

**Holy Cross College (Autonomous), Nagercoil-629004
Kanyakumari District, Tamil Nadu.**

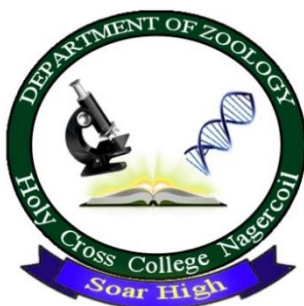
Nationally Re-Accredited with A+ by NAAC IV cycle – CGPA 3.35

Affiliated to

Manonmaniam Sundaranar University, Tirunelveli



**DEPARTMENT OF ZOOLOGY
POST-GRADUATE PROGRAMME**



**TEACHING PLAN
EVEN SEMESTER 2023 – 2024**



DEPARTMENT OF ZOOLOGY

VISION

Empower the students with Academic skills, Research aptitude and social commitment through holistic education.

MISSION

1. Foster knowledge and skills through innovative teaching and instill moral and ethical values.
2. Render opportunities for critical thinking, communication, and collaboration.
3. Create research ambience to promote innovations and contemporary skills relevant to local and global needs.
4. Inspire to explore the natural resources and connect with nature.
5. Promote passion to serve the local community by creating empowered women of
6. Commitment and social consciousness through outreach and exposure programmes.
7. Facilitate life-long learning, participatory leadership, and commitment to society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

POs	Upon completion of M.A./ M. Sc. /MSW Degree Programme, the graduates will be able to:	Mapping with Mission
PEO1	apply scientific and computational technology to solve socio ecological issues and pursue research.	M1, M2
PEO2	continue to learn and advance their career in industry both in private and public sectors	M4 & M5
PEO3	develop leadership, teamwork, and professional abilities to become a more cultured and civilized person and to tackle the challenges in serving the country.	M2, M5 & M6

PROGRAMME OUTCOMES (POS)

PO	Upon completion of M.Sc. Degree Programme, the graduates will be able to:	Mapping with PEOs
PO1	apply their knowledge, analyze complex problems, think independently, formulate and perform quality research.	PEO1 & PEO2
PO2	carry out internship programmes and research projects to develop scientific and innovative ideas through effective communication.	PEO1, PEO 2 & PEO3
PO3	develop a multidisciplinary perspective and contribute to the knowledge capital of the globe.	PEO 2
PO4	develop innovative initiatives to sustain ecofriendly environment	PEO1, PEO 2
PO5	pursue active career, team work and using managerial skills guide people to the right destination in a smooth and efficient way.	PEO 2
PO6	employ appropriate analysis tools and ICT in a range of learning scenarios, demonstrating the capacity to find, assess, and apply relevant information sources.	PEO1, PEO 2 & PEO3
PO7	learn independently for lifelong to execute professional, social and ethical responsibilities promoting sustainable development.	PEO3

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO	Upon completion of M.Sc. Programme, the graduates will be able to:	PO addressed
PSO1	explain the various aspects of life sciences including Biochemistry, Cell and Molecular Biology, Biosystematics, Genetics, Evolution, Physiology, Developmental Biology, Immunology, Microbiology, Endocrinology, Bioinformatics, Biotechnology and Nanobiology.	PO1, PO2
PSO2	carryout experimental techniques, analyze statistically, draw conclusions, write report, present effectively and publish in indexed journals effectively	PO2, PO4, PO5, PO6
PSO 3	develop personal and key transferable skills and entrepreneurial skills through industrial / field visits and internships.	PO2, PO3
PSO 4	independently assemble facts, summarize and draw conclusions from scientific text and develop competence in the design and execution of research.	PO1, PO2, PO3, PO4, PO6
PSO 5	discriminate societal and environmental problems, adopt relevant technology, synthesis solution and claim for IPR	PO4, PO5, PO7

Teaching plan

Class : I M.Sc. Zoology **Core Course – III**
Title of the Course : Cellular and Molecular Biology
Semester : II
Course Code : ZP232CC1

No. of Hours/ Week	No. of Credits	Total Hours	Marks
6	5	90	100

Pre-requisite

Students should have knowledge of the basic cellular structures and their salient functions.

Learning Objectives

1. To acquire knowledge on molecular organization of the cell and cell organelles, growth, and communications.
2. To develop skills needed to innovate and contribute to the advancement in cell and molecular biology.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall general concepts of cell biology and fundamental cellular structures and organelles.	K1
2.	explain the various cellular components and their activities.	K2
3.	identify the changes or losses in cell function caused by dysregulation.	K3
4.	compare different cellular processes, their regulation, and their significance.	K4
5.	assess the societal and environmental impacts through cellular and molecular research.	K5

K1- Remember; **K2-** Understand; **K3-** Apply; **K4-**Analyze; **K5-**Evaluate

Teaching modules

Total Contact hours: 90 (Including lectures, assignments, and tests)

Unit	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
I						
	1.	General features of the cell: Cell theory; Diversity of cell size and shapes	3	K1(R)	Brain Storming, Discussion	Slip test, MCQ
	2.	Protoplasm and deutroplasm – cell organelles;	4	K1(R)	Group discussion, Jigsaw method	Class test, just a minute

	3.	Membrane structure and functions - membrane models	4	K2(U)	Index cards,	Word splash, objective test
	4.	membrane/channel proteins, diffusion, osmosis.	3	K4(An)	Mind mapping, chalk and Board, lecture	Oral test, Mind Map
	5.	active pumps (Sodium and potassium pump). transport, ion	4	K5(E)	Peer tutoring, jigsaw	Long essay test, oral test
II	1	Cell organelles: Ultra-structure and functions of intracellular organelles – nucleus, nuclear pore complex, nucleolus,	4	K2(U)	Blended learning, Lecture, Demonstration	seminar, preparation of question bank
	2	Chromosomes, mitochondria,	5	K3(Ap)	Demonstration , lecture using videos	online Assignments, peer review
	3	Golgi bodies, lysosomes,	3	K3(Ap)	PPT, group discussion	MCQ, Group discussion
	4	Endoplasmic reticulum, centrosomes,	3	K4(An)	Review, mind map	Short essays, Quizzes
	5	Peroxisomes, ribosomes.	3	K3(Ap)	Chalk and Board, Lecture, you tube videos	Open book test, assignment
III	1	Cell cycle and cell division: Phases of Cell Cycle	2	K3(Ap)	Group Discussion, Interactive PPT	Objective test (Fill in the blanks), word splash
	2	Mitosis, Significance of Mitosis	3	K4(An)	Mind mapping, Debate	MCQ, mind map
	3	Meiosis, significance of meiosis.	2	K4(An)	Peer tutoring, lecture using videos	Slip test, poster making
	4	Control of the cell cycle - regulator molecules - positive regulation - negative regulation.	3	K2(U)	Flipped classroom, Peer tutoring	MCQ, Oral test
	5	Structure of DNA and RNA; Process of DNA replication,	4	K3(Ap)	PPT, Group discussion	Model making, seminar
	6	transcription, and translation in pro- and eukaryotic cells.	4	K4(An)	Brainstorming, YouTube videos, team teaching	Quizzes, panel discussion
IV	1	Cell communication and cell signaling-	2	K1(R) K2(U)	KWL, Inquiry based & PPT	Nearpod Collaborative

	2	Membrane-associated receptors for peptide and steroid hormones		K4(An)	Flipped classroom, Socratic method	Oral test
	2	Signaling through G-protein coupled receptors.	4	K3(Ap)	PPT & lecture Role play	Traffic light and Mind mapping
	3	Signal transduction pathways (RTK pathway and MAP kinase pathway).	4	K3(Ap)	PPT & lecture Role play	Four corner and Mind mapping
	4	Gap junction and tight junction, extracellular space and matrix.	3	K4(An)	Seminar, Peer group teaching, Group discussion.	Quizzes, Summarisation, Oral test
	5	Interaction of cells with other cells and non-cellular structures.	3	K4(An)	KWL, Interactive PPT	Think and pair, Oral test
V	1	Cancer cells: Characteristic features of normal and cancer cells.	3	K2(U)	Seminar, Collaborative learning	Ticket out the door method, Nearpod Collaborative
	2	Carcinogens: types and cancer induction. Metastasis.	4	K2(U) K4(An)	Seminar, Jigsaw, Group Discussion	Quizzes, Oral test, Summarisation
	3	Oncogenes and tumor suppressor genes.	3	K2(U)	Seminar, Interactive PPT, Index card	Short test with open ended question
	4	Therapeutic interventions of uncontrolled cell growth.	4	K4(An)	Interactive PPT, Jigsaw	Think and pair, Oral test
	5	Apoptosis – mechanism and regulation. Ageing and senescence.	4	K4(An)	Seminar & Index card, Chunking method	Four corner and Mind mapping, Quizzes

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Skill Development

Activities (Em/ En/SD): Differentiation of various stages of Mitosis and Meiosis (Practical) and structure of DNA (Model making)

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity):

Activities related to Cross Cutting Issues :

Assignment : 1. Compare prokaryotic and eukaryotic ribosomes.

