Semester I
Core I - Biochemistry
Course Code: PZ2011

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

Learning Objectives

1. To impart knowledge on chemical structure, functions and metabolic process of biomolecules in living system.
2. To develop analytical and communicative skills to conduct experiments and interpret the results.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	define structure and types of chemical bonds in biomolecules such as hydrogen ions, water, protein, carbohydrate, lipid, nucleotides, enzymes and vitamins.	PSO - 1	R
CO - 2	explain the fate of biomolecules in different metabolic pathways.	PSO - 1	U
CO - 3	apply cognitive, technical and creative skills to pursue higher studies and employability in industrial, biomedical and research laboratories.	PSO - 4	Ap
CO - 4	analyse biomolecules in biological systems and relate deficiency disorders.	PSO - 3	An
CO- 5	design biochemical experiments and publish the results through effective written and oral communication after drawing accurate conclusions.	PSO - 2	E

Teaching plan with Modules

Total Hours: 90 (Incl. Assignments & Test)

nit	Modules	Topics	Hours	Learning Outcome / CO addressed	Pedagogy	Assessment
	Basic concepts of biochemistry (18 Hrs.)					
	1	Scope. Atoms – Molecules – Chemical bonds – Primary bonds and secondary bonds.	4	Outlines the scope of Biochemistry. Recalls atoms, molecules and chemical bonds.	Seminar, PPT, Video, Classroomscreen	Formative Assessment I

			(CO-1)		& Quiz I
2	pH and Hydrogen ion concentration - Buffers - 'Henderson-HasselBalch' equation -	5	Demonstrates the importance of pH in biological system. Describes the derivation of pH as a measure of acidity in biological and chemical systems. **(CO-1,4)**	Seminar, PPT, Group Discussion	Seminar Online assignment
3	Buffer systems in blood - Mechanism of buffer action - Acid base balance – Regulation of acid base balance – Acidosis and Alkalosis.	5	Illustrates the mechanism of buffer action Interpret the acid – base balance to diseases. **(CO-1,2,4)**	PPT, Video, Flow chart	Class test: Online Quiz (MCQ) using Google Forms
4	Water – Colligative properties - Water turnover and balance. Electrolyte balance – Dehydration and Water intoxication.	4	Explains the properties of water. Describes electrolyte balance. **(CO-1,2,4)**	PPT, Video, Mind Map	
Carbohydrate (18 Hrs.)					
1	Classification, structure, properties of mono, oligo and polysaccharides and biological role of carbohydrates.	2	Explains structure of carbohydrate. **(CO-1,2,4)**	Lecture using screen capture technique Seminar	Formative Assessment I& QuizI Seminar Home assignment Class test: Quizizz Kahoot
2	Carbohydrate metabolism - glycogenesis, glycogenolysis, glycolysis.	4	Distinguish and describes catabolic and anabolic process. **(CO-1,2,3,4)**	Interactive PPT, Seminar Slido	
3	Krebs cycle, Electron transport and Oxidative phosphorylation, Energetics of glucose metabolism.	3	Summaries the ATP producing process in the biological system. **(CO-1,2,3,4)**	Interactive PPT, Video, Chart	
4	Pasteur effect–HMP shunt - gluconeogenesis – glyoxylate pathway– Cori cycle.	4	Differentiate different pathways of metabolism. **(CO-1,2,3,4)**	Lecture with PPT, Mind map	
5	Regulation and hormonal control of carbohydrate metabolism.	2	Correlate hormones to carbohydrate metabolism and diseases. **(CO-1,2,3,4)**	Lecture using jamboard tool, Discussion	
6	Glycogen storage diseases – blood sugar level – Glycosuria - Glucose tolerance test – Diabetes.	3	apply knowledge to glycogen storage diseases. **(CO-3,4)**	Lecture with video links	

Proteins (18 Hrs.)					
1	Classification, structure, Ramachandran plot, Properties and biological role.	3	Classify proteins. Describes the structure and discuss the role of proteins. **(CO-1,4)**	Seminar, PPT, Video	Formative Assessment II & Quiz II
2	Amino acids - classification, structure and properties.	3	Describes the structure and properties of amino acids. **(CO-1,2)**	Seminar, PPT, Group Discussion	Group Discussion
3	Metabolism of proteins - deamination, transamination – transmethylation and decarboxylation of amino acids.	4	Differentiate different methods ofmetabolism of amino acids.**(CO-2,3,4)**	PPT, Video, E-Content	Seminar Slip test (MCQ) using Google Forms
4	Glycogenic and ketogenic amino acids. Formation and transport of ammonia - glucose-alanine cycle - Ornithine cycle.	4	Recalls and compare the metabolism of protein and carbohydrate. **(CO-2,3,4,5)**	PPT, Video, Google jamboard	
5	Metabolism of Phenylalanine, Tyrosine. Tryptophan. Porphyrins	4	Explains amino acids metabolism **(CO-3)**	Seminar, PPT, Video	
Lipids (18 Hrs.)					
1	Classification, structure and Biological role – Chylomicrons.	3	Describe structure and Define Chylomicrons. **(CO-1,2,4)**	Lecture with PPT, Seminar	Formative Assessment II& QuizII
2	VLDL, LDL, HDL - Lipid metabolism. Theories of oxidation of fatty acids.	3	Define VLDL, LDL, HDL Describes oxidation theories. **(CO-1,2,3,4)**	Lecture, PPT, Classroomscreen	Online assignment through Google classroom
3	Oxidation of any one fatty acid and its bioenergetics (palmitic acid).	3	Explains beta oxidation. **(CO-1,2,3,4)**	Interactive PPT, Flow chart	
4	Ketogenesis - Biosynthesis of palmitic acid.	3	Identify different steps in the process of biosynthesis. **(CO-1,2,3,4)**	Video link, PPT	
5	Metabolism of cholesterol - lipid storage diseases – Role of liver in fat metabolism. Prostaglandins.	3	Describes and interpret role of liver. Explains role of Prostaglandins. **(CO-1,2,3,4)**	Lecture with PPT, Group discussion	Seminar Class test: Mind map
6	Integration of carbohydrate, protein and lipid metabolism.	3	Summarise the integration of metabolism. **(CO-1,2,4)**	Self-paced class –E-content, Mind map	
Nucleotide metabolism, Enzymes, Vitamins (18 Hrs.)					
1	Biosynthesis and degradation of purines and pyrimidines**.**	4	Describes the biosynthetic process of Purines & Pyrimidines. Recall DNA structure.	Video links and PPT, Classroomscreen	Formative Assessment I& QuizI (2,3,4)

			(CO-1,2,4)		
2	Enzymes: Classification, nomenclature, enzyme kinetics.	3	Recall and Identify the enzymes. **(CO-1,2,4)**	Lecture using PPT, Seminar	Formative Assessment II & QuizII (1,5) Class test: Quiz through slido.com Online assignments: Mind map Seminar
3	Michaelis - Menten constant, enzyme inhibition, mechanism of enzyme action, factors affecting enzyme activity, isozymes, coenzymes.	4	Describes the role of enzymes and recall physiology of digestion. **(CO-1,2,3,4,5)**	Lecture using PPT, Seminar	
4	Classification of Vitamin (fat soluble and water soluble), occurrence and biochemical role.	3	Recall the nutrients and identify the sources and symptoms. **(CO-1,2,3,4,5)**	Thematic Discussion, Chart	
5	Mechanism of detoxification (oxidation, reduction, conjugation) - cytochrome P 450 system.	4	Explain and appreciate the detoxification process in the biological system. **(CO-1,2,3,4,5)**	Video lesson, Google jamboard, PPT	

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

J. Vinoliya Josephine Mary
Dr.S. Mary Mettilda Bai

nar & Assignment topics

UNIT I

1. Scope of Biochemistry.
2. Atoms - molecules - chemical bonds - primary bonds and secondary bonds.
3. Hydrogen ion concentration and buffers.
4. Colligative properties of water.

UNIT II

5. Carbohydrates:Classification and structure.
6. Properties of mono, oligo and polysaccharides.
7. Biological role of carbohydrates.
8. Glycogenesis and glycogenolysis.
9. Glycolysis
10. Krebs cycle
11. Electron transport and Oxidative phosphorylation

UNIT III

12. Proteins:Classification and structure
13. Properties and biological role of proteins
14. Amino acids – classification and structure
15. Properties of amino acids.

UNIT IV

16. Lipids: Classification, structure and biological role.
17. Chylomicrons, VLDL, LDL, HDL

18. Lipid metabolism – general
19. Theories of oxidation of fatty acids.

UNIT V

20. Enzymes: classification, nomenclature.
21. Enzyme kinetics and mechanism of enzyme action.
22. Factors affecting enzyme activity.
23. Classification of fat soluble vitamins.
24. Classification of water soluble vitamins.
25. Vitamins: occurrence and biochemical role.

