts of heredity, population genetics, karyotyping and genetic counselling.	PSO - 1	R
CO - 2	describe Mendelian, polygenic and cytoplasmic inheritance, chromosome mapping, nondisjunction, gene frequency and eugenics.	PSO - 1	U
CO - 3	apply the principles of heredity to real life situations.	PSO - 2	Ap
CO - 4	execute and analyze the results of genetic experimentation in animal and plant models.	PSO - 3	An
CO - 5	evaluate the genetic data of a population.	PSO - 4	E

Unit I

(12 hrs.)

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

Unit II

(12 hrs.)

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

Unit III

(12 hrs.)

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

Unit IV

(12 hrs.)

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

Unit V

(12 hrs.)

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

Textbook

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

Reference Books

1. Verma, P.S. & Agarwal, V.K. (2009). *Genetics*, Revised ed. New Delhi: S. Chand & Co.
2. Peter Snustad, D. & Michael J. Simmons (2010). *Principles of Genetics* (2nd ed.). USA: John Wiley and Sons.
3. Chatterjee, S. (2009). *Genetics*. New Delhi: APH Publishing Corporation.
4. Singh, B.D. (2008). *Fundamentals of Genetics* (4th 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 dihybrid cross, 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 illustrate Polygenic inheritance. (CO-1,2,3)	Lecture, PPT, video, Mind map, Diagram	
	4	Multiple alleles: ABO blood group in man, Rh factor in man, coat colour in rabbit.	2	Illustrate multiple alleles. (CO-1,3,4)	Lecture, PPT.	
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 and crossing over. (CO-1,2,3)	Lecture.	Internal Test I & Quiz I Class test 2 Assignment
	2	Chromosome map - two point and three point cross, construction of chromosome map.	3	Demonstrate chromosome map. (CO-1,2)	Lecture.	
	3	Sex determination in man and <i>Drosophila</i> .	2	Illustrate sex determination in man and <i>Drosophila</i> . (CO-1,3,4)	Lecture, PPT, Mind map	
	4	Nondisjunction - Primary and secondary nondisjunction in <i>Drosophila</i> . Syndromes in man: Turner's, Klinefelter's and Down syndrome.	3	Explain nondisjunction and identify syndromes in man. (CO-1,2,3,5)	Lecture, PPT.	
III	Cytoplasmic inheritance and Mutation (12 Hrs.)					
	1	Cytoplasmic inheritance - Kappa particles in <i>Paramecium</i> , milk factor in mice, shell coiling in <i>Limnaea</i> .	4	Interpret cytoplasmic inheritance. (CO-1,3,4)	Lecture.	Internal Test I & Quiz I (1,2) Internal Test II & Quiz II (3,4)
	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.	Class test - Open book test
	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.	Assignment
	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
	2	Factors affecting gene frequency – selection, mutation, genetic drift and migration.	3	Identify the factors affecting gene frequency. (CO-1,2)	Lecture, Video lesson, PPT	
	3	Inbreeding, out breeding and heterosis. Eugenics, Euthenics and Euphenics.	3	Comprehend inbreeding, out breeding, heterosis, eugenics, euthenics and euphenics. (CO-1,2,4,5)	Lecture, PPT.	Class test 4 Oral test
	4	Pedigree analysis. Genetic prognosis - Genetic counselling.	3	Demonstrate Pedigree analysis. Interpret genetic prognosis and Genetic counselling. (CO-1,3,4,5)	Lecture, Flow chart	

Course Instructors Head of the Department

Dr. A. Punitha

Dr. S. Mary Mettilda Bai

Dr. F. Brisca Renuga

Major Practical III
Semester

IV

Name of the course : Genetics, Biostatistics and Computer Applications

Sub. Code : ZC20P2

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

1. To

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

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

Course Outcome

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

Genetics

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

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

Teaching Plan with Modules

Total Hours: 30 (Incl. Test)

Section	Description	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 <i>Drosophila</i> .	4	Culture <i>Drosophila</i>	Demonstration	

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

Course instructors

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

Head of the Department

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

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

Objectives

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

Course outcomes

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

Teaching Plan with Modules

Total Hours: 60 (Incl. Test)

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

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)	Comparative Chart, Discussion		

Course In-charge:
Punitha
Dr. X. Venci Candida

Head of the Department:
Dr. F. BriscaRenuga

Dr. C. Dr.