Assignment : 2 . Model making: Cell signalling. (Group work)

Seminar Topics:

1. Protoplasm and deuteroplasm
2. Structure and function of Plasma membrane
3. Membrane proteins
4. Active transport
5. Structure and function of nucleus and nuclear pore complex
6. Structure and function of chromosomes
7. Structure and function of Golgi bodies
8. Structure and function of centrosome
9. Cell cycle and its phases
10. Mitosis
11. Structure of DNA
12. Structure of RNA
13. Cell communication
14. Gap junction and tight junction.
15. Extracellular space and matrix.
16. Oncogenes and tumour suppressor genes.
17. Characteristic features of normal and cancer cells
18. Types of cancer.
19. Carcinogens: types and cancer induction
20. Ageing and senescence.

Sample questions

Part A

1. Which of the following processes involves the movement of molecules from an area of high concentration to an area of low concentration?
a. Active transport b. Osmosis c. Diffusion d. Endocytosis
2. The nucleus is the site of protein synthesis in the cell. (**State True or False**)
3. In the cell cycle, the phase where the cell undergoes division of its nucleus and cytoplasm is called _____.
- 4 Which type of signalling molecules can cross the cell membrane to bind with intra cellular receptors
a) Steroid hormones b) Protein hormones c) Peptide hormones d) Amino acid derivatives
5. Which one of the following is the oncogenes
a) APC b) p53 c) Ras d) MAPK

Part B

1. Discuss the fluid mosaic model and the roles of membrane proteins.
2. Elaborate on the structure and functions of lysosomes. Discuss how lysosomes are involved in the breakdown of cellular waste and the digestion of foreign substances.
3. Explain the significance of mitosis in maintaining genetic stability and ensuring proper growth, repair, and maintenance of multicellular organisms.
4. Discuss the role of cell adhesion molecules in mediating interactions between adjacent cells.
5. Discuss the role of proto-oncogenes in normal cellular functions.

Part C

1. Discuss the diversity of cell size and shape among different organisms. Provide examples of specialized cell shapes and their functions.
2. Explain the ultrastructure of mitochondria and their role in cellular respiration. Include the key steps of cellular respiration and the importance of this process in providing energy for the cell.
3. Explain the process of meiosis, including the key events in both meiosis I and meiosis II. Discuss the significance of meiosis in the generation of genetic diversity and the formation of haploid cells.
4. Explain the concept of cell- cell communication in the context of development and tissue homeostasis.
5. Analyse the role of angiogenesis in the process of cancer progression.

Head of the Department

Dr. A. Shyla Suganthi

Course Instructors

Dr. X. Venci Candida

Dr. F. Brisca Renuga

Class : II M. Sc. Zoology
Semester : II
Title of the Course : Developmental Biology
Course Code : ZP232CC2

Core Course – IV

No. of Hours/ Week	No. of Credits	Total Hours	Marks
6	5	90	100

Pre-requisite

A basic understanding of biology and genetics is recommended to effectively grasp the concepts in developmental biology.

Learning Objectives

1. Understand the principles of developmental biology to analyze and compare the embryonic development of different animal species.
2. Study the concepts, procedures, and uses of genes and hormones to propose strategies to improve and control the development of certain animal species.

Course Outcome

On the successful completion of the course, student will be able to:		
CO - 1	recall and summarize the chief events in animal development, recognizing their significance and historical context	K1
CO - 2	understand the different mechanisms and how extrinsic and intrinsic factors influence embryonic development in various animal embryos.	K2
CO - 3	apply their knowledge to explain the role of hormones in animal development.	K3
CO - 4	analyze the different stages of embryonic development and the genetic control mechanisms involved.	K4
CO - 5	critically evaluate ethical issues associated with cryopreservation in mammalian reproduction.	K5
CO - 6	design and propose experiments related to biochemical changes during regeneration or cryopreservation techniques.	K6

. K1- Remember; K2- Understand; K3- Apply; K4-Analyze; K5-Evaluate; K6- Create

Modules with Teaching Plan

Total Contact hours: 90 (Including lectures, assignments, and tests)

Units	Modules	Topics	Hours	Cognitive level	Pedagogy	Assessment
I	Pattern of animal development (18 Hrs.)					
	1	Pattern of animal development: Chief events in animal development	2	K1 (R) K2 (U)	Group discussion, Open board	Quizzes through Google form

	2	Origin of germ cells, spermatogenesis - sperm morphology in relation to the type of fertilization	3	K1 (R) K2 (U)	Seminar by student Interactive PPT	Quizzes through poll
	3	Oogenesis - oogenesis in insects and amphibians; composition and synthesis of yolk in invertebrates (insects and crustaceans)	5	K1 (R) K2 (U)	Flipped learning	MCQ, Flow chart
	4	Oogenesis - oogenesis in vertebrates; composition and synthesis of yolk in vertebrates	4	K1 (R) K2 (U)	Seminar,	MCQ, Flow chart
	5	Genetic control of vitellogenin synthesis in amphibians.	4	K2 (U)	Jigsaw method	Mind map, MCQ, Oral test
II	Fertilization (18 Hrs.)					
	1	Fertilization: Sperm aggregation, sperm activation, chemotaxis, sperm maturation and capacitation in mammals, acrosome reaction. sperm – egg interaction	4	K1 (R) K2 (U)	Team-based learning	Quiz, Group discussion
	2	Sperm entry into the egg - egg activation - intracellular calcium release - cortical reaction	3	K1 (R) K2 (U)	Jigsaw method	Flow chart, Peer review
	3	Physiological polyspermy - fusion of male and female pronuclei post fertilization metabolic activation	5	K2 (U)	Fish bowl discussion	MCQ, Slip test
	4	parthenogenesis	6	K2 (U)	Flipped learning	Slip test, Oral test
III	Cleavage and gastrulation (18 Hours)					
	1	Cleavage and gastrulation: Pattern of embryonic cleavage, mechanisms of cleavage	5	K4 (An)	Didactive teaching	Diagnostic Assessment Dictation, Peer review
	2	Gastrulation - morphogenic movements - gastrulation in respective animal embryos -Sea urchin	5	K4 (An)	Expository teaching	Mind map, Slip test
	3	Gastrulation - morphogenic movements - gastrulation in respective animal embryos - Amphibians	3	K4 (An)	Scaffolding	Mind map Class test
	4	Gastrulation - morphogenic movements - gastrulation in respective animal embryos - Mammals	2	K4 (An)	Fish bowl discussion	Flow chart Self-Assessment

	5	Fate maps - (Amphibian and Chick),	2	K4 (An)	Conceptual puzzles	Quizzes through menti-meter
	6	Epigenesis and preformation – Formation of primary germ layers	1	K4 (An)	Dialogue circles	Quizzes through slido
IV	1	Embryonic Development; Embryonic development of fish	3	K2 (U) K3 (Ap)	Didactive teaching YouTube Video	Illustration Open book test
	2	Embryonic development of birds,	2	K2 (U) K3 (Ap)	Expository teaching	Flowchart/ Mind map
	3	Formation of extra embryonic membranes in mammal	2	K2 (U)	Scaffolding Peer interaction	Seminar
	4	Formation and migration of neural crest cells - types of neural crest cells - primary and secondary neurulation.	2	K2 (U)	PPT, YouTube Video	Quizzes
	5	Organogenesis (mammal): Development of ectodermal derivatives (nervous system). endodermal (digestive system), mesodermal (circulator system).	2	K2 (U)	Fish bowl discussion	Conceptual puzzles,
	6	Gene and development: Anterior-posterior axis in determination in drosophila	2	K2 (U) K3 (Ap)	Didactive teaching Dialogue circles	Diagnostic Assessment
	7	Maternal effect genes - <i>Bicoid</i> and <i>Nanos</i> proteins;	2	K2 (U)	PPT Peer coaching	Online quiz: Slido
	8	Generation of dorsal - ventral polarity- Genetic control of segmentation – Gap genes	2	K2 (U)	PPT Jigsaw method	Instant test polls
	9	Pair rule genes; Homeotic genes	1	K2 (U)	Team-based learning	
V	1	Post embryonic development metamorphosis: Endocrine control of metamorphosis in insect	3	K2 (U) K3 (Ap)	Chalk and talk Peer observation	Oral question MCQ
	2	Post embryonic development metamorphosis: Endocrine control of metamorphosis in amphibian	3	K2 (U) K4 (An)	Flipped classroom Jigsaw method	Open book test Flow chart
	3	Endocrine control of moulting and growth in crustaceans and insects - Neoteny and pedogenesis	3	K2 (U) K4 (An)	PPT Fish bowl discussion	Mind map Class test