II. On line assignment – Conducting test through Google form and submission of marks from the allotted seminar topics.

Semester I

Core II - Ecobiology

Course Code: PZ2012

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

Learning Objectives

1. To impart knowledge on ecosystem, population, community, environmental pollutions and natural resources.
2. To develop the skill to sensitize environmental issues and work productively within and beyond the academy for sustainable environment.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	define various laws of ecology, components of ecosystem, characteristics and dynamics of population and community, natural resources and environmental pollutants.	PSO - 1	R
CO - 2	classify different types of ecosystem, habitat, environmental factors and interpret the population processes, ecological succession, biological clock, biogeochemical cycles, biogeography, natural disasters and causes of pollution.	PSO - 1	U
CO - 3	develop cognitive, technical and creative skills which enable students for life-long learning and participate in environmental protection and conservation activities for sustainable environment and gain employability.	PSO - 3	Ap
CO - 4	analyse the nature of ecosystem, habitat, population, community, natural resources and environmental pollutions.	PSO - 2	An
CO - 5	assess the environmental issues like population explosion, urbanization, depletion of natural resources, pollution and waste managements.	PSO - 2	E

CO - 6	formulate hypotheses and test them by designing appropriate experiments, analyze, interpret the data and communicate the results through effective written and oral communication.	PSO - 4	C

Teaching Plan with Modules

Total Hours: 90(Incl. Seminar & Test)

Unit	Modules	Topics	Hours	Learning outcome / CO addressed	Pedagogy	Assessment
I	**Introduction to Ecology (18 Hrs)**					
	1	Scope of Ecobiology. Environmental concepts - laws and limiting factors.The environment - physical factors (climatic factors, topographic factors, edaphic factors),	3	Explain the advantages of being aware of ecobiology concepts, laws and factors. **(CO-1,2)**	Lecture, PPT, E-Content	Short test, MCQ, Seminar, Online assignment, Formative assessment I (1,2,3,4,5) Quiz I
	2	Biotic factors and their interactions (symbiosis, commensalism, parasitism and competition- prey-predator interactions - Scramble and contest competition).	3	Summarize ecosystem and its functions. **(CO-1,2)**	Lecture, PPT, You tube links, Blended teaching, E-Contents	
	3	Ecosystem: Concepts of ecosystem - structure and functions. Energy flow - single channel energy model, Y - shaped energy flow models.	3	Differentiate between the various models of energy flow. **(CO-1,2)**	Lecture, PPT, E-Contents, Mind map	
	4	Productivity - Primary production, secondary production, measurement of primary productivity. Homeostasis of the ecosystem	4	Summarize productivity and its types. **(CO-1,2)**	Lecture, PPT, Flow Chart, E-Contents	
	5	Habitat ecology: freshwater, marine, estuarine, mangrove and terrestrial.	5	Differentiate between the various ecological habitats. **(CO-1,2)**	Lecture, PPT, Youtube links, Flow charts.	
II	**Population and Community (18 Hrs)**					

	1	Population: Structure and regulation, growth form, population fluctuations, population processes.	4	Summarize the concept of population and various processes associated with it. **(CO-3,4)**	Lecture, PPT, E-Content	MCQ , Seminar, Online assignment, Formative assessment II (1,2,3,4,5) Quiz I Online assignment, Seminar
	2	life history strategies - diagrammatic and conventional life tables.Concept of Metapopulation.	3	Explain life table and life history strategies. **(CO-3,4)**	Lecture, PPT, Youtube links, Blended teaching, E-Contents	
	3	Community - basic terms, community structure, composition and stratification.	4	Describe community concept, structure etc. **(CO-1,3,4)**	Lecture, PPT, E-Contents, Mind map	
	4	Ecological niche, Ecotone and Edge effect, Ecotype.	3	Explain ecological niche and ecotype. **(CO-1,3)**	Lecture, PPT, Flow Chart, E-Contents	
	5	Ecological succession: types, general process, Concept of climax.	4	Summarize ecological succession. **(CO-1,3)**	Lecture, PPT, Youtube links, Flow charts.	
Unit III	**Biogeochemical cycles (18 Hrs)**					
	1	Water cycle, carbon cycle, nitrogen cycle	3	Summarize Gasceous cycle **(CO-1,2)**	Naitalism	
	2	Sulphur cycle and phosphorous cycle.	3	Summarize Sedimentary cycle **(CO-1,2)**	PPT , Web based	Short test, MCQ, Seminar, Online assignment, Formative assessment I (1,2,3,4,5,6, 7) Quiz I
	3	**Natural resource ecology**: Classification of resource, mineral resource	2	Classify Natural resources **(CO-5,6)**	PPT, You tube	
	4	Land resource, forest resource, water resource,	3	Describe different resources **(CO-5,6)**	PPT, Mind map	

	5	energy resource-conventional and non-conventional	2	Describe different energy resources **(CO-5,6)**	PPT, Group discussio n	
	6	**Remote sensing**: Physical basis – information extraction – role in ecological research.	2	Summarize remote sensing **(CO-5,6)**	Group discussio n, Web based	
	7	**Natural Disaster Management**: Floods, earthquakes, cyclones, landslides, Tsunami, Mitigation and Disaster Management.	3	Differentiate different types of disaster **(CO-5,6)**	You tube, Group discussio n	
	Biogeography (18 Hrs)					
Unit IV	1	Patterns of distribution (continuous, discontinuous, endemic), descriptive zoogeography, zoogeographical regions of the world	3	Differentiate the patterns of distribution **(CO-5,6)**	PPT, Web based	Slido Short test, MCQ, Seminar, Online assignment, Formative assessment I (1,2,3) Quiz I Formative assessment II (3,4,5,6) Quiz II
	2	Dynamic biogeography (dispersal dynamics, dispersal pathways, migration, ecesis).	3	Summarize different biogeography**(CO-5,6)**	You tube, Group discussio n	
	3	**Biodiversity**:Importance, Human impact on biodiversity,Endangered wildlife species - special projects in India - IUCN red list - hot spots.	3	Evaluate the importance of Biodiversity**(C O-5,6)**	Group discussio n, Web based	
	4	Levels of diversity - species, genetic, ecosystem.GIS and satellite imaging in	3	Explain different levels of diversity**(CO-**	PPT, You tube	
		biodiversity assessment.		**5,6)**		
	5	Biodiversity indices**:** Shannon-Weiner index, Simpson index, Similarity and dissimilarity index, Association index.	3	Formulate hypothesisand test them by designing appropriate experiments**(C O-4,5)**	PPT, Group Discussio n	

	6	Conservation of species: *In situ* and *Ex situ*- Wildlife sanctuaries, national parks and biosphere reserves - Indian Board of Wild Life (IBWL) - National Board for Wild Life (NBWL) - Wild Life Conservation Laws and Trade Laws (CITES) in India.	3	Summarize national parks and biosphere reserves**(CO-5,6)**	Group discussion, Web based	
Unit V	**Pollution ecology (18 Hrs)**					
	1	Green House gas emission and Global warming. Impact of chemicals on biodiversity - Pesticides and fertilizers in agriculture	4	Describe the impact of chemicals on biodiversity**(CO-3,6)**	PPT, You tube	Nearpod Short test, MCQ, Seminar, Online assignment, Formative assessment II (1,2,3,4,5) Quiz II
	2	Bio-indicator and biomarkers of environment.Carbon footprint, Carbon sink. Waste management: solid, liquid and gaseous wastes. e-wastes.	4	Evaluate the social and environmental issues**(CO-3,6)**	Group discussion, Web based	
	3	Toxicology: Biomagnification and bioaccumulation, toxicants, classification, toxicity (LC_{50} and LD_{50}), OECD Test Guidelines for the Chemicals (420, 423), mode of action of toxicants	4	Formulate hypotheses and test them by designing appropriate experiments, analyze, interpret data **(CO-4,5)**	Group discussion, Web based	
	4	. **Urbanization**: Possible advantages of urbanization – problems, solutions – satellite villages- biovillages.	3	Describe the advantagesproblems and solutions of urbanization **(CO-5,6)**	Group discussion, PPT	
	5	Environmental ethics.Central and State Pollution Control Boards.Environmental auditing, Environmental	3	Evaluate contemporary social and environmental issues**(CO-5,6)**	Group discussion, PPT	

	impact assessment, Legislations for environmental Protection.			

Course Instructors
Dr. Jeni Chander Padua
C. Josephine Priyatharshini

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Seminar (Three from each unit)

1. Seminar : Scope of Ecobiology
   Assignment : Laws of environment
2. Seminar : Physical factors of environment
   Assignment : Biotic factors of environment
3. Seminar : Structure and functions of Ecosystem
   Assignment : Concepts of Ecosystem
4. Seminar : Energy flow – Single channel model
   Assignment : Y Shaped Energy Flow model
5. Seminar : Primary productivity
   Assignment : Secondary productivity
6. Seminar : Structure of population
   Assignment : Regulation, growth and population fluctuations in population
7. Seminar : Life history strategies - diagrammatic table
   Assignment : Life history strategies - conventional table
8. Seminar : Concept of metapopulation
   Assignment : Population processes
9. Seminar : Structure of community
   Assignment : Composition and stratification of community.
10. Seminar : Ecological niche, Ecotone and Edge effect
    Assignment : Ecological succession
11. Seminar : Water cycle
    Assignment : Floods and Tsunami
12. Seminar : Carbon cycle
    Assignment : Earthquakes and landslides
13. Seminar : Nitrogen cycle
    Assignment : Cyclones
14. Seminar : Sulphur cycle
    Assignment : Mitigation
15. Seminar : Phosphorous cycle
    Assignment : Mineral resources

16. Seminar : Biogeography – Patterns of distribution
    Assignment : Zoogeographical regions of the world
17. Seminar : Dynamic Biogeography
    Assignment : Importance of Biodiversity
18. Seminar : Endangered wildlife species - special projects in India
    Assignment : IUCN red list - hot spots.Levels
19. Seminar : Indian Board of Wild Life - IBWL
    Assignment : National Board for Wild Life - NBWL
20. Seminar : Wild Life Conservation Laws and Trade Laws (CITES) in India.
    Assignment : Conservation of species: *In situ* and *Ex situ*
21. Seminar : Green House gas emission and Global warming
    Assignment : Impact of chemicals on biodiversity
22. Seminar : Bio-indicator and biomarkers of environment
    Assignment : Carbon footprint, Carbon sink.
23. Seminar : Biomagnification and bioaccumulation, toxicants
    Assignment : Guidelines for the Chemicals (420, 423), mode of action of toxicants
24. Seminar : Environmental ethics.Central and State Pollution Control Boards.
    Assignment : Legislations for environmental Protection

Semester I

Core III - Structure and Function of Invertebrates

Course Code: PZ2013

No. of hours/ week	No. of credits	Total number of hours	Marks
5	3	75	100

Learning Objectives

1. To provide knowledge on the functional aspects of systems of invertebrates on a comparative basis.
2. To empower students with skills to comprehend the taxonomical and physiological functions of vital systems in invertebrates.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recognise the organisation of coelom, mode of locomotion, nutrition, respiration, excretion and significance of larval forms of invertebrates.	PSO - 1	R
CO - 2	comprehend the systematic position and physiological functions of vital systems in invertebrates.	PSO - 4	U

CO - 3	apply the cognitive skills to pursue higher studies and employability relevant fields.	PSO - 3	Ap
CO - 4	explore the structure and functions of vertebrates.	PSO - 2	An

Teaching Plan with Modules

Total Hours: 75(Incl. Seminar & Test)

Unit	Modules	Topics	hrs	Learning Outcome	Pedagogy	Assessment
I	**Principle of Animal taxonomy** (12 hrs)					
	1	Species concept.	1	Demonstrate the knowledge of the concept of speciation.	PPT, Group discussion	Quiz through Google link, Test through Google classroom Assignment Formative Assessment - I
	2	International code of zoological nomenclature - Taxonomic procedures.	3	Discuss the principle of animal nomenclature. Identify species using taxonomical rules on animal classification.	PPT, Video, Identify and classify one invertebrate	
	3	New trends in taxonomy - Animal collection, handling and preservation.	4	Identify species using molecular taxonomy. Skill in collecting and preserving animals.	PPT, Video captured e-content.	

