

Semester II
Practical I - Biochemistry and Ecobiology
Course Code: PZ20P1

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

Learning Objectives

1. To design and perform biochemical experiments.
2. To understand the interaction between abiotic and biotic environment.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	describe the knowledge necessary for professional or academic work in the field of biochemistry and ecology.	PSO - 1	U
CO - 2	analyse the biomolecules and physico-chemical parameters in samples.	PSO - 2	An
CO - 3	develop drawing and writing skills and design experiments.	PSO - 4	Ap
CO - 4	estimate the components of an ecosystem.	PSO - 2	E

Teaching Plan with Modules
Total Hours 30

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

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

Course Instructor

Dr. J. Josephine Vinoliya Mary

Head of the Department

Dr. S. Mary Mettilda Bai

Teaching plan with Modules

Total Hours: 30 (Incl. Test)

Ecobiology (30 Hours)

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

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

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

Course Instructor
Dr. Jeni Chander Padua

Head of the Department
Dr. S. Mary Mettilda Bai

Semester: II

Core V

Name of the Course: Biostatistics, Computer Applications and Bioinformatics

Course code : PZ2021

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

Learning Objectives

1. To enable the students to collect and use the data to derive inferences in various biological experiments.
2. To develop analytical skills of statistics and draw valid conclusions in research.

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	recall different biological data, methods of collection, processing and retrieval tools in sequence analysis.	PSO - 1	R
CO - 2	Explain measures of dispersion, significance of data and soft wares applied in biostatistics and biological databases.	PSO - 2	U
CO - 3	analyze the data and interpret the results manually or by using software.	PSO - 2	An
CO - 4	apply statistical and bioinformatics tools in research and gain employability in Research and Development organizations.	PSO - 3	Ap
CO - 5	evaluate biological data and critically analyse the research findings.	PSO - 4	E
CO - 6	formulate hypothesis, solve problems and present data to the scientific community.	PSO - 4	C

Modules with Teaching Plan

Total Hours: 90 (Incl. Seminar & Test)

UNIT	Section	Description	Hours	Learning outcome / CO addressed	Pedagogy	Assessment
I	Data collection and presentation (18 hrs)					
	1	Population and sample in biological studies, variables and sampling methods	2	Classifies variables and constants. Differentiate population and sample. (CO-1)	PPT	Short test, MCQ, Seminar, Online Assignment

	2	Types of biological data.	2	Compares primary and secondary data (CO-1)	PPT	Class test I Formative assessment I Quiz I
	3	Measurement scales - ratio scale, interval scale, ordinal scale, nominal scale - parameters and statistics. Accuracy and precision.	4	Recognize different kinds of scales (CO-2)	PPT, Group discussion	
	4	Data collection and presentation - Tabulation	3	Recognize different methods of Classification and Tabulation. (CO-3)	PPT, Group discussion	
	5	Data collection and presentation – graphs and diagrams	3	Creates different types of diagrams and graphs (CO-3)	problem based learning	
	6	Measures of central tendency: types of mean, median, mode.	4	Distinguish measures of central tendency. (CO-1)	Problem solving	
II	Measures of dispersion (18 hrs)					
	1	Measures of dispersion: range – quartile and percentile.	2	Assess and construct Quartiles and Percentiles. (CO-2)	PPT	MCQ Mind map
	2	Mean deviation - standard deviation - coefficient of variation	2	Differentiates absolute and relative measures of dispersion. (CO-2)	Problem solving	Seminar, Online Assignment
	3	Skewness and kurtosis - standard error	2	Evaluates and interprets the skewness and	PPT, Problem solving	Formative assessment I (1)
				kurtosis. (CO-2)		Quiz I
	4	Distribution: Binomial, Poisson and Normal.	2	Apply probability distributions to solve problems. (CO-3)	PPT, Problem solving. video clipping	Formative assessment II (2,3,4, 5,6,7) Quiz II
	5	Parametric and non parametric tests.	2	Apply parametric and non-parametric analysis. (CO-3)	PPT	
	6	Hypothesis testing – single and two population mean - types of error (Type I and Type II)	4	Relate Type I and Type II error and statistical significance. (CO-6)	Problem solving, Chalk and talk	