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

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

Objectives

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

Course outcomes

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

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

Genetics

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

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

Clinical Laboratory Technology

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

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

Course In-charge

Dr. C. Josephine Priyatharshini

Head of the Department

Dr. F. BriscaRenuga

Semester

: VI

Major Core VIII

Name of the Course

: Developmental Biology

Course code

: ZC2061

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

Objectives

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

Course Outcomes

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

Teaching Plan with Modules

Total Hours: 90 (Incl. Assignment & Test)

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

	3	Fertilization -types, chemical and cytological factors involved in fertilization, physiological changes in fertilization, significance, Prevention of polyspermy	5	Identifies the cytological and physiological changes during fertilization. (CO-1)	PPT, video Lecture	mind map
	4	Asexua reproduction. Parthenogenesis - types and significance.	4	Illustrates the process of parthenogenesis. (CO-1)	PPT, video Lecture	
II	Cleavage and Gastrulation(18 Hrs.)					
	1	Cleavage: Planes and patterns of cleavage, factors controlling cleavage, cleavage and blastulation in frog.	4	Relates the different planes and patterns of cleavage. (CO-2)	Video links and PPT	<p>Quiz through google classroom, Quiz through slido.com</p> <p>Online assignments</p> <p>Mind map on development of organ systems</p> <p>Formative Assessment I</p>
	2	Fate map of frog. Morphogenetic movements.	3	Relates the morphogenetic movements during blastulation. (CO-2)	Video lesson, Lecture, PPT	
	3	Gastrulation in frog.	2	Explores the process involved in gastrulation. (CO-2)	PPT.	
	4	Organizer –Spemann’s experiments - organizer in amphibian embryo, embryonic induction - neural induction.	6	Records how the different organs are developed. (CO-3)	PPT, Video on you tube.	
	5	Competence. Gradient theory gradient system - types experimental evidences mechanism.	3	Recognize the development of digestive system. (CO-3)	Lecture using PPT	
III	Organogenesis(18 Hrs.)					
	1	Development of eye, heart, digestive system in frog	4	Recognize the development of digestive system. (CO-2)	Video links and PPT, Lecture	<p>MCQ, Flow chart, Mind map, Short Answer Test,</p> <p>Formative assessment II</p> <p>Quiz II, Online assignment</p>
	2	Extra embryonic membranes - development of fetal membranes.	3	Relates the development of fetal membranes. (CO-2)	Video lesson, Lecture using PPT	
	3	Placenta in mammals - classification, functions	2	Explores the process involved in gastrulation. (CO-2)	PPT.	
	4	Development Stemcells, Preservation of cord blood	6	Records the development of Stem cells, Preservation of	Narrative PPT –Screen	

		stem cells.		cord blood stem cells.. (CO-3)	capture using Camtasia tool, Develop and upload video on you tube.	
	5	Principles of collections of Umbilical cord, gametes and embryos.	3	Explore the collections of Umbilical cord. (CO-3)	Lecture using PPT	
IV Metamorphosis and Regeneration (18 Hrs.)						
	1	Metamorphosis: Types, Insect and Amphibian metamorphosis.	3	Explores the process of metamorphosis. (CO-4)	Flow Chart using PPT, Seminar by student Video link	Quiz through quizziz, Quiz through mentee.com Online assignments Flow chart of metamorphosis Formative Assessment II
	2	Hormonal control of metamorphosis in Insect and Amphibian.	4	Records how hormones control metamorphosis. (CO-4)	Lecture with PPT.	
	3	Regeneration: types, regeneration in Planaria, Amphibia and human liver.	3	Recognize the regeneration process in Planaria, amphibian and human. (CO-4)	Seminar by student Interactive PPT.	
	4	Factors influencing regeneration, physiological changes involved in regeneration.	3	Identifies the factors involved in regeneration. (CO-4)	Lecture with PPT online video lesson.	
	5	Nucleo - cytoplasmic interaction- Acetabularia. Ageing-concepts and theories	3	Explore the concepts and theories of ageing	Chalk and Talk. Lecture	
	6	Syntheticbiology– syntheticlife.	2	Explains synthetic biology– synthetic life.	Lecture, PPT	
V Embryological Techniques(18 Hrs.)						
	1	Infertility– causesanddiagnosticparameters– hormonalimbalance,PolycysticOvarianDiseases(PCOD).Rhfactorsandincompatibility	2	Explains infertility causes and diagnosis. (CO-3)	Open board, Animation videos	Quiz through google classroom, Flow Chart Formative