	4	Organization of coelom - Acoelomates - Pseudocoelomates - Coelomates.	3	Classify animals based on presence or absence of coelom.	Narrated PPT, Animation & Video	(1 - 5)
	5	Protostomia and Deuterostomia. .	1	Differentiate protostomes and deuterostomes.	PPT, Online images, Video	
II	**Locomotion and Nutrition**					
	1	Pseudopodia – Flagella and ciliary movement in protozoa	2	Explain the movements in protozoa.	PPT, captured e-content	Quiz through Google link, Assignment Google classroom Formative Assessment - I (1 - 3) Formative Assessment - I (3-4)
	2	Hydrostatic movement in Coelenterate, Annelida and Echinodermata.	3	Contrast the movements in lower invertebrates.	PPT, Animation video	
	3	Nutrition and digestion Free Digestive organs in invertebrates	2	Contrast animal groups with regard to nutrition and digestion.	PPT, Discussion	
	4	Patterns of feeding and digestion in lower metazoan Filter feeding in polychaeta, Mollusca and Echinodermata.	5	Recall and contrast the patterns of feeding in lower invertebrates	PPT, Video and animation	
III	**Respiration and Excretion**					
	1	Organs of respiration - gills, lungs and trachea, respiratory pigments	2	Describe the organs of respiration and respiratory pigments.	PPT, E content video	Quiz through Google link, Assignment Google classroom Formative Assessment-II (1 - 4)
	2	Mechanism of respiration.	3	Explicate the mechanism of respiration in invertebrates	PPT, video (YouTube)	
	3	Excretion – organs of excretion- coelom, coelomoducts, nephridia and Malpighian tubules	4	Describe and relate excretion of invertebrates using different excretory organs.	PPT, images and animation	
	4	Mechanisms of excretion and osmoregulation	3	Describe how invertebrates solve the physiological and environmental challenges.	PPT, images and animation	
IV	**Nervous system**					
	1	Primitive nervous system - Coelenterata and Echinodermata	3	Narrate the organization of nervous system in Coelenterata& Echinodermata.	PPT, Online images, e content	Quiz and Assignment Google classroom Formative Assessment -II (1)
	2	Advance nervous system - Annelida, Arthropoda (crustacean and insects), Mollusca (Cephalopoda).	5	Narrate the organization of nervous system in higher invertebrates,	PPT, animation	
	3	Endocrine organs in Invertebrates.	4	Explain the structure and role of endocrine organs in invertebrates	PPT and video	Formative Assessment - III (2&3)

V	Invertebrate larvae and Minor Phyla					
	1	Larval forms of free-living invertebrates, Larval forms of parasites	4	Explain why invertebrates exhibit different larval forms.		Quiz and Assignment via Google classroom Formative Assessment - III (1-4)
	3	Strategies and evolutionary significance of larval forms.	2	Explicate the strategies and evolutionary relationship of different larval forms.	PPT, animation, discussion	
	4	Minor Phyla (structural features and affinity) – significance – organization and general characters.	4	Identify the major characters and organization of minor phyla.	PPT, animation, discussion	

Course Instructor
Dr. A. Shyla Suganthi

Head of the Department
Dr. S. Mary Mettilda Bai

Semester I
Core IV - Comparative Anatomy of Chordates
Course Code: PZ2014

No. of hours/ week	No. of credits	Total number of hours	Marks
5	3	75	100

Learning Objectives

1. To provide the knowledge of origin, structure and function of different organ system of vertebrates.
2. To develop the skills to analyse the anatomy of vertebrates and its significance.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	identify the morphology and anatomy of major groups of vertebrates.	PSO - 1	R
CO - 2	interrelate the development of integuments, circulatory system, respiratory system, skeletal system, sense organs and nervous system.	PSO - 1	U
CO - 3	apply the cognitive skills to pursue higher studies and gain employability in academic and research institutions.	PSO - 3	Ap
CO - 4	analyse the anatomy of different groups of vertebrates.	PSO - 4	An

Teaching Plan with Modules

Total Hours 75 (Incl. Seminar & Test)

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	**Protochordates (15 Hrs.)**					
	1	Origin of chordates, chordate characters	4	Identify the chordate characters**(CO-1)**	PPT	MCQ, Flow chart, Mind map, Short Answer Test, seminar Formative assessment I (1-4) Quiz I Online assignment
	2	classification of protochordata- general characteristics	4	Classify prochordates**(CO-1)**	Interactive PPT	
	3	development and affinities of Hemichordata	3	Analyse the affinities of Hemichordates **(CO-4)**	Open Board class	
	4	Urochordata, Chephalochordata.	4	Interrelate the characters of Urochordates and Cephalochordates **(CO-2)**	Youtube videos, comparative tables, PPT	
II	**Vertebrate Integument (15 Hrs.)**					
	1	Origin and classification of vertebrates	3	Classify vertebrates **(CO-1)**	Interactive PPT	MCQ, Comparative table, Mind map, Diagram test, Short Answer Test, seminar Formative assessment I (1)
	2	Vertebrate integument and its derivatives - development	4	Interrelate the development of integuments **(CO-2)**	Comparative pictures, You tube videos	
	3	general structure and functions of skin and its derivatives - glands	4	Anlayse the anatomy of skin and its derivatives **(CO-4)**	Open board class	
	4	scales, horns, claws, nail, hoofs, feathers and hairs	4	Compare the formation of scales,	PPT, Animation	

				horns, claws, nail, feathers and hairs **(CO-2)**	videos, Open board class	Quiz I Formative assessment II (2,3,4) Quiz II Online assignment
III	**Circulation and Respiration (15 Hrs.)**					
	1	General plan of circulation in various groups - blood - evolution of heart	4	Identify the circulatory pathway and components of blood **(CO-1)**	Interactive PPT, open board	MCQ, Flow chart, Mind map, Short Answer Test, seminar Formative assessment II (1,2,3,4) Quiz II, Online assignment
	2	evolution of aortic arches and portal systems	4	Analyze the evolution of aortic arches and portal systems **(CO-4)**	You tube video links, PPT	
	3	Respiratory system – characters ofrespiratory tissue - internal and external respiration	4	Describe the internal and external respiration **(CO-2)**	Open board, Animation videos	
	4	comparative account of respiratory organs.	3	Distinguish the various respiratory organs **(CO-4)**	PPT	
IV	**Skeletal and Urinogenital system (15 Hrs.)**					
	1	Skeletal system - form, function, body size and skeletal elements of the body	5	Explain the structure and function of skeletal system **(CO-2)**	Online diagrams and open board	MCQ, Comparative table, Mind map, Diagram test, Short Answer Test, seminar Formative assessment I (1-4) Quiz I Online assignment
	2	comparative account of jaw suspensorium,	3	Compare jaw suspensorium of vertebrates **(CO-2)**	Interactive PPT	
	3	vertebral column - limbs and girdles.	3	Identify the bones of limbs and girdles **(CO-1)**	You tube videos	
	4	Evolution of urinogenital system in vertebrate series	4	Recognize the evolution of urinogenital system in vertebrates **(CO-2)**	PPT, open board	
V	**Sensory and Nervous system (15 Hrs.)**					
	1	Sense organs - simple receptors – organs of olfaction, taste and hearing	4	Explain the different sense organs **(CO-1)**	PPT	MCQ, Flow chart, Mind map,

	2	lateral line system – electroreception.	2	Describe lateral line system **(CO-1)**	Interactive powerpoint	Short Answer Test, seminar Formative assessment I (1) Quiz I Formative assessment II (2,3,4) Quiz II Online assignment
	3	Nervous system – comparative anatomy of the brain in relation to its functions	4	Compare the functions of brain in vertebrates **(CO-2)**	Online videos, PPT	
	4	comparative anatomy of spinal cord – nerves – cranial, peripheral andautonomous nervous system.	5	Interrelate the cranial, peripheral and autonomous nervous system **(CO-2)**	Comparative diagrams, Open board	

Course Instructor **Head of the Department**

Dr. X.Venci Candida **Dr. S. Mary Mettilda Bai**

Assignments

1. Chordate characters.
2. General characteristics of prochordates.
3. Affinities of Hemichordata.
4. Affinities of Urochordata.
5. Affinities of Cephalochordata.
6. Origin of vertebrates.
7. Structure and function of Skin.
8. Derivatives of skin - scales, horns, claws.
9. Nail, hoofs, feathers and hairs.
10. Blood.
11. Characters of respiratory tissue.
12. Internal and external respiration.
13. Comparative account of respiratory organs.
14. Skeletal elements of the body.
15. Comparative account of jaw suspensorium.
16. Forelimbs and girdles.
17. Hindlimbs and girdles.
18. Urinogenital system in vertebrates.
19. Simple receptors.
20. Organs of olfaction, taste and hearing.
21. Lateral line system.
22. Electroreception.
23. Peripheral nervous system.
24. Autonomous nervous system.