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

				models. (CO-5)		
IV	Computer applications (18 hrs)					
	1	Computer applications. Microsoft office - M.S. Power point	3	Create document and power point slides in Microsoft word programs. (CO-1)	PPT, Practical	MCQ Seminar, Online Assignment
	2	MS Excel	2	Generate charts and graphs. (CO-1)	PPT, Practical	Formative assessment I - (1- 4)

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

4	Biological sequence analysis (BLAST, FASTA Biological sequence analysis: sequence alignment, pair-wise alignment and multiple sequence alignment (CLUSTALW).	5	Perform pairwise and multiple sequence alignment using software. (CO-1)	PPT, Mind storming Jigsaw
5	Protein structure visualizing tools (RasMol, Swiss PDB Viewer).	3	Analyze structure of proteins. (CO-4)	Chart, video
6	Applications of bioinformatics tools.	2	Recall the applications of bioinformatics tools. (CO-4)	Discussion

Course instructor

Dr. Josephine Vinoliya Mary
Dr. F. Brisca Renuga

Head of the Department

Dr. S. Mary Mettilda Bai

Seminar topics

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

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

Semester : II

Core VI

Name of the Course : Cell and Molecular Biology

Course code : PZ2022

No. of Hours/ week	No. of Credits	Total Number of Hours	Marks
6	4	90	100

Learning Objectives

1. To provide knowledge on the structure and functions of bio-membranes, cell organelles and signaling pathways.
2. To avail employment in educational institutions and research laboratories.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recognize the structural and functional organization of plasma membrane, cell organelles, cell receptors, protein synthesis and abnormal cell growth.	PSO - 1	R
CO - 2	illustrate cellular organization and changes occurring in cells.	PSO - 1	U

CO - 3	analyse the prokaryotic and eukaryotic cells, flow of genetic information from DNA to protein, cell signaling and regulation of cell cycle.	PSO - 2	An
CO - 4	evaluate the changes in the cells, cell cycle and proteins involved in the regulation and apoptosis.	PSO - 4	E
CO - 5	apply the principles and techniques of molecular biology for research and employment.	PSO - 3	Ap

Teaching Plan with Modules

Total Hours: 90 (Incl. Seminar & Test)

Units	Modules	Topic	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	Cell Structure & Functions of cell organelles (18 Hrs.)					
	1	prokaryotic and eukaryotic cells – structure.	2	Differentiate prokaryotic cells from eukaryotic cells. (CO-3)	Lecture, ppt, Group discussion	Short test, MCQ, Seminar, Online Assignment Formative assessment - I (1,2,3,4,5,6) Quiz I
	2	Plasma membrane: Structure and function - active transport and pumps	4	Explain transport across membranes and the role of the proteins involved in it. (CO-1)	Lecture, video	
3	Transport by transporter proteins – membrane potential.	3	Comprehend the mechanism of resting membrane potential (CO-1)	Lecture, ppt		
	4	Tight junction Gap junction.	2	Recall and relate the role of tight and gap junction. (CO-1)	Lecture, ppt	
	5	Cytoskeleton – Microfilaments, intermediate filaments and microtubules.	4	Describe the structure and role of cytoskeletons of the cell. (CO-2)	Lecture, video	
	6	Extracellular matrix – Collagen and non – collagen components.	3	Evaluate the function of extracellular matrix. (CO-2)	Lecture, ppt	
II	Cell organelles and Nucleic acids (18 Hrs.)					
	1	Structure and functions of Nucleus, mitochondria and Endoplasmic reticulum.	6	Illustrate and relate the coordination of Nucleus, mitochondria and ER. (CO-2)	Seminar, Lecture, video	Short test, Seminar, Online Assignment,