	4	Regeneration: Types of regeneration, Regeneration in planaria and frog - Regenerative ability in different animal groups. Factors stimulating regeneration	2	K1 (R) K4 (An) K6 (C)	Collaborative learning Team-based learning	Online Assignment K1(R)
	5	Aging and senescence: Biology of senescence- cause of aging-mechanism involved in apoptosis.	2	K1(R) K2 (U)	Real –world application Animation video	Class test Online assessments
	6	Experimental Embryology: Mammalian reproduction: Mammalian reproductive cycle, Hormonal regulation	2	K1(R) K2 (U)	Fish bowl discussion Role playing	Seminar Models/ Charts
	7	Endocrine changes associated with normal pregnancy, Induced ovulation in humans	2	K1(R) K2 (U) K3(Ap)	Peer coaching	
	8	Cryopreservation of gametes/embryos - Ethical issues in cryopreservation	1	K3(Ap) K5 (E) K6 (C)	Flipped learning	

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Skill Development

Activities (Em/ En/SD): Clinical implications of the development, gender based reproductive disorders and intervening mechanism.

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Human Values

Activities related to Cross Cutting Issues:

Assignment: Cause of aging, induced ovulation in humans, Pattern of embryonic cleavage, mechanisms of cleavage

Seminar Topic:

1. Sperm morphology in relation to the type of fertilization.
2. oogenesis in insects
3. oogenesis in amphibians.
4. synthesis of yolk in invertebrates - insects and crustaceans)
5. synthesis of yolk in invertebrates - crustaceans)
6. Sperm aggregation, activation, chemotaxis, maturation and capacitation in mammals
7. sperm – egg interaction. Sperm entry into the egg - egg activation
8. parthenogenesis
9. Pattern of embryonic cleavage, mechanisms of cleavage
10. Gastrulation: morphogenic movement
11. Gastrulation in Amphibians
12. Gastrulation in Mammals
13. Formation of primary germ layers
14. Embryonic development of fish,
15. Embryonic development of birds,
16. Primary and secondary neurulation
17. Genetic control of segmentation – Gap genes; pair rule genes.
18. Endocrine control of metamorphosis in insect.
19. Endocrine control of metamorphosis in amphibian.
20. Aging and senescence
21. Mammalian reproductive cycle
22. Ethical issues in cryopreservation.

Sample questions

Part A

1. In invertebrates like crustaceans, the yolk serves as a source of _____ for developing embryos.
2. Chemotaxis plays a role in guiding sperm towards the egg during fertilization. **(True/False).**
3. Which of the following animals is commonly used to study gastrulation processes?
a. Fruit fly (*Drosophila*) b. Sea urchin c. Zebrafish d. All of the above
4. What is the role of extraembryonic membranes in mammalian development?
5. **Assertion:** Thyroxine plays a crucial role in the endocrine control of metamorphosis in amphibians.

Reason: Thyroxine stimulates the breakdown of larval tissues and promotes the development of adult structures during metamorphosis.

- a. Both assertion and reason are correct
- b. Assertion is correct and reason is wrong
- c. Both assertion and reason are wrong
- d. Assertion is wrong and the reason is correct

Part B

1. Discuss vitellogenin synthesis in amphibians.
2. Analyze Parthenogenesis with example.
3. Differentiate the structure of blastula and gastrula.
4. Explain embryonic development in fish.
5. Summarize the ethical issues in cryopreservation.

Part C

1. Analyse Oogenesis in insects.
2. Describe the steps involved in fertilization.
3. Discuss gastrulation in respective to amphibian.
4. Differentiate *Bicoid* and *Nanos* proteins.
5. Summarize Endocrine control of moulting and growth in crustaceans.

Head of the Department

Dr. A. Shyla Suganthi

Course Instructor

Dr. A. Shyla Suganthi

Dr. C. Josephine Priyatharshini

Class : I M. Sc. Zoology **Elective III**
Title of the Course : (a): Economic Entomology
Semester : II
Course Code : ZP232EC1

Credits	Inst. Hours	Total Hours	marks
3	4	60	100

Objectives

1. To develop the ability to identify and classify insects into major orders and understand their economic importance.
2. To acquire practical skills in observing and documenting the life cycles and behaviors of beneficial and destructive insects.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the features of various insect orders and describe the life history, social organization, and management practices of insects.	PSO - 1	K1(R)
CO - 2	understand the biology of insects associated with medical, household, and veterinary/public health importance.	PSO - 1	K2(U)
CO - 3	apply their knowledge of pest biology to assess damage and beneficial insect life cycles to practical rearing.	PSO - 3	K3(Ap)
CO - 4	analyze the causes of pest outbreaks and the economic threshold levels.	PSO - 2	K4(An)
CO - 5	synthesize knowledge to propose effective control measures for vectors associated with medical, household, and veterinary/public health importance.	PSO - 4	K5(E)

Modules with Teaching Plan

Total Hours: 60 (Including lectures, assignments and tests)

Unit	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
I	Overview of insects and insect taxonomy (12 hrs)					
	1	Insects and their biological success-Man and Insects	3	K1 (R) K2 (U)	Brainstorming Lecture, PPT (GC	Mentimeter, Mind map
	2	Salient features of Class Insecta and orders- Orthoptera, Isoptera, Hemiptera, Diptera, Coleoptera, Lepidoptera, Dermaptera, Odonata, Neuroptera, Hymenoptera.	3	K2 (U)	Demonstrative Lecture, Peer Teaching	Seminar

	3	Basic concepts in Insect Taxonomy	3	K2 (U) K3 (Ap)	Flipped learning, Collaborative teaching	Slido, Flow Chart
	4	Classification of insects	3	K3 (Ap)	Interactive Lecture, PPT (GC), Group Discussion	Seminar, Class Note
II	Beneficial insects (12 hrs)					
	1	Silkworms: Types, life cycle, diseases and its management, rearing methods	3	K1 (R) K2 (U)	Brainstorming, Explicit Instruction, PPT (GC)	Mind Map Whatsapp Polls
	2	Honey bees: Types, life history, social organization (Colonies and Caste system) Honey Bee care and Management of bee hive	3	K2 (U) K3 (Ap)	Inquiry based Learning, Peer-instruction	Slido, Online assignment Seminar
	3	Lac insects: Life History, Lac cultivation	3	K2 (U)	Online Videos, Illustrative lecture, Case Study based discussion, Quiz	Quiz (Google Form)
	4	Pollinators, predators, parasitoids, scavengers, weed killers, soil-builders	3	K2 (U) K3 (Ap)	Interactive Lecture, Reasoning, Case study – sharing.	Vocabulary test, Seminar
III	Destructive insects (12 hrs)					
	1	Insect pests: Definition, categories, Types of damage to plants by insects	3	K2 (U)	Collaborative Learning, Group discussion, Review of insect pests.	Open Book Test - Quiz, Seminar
	2	Causes of pest outbreak, Economic threshold level	3	K3 (Ap)	Reflective thinking, Peer teaching	Slip test Seminar
	3	Biology of the insect pests	3	K4 (An)	Illustrative lecture, PPT, WordPress	Class Note, Seminar
	4	Pests of paddy, cotton, sugarcane, vegetables, Coconut and stored grains, cereals.	3	K4 (An)	Illustrative lecture, PPT, WordPress	Class Note, Seminar