Semester I

Elective I (a) - Animal Husbandry
Course Code: PZ2015

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

Learning Objectives

1. To gain knowledge on livestock management and construction of farms.
2. To develop skills on livestock farming and extend it to the society.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	acquire knowledge on Livestock resources, construction and management of Livestock farms.	PSO - 1	U
CO - 2	identify the breeds and stages of livestock.	PSO - 1	R
CO - 3	analyse the ethical laws formulated by the Animal Welfare Board.	PSO - 4	An
CO - 4	develop entrepreneurial skills and gain employability in animal farms and research laboratories.	PSO - 3	Ap

Teaching plan with Modules

Total Hours: 60 (Incl. Assignments & Test)

Unit	Modules	Topics	Hours	Learning Outcome	Pedagogy	Assessment
I	Livestock farming (Ruminants I): (12 hrs)					
	1	Prospects of livestock industry in India. Introduction and scope of cattle farming.	2	Explains the scope of livestock industry in India. (CO-1)	PPT, You tube links, Lecture	MCQ Online assignment, Seminar Formative Assessment I (1,2,3,4,5,6), Quiz.
	2	Housing systems-selection of site, layout and design.	2	Illustrate the Housing systems. (CO-1)	PPT, Video lesson, Lecture.	
	3	Selection of cattle - important exotic and indigenous breeds and their characteristics.	2	Identification of important exotic and indigenous breeds and their characteristics. (CO-2)	Flipped learning, Video, PPT	

	4	Fodder production and preservation of green fodder.	2	Explains the fodder production and preservation of green fodder. (CO-1)	PPT, Video, Lecture.	
	5	Management and feeding practices of calves, heifers, pregnant, lactating and dry animals, bulls and working animals.	2	Describes different stages of calves, heifers, pregnant, lactating and dry animals, bulls and working animals. (CO-2)	Discussion, PPT, Lecture.	
	6	Cattle diseases. Parasites – ecto and endo parasites.	2	Identifies different cattle diseases. (CO-1)	PPT, Flipped learning.	
II	Livestock farming (Ruminants II) (12 hrs)					
	1	Breeds of sheep and goat. Important economic traits for meat, milk and fibre.	2	Illustrate the breeds of sheep and goat. Important economic traits for meat, milk and fibre.(CO-2)	Video, Lecture, PPT.	Online assignment Seminar, Formative Assessment I, (1,2,3,4.5,6), Quiz.
	2	Management and feeding practices during different stages of growth and production (milk, meat and wool).	2	Explains management and feeding practices during different stages of growth and production. (CO-2)	Discussion, Lecture, PPT.	
	3	Breeding schedule and management of ram and buck.	2	Differentiates the ram and buck. (CO-2)	PPT, Lecture, flipped learning.	
	4	Weaning and fattening of lambs and kids.	2	Describes weaning and fattening of lambs and kids. (CO-2)	Video, PPT, Lecture.	
	5	Methods of milking and precautions.	2	Explain methods of milking and precautions. (CO-2)	Video, PPT, Lecture.	
	6	Factors affecting quality and quantity of milk production and milk products.	2	Identification of factors affecting quality and quantity of milk production and milk products. (CO-2)	PPT, flipped learning.	
III	Livestock (Non ruminants) (12 hrs)					

	1	Scope of swine farming. Important exotic and indigenous breeds and their characteristics.	2	Describes swine farming and different breeds and their characteristics. (CO-2)	PPT, You tube links, Lecture.	Online assignment Seminar, Formative Assessment I, (1,2,3,4,5), Quiz. Formative Assessment II, (4,5)
	2	Housing and feeding of swine.	1	Illustrates the housing and feeding of swine. (CO-2)	PPT, Video, Lecture.	
	3	Management of different categories of swine: pregnant sows, pig-lets, growing stock, lactating sows.	4	Identify the management of different categories of swine. (CO-2)	Flipped learning, Video, PPT	
	4	Horses, donkeys and mules: feeding, Foaling and care of newborn.	3	Describes feeding, Foaling and care horses, donkeys and mules. (CO-2)	PPT, Video, Lecture.	
	5	Care of race horses and preparing horses for show.	2	Explains care of race horses and preparing horses for show. (CO-2)	Discussion, PPT, Lecture	
IV	Laboratory and Pet animal management (12 hrs)					
	1	Handling, weighing, sexing and weaning of laboratory animals (rat and rabbit).	3	Describes the handling, weighing, sexing of laboratory animals. (CO-4)	PPT, Video, Lecture.	Online assignment Seminar, Formative Assessment II, (1,2,3,4,5), Quiz.
	2	Marking for identification, Feeding schedule.	2	Marking for identification, Feeding schedule. (CO-4)	Flipped learning, Video, PPT	
	3	Prophylactic measures and Hygienic care.	2	Explains the prophylactic measures and Hygienic care. (CO-4)	PPT, Video, Lecture.	
	4	Handling of dogs and pet birds - Feeding practices and care of young ones.	3	Describes the handling and feeding practices of pet animals. (CO-4)	PPT, Video, Lecture.	
	5	Grooming and bathing of dogs. Marketing.	2	Explains the methods of Grooming, bathing and marketing of dogs. (CO-4)	Blended learning, Video, PPT, Lecture	
V	Animal welfare (12 hrs)					

	1	Animal welfare and ethics - role and current status of Animal Welfare Board of India and other welfare organizations.	4	Describes the role of Animal Welfare Board of India and other welfare organizations. (CO-3)	PPT, Video, Lecture.	Online assignment Seminar, Formative Assessment II, (1,2,3,4), Quiz.
	2	Common offences against animals - Prevention of Cruelty to Animals (PCA) Act, 1960.	4	Explains the common offences against animals. (CO-3)	Flipped learning, Video, PPT	
	3	Functions of Animal ethics committee (CPCSEA).	2	Explains the functions of Animal ethics committee (CPCSEA). (CO-3)	PPT, Video, Lecture.	
	4	Livestock Importation Act - Evidence, liability and insurance.	2	Describes the livestock Importation Act. (CO-3)	Blended learning, PPT, Lecture	

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Course Instructor
Dr. Prakash Shoba

Head of the Department
Dr. S. Mary Mettilda Bai

Semester **III**

Core VII

Name of the Course **: Physiology**

Course code **:PZ1731**

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

Learning Objectives

1. To impart knowledge on the structure and functions of various organs,organ systems and also to know about the associateddisorders.
2. To get job in diagnostic centers, research and academic institutions.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	describe the anatomy of different physiological systems at the tissue and cellular levels.	PSO - 1	U
CO - 2	evaluate the physiological functioning of different organs.	PSO - 2	E
CO - 3	analyze the physiological changes in relation to environmental conditions.	PSO - 7	Ap; An
CO - 4	identify different tissues related to anatomy and physiology from an evidence-based perspective.	PSO - 9	U
CO - 5	carry out physiological studies in the laboratory, interpret data and graphs and write a report.	PSO - 9	Ap; An

Teaching Plan with Modules

Total Hours 90 (Incl. Seminar & Test)

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	**Nutrition** (18 Hrs.)					
	1	Types of nutrition and feeding mechanisms in animals.	2	Compare the different types of feeding and nutrition in animals. **(CO-1)**	Lecture, Video	Short test MCQ Open book test

	2	Digestion - Functional anatomy of the digestive system (human) Movements of gastrointestinal tract Secretory functions of the alimentary tract and glands Digestion and absorption.	5	Describe the anatomy and physiology of digestive system. **(CO-1)**	Lecture, PPT	Formative assessment I (1-5) Quiz I Online assignment Seminar
	3	Metabolism of protein Metabolism of carbohydrate Metabolism of lipid.	6	Explain the metabolism of protein, fat and carbohydrate. **(CO-2)**	Lecture, Discussion	
	4	Balanced diet – Malnutrition - Energy balance – BMR.	2	Interpret the value of a healthy diet. **(CO-5)**	Lecture, PPT	
	5	Gastrointestinal disorders: Gall stones liver cirrhosis, gastritis, peptic ulcer and appendicitis.	3	Correlate different gastrointestinaldisorders with the physiology of digestive system.**(CO-4)**	Video	
II	**Respiration and Homeostasis** (18 Hrs.)					
	1	Respiratory organs and respiratory pigment in animals.	2	Compare respiratory organs and pigment in different animals. **(CO-2)**	Lecture, PPT	MCQ through EDMODO Slip test Formative assessment I (1,2,3,4) Formative assessment II (5,6) QuizII Online assignment Seminar
	2	Physiological anatomy of the respiratory system (human) Transport of respiratory gases. Regulation of respiration.	4	Comprehend the structure and function of respiratory system. **(CO-1)**	Lecture, Video	
	3	Respiratory problems - bronchial asthmapneumonia and pulmonarytuberculosis.	2	Identify the symptoms of respiratory problems. **(CO-4)**	Lecture, PPT	
	4	Homeostasis Osmoregulation - types and mechanism Thermoregulation : Classification thermoregulatorymechanism in animals Aestivationand hibernation.	4	Outline the basics of homeostasis and adaptations. **(CO-3)**	Seminar Lecture	
	5	Deep sea physiology High altitude and space physiology Effects of exposure to cold and heat.	4	Explain the physiological changes at different altitude. **(CO-3)**	Lecture, Interactive session through MOODLE	
	6	Bioluminescence – physiology and functions.	2	Appreciate the biochemical changes during bioluminescence. **(CO-2)**	Lecture	

III	**Circulation** (18 Hrs.)					
	1	Components and functions of blood. Blood clotting.	3	Compare blood cells and its functions. **(CO-1)**	Seminar, Lecture	Mind map Short test Online assignment Seminar Formative assessment – II (1-7) Quiz II
	2	Haemopoiesis Myogenic and neurogenic heart.	2	Explain the formation and differentiation of blood cells. Differentiate heart. **(CO-1)**	Lecture	
	3	Functional anatomy of human heart.	2	Explain the structure of heart. **(CO-1)**	Seminar, ppt	
	4	Cardiac cycle, pace maker, heart rate Bradycardia and tachycardia.	3	Discuss the cardiac cycle and cardiac problems. **(CO-2)**	Lecture	
	5	Electrocardiogram (ECG).	2	Analyze the rhythmic pattern of heart beat. **(CO-5)**	Seminar	
	6	Heart diseases (Atherosclerosis coronary thrombosis and angina pectoris).	3	Identify the causes of heart diseases. **(CO-4)**	Lecture, video	
	7	Lymphatic system - organization, composition of lymph and functions.	3	Describe the lymphatic system. **(CO-1)**	Lecture	
IV	**Neuro-muscular system** (18 Hrs.)					
	1	Structure of brain and neuron.	4	Explain the structure of central nervous system. **(CO-1)**	Seminar	Formative assessment II (1,2) Quiz II Formative assessment III (3,4,5,6) Memory matrix (Neuro-transmitters) Short test Online assignment Seminar
	2	Neurotransmitters - Synapse- Nerve impulse conduction.	2	Differentiate transmission of nerve impulse. **(CO-2)**	Lecture, ppt, video Seminar	
	3	Reflex activity Inborn and conditioned reflex actions.	2	Explain reflex activity. **(CO-3)**	Lecture, ppt	
	4	Electroencephalogram. Neural disorders - Meningitis and epilepsy.	3	Comprehend and analyse the role of EEG in identifyingneural disorders.**(CO-5)**	Lecture, video	
	5	Types of muscle - structure and properties of skeletal muscle. Mechanism of muscle contraction. Neuromuscular junction.	5	Identify the types of muscle and the mechanism of contraction. **(CO-1)**	Lecture, ppt	
	6	Sense organs - Structure and functions of skin, eye, ear.	2	Differentiate the receptor organs, its structure and function. **(CO-1, 2)**	Lecture, model	