	2	Structure, functions of Golgi complex and lysosomes.	4	Identify and describe the structure of the Golgi complex and lysosomes and infer their relationship. (CO-1)	Lecture, Group discussion	Formative assessment – I (1,2,3)
	3	Ribosomes and translation of genetic information.	3	Discriminate the flow of information from DNA to a protein. (CO-3)	Lecture, ppt, video clipping	Quiz I
	4	Types, structure and functions of DNA.	3	Identify the main cytoskeletal components in diagrams and EM micrographs. (CO-1)	Seminar, ppt	Formative assessment – II (4,5)
	5	Types, structure and functions of RNA.	2	Recall the role of RNAs. (CO-3)	Seminar	Quiz II (4,5)
III	Cell signaling (18 Hrs.)					
	1	Signaling pathways: Cell adhesion molecules - Extra cellular signaling	3	Describe the structure and functions of the different families of cell adhesion receptor molecules. (CO-3)	Lecture, ppt	Short test, MCQ, Seminar, Online Assignment
	2	Signaling molecules and their receptors	2	Explain the types of signaling molecules and functions of the cell surface receptors. (CO-3)	Lecture, ppt	Formative assessment - I (1,2) Quiz I
	3	Pathways of intracellular signal transduction: G protein coupled receptors	3	Understand the intracellular signal transduction pathways and G protein coupled	Lecture, video, mind map	Formative assessment - II (3,4, 5, 6) Quiz II

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

3	Apoptosis– mechanism and significance.	3	Explain the mechanism and significance of Apoptosis. (CO-4)	Lecture, Ppt, mind map	Formative assessment -
4	Molecular aspects of cancer, proto-oncogenes – oncogenes, tumour suppressor genes	5	Analyse the role of oncogenes and tumour suppressor genes. (CO-4)	Lecture, video,	II (1,2,3,4) Quiz - II

Course instructor

Dr. C. Josephine Priyatharshini (In - charge)
Dr. P. T. Arokya Glory

Head of the Department

Dr. S. Mary Mettilda Bai

Seminar and Online Assignment topics

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

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

Semester : II
Name of the Course : Developmental Biology
Course code : PZ2023

Core VII

No. of hours/ week	No. of credits	Total number of hours	Marks
5	4	75	100

Learning Objectives

- To enable the students to gain knowledge on the process by which a zygote multiplies, differentiates and develops into an adult.
- To gain employment at fertility centers, hospitals and health centers.

Course Outcome

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	discuss basic concepts and developmental processes of different organ systems and techniques in reproductive biology.	PSO - 1	R
CO - 2	distinguish the embryonic structures, origin and development of organ systems.	PSO - 1	U
CO - 3	analyse the regulating mechanisms of developmental processes and identify deformities.	PSO - 2	An
CO - 4	apply knowledge to pursue higher studies and gain employability in biological research laboratories.	PSO - 3	Ap

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

Unit	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	Introduction (15 Hrs.)					
	1	Historical perspectives and theories of embryology.		Explain the theories of embryology. (CO-2)	PPT	Short test, Quizziz, Mind map, Formative
	2	Sexual and asexual		Differentiate the process	Lecture	
		reproduction - Parthenogenesis and types.		and types of reproduction (CO-3)	with Open board	assessment I (1,2,3,4) Quiz 1(1,2,3,4) Seminar, Online Assignment
	3	Male reproductive system of a mammal, spermatogenesis, structure and function of sperm, semen and seminal fluid.		Discuss the structure and function of male reproductive system and its function (CO-2)	PPT, Video lesson	
	4	Female reproductive system of a mammal, oogenesis, ovulation, vitellogenesis, types of eggs.		Explain the process of oogenesis and structure of female reproductive system Classify the types of eggs based on various factors (CO-3)	PPT, Flipped classroom	
II	Fertilization and molecular aspects (15 Hrs.)					
	1	Mechanism of fertilization, Theories of fertilization.		Analyze the theories of fertilization with the mechanism (CO-3)	PPT	MCQ Open book test Flow chart Formative assessment I (1) Quiz 1(1)
	2	Cleavage: laws - planes – patterns – chemical changes during cleavage		Identify the planes and patterns of cleavage Summarize the chemical changes that takes place during cleavage (CO-4)	Video lesson, Lecture with open board	