IV	Pest management/Control strategies (12 hrs)					
	1	Methods and principles of pest control	3	K3 (Ap)	Demonstrative Lecture, PPT (GC), Case study-based Learning.	Online assignment, Slip Test, Seminar
	2	Natural control, Artificial control	2	K4 (An)	Inquiry based Learning, PPT (GC), Peer teaching, Online Video links	
	3	Merits and demerits or limitations of these methods in pest control	2	K2 (U) K5 (E)	Illustrative lecture, Reflective thinking	Home Assignment
	4	Development and uses of pest resistant plant varieties	3	K3 (Ap)	Brainstorming, PPT, Peer teaching	Short test, Quiz, Seminar
	5	Integrated pest management- Concepts and practice	2	K1 (R) K3 (Ap)	Illustrative lecture, Group Discussion	Discussion, Seminar
V	Vector biology (12 hrs)					
	1	Stable fly, cattle fly, Fowl-shaft louse, chicken flea	3	K1 (R) K3 (Ap)	Illustrative Lecture, presentation PPT-Video	Online assignment - Quizlet, Seminar
	2	Sheep and Goat-Head Maggot and Sheep Ked-Insects associated with medical importance and Management	3	K4 (An)	Illustration, Flipped learning, Ms-PPT	Class Note
	3	Head Louse- <i>Pediculus Humanus capitis</i> , mosquitos, <i>Anosphelles, culex, Aedes</i> , flea- <i>xenopsylla cheopis</i> eye fly, sand fly, ticks, mites and bed bugs. Insects associated with household-cockroach, termite and silver fish	3	K2 (U) K3 (Ap)	Illustrative Lecture, Peer teaching	Quizzes
	4	Vectors of veterinary and public health importance-mosquitoes as potential vectors of human diseases – control measures.	3	K5 (E)	Brainstorming, PPT, Interactive Lecture	MCQ Seminar Short answers

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Entrepreneurship & Employability

Activities (Em/ En/SD): Rearing of honey bees, Rearing of silkworm

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues:

i) Field visit

Conduct field surveys to identify and quantify insect pest.

ii) Assignment Topics and Type:

Flow Chart: Classification of insects, Mind Map: Classification of pollinators

iii) Seminar (Invitation, Study material with reference, PPT/ Video, Possible questions, Attendance)

Topics:

- | | |
|---|---|
| 1. Classification of insects | 12. Pests of sugarcane, vegetables |
| 2. Silkworms: diseases | 13. principles of pest control |
| 3. Honey bees: life history | 14. Natural control, Artificial control |
| 4. Lac insects: Life history | 15. Merits and demerits of pest control methods |
| 5. Pollinators, predators, | 16. Development of pest resistant plant varieties |
| 6. Parasitoids, scavengers | 17. Integrated pest management |
| 7. Insect pests: Definition, categories | 18. Stable fly, cattle fly, |
| 8. Causes of pest outbreak, | 19. Fowl-shaft louse, chicken |
| 9. Economic threshold level | 20. Vectors of veterinary animals |
| 10. Biology of the insect pests | |
| 11. Pests of paddy, cotton, | |

iv) Quizlet Topic:

Pollinators and Predators

Sample questions:

Part A

What are the key factors contributing to the biological success of insects?

- A) Warm-blooded metabolism
 - B) Exoskeleton and flight capabilities
 - C) High reproductive potential
 - D) Social organization
2. Define the term "biological success" in the context of insects and provide two examples.
3. **Match the following insect orders with their salient features:**

- | | |
|----------------|---|
| A) Coleoptera | i. Complete metamorphosis |
| B) Lepidoptera | ii. Forewings modified into hard elytra |
| C) Diptera | iii. Two pairs of membranous wings |
| D) Hymenoptera | Iv. Stinging structures in females |

4. Fill in the blank: Silkworms undergo _____ metamorphosis.

5. Match the following:

- | | |
|------------------|-----------------|
| i. Pollinators | A. Honey bees |
| ii. Predators | B. Ladybugs |
| iii. Parasitoids | C. Wasps |
| iv. Scavengers | D. Dung beetles |

6. Fill in the blank: Insects causing damage to vegetables are classified as _____ pests.

7. Match the following pest control methods with their characteristics:

- | | |
|---------------------------|-------------------------------|
| i. Natural control | A. Use of chemical pesticides |
| ii. Artificial control | B. Predators and parasites |
| iii. Chemical Fertilizers | C. Crop rotation |

8. Discuss one merit and one demerit of using pest-resistant plant varieties.

9. Define integrated pest management in one sentence.

10. Fill in the blank: Insect pests cause damage to crops by _____.

Part B

1. Describe two adaptations that contribute to the success of insects in diverse environments.
2. Explain the concept of "metamorphosis" and its significance in the life cycle of insects.
3. Discuss the economic importance of insects belonging to the order Hymenoptera.
4. Explain how the structure of elytra in Coleoptera is related to their ecological roles.
5. Compare and contrast the Linnaean and cladistic systems of insect classification.
6. Provide examples of two insect species that were initially misclassified but later corrected through molecular analysis.
7. Illustrate the hierarchical levels used in classifying insects, giving examples at each level.
8. Discuss the challenges associated with classifying insects solely based on morphological characteristics.
9. Evaluate the role of honey bees in pollination and its impact on crop production.
10. Compare the life history and cultivation methods of lac insects with silkworms.

Part C

1. Analyze the ecological roles of scavenger insects in various ecosystems.
2. Discuss the impact of social organization on the survival and reproduction of honey bees.
3. Evaluate the economic significance of insects belonging to the order Diptera in agriculture.
4. Explore the evolutionary advantages of having two pairs of wings in insects.
5. Develop an argument supporting the use of molecular data over morphological characteristics in modern insect taxonomy.
6. Construct a flowchart illustrating the process of identifying an unknown insect species using taxonomic keys.

7. Examine the role of molecular techniques in resolving taxonomic uncertainties within insect orders.
8. Justify the importance of understanding insect classification for effective pest management strategies.
9. Propose an integrated pest management plan for a crop of your choice, emphasizing the use of beneficial insects.
10. Evaluate the impact of insect pollinators on biodiversity and ecosystem stability.

Head of the Department

Dr. A. Shyla Suganthi

Course Instructors

Dr. Jeni Chandar Padua

Dr. C. Anitha

Class : I M. Sc. Zoology Elective Course IV
Title of the Course : (a) - Research Methodology
Semester : II
Course Code : ZP232EC4

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

Objectives

1. To impart knowledge on the basic principle, methodologies and applications of instruments in biological sciences.
2. To develop essential research skills to operate and apply various biological science instruments.

Course Outcomes

CO	Upon completion of this course the students will be able to:	CL
CO - 1	recall the principles of laboratory equipment, research techniques and the process of scientific report writing.	K1(R)
CO - 2	explain the procedures involved in operating laboratory equipment, applying research techniques, and engaging in scientific writing.	K2(U)
CO - 3	apply biological techniques in laboratory settings to gain practical experience in research processes and scientific report writing.	K3(Ap)
CO - 4	analyze the principles and techniques to make wise choices in experimental design, data interpretation, and research reports in biological sciences.	K4(An)
CO - 5	evaluate the quality, reliability, and limitations of data generated by research techniques and obtained from literature for specific research goals.	K5(E)

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

Unit	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
I	Analytical Techniques (12 Hrs.)					
	1	Good laboratory practice (GLP), pH meter	3	K1 (R) K2 (U) K3 (Ap)	Brainstorming, Inquiry based learning, Performance based learning	Experiment – find the pH of the sample, Seminar
	2	Colorimeter, Spectrophotometer - UV-Visible, Atomic Absorption	5	K1 (R) K2 (U) K3 (Ap) K4 (An) K5 (E)	Illustrative lecture, Reflective Thinking - Slido, Performance based learning.	Flow chart, Experiment – find the OD of the sample, Seminar