V	**Excretion and Reproduction** (18 Hrs.)					
	1	Excretory organs in different groups of animals.	3	Illustrate the excretory organs and types of excretion in animals. **(CO-2)**	Seminar	Formative assessment III (1-5) Listing important terms Sliptest MCQ through Quizizz
	2	Patterns of excretion.				
	3	Structure and function of kidney (human) Nephron- Formation of urine Micturition- Renal disorders – nephritis - renal calculi Dialysis.	6	Explain the structure and function of human kidney and associated disorders. **(CO-2, 4)**	Seminar, Lecture, Demonstration	
	4	Structure of testis and ovary (human).	3	Differentiate male and female gonad. **(CO-1)**	Lecture, chart	
	5	Oestrus and menstrual cycle Pregnancy parturition and lactation. Hormonal regulation of reproduction.	6	Explain the physiology of reproduction and apply the knowledge in day today life. **(CO-2)**	Lecture, PPT	

Courseinstructor **Head of theDepartment**

Dr. P.T. Arockya Glory **Dr. S. Mary MettildaBai**

Seminar & Assignments Topics

1. Seminar: Feeding mechanisms in animals.
   Assignment: Types of nutrition.
2. Seminar: Malnutrition - Energy balance – BMR.
   Assignment: Balanceddiet.
3. Seminar: Anatomy of the respiratory system (human).
   Assignment: Regulation ofrespiration.
4. Seminar: High altitude and space physiology.

Assignment: Effects of exposure to cold andheat.

5. Seminar: Components and functions of blood.
   Assignment: Bloodclotting.
6. Seminar: Electrocardiogram(ECG).
   Assignment: Cardiaccycle.
7. Seminar:Electroencephalogram.

Assignment: Neural disorders - Meningitis and epilepsy.

8. Seminar: Structure and functions of eye.
   Assignment: Structure and functions ofear.
9. Seminar: Oestrus and menstrual cycle.
   Assignment: Hormonal regulation ofreproduction.

Semester : IIICoreVIII

Name of the Course:Immunology

CourseCode : PZ1732

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

Learning Objectives

1. To facilitate the students to understand and appreciate the defense functions ofthe immunesystem.
2. To develop the skill to determine the imunomodulatory strategies used to enhanceor suppress the immuneresponse.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	explain the importance of innate immune response in providing adaptive immunity.	PSO - 1	U
CO - 2	know the evolution of immune molecules in different groups of animals.	PSO - 1	U
CO - 3	differentiate the types of hypersensitive allergic reactionsby seeing the symptoms and duration and suggest theremedies.	PSO - 2	R; An
CO - 4	discuss the role of immune molecules in different diseases and organ transplantation.	PSO - 6	Ap
CO - 5	demonstrate detailed knowledge and understanding of immunology and the way it is applied in diagnostic and therapeutic techniques and research.	PSO - 9	U; Ap

Teaching plan with Modules

Total Hours: 90 (Incl. Seminar & Test)

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	**Immune system in invertebrates and vertebrates** (18 Hrs.)					
	1	Immunity- Innate and acquired Immunity-Types – natural and artificial, active and passive immunity, II, III and IV line of defense.	3	Differentiate innate and acquired Immunity. **(CO-1)**	Lecture, Partnering, Xenography Seminar.	MCQ Short test Memory matrix Formative Assessment I
	2	Lymphoid organs, Cells involved in immune response.	3	Describe lymphoid organs and cells involved in immune response. **(CO-1, 2)**	Lecture, Gamification Virtual class	

	3	Antigens**,** Immunoglobulins – characteristics Haptens and types.	3	Discuss the structure and functions of antigens and immunoglobulins. **(CO-1, 2)**	Seminar, Web based, Lecture, Video.	(1,2,3,4,5) Formative Assessment I (6) Schoology
	4	Immune Response: Humoralimmune response, Cell mediatedimmune response, primary immune response and secondary immuneresponse.	5	Categorize immune response. **(CO-1, 2)**	Lecture, Video.	
	5	Importance of B cells in humoral immune response (antibody formation), Factors influencing antibody formation and Immunological memory (Anamnesis).	2	Illustrate the role of B cells in humoral immune response and immunological memory. **(CO-4)**	Lecture, Virtual classroom	
	6	Immunization: immunization schedule and vaccines.	2	Apply immunization schedule and vaccines. **(CO-1)**	Lecture, Team teaching Heutogogy	
I I	**Major and minor histocompatibility complex** (18 Hrs.)					
	1	MHC class I molecules**,** MHC class II molecules**,** Cellular distribution and regulation of MHC expression.	5	Differentiate the MHC class I and MHC class II molecules. **(CO-1)**	Lecture, Androgogy Suggesto-pedia	MCQ Short test Mind Map Formative Assessment I (1,2,3,) Formative Assessment II (4) Worksheet - Kahoot
	2	MHC in immune responsiveness**,** MHC and susceptibility to infectious diseases, Minor histocompatibility (H) antigens.	5	Explain the role of MHC in immune responsiveness and susceptibility to infectious diseases. **(CO-1)**	Lecture, Flip class	
	3	Immune effector mechanisms**:** Cytokines and their functions.	3	Appreciate cytokines and their functions. **(CO-1)**	Lecture, Reflective PPT	
	4	Complement system – classical pathways, alternate pathways and biological functions	5	Differentiate the classical and alternate pathways of complement system. **(CO-1)**	Lecture, Suggesto-pedia PPT	
III	**B and T cell** (18 Hrs.)					
	1	B cells **–** Maturation**,** B cells **–** activation**,** B cells **–**differentiation**,** B cell receptor (BCR) and B cell co-receptorcomplex. Signal transduction from B cell antigen receptor and Major pathways of BCRsignaling.	6	Describe B cells and B cell co-receptor complex. **(CO-1)**	Lecture, Partnering PPT	MCQ Short test Mind Map Formative Assessment II

	2	T cells – maturation, T cells - activation and differentiation, T cell receptor (TCR). T cell co-receptor complex**,** Formation of T and B cell conjugates. Co-stimulation in T cell response and signal transduction, Clonal anergy.	7	Illustrate T cells and signal transduction. **(CO-1)**	Lecture, Online Video	(1,2,3) Online assignment through Edmodo, Schoology
	3	Antigen processing and presentation – role of antigen presenting cells, cytosolic pathway and endocytic pathway	5	Recognize antigen processing and presentation. **(CO-1)**	Lecture, Team teaching Video.	
IV	**Immune system in health and diseases** (18 Hrs.)					
	1	Tumour immunology- properties of tumour cells and causes of tumours, tumour antigens, immune response to tumour and immune surveillance. Immunodiagnosis of tumour antigens and immuno therapy of tumour.	4	Acquire knowledge on the-properties of tumours and immuno therapy. **(CO-4)**	Lecture, Xenography PPT	Short test MCQ Formative Assessment II (1,2,3,4,5) Quiz II Formative Assessment III (6) Online worksheet through Edmodo
	2	Hypersensitivity: factors causing hypersensitivity, Type I, II, III, and IV reactions	4	Discuss the factors and types of hypersensitivity. **(CO-3)**	Seminar, Problem based, Lecture	
	3	Immunodeficiency – primary and secondary	2	Describe the immunodeficiency diseases. **(CO-4, 5)**	Lecture, Problem based PPT	
	4	Autoimmune diseases - characteristics, causes, classification	2	Acquire knowledge on autoimmune diseases. **(CO-4, 5)**	Lecture, Evaluative PPT	
	5	Autoimmune diseases - localized (Diabetes mellitus and Addison's disease); systemic (lupus erythromatous and rheumatoid arthritis)	3	Recognize different types ofautoimmune diseases. **(CO-4, 5)**	Seminar, Problem based Lecture	
	6	Immune response to infectious diseases and treatment - Protozoan disease (Malaria), Bacterial disease (Tuberculosis) and Viral disease (AIDS).	3	Discuss the immune response to infectious diseases and treatment. **(CO-4, 5)**	Lecture, Team teaching PPT	
V	**Antigen-antibody interaction** (18 Hrs.)					
	1	Antigen-antibody interaction: strength, affinity, avidity and cross reactivity.	2	Describe the antigen-antibody interaction.**(CO-2)**	Seminar, Demonstration.	Slip test Formative
	2	Complement fixation test-precipitation reaction in fluids and precipitin curve.	2	Discuss the complement fixation test**. (CO-2)**	Lecture, Role play, PPT	

	3	Radial immunodiffusion and Double immunodiffusion.	2	Demonstrate immunodiffusion. **(CO-2)**	Heutogogy Lecture	Assessment III Seminar Assignment- Kahoot Quizizz
	4	Immunoelectrophoresis – counter electrophoresis and rocket electrophoresis. Agglutination reaction–hemagglutination and bacterial agglutination. Agglutination reaction- coated particle agglutination and agglutination inhibition.	3	Demonstrate immunoelectrophoresis, hemagglutination and bacterial agglutination **(CO-2)**	Seminar, Lecture and Video	
	7	Radio immuno assay, ELISA and Western blotting, Immunofluorescence.	4	Demonstrate radio immuno assay, ELISA, western blotting and Immunofluorescence. **(CO-2)**	Seminar, Technology based Lecture	
	9	Flow cytometry.	2	Explain flowcytometry. **(CO-2)**	Seminar, Youtube Lecture	
	10	Transplantation: classification of grafts, mechanism of graft rejection, graft versus host reaction, immuno suppressive therapy during transplantation.	3	Describes transplantation. **(CO-2)**	Lecture, Androgogy	

Course Instructor **Head of the Department**

Dr. Brisca Renuga **Dr.S Mary Mettilda Bai**

Seminar & Assignment Topics

1. Seminar: Innate and acquiredImmunity.
   Assignment: Types of Immunity.
2. Seminar: Immunoglobulins – characteristics.
   Assignment: Immunization schedule andvaccines.
3. Seminar: Cytokines and their functions.
   Assignment: MHC and susceptibility to infectious disease.
4. Seminar: Hypersensitivity: factors causing hypersensitivity, Type I andII.
   Assignment: Classical pathways, alternatepathways.
5. Seminar: Autoimmune diseases - localized (Diabetes mellitus and Addison's disease).
   Assignment: Autoimmune diseases- characteristics, causes,classification.
6. Seminar: Antigen-antibody interaction: strength, affinity, avidity and cross reactivity.
   Assignment: Properties of tumour cells and causes oftumours.
7. Seminar: Immunoelectrophoresis – counter electrophoresis and rocket electrophoresis.
   Assignment: Radial immunodiffusion and Doubleimmunodiffusion.
8. Seminar: Radio immuno assay, ELISA and Westernblotting.
   Assignment:Immunofluorescence.
9. Seminar: Flowcytometry.
   Assignment: Transplantation: classification of grafts, graft versus host reaction.