	3	Cleavage and blastulation in chick and mammal.		Outline the concepts of cleavage and blastulation in chick and mammal (CO-2)	PPT, Video	Formative assessment II (2,3,4) Quiz II (2,3,4) Seminar, Online Assignment
	4	Cell lineage, Fate map of chick and Mammal.		Explain the cell lineage and fate map of chick and mammal (CO-3)	PPT, Discussion	
III	Morphogenetic movements & Organogenesis (15 Hrs.)					
	1	Morphogenetic movements and Gastrulation in chick and mammal. Germinal layers and their derivatives.	5	Differentiate the types of morphogenetic movements and the dermal derivatives Describe gastrulation in chick and mammal. (CO-2)	PPT, Video	MCQ Short test, Quiz, Mind map Flow chart Formative assessment I Quiz 1 Seminar, Online Assignment
	2	Neurogenesis, Notogenesis, development of mesoderm and coelom.	2	Illustrate neurogenesis and notogenesis. Comprehend the development of mesoderm and coelom. (CO-1)	PPT, Video	
	3	Development of eye, skin	3	Explain the formation of	Flipped	
		and its derivatives in chick and mammal.		eye and skin. (CO-3)	Class: PPT	
	4	Development of heart, kidney, limbs, alimentary canal and its derivatives in chick and mammal.	5	Explain the development of heart, kidney, limbs, alimentary canal and its derivatives in chick and mammal. (CO-3)	PPT, Discussion	
IV	Development of reproductive organs in man (15 Hrs.)					
	1	Development and differentiation of testis.	3	Comprehend the development of male reproductive organ. (CO-3)	PPT, Video	MCQ, Short test, Seminar, Online Assignment Seminar, Formative assessment II Quiz II
	2	Development of male genital ducts and accessory glands.	2	Differentiate the development of testis and accessory glands. (CO-3)	PPT, Video	
	3	Development and differentiation of ovary, female genital ducts and accessory glands.	4	Differentiate the development of ovary and accessory glands. (CO-3)	PPT, Video	
	4	Teratogenesis and teratogens. Infertility – causes and treatment	3	Analyse the different causes of infertility and methods to solve. (CO-3,4)	PPT, Video	

	5	Development of extra embryonic membranes. Placentation in mammals.	3	Identify the extra embryonic membranes. Compare the placenta of mammals. (CO-3)	PPT, Video	
V	Embryonic induction, Metamorphosis&Regeneration (15 Hrs.)					
	1	Embryonic induction in vertebrates – types – exogenous and endogenous. Theories of organizer or inductor, competence.	4	Explain the process of induction and competence. (CO-3)	PPT, Classroom screen	MCQ. Short test. Online Assignment. Formative assessment II (1,2,3,4) Quiz II (1,2,3,4). Seminar
	2	Differentiation - characteristics and types, selective action of genes in differentiation.	3	Explain the role of genes in differentiation. (CO-4)	PPT, Video	
	3	Metamorphosis in insects and amphibians. Neoteny.	3	Explain the process of metamorphosis and neoteny. (CO-1)	PPT, Video	
	4	Regeneration - Regenerative ability in animals and mechanism.	5	Analyse the regenerative ability of animals. (CO-3)	PPT, Video	

Course instructor
Dr. X. Venci Candida
Mettilda Bai

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

Seminar & Assignment Topics

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

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

M.Sc. Zoology Semester II

Core VIII

Name of the Course: Research Methodology Coursecode : PZ2024

No.ofhours/week	No.ofcredits	Totalnumberofhours	Marks
5	3	75	100

Learning Objectives

1. To enable the student to understand the working principles of bio-instruments and methodologies used in biological investigations.
2. To enhance report writing skills and create self-employment opportunities.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO-1	outline the principles and working mechanism of laboratory equipment and research techniques.	PSO-1	R
CO-2	explain laboratory or field procedures, methods, and instrumentation for biological studies.	PSO-1	U
CO-3	analyze scientific methods to develop hypotheses, design and execute experiments by selecting the appropriate research techniques.	PSO-2	An
CO-4	conceptualize research processes, data presentation, report writing and publication in journals.	PSO-3	Ap
CO-5	evaluate scientific ideas and design experiments to address medical, social and environmental problems.	PSO-4	E

Teaching Plan with Modules

Total Hours: 75 (Incl. Seminar & Test)

Unit	Section	Description	Hours	Learning outcome/CO addressed	Pedagogy	Assessment
I	Microscope (15 Hrs.)					
	1	Principle-types-interference, fluorescence, confocal, electron microscopes-scanning tunneling microscope.	8	Explain the instrumentation of different types of microscope (CO-1,2).	PPT	MCQ Short test
	2	Atomic force microscope, Near field scanning optical microscope.	4	Discuss the principle and instrumentation of atomic force, near field scanning optical and Magnetic force microscope (CO-1,2).	Lecture, PPT	Formative Assessment I,
	3	Magnetic force microscope. Photomicrography.	3	Apply the principle of photography in taking photos of micro and macro-organisms (CO-1,2).	Lecture, Video, PPT	Quiz I
II	Centrifugation (15 Hrs.)					
	1	Principle-factors affecting sedimentation rate-Types and applications of centrifuges.	4	Operate the common centrifuges available in research/clinical labs. (CO-1,2).	Lecture, PPT	MCQ Open book test