	3	Flame photometer	2	K1 (R) K2(U) K4 (An)	Reasoning, Demonstrative lecture	Open Book Test, Flow chart
	4	FTIR spectrometry	2	K1 (R) K2 (U) K4 (An)	Interactive lecture, Cooperative learning, Nearpod	Class note, Preparation of MCQs
II	Microscopy & Micro techniques (12 Hrs.)					
	1	Principle, Working mechanism and applications of Bright field, Phase contrast microscope.	4	K1 (R) K2 (U) K3 (Ap) K4 (An) K5 (E)	Collaborative teaching, Peer teaching, Ms-PPT Video	Oral test, Seminar, Preparation of study materials
	2	Principle, Working mechanism and applications of Electron, Confocal Microscope and Atomic force microscope.	3	K1 (R) K2 (U) K4(An)	Interactive lecture, Blended learning,	Illustrative Diagrams, Online Assignment
	3	Histology – Fixation, Sectioning and Staining.	2	K1 (R) K1 (R) K3 (Ap) K4 (An)	Illustrative Lecture, Ms-PPT, Prezi video, Peer teaching	Quiz, Experiment – staining the sample, Student presentations
	4	Histochemistry for carbohydrates, proteins, lipids.	3	K1, K2, K3, K5	Brainstorming, Reasoning, Demonstrations, WordPress	Class test - Slip Test, Preparation of Questions, Presentations
III	Separation Techniques (12 Hrs.)					
	1	Centrifugation – Differential and Density gradient, types and applications of Centrifuges.	3	K1 (R) K2 (U) K3 (Ap)	Open ended questioning Demonstration Video lecture	Mind map on centrifuge types and applications Seminar
	2	Chromatography - Principle, HPLC and Affinity chromatography.	3	K1 (R) K2 (U) K3 (Ap) K4 (An)	Demonstration, PPT	Seminar
	3	GAS Chromatography Mass Spectrometry.	2	K1 (R) K2 (U) K3 (Ap) K4 (An)	PPT	Oral questioning
	4	Electrophoresis - Principle, Agarose gel electrophoresis and PAGE.	4	K1 (R) K2 (U) K3 (Ap) K4 (An)	virtual demo of electrophoresis Interactive lecture	Seminar

IV	Tracer techniques (12 Hrs.)					
	1	Radioactive isotopes.	2	K1 (R) K2 (U) K3 (Ap) K4 (An)	Discussion on radioisotopes	Quiz using Mentimeter
	2	Radiolabeling.	2	K1 (R) K2 (U) K3 (Ap) K4 (An)	Lecture	Slip test
	3	Radiocarbon dating.	2	K1 (R) K2 (U) K3 (Ap) K4 (An)	Lecture-video	Assignment
	4	Radioactivity counters - Scintillation Counter, Geiger Muller Counter.	6	K1 (R) K2 (U) K3 (Ap) K4 (An)	Lecture -ppt Demonstration	Quiz Short test
V	Scientific Writing (12 Hrs.)					
	1	Essential steps in research, Review of literature, Literature citation.	3	K1 (R) K4 (An) K5 (E)	Prepare a review of an article - lecture Flash card	Plan a research and write a proposal
	2	Research report – Abstract, Tables - Figures - Formatting and typing.	3	K1 (R) K4 (An) K5 (E)	Preparation of a report using MS-word	Write a research report for a journal without plagiarism
	3	Open access journals, Predatory journals.	2	K1 (R) K3 (Ap) K4 (An) K5 (E)	Brainstorming, Interactive Lecture, Study with examples	Quizlet, MCQ, Peer Review
	4	Impact factor, Citation index, H-index, Plagiarism, Copy Right.	4	K3 (Ap) K4 (An) K5 (E)	Illustrative lecture, Theme based Interaction	Google Forms, Panel Discussion

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Skill Development

Activities for Skill development

- i) Operation of pH meter, colorimeter, UV-Vis Spectrophotometer, Flame Photometer, Microscope, Centrifuge.
- ii) Preparation of common Fixative - 10% formalin and Stain - methylene blue
- iii) Group discussion: Open access journals and Predatory journals

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/ Environment Sustainability/ Gender Equity): *Professional ethics*

Activities related to Cross Cutting Issues: Professional ethics

- i) Assignment: Prepare a research review with less than 20% plagiarism.
- ii) Group discussion: Plagiarism and Copyright

Seminar: (Invitation, Study material with reference, PPT/ Video, Possible questions, Attendance)

- | | |
|--|--------------------------------------|
| 1. Principle, Working mechanism and applications of pH meter | 7. Fixation and Fixatives |
| 2. Principle, Working mechanism and applications of Colorimeter | 8. Sectioning and Microtome |
| 3. Principle, Working mechanism and applications of UV-Visible Spectrophotometer | 9. Staining and Stains |
| 4. Principle, Working mechanism and applications of Bright field microscope | 10. Histochemistry for carbohydrates |
| 5. Principle, Working mechanism and applications of Phase contrast microscope | 11. Types of centrifuges |
| 6. Principle, Working mechanism and applications of EM | 12. Density gradient centrifugation |
| | 13. HPLC |
| | 14. Affinity chromatography |
| | 15. Agarose gel electrophoresis |
| | 16. PAGE |
| | 17. Scintillation Counter |
| | 18. Geiger Muller Counter |
| | 19. Essential steps in research |
| | 20. Tables and figures, Formatting |

Sample questions

Part A

- 1. Beer Lambert's law gives the relation between which of the following?
 - a) Reflection of light and concentration
 - b) Scattered light radiation and concentration
 - c) Light energy absorption and concentration
 - d) Heat energy absorption and concentration
- 2. **Assertion (A):** Atomic Absorption Spectroscopy is an analytical technique used to determine how much of certain elements are in a sample.
Reason (R): It uses the principle that atoms (and ions) can absorb light at a specific, unique wavelength.
 - a) Statement 'A' is correct and 'R' is the correct explanation of 'A'.
 - b) Statement 'A' and 'R' are wrong
 - c) Statement 'A' is correct, but 'R' is wrong.
 - d) Statement 'A' is wrong and 'R' is correct.
- 3. Which part of the compound microscope helps in gathering and focusing light rays on The specimen to be viewed? _____
 - 1. Paraffin embedded sections of tissues are cut by Laser. (State **True** or **False**)

5. Which of the following statements is correct?
- Centrifugation works on the principle of sedimentation.
 - Large particles settle faster.
 - The unit is rpm.
 - Optimum pH is required for centrifugation.
- a) i, ii and iii b) i, iii and iv c) ii, iii and iv d) All of the above
6. HPLC works on the principle of -----.
7. Which of the following techniques is used to identify the molecular weight of the sample?
- pH
 - Electrophoresis
 - Affinity chromatography
 - GM counter
8. Kanyakumari is prone to radiation problems. Name an instrument which can be used to identify the radiation.
9. A title must be first fixed before deciding the area of research. (State **True** or **False**)
10. **Match the following**
- | | |
|----------------|---|
| Impact factor | - number of publications for which an author has been cited |
| Citation index | - unethical practice of an author |
| H-index | - relative importance of a journal |
| Plagiarism | - legal protection provided to the author |

Part B (6 marks)

- Appraise good laboratory practice.
- Evaluate FTIR spectrometry.
- Explain the structure and function of the confocal microscope.
- Explain the histochemistry for carbohydrates.
- Differentiate density from differential centrifugation.
- Explain the principle of centrifugation.
- Comment on the principle and procedure of affinity chromatography.
- How is the molecular weight of DNA identified? Explain.
- Highlight on the methods of review of literature.
- Differentiate Open access journals from Predatory journals.

Part C (12 marks)

- Inspect the principle, instrumentation, and application of pH meter.
- Analyse the role of the Flame photometer in the biological field.
- Illustrate the principle and working mechanism of Electron microscope.
- Classify stains and narrate the staining of histological specimens.
- Discuss the types of centrifuges in view of its application.
- A researcher would like to separate a protein from a tissue. Which method would give 99% purity? Discuss the method.
- Discuss the protocol applied in PAGE.
- Explain the principle and working procedure of GCMS.
- Discuss the essential steps in research.
- Analyse the importance of i) Impact factor, ii) Citation index, iii) H-index

Head of the Department

Dr. A. Shyla Suganthi

Course Instructor

Dr. S. Mary Mettilda Bai

Dr. J. Vinoliya Josephine Mary

Class : I M.Sc. Zoology
Title of the Course : Poultry Farming
Semester : II
Course Code : ZP232SE1

SEC -1

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

Pre-requisite

Students should be aware of economic and cultural importance of Poultry farming.

Learning Objectives:

- To know the needs for Poultry farming and the status of India in global market.
- Acquire the skills to apply the techniques and practices needed or Poultry farming.