Semester : **III** **Elective III (a)**

Name of the Course : **General Endocrinology**

Course code : **PZ1733**

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

Learning Objectives

1. To learn how the endocrine system functions under normal circumstances, as well asthe pathologies that arise when homeostasis fails.
2. To get job in clinical laboratory and endocrine researchinstitutes.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	discuss the principles of endocrine system, hormonal communication and neuroendocrine mechanism in animals.	PSO - 1	U
CO - 2	explain the secretion and transportation of hormones to maintain homeostasis.	PSO -10	U
CO - 3	apply the knowledge of endocrinology to understand hormone-related disorders.	PSO - 8	Ap
CO - 4	explain women related physiological processes such as menstruation, gestation and lactation.	PSO - 3	Ap
CO - 5	correlate endocrine regulation of reproduction and metamorphosis in various invertebrates and vertebrates.	PSO -5	Ap;An

Teaching plan with Modules

Total Hours 90 (Incl. Seminar & Test)

Unit	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	**Introduction** (18 Hrs.)					
	1	Historical perspective and scope of endocrinology.	3	Explain the history and Scope of Endocrinology. (**CO-1)**	Seminar, andgroup discussion	MCQ Short test Formative Assessment I (1,2,3,4,5)
	2	Endocrine methodologies - assay of hormones, surgical methods, radioisotope studies, pharmacological methods, and replacement therapy.	6	Differentiate the various methods of Hormonal assays. **(CO-1)**	Lecture, and group discussion	

	3	Animal models for research.	3	Identify different animals used in Research. (**CO-1)**	Lecture Group discussion	Quiz I Seminar Assignment (Edmodo)
	4	Chemical messengers - neurocrine, paracrine, autocrine, endocrine.	4	Illustrate the action of hormones as Messengers. (**CO-2)**	Lecture / Video class	
	5	Pheromones and chalones.	2	Relate the hormone and behaviour. (**CO-2)**	Lecture	
II	**Neurosecretion and Neuroendocrine mechanisms** (18 Hrs.)					
	1	Neuroendocrine integration.	3	Relate the integration between the nervous system and the endocrine system. (**CO-2)**	Lecture, Mind map	Slip test Formative Assessment I (1,2,3,4) Quiz I Formative Assessment II (5) Quiz II Seminar Assignment (Quizizz)
	2	Evolution of regulatory mechanisms.	3	Explore the evolution of regulatory mechanism. (**CO-1)**	Lecture, PPT	
	3	Endocrine control of neural function.	3	Appreciate the control of nervous system by endocrine organs. (**CO-1)**	Lecture, Video	
	4	Neuroendocrine mechanisms and functions in insects, crustaceans, non-arthropod invertebrates.	5	Identify the role of Neuroendocrine mechanisms in insects and non-arthropod invertebrates. **(CO-5)**	Seminar, Lecture	
	5	Analogous neurosecretory systems of invertebrates and vertebrates.	4	Recognize the analogy of endocrine glands and their function in vertebrates and invertebrates. **(CO-5)**	Seminar, Lecture, PPT	
III	**Endocrine glands and hormones** (18 Hrs.)					
	1	Organization of the endocrine system, Classification of hormones.	3	Describe the different types of hormones. **(CO-1)**	Lecture. Discussion	MCQ Short test, Online assignment (Edmodo) Seminar,
	2	Structure, functions and pathophysiology of hypothalamus, pituitary.	4	Explain the structure and functions of hypothalamus and pituitary. Identify pathological conditions. **(CO-3)**	Seminar, Lecture, PPT	
	3	Structure, functions and pathophysiology of thyroid and parathyroid.	4	Explain the structure and functions of thyroid and parathyroid. Identify pathological conditions. **(CO-3)**	Seminar, Lecture, PPT	Formative Assessment II (1,2,3,4,5)

	4	Structure, functions and pathophysiology of adrenal, pancreas and gonads.	4	Explain the adrenal gland and pancreas.Interpret pathological conditions of gonads. **(CO-3)**	Lecture, PPT	Quiz II
	5	Gastro-intestinal hormones.	3	Describe Gastro-intestinal hormones. **(CO-3)**	Lecture, Video	
IV	**Hormone synthesis and mechanism of Hormone action** (18 Hrs.)					
	1	Biosynthesis, storage and release of amine (catecholamines and thyroxine) protein (growth hormone and insulin) and steroid hormones (sex hormones).	5	Explain the synthesis of amine, protein and steroid hormones. (**CO-2)**	Lecture, Mind map	MCQ, Shorttest, Online assignment (Quizizz) Seminar, Formative Assessment II(1,2) QuizII, Formative Assessment III (3,4,5)
	2	Mechanism of hormone action - receptors (membrane and cytosolic) - second messengers, signal transduction, termination of hormone activity.	4	Discuss hormone and cell communication. (**CO-2)**	Lecture, PPT	
	3	Pathophysiological correlates of hormone action.	4	Analyse the importance of receptor number for proper functioning of hormone. (**CO-3)**	Lecture, Group discussion	
	4	Endocrine disorders due to receptor number and function.	3	Outline the importance of receptor number. (**CO-3)**	Lecture, PPT	
	5	Hormonal therapy.	2	Evaluate the therapeutic role of hormones. (**CO-3)**	Lecture, PPT	
V	**Endocrine Integration** (18 Hrs)					
	1	Diffuse effect of hormones.	2	Interpret the varied role of one hormone on different organs. (**CO-2)**	Lecture, Flow Chart	MCQ Shorttest, Online
	2	Hormonal regulation of growth, development and metabolism.	4	Appreciate the physiological regulation of hormones. (**CO-2)**	Lecture, Mind map	

	3	Hormonal regulation of reproductive cycle and pregnancy, parturition and lactation.	4	Describe the role of hormones in reproduction. **(CO-4)**	Lecture, Videos	assignment (Edmodo) Seminar, Formative Assessment III (1,2,3,4,5)
	4	Hormonal regulation of migration (birds and fishes).	3	Analyse the reason and changes in animals during migration. **(CO-5)**	Lecture, PPT	
	5	Hormonal regulation of	5	Describe the	Lecture,	

Course Instructor
Dr. Punithaa
Dr. C. JosephinePriyatharshini

Head of the Department
Dr. SMary Mettilda Bai

Semester : III Core VII
Name oftheCourse : Physiology
Coursecode :PZ1731

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

Learning Objectives

1. To impart knowledge on the structure and functions of various organs,organ systems and also to know about the associateddisorders.
2. To get job in diagnostic centers, research and academic institutions.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	describe the anatomy of different physiological systems at the tissue and cellular levels.	PSO - 1	U
CO - 2	evaluate the physiological functioning of different organs.	PSO - 2	E
CO - 3	analyze the physiological changes in relation to environmental conditions.	PSO - 7	Ap; An
CO - 4	identify different tissues related to anatomy and physiology from an evidence-based perspective.	PSO - 9	U
CO - 5	carry out physiological studies in the laboratory, interpret data and graphs and write a report.	PSO - 9	Ap; An

Teaching Plan with Modules

Total Hours 90 (Incl. Seminar & Test)

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	**Nutrition** (18 Hrs.)					
	1	Types of nutrition and feeding mechanisms in animals.	2	Compare the different types of feeding and nutrition in animals. **(CO-1)**	Lecture, Video	Short test MCQ Open book test
	2	Digestion - Functional anatomy of the digestive system (human) Movements of gastrointestinal tract Secretory functions of the alimentary tract and glands Digestion and absorption.	5	Describe the anatomy and physiology of digestive system. **(CO-1)**	Lecture, PPT	Formative assessment I (1-5) Quiz I Online assignment Seminar
	3	Metabolism of protein Metabolism of carbohydrate Metabolism of lipid.	6	Explain the metabolism of protein, fat and carbohydrate. **(CO-2)**	Lecture, Discussion	
	4	Balanced diet – Malnutrition - Energy balance – BMR.	2	Interpret the value of a healthy diet. **(CO-5)**	Lecture, PPT	
	5	Gastrointestinal disorders: Gall stones liver cirrhosis, gastritis, peptic ulcer and appendicitis.	3	Correlate different gastrointestinaldisorders with the physiology of digestive system.**(CO-4)**	Video	
II	**Respiration and Homeostasis** (18 Hrs.)					
	1	Respiratory organs and respiratory pigment in animals.	2	Compare respiratory organs and pigment in different animals. **(CO-2)**	Lecture, PPT	MCQ through EDMODO Slip test Formative assessment I (1,2,3,4) Formative assessment II (5,6) QuizII
	2	Physiological anatomy of the respiratory system (human) Transport of respiratory gases. Regulation of respiration.	4	Comprehend the structure and function of respiratory system. **(CO-1)**	Lecture, Video	
	3	Respiratory problems - bronchial asthmapneumonia and pulmonarytuberculosis.	2	Identify the symptoms of respiratory problems. **(CO-4)**	Lecture, PPT	