	2	<i>Invitro</i> fertilization,artificialinsemination,cryopreservationof sperm and ovum-test tube babies – amniocentesis.	4	Recalls the causes of infertility. (CO-3)	PPT	Assessment I Quiz I, Online assignment,
	3	Teratogenesis-agents and their effects.	4	Identifies teratogenesis-agents and their effects. (CO-3)	Online diagrams and open board	
	4	Cryopreservation of sperm and ovum - test tube babies – amniocentesis.	3	Illustrates the process of cryopreservation. (CO-4)	Lecture with PPT.	
	5	Birthcontrol- physical barriers-contraceptive devices- IUCD, surgicalmethod.	2	Relates the different contraceptive devices. (CO-4)	Video lesson	
	6	Hormonal and therapeutic methods of birth control	3	Explores the hormonal and therapeutic methods of birth control. (CO-4)	Lecture with PPT	
Course instructor					Head of the Department	
Dr. S. Prakash Shoba			Dr. A. Shyla Suganthi		Dr. C. Josephine Priyatharshini	

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

Major Core IX

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

Objectives

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

CourseOutcomes

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

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

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

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

		infections - Humoral immune response, Cell-mediated immune response.		response. Illustrate cell mediated response. (CO-2)	Lecture, Group discussion	test, Internal test II – Quiz II
	3	Hypersensitivity: Allergens and types of hypersensitivity.	4	Summarize Allergens and types of hypersensitivity. (CO-2)	Interactive classroom	
	4	Autoimmunity - Rheumatoid arthritis. Immunobiotics – definition, respiratory and digestive ailments.	4	Identify the causes, symptoms and treatment of Rheumatoid arthritis. (CO-2)	video, interactive classroom	
	5	Vaccines and Immunization schedule.	2	Indicate Immunization schedule. (CO-2)	PPT, Chart, Blended classroom	
IV	Microbiology (18 Hrs.)					
	1	History and scope of microbiology. Whittaker's and Bergy's classification of microbes.	4	Enumerate the history of microbiology. (CO-3)	PPT, Chart, Storytelling Lecture	Mind map, online Assignment Open book test, Internal test I, Quiz I
	2	Bacteria: structure of <i>E. coli</i> , bacterial growth kinetics.	3	Explain the structure of <i>E. coli</i> and bacterial kinetics. (CO-3)	Interactive Lecture, PPT, Video	
	3	Culture media. Culture techniques - batch culture and continuous culture (chemostat and turbidostat).	5	Differentiate and apply culture media. Describe different culture technique. (CO-3)	Lecture-Demonstration, Group discussion, Video	
	4	Virus: structure (SARS and T4 phage) – reproduction of T4 phage (lysogenic and lytic).	4	Illustrate the structure of Virus and its reproduction. (CO-3)	Lecture, Video, PPT	
	5	Synthetic Biology	2	Outline Synthetic Biology. (CO-3)	Interactive Lecture, PPT	
V	Food Microbiology, Industrial Microbiology and Medical Microbiology (18 Hrs.)					
	1	Food Microbiology - Food poisoning, food spoilage and preservation.	4	Explain food poisoning and spoilage. (CO-5)	Formal Lecture, PPT, Peer group discussion.	Short test, Class test, Internal test II Quiz II