Course Outcomes

CO	Upon completion of this course, the students will be able to:	Cognitive level
CO - 1	recall the key components of a poultry house to ensure optimal living conditions for poultry.	K1 (R)
CO - 2	explain the different methods of rearing and the significance of proper vaccination programs in poultry farming.	K2 (U)
CO - 3	develop a practical feeding plan for a specific stage of poultry considering their nutritional requirements.	K3 (Ap)
CO - 4	analyze the impact of different housing systems on poultry welfare and productivity,	K4 (An)
CO - 5	critically assess the effectiveness of poultry feeds and the disease control measures in poultry farming,	K5 (E)
CO - 6	design a comprehensive waste management and recycling system for poultry farms.	K6 (C)

K1- Remember; **K2-** Understand; **K3-** Apply; **K4-**Analyze; **K5-**Evaluate; **K6-**Creative

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

Units	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
I	1.	General introduction to poultry farming - Definition of Poultry -	2	K1 (R)	Brain storming, Cooperative learning	MCQ, Slip test
	2.	Past and present scenario of poultry industry in India	4	K2 (U)	Lecture, Group discussion	Seminar, Summarisation, Class test
	3.	Principles of poultry housing - Poultry houses	4	K3 (Ap)	PPT & Lecture	Model making, Oral test

	4.	Systems of poultry farming	2	K4 (An)	Blended learning	Mind mapping, Open Book test
II	1	Management of chicks - growers	5	K3 (Ap)	Flipped classroom	Seminar, Quiz using Mentee metre
	2	Management of layers, Broilers.	5	K3 (Ap)	Peer tutoring, lecture using videos	Seminar, Class test
	3	Preparation of project report for banking and insurance.	2	K6 (C)	Project based	Slip test, Slido - MCQ
III	1	Poultry feed management-Principles of feeding	4	K4 (An)	Collaborative learning	Oral presentation
	2	Nutrient requirements for different stages of layers and broilers	4	K3 (Ap)	Mind mapping, Debate	Assignment, mind mapping
	3	Feed formulation and Methods of feeding.	4	K4 (An)	Peer tutoring, lecture using videos	Slip test, poster making
IV	1	Poultry diseases-viral, bacterial	4	K5 (E)	KWL, Inquiry based & PPT	Nearpod Collaborative
	2	fungal and parasitic (two each); symptoms, control and management	4	K5 (E)	Flipped classroom, Socratic method	Oral test, Slido - MCQ
	3	Vaccination programme.	4	K3 (Ap)	PPT & lecture	Seminar, Mind mapping
V	1	Selection, care and handling of hatching eggs - Egg testing. -	4	K2 (U)	Seminar, Collaborative learning	Seminar, Socratic, Collaborative
	2	Methods of hatching. - Brooding and rearing -. Sexing of chicks.	4	K2 (U)	Seminar, Jigsaw, Group Discussion	Quizzes, Oral test Summarisation
	3	Farm and Water Hygiene - Recycling of poultry waste.	4	K5 (E)	Seminar, Interactive PPT, Index card	Short test with open ended question

Course Focussing on Employability/ Entrepreneurship/ Skill Development:
Entrepreneurship

Activities (Em/ En/SD): Poultry houses (Model making)

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues: Group Discussion on “Poultry Farming in relation to Environment Sustainability”

Assignment: Nutrient requirement for different stages of broilers (online assignment)

Seminar Topics

1. Past and present scenario of poultry industry in India
2. Principles of poultry housing.
3. Systems of poultry farming.
4. Management of chicks.
5. Management of grower.
6. Management of layer.
7. Management of Broiler.
8. Principles of feeding.
9. Nutrient requirements for different stages of layers.
10. Nutrient requirements for different stages of Broilers.
11. Feed formulations.
12. Methods of feeding.
13. Fungal diseases.
14. Bacterial diseases.
15. Viral diseases.
16. Parasitic diseases.
17. Brooding of chicks.
18. Sexing of chicks.
19. Farm and Water Hygiene.
20. Recycling of poultry waste.

Sample questions

Part A

1. Droppings Pit is a raised platform constructed inside the _____ house.
2. The chick rearing is the most difficult of all the operations in poultry farming (**State True or False**).
3. Which nutrient is essential for promoting rapid growth and muscle development in broilers?
a) Fiber b) Phosphorus c) Vitamin K d) Sodium
4. External parasites like mites and lice can cause skin and feather problems in poultry (**State True or False**).
5. **Assertion (A):** Recycling poultry waste is an effective strategy for sustainable farming practices.

Reason (R): Poultry waste, when properly managed, can be converted into valuable fertilizers or bioenergy, contributing to environmental sustainability.

- a) Both A and R are correct
- b) Both A and R are wrong
- c) A is correct and R is wrong
- d) A is wrong and R is correct

Part B

1. List the factors to be considered while selecting a site for a poultry farm.
2. What is the optimal temperature range for a brooder house to ensure the health and well-

- being of chicks during the early stages of their development?
3. Identify the different methods of feeding poultry birds.
 4. Elaborate on the key components of an effective poultry vaccination program.
 5. Explain the steps involved in the selection, care, and handling of hatching eggs for successful incubation.

Part C

1. Describe the optimal layout strategies for designing an efficient and productive broiler farm.
2. Explain the management techniques that contribute to successful broiler farming.
3. Examine the challenges faced in feed formulation for poultry production.
4. Discuss the lifecycle, clinical manifestations, and economic impact of any two bacterial infestations in poultry. Evaluate different methods of control and treatment.
5. Explore the significance of maintaining high levels of farm and water hygiene in poultry production.

Head of the Department

Dr. A. Shyla Suganthi

Course Instructors

Dr. P.T. Arokya Glory

Dr. X. Venci Candida

Class : II M.Sc. Zoology
Semester : IV
Name of the Course : Microbiology
Course code : PZ2041

Core XII

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

Objectives

1. To facilitate the students to understand the microbes and their significance.
2. To develop skills in microbial techniques relevant to industries, environment and disease management.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	describe the structure, distribution and life cycle of microorganisms and their role in human welfare.	PSO - 1	R
CO - 2	explain culture techniques, growth, fermentation and microbial products.	PSO - 2	U
CO - 3	Apply the microbiological laboratory skills in clinical research, food industries and environmental management.	PSO - 3	Ap
CO - 4	analyze beneficial and harmful microbes	PSO - 3	An
CO - 5	evaluate the microbial importance and applications in various fields.	PSO - 4	E

Teaching plan with Modules Total Hours: 90 (Incl. Seminar & Test)

Units	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
I	Virus, Fungi and Protists (18 hrs)					
	1	History and scope of microbiology. Classification of microorganisms - Whittaker's five kingdoms and three domain classification.	3	K1 (R) K2(U)	Brainstorming, Lecture, PPT	Class test, Flow chart, Seminar
	2	Virus - General properties, viral taxonomy.	2	K1(R),	Brainstorming, Discussion	Assignment, Flow chart

	3	Bacteriophages – life cycle – Lytic and Lysogenic.	4	K1 (R),	Inquiry based learning, Peer teaching, Flipped learning, Illustration	Seminar, Home assignment, Slip test, Illustration
	4	Sub viral agents – viroid, virusoids, prions and satellite viruses.	2	K1 (R), K4(An)	Interactive lecture, Group Discussion,	Study material preparation, Seminar
	5	Cultivation of viruses and purification assays. Virus-host interactions.	4	K1 (R), K2(U)	PPT, Video class, Collaborative learning	Seminar, Open book test, short test, class test
	6	Fungi: classification – morphology - filamentous, non-filamentous and dimorphic fungus. Apicomplexa– <i>Toxoplasma</i> .	3	K1(R), K2 (U), K3(Ap)	Interactive teaching, PPT, Partnering teaching	MCQ, Seminar, Online assignment, Class interaction
II	Bacteria and culture techniques (18 hrs)					
	1.	Bacteria -classification – Bergey’s system.	2	K1 (R)	Collaborative teaching, Peer teaching (Seminar), PPT	Mind map, Oral test
	2.	Morphology, structure and functions of cell walls (Gram positive & Gram negative), flagella, fimbriae and pili.	3	K1(R)K3 (Ap)	Interactive lecture, Group discussion, Illustration	Diagrams, Online Assignment Seminar, MCQ
	3.	Fine structure of <i>Escherichia coli</i> .	2	K3(Ap) K4(An)	Illustration, Peer teaching	Illustration, Assignment
	4.	Bacterial nutrition - nutrient requirements, nutritional classes, uptake of nutrients.	3	K3(Ap) K4(An) K5 (E)	Brainstorming, Mind map, peer teaching	Class test, Seminar, Flow chart
	5.	Bacterial growth and measurements.	3	K3(Ap) K4(An)	Video teaching, Demonstration on Interactive class	Practical, Discussion, Quiz
	6	Types of culture media	2	K2(U)	Partnering, Collaborative learning	Quiz, Class test