	4	Homeostasis Osmoregulation - types and mechanism Thermoregulation : Classification thermoregulatorymechanism in animals Aestivationand hibernation.	4	Outline the basics of homeostasis and adaptations. **(CO-3)**	Seminar Lecture	Online assignment Seminar
	5	Deep sea physiology High altitude and space physiology Effects of exposure to cold and heat.	4	Explain the physiological changes at different altitude. **(CO-3)**	Lecture, Interactive session through MOODLE	
	6	Bioluminescence – physiology and functions.	2	Appreciate the biochemical changes during bioluminescence. **(CO-2)**	Lecture	
III	**Circulation** (18 Hrs.)					
	1	Components and functions of blood. Blood clotting.	3	Compare blood cells and its functions. **(CO-1)**	Seminar, Lecture	Mind map Short test Online assignment Seminar Formative assessment – II (1-7) Quiz II
	2	Haemopoiesis Myogenic and neurogenic heart.	2	Explain the formation and differentiation of blood cells. Differentiate heart. **(CO-1)**	Lecture	
	3	Functional anatomy of human heart.	2	Explain the structure of heart. **(CO-1)**	Seminar, ppt	
	4	Cardiac cycle, pace maker, heart rate Bradycardia and tachycardia.	3	Discuss the cardiac cycle and cardiac problems. **(CO-2)**	Lecture	
	5	Electrocardiogram (ECG).	2	Analyze the rhythmic pattern of heart beat. **(CO-5)**	Seminar	
	6	Heart diseases (Atherosclerosis coronary thrombosis and angina pectoris).	3	Identify the causes of heart diseases. **(CO-4)**	Lecture, video	
	7	Lymphatic system - organization, composition of lymph and functions.	3	Describe the lymphatic system. **(CO-1)**	Lecture	
IV	**Neuro-muscular system** (18 Hrs.)					
	1	Structure of brain and neuron.	4	Explain the structure of central nervous system. **(CO-1)**	Seminar	Formative assessment II (1,2) Quiz II
	2	Neurotransmitters - Synapse- Nerve impulse conduction.	2	Differentiate transmission of nerve impulse.	Lecture, ppt,	

				(CO-2)	video Seminar	Formative assessment III (3,4,5,6) Memory matrix (Neuro-transmitters) Short test Online assignment Seminar
	3	Reflex activity Inborn and conditioned reflex actions.	2	Explain reflex activity. **(CO-3)**	Lecture, ppt	
	4	Electroencephalogram. Neural disorders - Meningitis and epilepsy.	3	Comprehend and analyse the role of EEG in identifyingneural disorders.**(CO-5)**	Lecture, video	
	5	Types of muscle - structure and properties of skeletal muscle. Mechanism of muscle contraction. Neuromuscular junction.	5	Identify the types of muscle and the mechanism of contraction. **(CO-1)**	Lecture, ppt	
	6	Sense organs - Structure and functions of skin, eye, ear.	2	Differentiate the receptor organs, its structure and function. **(CO-1, 2)**	Lecture, model	

V	**Excretion and Reproduction** (18 Hrs.)					
	1	Excretory organs in different groups of animals.	3	Illustrate the excretory organs and types of excretion in animals. **(CO-2)**	Seminar	Formative assessment III (1-5) Listing important terms Sliptest MCQ through Quizizz
	2	Patterns of excretion.				
	3	Structure and function of kidney (human) Nephron- Formation of urine Micturition- Renal disorders – nephritis - renal calculi Dialysis.	6	Explain the structure and function of human kidney and associated disorders. **(CO-2, 4)**	Seminar, Lecture, Demonstration	
	4	Structure of testis and ovary (human).	3	Differentiate male and female gonad. **(CO-1)**	Lecture, chart	
	5	Oestrus and menstrual cycle Pregnancy parturition and lactation. Hormonal regulation of reproduction.	6	Explain the physiology of reproduction and apply the knowledge in day today life. **(CO-2)**	Lecture, PPT	

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Seminar & Assignments Topics

10. Seminar: Feeding mechanisms in animals. Assignment: Types of nutrition.
11. Seminar: Malnutrition - Energy balance – BMR. Assignment: Balanceddiet.
12. Seminar: Anatomy of the respiratory system (human). Assignment: Regulation ofrespiration.
13. Seminar: High altitude and space physiology. Assignment: Effects of exposure to cold andheat.
14. Seminar: Components and functions of blood. Assignment: Bloodclotting.
15. Seminar: Electrocardiogram(ECG). Assignment: Cardiaccycle.
16. Seminar:Electroencephalogram. Assignment: Neural disorders - Meningitis and epilepsy.
17. Seminar: Structure and functions of eye. Assignment: Structure and functions ofear.
18. Seminar: Oestrus and menstrual cycle.

Assignment: Hormonal regulation ofreproduction.

Semester : III **Core VIII**

Name of the Course:Immunology

CourseCode : PZ1732

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

Learning Objectives

1. To facilitate the students to understand and appreciate the defense functions ofthe immunesystem.
2. To develop the skill to determine the imunomodulatory strategies used to enhanceor suppress the immuneresponse.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	explain the importance of innate immune response in providing adaptive immunity.	PSO - 1	U
CO - 2	know the evolution of immune molecules in different groups of animals.	PSO - 1	U
CO - 3	differentiate the types of hypersensitive allergic reactionsby seeing the symptoms and duration and suggest theremedies.	PSO - 2	R; An
CO - 4	discuss the role of immune molecules in different diseases and organ transplantation.	PSO - 6	Ap
CO - 5	demonstrate detailed knowledge and understanding of immunology and the way it is applied in diagnostic and therapeutic techniques and research.	PSO - 9	U; Ap

Teaching plan with Modules

Total Hours: 90 (Incl. Seminar & Test)

Units	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	**Immune system in invertebrates and vertebrates** (18 Hrs.)					
	1	Immunity- Innate and acquired Immunity-Types – natural and artificial, active and passive immunity, II, III and IV line of defense.	3	Differentiate innate and acquired Immunity. **(CO-1)**	Lecture, Partnering, Xenography Seminar.	MCQ Short test Memory

	2	Lymphoid organs, Cells involved in immune response.	3	Describe lymphoid organs and cells involved in immune response. **(CO-1, 2)**	Lecture, Gamification Virtual class	matrix Formative Assessment I
	3	Antigens**,** Immunoglobulins – characteristics Haptens and types.	3	Discuss the structure and functions of antigens and immunoglobulins. **(CO-1, 2)**	Seminar, Web based, Lecture, Video.	(1,2,3,4,5) Formative Assessment I (6) Schoology
	4	Immune Response: Humoralimmune response, Cell mediatedimmune response, primary immune response and secondary immuneresponse.	5	Categorize immune response. **(CO-1, 2)**	Lecture, Video.	
	5	Importance of B cells in humoral immune response (antibody formation), Factors influencing antibody formation and Immunological memory (Anamnesis).	2	Illustrate the role of B cells in humoral immune response and immunological memory. **(CO-4)**	Lecture, Virtual classroom	
	6	Immunization: immunization schedule and vaccines.	2	Apply immunization schedule and vaccines. **(CO-1)**	Lecture, Team teaching Heutogogy	
II	**Major and minor histocompatibility complex** (18 Hrs.)					
	1	MHC class I molecules**,** MHC class II molecules**,** Cellular distribution and regulation of MHC expression.	5	Differentiate the MHC class I and MHC class II molecules. **(CO-1)**	Lecture, Androgogy Suggesto-pedia	MCQ Short test Mind Map Formative Assessment I (1,2,3,) Formative Assessment II (4) Worksheet - Kahoot
	2	MHC in immune responsiveness**,** MHC and susceptibility to infectious diseases, Minor histocompatibility (H) antigens.	5	Explain the role of MHC in immune responsiveness and susceptibility to infectious diseases. **(CO-1)**	Lecture, Flip class	
	3	Immune effector mechanisms**:** Cytokines and their functions.	3	Appreciate cytokines and their functions. **(CO-1)**	Lecture, Reflective PPT	
	4	Complement system – classical pathways, alternate pathways and biological functions	5	Differentiate the classical and alternate pathways of complement system. **(CO-1)**	Lecture, Suggesto-pedia PPT	
III	**B and T cell** (18 Hrs.)					
	1	B cells **–** Maturation**,** B cells **–** activation**,** B cells **–**differentiation**,** B cell receptor (BCR) and B cell co-receptorcomplex. Signal transduction from B cell antigen receptor and Major pathways of BCRsignaling.	6	Describe B cells and B cell co-receptor complex. **(CO-1)**	Lecture, Partnering PPT	MCQ Short test Mind Map Formative Assessment II

	2	T cells – maturation, T cells - activation and differentiation, T cell receptor (TCR). T cell co-receptor complex**,** Formation of T and B cell conjugates. Co-stimulation in T cell response and signal transduction, Clonal anergy.	7	Illustrate T cells and signal transduction. **(CO-1)**	Lecture, Online Video	(1,2,3) Online assignment through Edmodo, Schoology
	3	Antigen processing and presentation – role of antigen presenting cells, cytosolic pathway and endocytic pathway	5	Recognize antigen processing and presentation. **(CO-1)**	Lecture, Team teaching Video.	
IV	**Immune system in health and diseases** (18 Hrs.)					
	1	Tumour immunology- properties of tumour cells and causes of tumours, tumour antigens, immune response to tumour and immune surveillance. Immunodiagnosis of tumour antigens and immuno therapy of tumour.	4	Acquire knowledge on the-properties of tumours and immuno therapy. **(CO-4)**	Lecture, Xenography PPT	Short test MCQ Formative Assessment II (1,2,3,4,5) Quiz II Formative Assessment III (6) Online worksheet through Edmodo
	2	Hypersensitivity: factors causing hypersensitivity, Type I, II, III, and IV reactions	4	Discuss the factors and types of hypersensitivity. **(CO-3)**	Seminar, Problem based, Lecture	
	3	Immunodeficiency – primary and secondary	2	Describe the immunodeficiency diseases. **(CO-4, 5)**	Lecture, Problem based PPT	
	4	Autoimmune diseases - characteristics, causes, classification	2	Acquire knowledge on autoimmune diseases. **(CO-4, 5)**	Lecture, Evaluative PPT	
	5	Autoimmune diseases - localized (Diabetes mellitus and Addison's disease); systemic (lupus erythromatous and rheumatoid arthritis)	3	Recognize different types ofautoimmune diseases. **(CO-4, 5)**	Seminar, Problem based Lecture	
	6	Immune response to infectious diseases and treatment - Protozoan disease (Malaria), Bacterial disease (Tuberculosis) and Viral disease (AIDS).	3	Discuss the immune response to infectious diseases and treatment. **(CO-4, 5)**	Lecture, Team teaching PPT	
V	**Antigen-antibody interaction** (18 Hrs.)					
	1	Antigen-antibody interaction: strength, affinity, avidity and cross reactivity.	2	Describe the antigen-antibody interaction.**(CO-2)**	Seminar, Demonstration.	Slip test Formative
	2	Complement fixation test-precipitation reaction in fluids and precipitin curve.	2	Discuss the complement fixation test**. (CO-2)**	Lecture, Role play, PPT	