	2	Cryotechniques - cryopreservation. Cytotechnique: Whole mounts.	2	Discuss the cryopreservation(CO-1,2).	Lecture, PPT	Shortest
	3	Microtome: Rotary and Freezing microtome. Microtomy: Fixation, Dehydration and Clearing, Microtomy: Embedding and Sectioning, Staining and Mounting.	9	Prepare whole and permanent mount of specimens/tissues(CO-1,2).	Lecture, PPT,	Formative Assessment I(1, 2) Quiz I & II Formative Assessment II(3)
III	Chromatography(15Hrs.)					
	1	Chromatography: Principle	2	Discuss the principle of chromatography(CO-1,2).	Lecture, PPT	MCQ
	2	types - gas and liquid chromatography - High Performance Liquid Chromatography - Ion exchange - Affinity chromatography.	6	Explain the principle and applications of different types of chromatography(CO-1,2).	Lecture, PPT	Formative Assessment II (1,2) Quiz II
	3	Electrophoresis: Principles, types - gel - Polyacrylamide gel, agarose gel, blotting techniques, Iso-electric focusing - Immuno-electrophoresis.	5	Demonstrate principles, types of electrophoresis and blotting techniques(CO-1, 2).	Online video, PPT, Interactive class	Formative Assessment I (3,4) Quiz I
	4	Protein sequencing methods.	2	Develop phylogram using sequencing methods (CO-1,2).	PPT, Virtual demonstration	
IV	Spectrophotometer(15Hrs.)					
	1	Spectrophotometer: principle, design and applications. Spectroscopy: principle-design	3	Analyze samples using spectrophotometer and spectroscopy(CO-1,2).	PPT, video	MCQ, Class
	2	Types - Atomic Absorption Spectroscopy, Flame photometer,	3	Analyze the constituents of the samples using AAS and flame photometer(CO-1,2).	PPT, online video	
	3	Chemiluminometer	1	Examine chemiluminescence of compounds/samples(CO-	video, Interactive	test Online

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

Courseinstructor

Dr.ShylaSuganthi

Dr.A.Punitha

HeadoftheDepartment

Dr. MaryMettilda Bai

Seminar Topics

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

Semester : II Elective II (a)
Name of the Course : Animal Behaviour and Chronobiology
Course code : PZ2025

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

Learning Objectives

1. To acquaint students with deep understanding of Animal behaviour and Chronobiology.
2. To develop skills of animal watching and procure jobs insanctuaries.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	describe animal behaviour, reflexes, biological rhythms and Chronobiology.	PSO - 1	R
CO - 2	summarize the history of ethology, social behaviour in animals, organization of circadian system in multicellular animals.	PSO - 1	U
CO - 3	illustrate the developing compassion towards animals, group selection, altruism, predict biological clock system, circadian pacemaker system in vertebrates.	PSO - 1	Ap
CO - 4	analyse the patterns of animal behaviour and complexity of biological clock system in vertebrates.	PSO - 3	An
CO - 5	assess the relevance of biological clocks for human welfare and taking decisions.	PSO - 4	E

Teaching Plan with Modules

Total Hours: 60 (Incl. Seminar & Test)

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

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

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

Course instructor

Dr. Jeni Chandar Padua

Head of the Department

Dr. S. Mary Mettilda Bai

Semester : II

Practical II

Name of the Course: Biostatistics, Computer applications and Bioinformatics & Cell and Molecular Biology

Course code : PZ20P2

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

Learning Objectives

1. To design an experimental problem and evaluate critically with inferential biostatistics and necessary computer skills.

2. To develop the skills involved in cell biology, histology and biomolecules separation techniques.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	analyze and interpret the collected data using statistical methods manually and soft wares.	PSO - 1	An
CO - 2	evaluate the biological samples applying research techniques.	PSO - 2	E
CO - 3	develop drawing and writing skills through record and design experiments.	PSO - 2	Ap
CO - 4	design biological experiments.	PSO - 2	C

Teaching Plan with Modules

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

Biostatistics, Computer applications and Bioinformatics (30 Hrs.)