	7	Pure culture and isolation techniques - Streak plate and pour-plate technique.	3	K3(Ap)	Interactive class, Video class Demonstration	Quiz, Seminar, Slip test, Online assignment
III	Industrial Microbiology (18 hrs)					
	1	Fermentation - microbial products - alcohol (ethanol), antibiotics (penicillin),	3	K3(Ap)	Video, Group Discussion, Interactive PPT	Mind mapping, Portfolio review.
	2	Production of vitamin B ₂ and Vitamin B ₁₂ .	3	K2(U)	Role reversal, Interactive PPT	Slido - MCQ, Oral test
	3	Biofertilizers - steps for preparing bacterial biofertilizers	3	K2(U)	Debate, Jigsaw	Four corner Slip test
	4	Mass cultivation of <i>Cyanobacteria</i> , <i>Azolla</i> and <i>Trichoderma</i>	3	K3(Ap)	Flipped classroom, Peer tutoring	Oral test, Summarization
		Production of mycorrhizal fungi– Vesicular Arbuscular Mycorrhiza (VAM) and yeast.	3	K2(U)	Seminar, Think – pair share	Presentation assessment, Traffic light.
		Industrial uses of yeast and moulds. Probiotics- <i>Lactobacillus</i> and <i>Saccharomyces</i> .	2	K2(U)	Flipped classroom.	Thumps up / down, Listing out important steps
		Bacterial insecticides – <i>Bacillus</i> species.	1	K2(U)	Peer group teaching Listing out important terms.	Test using Padlet
IV	Environmental Microbiology (18 Hrs)					
IV	1	Microbiological analysis of water - Coliform test, Most Probable Number (MPN) test, and Membrane Filter (MF) test	4	K4(An) K5 (E)	KWL, Inquiry based PPT	Nearpod Collaborative Slido
	2	Sewage treatment – small scale and large-scale treatment. Biogas production– solubilization, acetogenesis and methanogenesis	3	K4(An)	Seminar, Flipped classroom, Socratic method	Oral test Quizzes, panel discussion
	2	Microbial leaching – copper and uranium leaching.	3	K2(U)	Interactive PPT & lecture gallery Walk	Traffic light and Mind mapping

	3	Biogas production – solubilization, acetogenesis and methanogenesis	3	K2(U)	Seminar Interactive PPT & lecture Role reversal	Four corner and Mind mapping
	4	Biodegradation of petroleum and xenobiotics, bioremediation and biosorption.	2	K2(U)	Seminar, Peer group teaching, Group discussion.	Quizzes, Summarization, Oral test
	5	Microbes as biofilms, biosensors, nanomaterials.	3	K4(An)	KWL, Interactive PPT	Think and pair, Oral test
V	Medical Microbiology (18 hrs)					
	1	Gnotobiotic animals, distribution of normal microbiota of the human body	2	K2(U)	Seminar, Collaborative learning	Ticket out the door method, Nearpod Collaborative
	2	Nosocomial infections. Fungal diseases - Candidiasis and Aspergillosis	3	K2(U))	Seminar, Jigsaw, Group Discussion	Quizzes, Oral test, Summarization
	3	Bacterial diseases - Streptococcal pneumonia, Typhoid, Tetanus.	2	K2(U)	Seminar, Interactive PPT, Index card	Short test with open ended question
	4	Viral diseases – SARS, MERS, Covid-19, Ebola, Hepatitis-B, Rabies.	2	K2(U)	Seminar Interactive PPT, Jigsaw	Think and pair, Oral test
	5	Sexually transmitted diseases – Gonorrhoea, Syphilis.,	1	K2(U)	Seminar Chunking method- Padlet	Quiz - Slido
	6	Microbial drugs - Drug administration, determination of antimicrobial activity, mechanism of antimicrobial agents' effectiveness of antimicrobial drugs.	4	K4(An)	Seminar & Index card,	Four corner and Mind mapping, Quizzes
	6	Methods of controlling microbes. Current problems of antibiotic resistance in man.	4	K4(An) K5 (E)	Interactive PPT, Collaborative learning, Reciprocal teaching	Ticket out the door method, Oral test

Course Focussing on Employability/ Entrepreneurship/ Skill Development:

Activities (Em/ En/SD):

Employability – Learn the culture techniques.

Entrepreneurship: Visit to a clinical laboratory.

Skill Development: Prepare fermented products and isolate and identify bacteria.

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity):

Professional Ethics and **Environment** Sustainability

Activities related to Cross Cutting Issues:

Professional Ethics – Killing bacteria after the study

Environment Sustainability – Analyse water sample to find out microbial load and apply bioremediation.

Assignment

1. Exhibition on Protozoan, Bacterial, Fungal, and Viral diseases sexually transmitted.
2. Culture of bacteria and measurement of growth.

Seminar Topics

1. History and Scope of Microbiology.
2. Viruses - General properties. Structure of viruses.
3. Viruses and cancer.
4. Viroid and Prions.
5. Bergey's system of bacterial classification.
6. Fine structure of *Escherichia coli*.
7. Bacterial nutrition - Common nutrient requirements.
8. Mass cultivation of *Cyanobacteria*, *Azolla* and *Trichoderma*
9. Production of mycorrhizal fungi– Vesicular Arbuscular Mycorrhiza (VAM) and yeast.
10. Industrial uses of yeast and moulds.
11. Sewage treatment – small scale, large scale
12. Biogas production- solubilization, acetogenesis and methanogenesis
13. Biodegradation of petroleum and xenobiotics.
14. Viral diseases - SARS, MERS, and Covid-19
15. Fungal diseases- Candidiasis and Aspergillosis.
16. Bacterial diseases - Streptococcal pneumonia, Typhoid, Tetanus.
17. Classification of Drug administration.
18. Current problems of antibiotic resistance in man.
19. Sexually transmitted diseases.

Sample Questions

Part A

1. Virus is a living material **True/ False**
2. Choose the dimorphic fungus from the following.
 - a. Basidiomycota
 - b. *Afflatoxin*
 - c. *Toxoplasma gondii*
 - d. *Histoplasma capsulatum*

3. What is a key step in preparing bacterial biofertilizers
 - a. Chemical synthesis
 - b. Autoclaving
 - c. Encapsulation
 - d. Inoculation with beneficial bacteria
4. Name the process which is commonly used in small scale sewage treatment
 - a. Activated sludge process
 - b. Trickling filter
 - c. Septic tank
 - d. Aeration Pond derivatives
5. Which chemical agent is commonly used for hand hygiene in medical settings
 - a) Hydrogen peroxide
 - b) Chlorine bleach
 - c) Isopropyl alcohol
 - d) Iodine tincture

Part B

1. Point out the general characteristic features of viruses.
2. Choose the suitable culture media for bacterial growth.
3. Differentiate the symbiotic relationship between Azolla and cyanobacteria
4. Briefly explain the purpose of the Coliform test in microbiological water analysis.
5. Discuss three regions of the human body where normal microbiota found add a note on the role of normal microbiota in these areas.

Part C

1. Explain the culture methods of viruses. Add a note on its purification assay.
2. Explain the culture and isolation techniques of bacteria. How will you measure their growth?
3. Elaborate the steps involved in the production of Vitamin B12 through fermentation. Include the microorganisms and key processes.
4. Discuss the role of microbes in biofilms, biosensors, and nanomaterials, highlighting their applications in various fields.
5. Discuss the challenges in diagnosing and treating these fungal diseases, and their significance in immunocompromised individuals.