	3	Radial immunodiffusion and Double immunodiffusion.	2	Demonstrate immunodiffusion. **(CO-2)**	Heutogogy Lecture	Assessment III Seminar Assignment- Kahoot Quizizz
	4	Immunoelectrophoresis – counter electrophoresis and rocket electrophoresis. Agglutination reaction–hemagglutination and bacterial agglutination. Agglutination reaction- coated particle agglutination and agglutination inhibition.	3	Demonstrate immunoelectrophoresis, hemagglutination and bacterial agglutination **(CO-2)**	Seminar, Lecture and Video	
	7	Radio immuno assay, ELISA and Western blotting, Immunofluorescence.	4	Demonstrate radio immuno assay, ELISA, western blotting and Immunofluorescence. **(CO-2)**	Seminar, Technology based Lecture	
	9	Flow cytometry.	2	Explain flowcytometry. **(CO-2)**	Seminar, Youtube Lecture	
	10	Transplantation: classification of grafts, mechanism of graft rejection, graft versus host reaction, immuno suppressive therapy during transplantation.	3	Describes transplantation. **(CO-2)**	Lecture, Androgogy	

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Seminar & Assignment Topics

10. Seminar: Innate and acquiredImmunity. Assignment: Types of Immunity.
11. Seminar: Immunoglobulins – characteristics. Assignment: Immunization schedule andvaccines.
12. Seminar: Cytokines and their functions. Assignment: MHC and susceptibility to infectious disease.
13. Seminar: Hypersensitivity: factors causing hypersensitivity, Type I andII. Assignment: Classical pathways, alternatepathways.
14. Seminar: Autoimmune diseases - localized (Diabetes mellitus and Addison's disease). Assignment: Autoimmune diseases- characteristics, causes,classification.
15. Seminar: Antigen-antibody interaction: strength, affinity, avidity and cross reactivity. Assignment: Properties of tumour cells and causes oftumours.
16. Seminar: Immunoelectrophoresis – counter electrophoresis and rocket electrophoresis. Assignment: Radial immunodiffusion and Doubleimmunodiffusion.
17. Seminar: Radio immuno assay, ELISA and Westernblotting. Assignment:Immunofluorescence.
18. Seminar: Flowcytometry. Assignment: Transplantation: classification of grafts, graft versus host reaction.

Semester : **III** **Elective III (a)**

Name of the Course : **General Endocrinology**

Course code : **PZ1733**

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

Learning Objectives

3. To learn how the endocrine system functions under normal circumstances, as well asthe pathologies that arise when homeostasis fails.
4. To get job in clinical laboratory and endocrine researchinstitutes.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	discuss the principles of endocrine system, hormonal communication and neuroendocrine mechanism in animals.	PSO - 1	U
CO - 2	explain the secretion and transportation of hormones to maintain homeostasis.	PSO -10	U
CO - 3	apply the knowledge of endocrinology to understand hormone-related disorders.	PSO - 8	Ap
CO - 4	explain women related physiological processes such as menstruation, gestation and lactation.	PSO - 3	Ap
CO - 5	correlate endocrine regulation of reproduction and metamorphosis in various invertebrates and vertebrates.	PSO -5	Ap;An

Teaching plan with Modules

Total Hours 90 (Incl. Seminar & Test)

Unit	Modules	Topics	Hours	Learning outcome/ CO addressed	Pedagogy	Assessment
I	**Introduction** (18 Hrs.)					
	1	Historical perspective and scope of endocrinology.	3	Explain the history and Scope of Endocrinology. (**CO-1)**	Seminar, andgroup discussion	MCQ Short test Formative Assessment I (1,2,3,4,5)
	2	Endocrine methodologies - assay of hormones, surgical methods, radioisotope studies, pharmacological methods, and replacement therapy.	6	Differentiate the various methods of Hormonal assays. **(CO-1)**	Lecture, and group discussion	

	3	Animal models for research.	3	Identify different animals used in Research. (**CO-1)**	Lecture Group discussion	Quiz I Seminar Assignment (Edmodo)
	4	Chemical messengers - neurocrine, paracrine, autocrine, endocrine.	4	Illustrate the action of hormones as Messengers. (**CO-2)**	Lecture / Video class	
	5	Pheromones and chalones.	2	Relate the hormone and behaviour. (**CO-2)**	Lecture	
II	**Neurosecretion and Neuroendocrine mechanisms** (18 Hrs.)					
	1	Neuroendocrine integration.	3	Relate the integration between the nervous system and the endocrine system. (**CO-2)**	Lecture, Mind map	Slip test Formative Assessment I (1,2,3,4) Quiz I Formative Assessment II (5) Quiz II Seminar Assignment (Quizizz)
	2	Evolution of regulatory mechanisms.	3	Explore the evolution of regulatory mechanism. (**CO-1)**	Lecture, PPT	
	3	Endocrine control of neural function.	3	Appreciate the control of nervous system by endocrine organs. (**CO-1)**	Lecture, Video	
	4	Neuroendocrine mechanisms and functions in insects, crustaceans, non-arthropod invertebrates.	5	Identify the role of Neuroendocrine mechanisms in insects and non-arthropod invertebrates. **(CO-5)**	Seminar, Lecture	
	5	Analogous neurosecretory systems of invertebrates and vertebrates.	4	Recognize the analogy of endocrine glands and their function in vertebrates and invertebrates. **(CO-5)**	Seminar, Lecture, PPT	
III	**Endocrine glands and hormones** (18 Hrs.)					
	1	Organization of the endocrine system, Classification of hormones.	3	Describe the different types of hormones. **(CO-1)**	Lecture. Discussion	MCQ Short test, Online assignment (Edmodo) Seminar, Formative Assessment II (1,2,3,4,5)
	2	Structure, functions and pathophysiology of hypothalamus, pituitary.	4	Explain the structure and functions of hypothalamus and pituitary. Identify pathological conditions. **(CO-3)**	Seminar, Lecture, PPT	
	3	Structure, functions and pathophysiology of thyroid and parathyroid.	4	Explain the structure and functions of thyroid and parathyroid. Identify pathological conditions. **(CO-3)**	Seminar, Lecture, PPT	

	4	Structure, functions and pathophysiology of adrenal, pancreas and gonads.	4	Explain the adrenal gland and pancreas.Interpret pathological conditions of gonads. **(CO-3)**	Lecture, PPT	Quiz II
	5	Gastro-intestinal hormones.	3	Describe Gastro-intestinal hormones. **(CO-3)**	Lecture, Video	
IV	**Hormone synthesis and mechanism of Hormone action** (18 Hrs.)					
	1	Biosynthesis, storage and release of amine (catecholamines and thyroxine) protein (growth hormone and insulin) and steroid hormones (sex hormones).	5	Explain the synthesis of amine, protein and steroid hormones. (**CO-2)**	Lecture, Mind map	MCQ, Shorttest, Online assignment (Quizizz) Seminar, Formative Assessment II(1,2) QuizII, Formative Assessment III (3,4,5)
	2	Mechanism of hormone action - receptors (membrane and cytosolic) - second messengers, signal transduction, termination of hormone activity.	4	Discuss hormone and cell communication. (**CO-2)**	Lecture, PPT	
	3	Pathophysiological correlates of hormone action.	4	Analyse the importance of receptor number for proper functioning of hormone. (**CO-3)**	Lecture, Group discussion	
	4	Endocrine disorders due to receptor number and function.	3	Outline the importance of receptor number. (**CO-3)**	Lecture, PPT	
	5	Hormonal therapy.	2	Evaluate the therapeutic role of hormones. (**CO-3)**	Lecture, PPT	
V	**Endocrine Integration** (18 Hrs)					
	1	Diffuse effect of hormones.	2	Interpret the varied role of one hormone on different organs. (**CO-2)**	Lecture, Flow Chart	MCQ Shorttest, Online assignment (Edmodo) Seminar, Formative Assessment III (1,2,3,4,5)
	2	Hormonal regulation of growth, development and metabolism.	4	Appreciate the physiological regulation of hormones. (**CO-2)**	Lecture, Mind map	
	3	Hormonal regulation of reproductive cycle and pregnancy, parturition and lactation.	4	Describe the role of hormones in reproduction. **(CO-4)**	Lecture, Videos	
	4	Hormonal regulation of migration (birds and fishes).	3	Analyse the reason and changes in animals during migration. **(CO-5)**	Lecture, PPT	
	5	Hormonal regulation of	5	Describe the	Lecture,	

		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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Seminar & Assignment Topics

3. Seminar: Animal models for research. Assignment: Endocrinemethodologies.

4. Seminar: Chemical messengers - neurocrine, paracrine, autocrine,endocrine. Assignment: Pheromones andchalones.

5. Seminar: Neuroendocrine mechanisms and functions in insects. Assignment: Hormonal regulation of migration inbirds.

6. Seminar: Neuroendocrine mechanisms and functions incrustaceans. Assignment: Hormonal regulation of migration infishes.

7. Seminar: Neuroendocrine mechanisms and functions in non-arthropod invertebrates. Assignment: Hormonal regulation of behavior andhibernation.

8. Seminar: Structure, functions and pathophysiology of pituitary. Assignment: Structure, functions and pathophysiology ofhypothalamus.

9. Seminar: Structure, functions and pathophysiology of thyroid. Assignment: Structure, functions and pathophysiology ofparathyroid.

10. Seminar: Biosynthesis, storage and release ofcatecholamines. Assignment: Biosynthesis, storage and release ofthyroxine.

11. Seminar: Biosynthesis, storage and release of growthhormone. Assignment: Biosynthesis, storage and release ofinsulin.