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

Semester : VI
 Name of the Course: Organic Evolution

Major Core X

Course Code: ZC2063

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

Objectives

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

Course Outcomes

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

Teaching Plan with Modules

Total Hours 75 (Incl. Assignments & Test)

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

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

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

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

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

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

Objectives

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

Course Outcome

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

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

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

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

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

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

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

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

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

Learning Objectives

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

Course Outcomes

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

Teaching plan with Module

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

Units	Module	Topic	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
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.
	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	Internal Assessment.
	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	3	Document the field trip.	Field Trip	

		and field report of the visit (compulsory).		(CO-4)		
	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-3)	Practical	Peer-assessment. Performance-based Assessment. Self-assessment Model examinations Record submission
	2	Prodigality of nature - Frog.	2	Identify the prodigality of nature – Frog and explain the concept of over-production. (CO-3)	Practical	
	3	Mutant forms in <i>Drosophila</i> .	4	Culture <i>Drosophila</i> and identify Mutant forms in <i>Drosophila</i> . (CO-3)	Demonstration	
	4	Observation of variation in finger prints.	2	Identify the various patterns of finger prints and prove the theory “variation is universal.” (CO-3)	Practical	
	5	Variations in the markings of Umbonium shells.	2	Observe the markings of Umbonium shells and prove the theory “No two individuals are alike.” (CO-3)	Practical	
	6	Demonstration of Natural selection on gene frequency using beads.	2	Analyse the impact of Natural selection on gene frequency using beads. (CO-3)	Demonstration	
	7	Demonstration of Genetic drift on gene frequency using beads.	2	Test the role of Genetic drift on gene frequency using beads. (CO-3)	Practical	
	8	Demonstration of DNA sequence alignment by BLAST and construction of cladogram.	4	Demonstrate DNA sequence alignment by BLAST and construction of cladogram. (CO-3)	Demonstration	
	9	Homology- fore limbs of vertebrates, Analogy - wings of animals.	2	Identify Homology and Analogy in animals and prove organic evolution. (CO-3)	Charts	

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

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

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

Learning Objectives

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

Course Outcomes

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

Teaching plan with Module

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

Units	Module	Topic	Hours	Learning Outcome/ CO addressed	Pedagogy	Assessment
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.
	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	Internal Assessment.
	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	3	Document the field trip.	Field Trip	

		and field report of the visit (compulsory).		(CO-4)		
	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-3)	Practical	Peer-assessment. Performance-based Assessment. Self-assessment Model examinations Record submission
	2	Prodigality of nature - Frog.	2	Identify the prodigality of nature – Frog and explain the concept of over-production. (CO-3)	Practical	
	3	Mutant forms in <i>Drosophila</i> .	4	Culture <i>Drosophila</i> and identify Mutant forms in <i>Drosophila</i> . (CO-3)	Demonstration	
	4	Observation of variation in finger prints.	2	Identify the various patterns of finger prints and prove the theory “variation is universal.” (CO-3)	Practical	
	5	Variations in the markings of Umbonium shells.	2	Observe the markings of Umbonium shells and prove the theory “No two individuals are alike.” (CO-3)	Practical	
	6	Demonstration of Natural selection on gene frequency using beads.	2	Analyse the impact of Natural selection on gene frequency using beads. (CO-3)	Demonstration	
	7	Demonstration of Genetic drift on gene frequency using beads.	2	Test the role of Genetic drift on gene frequency using beads. (CO-3)	Practical	
	8	Demonstration of DNA sequence alignment by BLAST and construction of cladogram.	4	Demonstrate DNA sequence alignment by BLAST and construction of cladogram. (CO-3)	Demonstration	
	9	Homology- fore limbs of vertebrates, Analogy - wings of animals.	2	Identify Homology and Analogy in animals and prove organic evolution. (CO-3)	Charts	

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

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

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

Objectives

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

Course Outcomes

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

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

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

Immunology and Microbiology

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

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

Course instructor	H e a d o f t h e D e p a r t m e n t	
Dr. A. Punitha	Dr. S. Mary Mettilda Bai	Dr. F. Brisca Renuga