UNIT	Section	Description	Hrs.	Learning outcome & CO addressed	Pedagogy	Assessment
I	1	Collection of biological data (Primary and Secondary).	4	Perform data collection.(CO-1)	Field visit and direct application	Pre-assessment.
	2	Classification and representation (Graphical and Diagrammatic) of collected data.	3	Analyse the data collected and apply graphical representation.(CO-2)	Practical	Performance-based Assessment.
	3	Measures of dispersion- Standard deviation and standard error	2	Recalls and apply the distribution.(CO-1)	Practical	Model examination
	4	Estimation of population by Mark and Recapture method using beads.	2	Estimate any population by mark and recapture method.(CO-4)	Practical	Self-assessment
	5	Correlation co-efficient – length and width of molluscan shells.	2	Recalls and analyse the relation between two variables.(CO-2)	Practical	

6	Study of probability using coin tossing with 2 and 3 coins and chi square test	2	Recalls and apply the theory. (CO-1)	Practical
7	Regression Analysis	2	Apply the theory and analyse the relation between two variables. (CO-41)	Practical
8	Test of significance (student's <i>t</i> -test).	2	Recalls and apply the theory. (CO-3)	Practical
9	Preparation of graph using M.S. Excel.	2	Apply the theory and Perform the same. (CO-3)	Practical
10	Retrieval of DNA and protein sequence from NCBI.	4	Retrieve protein and DNA sequence of biological data. (CO-1)	Practical

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

Course instructor

Dr. Josephine Vinoliya Mary

Dr. F. Brisca Renuga

Head of the Department

Dr. S. Mary Metilda Bai

Cell and Molecular Biology (30 Hrs.)

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

	10	Sectioning and staining of a tissue	3	Demonstrate staining techniques. (CO-4)	Practical	
		Spotters/ Slides Fluid mosaic model, Golgi complex, Cancer cell, Cadherins, Karyotype, Haemocytometer	3	Identify and narrate the structure and functions of cell organelles. (CO-3)	Observation	

Course instructor

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

Head of the Department

Dr. S. Mary Mettilda Bai

Semester**: IV****Practical****III Name of the Course: Physiology and Immunology****CourseCode****: PZ17P3**

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

Learning Objectives

1. To design experiments and apply it in physiological research.
2. To understand the various immune-techniques and apply in immunological experiments.

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO - 1	gain knowledge on the functioning of organ and organ systems.	PSO - 1	U
CO - 2	demonstrate the effect of abiotic factors on the physiology of the systems through experiments.	PSO - 2	Ap; An
CO - 3	identify the immune cells in a blood smear.	PSO - 1	R
CO - 4	demonstrate immune-techniques on antigen-antibody interaction.	PSO - 10	Ap

Teaching plan with Modules**Total Hours 30 (Incl. Practicals & Test)**

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

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

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

Course instructors
the Department

Dr. J. Vinoliya Josephine Mary
Mettilda Bai Dr. C. Josephine Priyatharshini

Head of

Dr. S. Mary

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

the Department

Dr. S. Mary Mettilda Bai
Mary Mettilda Bai

Head of

Dr. S.

Seminar & Assignment Topics

2. Seminar:
Animal models for research.
Assignment:
Endocrin

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

Semester
IV

:
Practical III Name of the

Course: Physiology and Immunology

CourseCode : PZ17P3

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

Learning Objectives

1. To design experiments and apply it in physiological research.
2. To understand the various immune-techniques and apply in immunological experiments.

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CI
CO - 1	gain knowledge on the functioning of organ and organ systems.	PSO - 1	U
CO - 2	demonstrate the effect of abiotic factors on the physiology of the systems through experiments.	PSO - 2	Ap; An
CO - 3	identify the immune cells in a blood smear.	PSO - 1	R
CO - 4	demonstrate immune-techniques on antigen-antibody interaction.	PSO - 10	Ap

Teaching plan with Modules

Total Hours 30 (Incl. Practicals & Test)

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

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

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

Course instructors
the Department
Dr. J. Vinoliya Josephine Mary Dr. S. Mary Mettilda Bai

Head of

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

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

Learning Objectives

- To design experiments and apply it in physiological research.
- To understand the various immune-techniques and apply in immunological experiments.

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CI
CO - 1	gain knowledge on the functioning of organ and organ systems.	PSO - 1	U
CO - 2	demonstrate the effect of abiotic factors on the physiology of the systems through experiments.	PSO - 2	Ap; An
CO - 3	identify the immune cells in a blood smear.	PSO - 1	R
CO - 4	demonstrate immune-techniques on antigen-antibody interaction.	PSO - 10	Ap

Teaching plan with Modules

Total Hours 30 (Incl. Practicals & Test)

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy
I	Physiology (30 Hrs.)				
	1	Effect of temperature on heartbeat of Freshwater Mussel and calculation of Q ₁₀ .	2	Find out the effect of temperature on heartbeat of Freshwater Mussel and calculate Q ₁₀ .(CO -2)	Demonstration & practical
	2	Effect of temperature on salivary amylase activity and calculation of Q ₁₀ .	2	Find out the effect of temperature on salivary amylase activity and calculate Q ₁₀ .(CO -2)	Demonstration & practical
	3	Effect of pH on salivary amylase activity.	2	Find out the action of salivary amylase in relation to pH. (CO -2)	Demonstration & practical
	4	Salt loss and salt gain in a freshwater fish.	2	Demonstrate Salt loss and salt gain in a freshwater fish. (CO -2)	Demonstration & practical
	5	Examination of excretory products of fish, bird and mammals.	2	Find out the type of nitrogenous waste eliminated by different animals. (CO -1)	Demonstration & practical
	6	Survey of digestive enzymes in Cockroach.	2	Find out the digestive enzymes present in the different parts of the digestive system of Cockroach. (CO -1)	Demonstration & Observation
	7	Counting of blood cells using haemocytometer.	2	Count blood cells using haemocytometer. (CO -1)	Demonstration & Observation
	8	Haemolysis of blood – Demonstration.	2	Demonstrate hemolysis of blood. (CO -1)	Demonstration & Observation
	9	Observation of haemin crystals in blood.	2	Mount haemin crystals in blood under microscope. (CO -1)	Demonstration & Observation
	10	Estimation of haemoglobin (any method).	2	Estimate the amount of haemoglobin in vertebrate blood samples. (CO -1)	Demonstration & Observation
	11	EEG, ECG, Conditional reflex, Skeletal muscle, Kymograph, Sphygmomanometer, Intestine, Nervous tissue, Liver, Lungs, Heart, Kidney.		Identify the apparatus/ equipments/ slides/ charts/ specimens/ models and comment on it. (CO -1)	Observation of apparatus/ equipments/ slides/ charts
II	Immunology (30 Hrs.)				
	1	Dissection of Lymphoid organs of a vertebrate (Demonstration).	2	Identify lymphoid organs. (CO -1)	Demonstration
	2	Histology of lymphoid organs (Chart / CD).	2	Identify cells and parts of lymphoid organs. (CO -1)	Chart / CD
	3	Identification of various types of immune cells in peripheral blood smear.	2	Identify blood cells. (CO -3)	Practical

	4	Separation and preparation of cellular antigen (RBC and bacteria).	2	Differentiate the RBCs and bacteria. (CO -3)	Practical
	5	Methods of immunization- Intravenous, intraperitoneal and subcutaneous routes.	4	Differentiate intravenous and subcutaneous routes. (CO -1)	Virtual lab
	6	Methods of blood collection and serum preparation.	4	Demonstrate different blood collection methods. (CO -1)	Virtual lab
	7	Antigen antibody interaction: Blood typing and Hemagglutination.	2	Identify different blood groups. (CO -4)	Demonstration and observation
	8	ELISA test (Demonstration).	2	Demonstrate ELISA. (CO -4)	Demonstration and observation
					observation
	9	Radial immunodiffusion,	4	Demonstrate immunodiffusion. (CO -4)	Demonstration and observation
	10	Double immunodiffusion	2	Demonstrate immunodiffusion. (CO -4)	Demonstration and observation
	11	Immuno-electrophoretic apparatus Semi dry blotting apparatus Counter current immunoelectrophoresis (chart), Rocket immunoelectrophoresis (chart).	4	Differentiate different Immuno electrophoretic apparatus. (CO -4)	Observation of apparatus/ charts

Course instructor

Head of

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