Head of the Department

Dr. A. Shyla Suganthi

Course Instructors

Dr. F. Brisca Renuga

Dr. C. Anitha

Class : II M.Sc. Zoology
Semester : IV
Name of the Course : Biotechnology & Nanobiology
Course code : PZ2042

Core XIII

Hours/ Week	Credits	Total Hours	Marks
6	4	90	100

Objectives

1. To enable the students to understand the essence of biotechnology and become aware of the advances in Nanobiology.
2. To develop skills to apply biotechnological principles in research related to genetic manipulations, industrial and environmental biotechnology.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO address ed	CL
CO - 1	explain the various techniques used in modern biotechnology.	PSO - 1	U
CO - 2	outline the basic concepts of Biotechnology and Nanobiology, its application and threat to the society.	PSO - 2	R
CO - 3	apply the biotechnological principles in research and judicial use of bio- and nanotechnology to solve societal problems.	PSO - 2	Ap
CO - 4	analyze the impact of biotechnological products and genetically modified organisms in bioremediation.	PSO - 3	An
CO - 5	evaluate the function, gene modulation and their effects on improvement of crops and animals after the applications of cloned genes.	PSO - 4	E
CO - 6	design simple experiments on biotechnology and communicate the results through publication.	PSO - 3	C

Teaching Plan with Modules

Total Hours: 90 (Incl. Seminar & Test)

Unit	Section	Topics	Hours	Cognitive level	Pedagogy	Assessment
I	Gene cloning (18 hrs)					
	1	Basic steps of gene cloning, restriction and modifying enzymes, linkers and adaptors.	4	K1 (R) K5 (C)	Lecture, Video class	Class test: MCQ

	2	Cloning and expression vectors, construction of chimeric DNA	4	K1 (R) K2 (U) K4 (An)	Brainstorming, Discussion	Seminar Assignment: Flow chart/ Mind map/ Drawings / Class notes
	3	Nucleic acid probes, DNA libraries.	3	K1 (R) K3 (Ap)	Group discussion, Jigsaw method	
	4	Polymerase chain reaction, blotting techniques, molecular markers.	3	K1 (R) K5 (C)	Mind mapping, chalk and Board, lecture	
	5	DNA sequencing, synthesis of oligonucleotides, DNA fingerprinting, Human Genome Project.	4	K1 (R) K5 (C)	Index cards, Chalk and board	Internal Test I & Quiz I
II	Animal Biotechnology (18 hrs)					
	1	Culture media, primary culture and cell lines; pluripotent stem cell lines; tissue engineering.	4	K1 (R) K2 (U)	Interactive Lecture, PPT, Video	Class test: Short test Assignment: Flow chart/ Mind map/ Drawings / Class notes
	2	<i>In vitro</i> fertilization and embryo transfer in animals; gene transfer methods.	4	K1 (R) K3 (Ap)	Story telling Lecture, Video, Group discussion	Internal test I & Quiz I (1,2) Seminar Internal test II & Quiz II (3,4)
	3	Primary explanation techniques – organ and embryo culture.	4	K1 (R) K3 (Ap)	Group discussion, Jigsaw method	
	4	Transgenic animals - cattle, sheep, fish and pigs transgenic animals as models of human disease. Ethical issues in transgenesis.	6	K1 (R), K2 (U), K3 (Ap), K5 (An) K5 (C)	Peer tutoring, jigsaw	
III	Medical Biotechnology (18 hrs.)					
	1	Hybridoma technology and Monoclonal antibodies.	4	K1 (U) K3 (Ap)	Blended learning, Lecture	Internal test II & Quiz II
	2	Applications of biotechnology in medicine, Vaccines, diagnostics, and forensics. Gene therapy – pharmacogenomics.	5	K3 (Ap), K4 (An) K5 (C)	Interactive Lecture, PPT, Debate	Class test: MCQ Seminar
	3	Enzyme biotechnology: Isolation and purification	4	K1 (R)	Formal Lecture,	

		of enzymes, uses of enzymes in industries, immobilization of enzymes and their uses.		K3 (Ap) K5 (C)	PPT, Peer group discussion	Assignment: Flow chart/ Mind map/ Drawings / Class notes Internal test II & Quiz II	
	4	Biosensors. Terminator and traitor technology.	3	K1 (R) K3 (Ap) K4 (An)	Team teaching, mind map		
	5	Intellectual Property Rights.	2	K2 (U) K4 (An) K5 (C)	Chalk and Board, Lecture, you tube videos		
IV	Industrial and Environmental Biotechnology (18 hrs.)						
	1	Industrial Biotechnology -design of fermenter, sterilization, media design, production of metabolites - Downstream processing and <i>in situ</i> recovery of products.	4	K1 (R) K2 (U) K3 (Ap)	Peer tutoring, lecture using videos	Internal test II & Quiz II Open book test: Objective type Seminar Assignment: Flow chart/ Mind map/ Drawings / Class notes	
	2	Microbial biotransformation, microbial biomass production (SCP).	3	K1 (R) K2 (U), K3 (Ap) K5 (C)	Interactive Lecture, PPT		
	3	Environmental Biotechnology - Bioremediation and Phytoremediation.	3	K1 (R) K2 (U) K4 (An)	Flipped classroom, Peer tutoring		
	4	Genetically engineered microorganisms (GEMs) - treating oil spills, detection of pesticide in soil and their degradation, sequestering heavy metals.	5	K2 (U) K4 (An) K5 (C)	Storytelling Lecture, PPT, videos		
	5	Biomining and Biofuels.	3	K3 (Ap) K4 (An)	Mind mapping, PPT		
V	Nanomaterials (18 hrs.)						
	1	Types and properties, DNA and protein nanoarrays	3	K1 (R) K2 (U)	Peer tutoring, jigsaw	Internal test I & Quiz I	
	2	Biosystems (microbes) as nanofactories.	3	K1 (R) K2 (U)	Flipped classroom, Peer tutoring	Class test: Slip test	

	3	Application of nanotechnology - medical diagnostics, imaging contact lenses, dental implants, Scaffolds for tissue engineering, cosmetics and drug delivery, agro-practices and nano food products.	5	K1 (R), K2 (U) & K3 (Ap)	Chalk and Board, Lecture, you tube videos	Seminar Assignment: Flow chart/ Mind map/ Drawings / Class notes
	4	Environmental remediation - prevention of contamination, maintenance, and quality enhancement.		K1 (R), K4 (An)	Team teaching, mind map	
	5	Risks and threats of nanoparticles in environment.	3	K1 (R) K2 (U) & K3 (Ap)	Lecture, Discussion, Debate	

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Skill Development

Activities (Em/ En/SD): Polymerase chain reaction (Mind Map)

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Human values

Activities related to Cross Cutting Issues: Debate on “Huma values.”

Assignment: DNA sequencing, dental implants

Seminar

1. DNA libraries
2. Polymerase chain reaction
3. Molecular markers
4. DNA fingerprinting
5. Human genome project
6. Primary culture and cell lines
7. In vitro fertilization and embryo transfer in animals, gene transfer methods.
8. Transgenic animals
9. Ethical issues in transgenesis
10. Hybridoma Technol. & Monoclonal antibodies
11. Applications of Biotechnology in medicine, vaccines, diagnostics & forensics
12. Gene therapy
13. Microbial biomass production
14. Environmental remediation
15. Genetically Engineered Microorganisms
16. Biomining and Biofuels
17. Nanomaterials: Types and properties
18. Application of nanotechnology
19. Environmental remediation
20. Risk and threats of nanoparticles in environment

Sample questions

Part A

1. Technique of DNA fingerprinting involves _____
a) ELISA b) Northern blotting c) Southern blotting d) PAGE
2. Which one of the following is used commonly to disaggregate epithelial cells?
a) EDTA b) Amylase c) Peptidase d) Collagenase
3. Immobilization of enzymes protect the enzymes from degradation.
4. Identify the correct sequence during the industrial production of substances.
a) Inoculation, screening, fermentation, downstream processing, removal of waste
b) Screening, Inoculation, fermentation, downstream processing, removal of waste
c) Fermentation, screening, inoculation, removal of waste, downstream processing
d) Fermentation, inoculation, inoculation, removal of waste, downstream processing
5. A particular molecule of carbon made up of sixty carbon atoms has received some press as
a structure that shows promise as a basic building block in the area of molecular manufacturing. What is the whimsical nontechnical name for these molecules?
a) Fullerrods b) Nanonodes c) Buckyballs d) Nanocubes

Part B

1. Briefly describe the desirable characters of cloning vectors.
2. Evaluate the various types of gene transfer methods.
3. Demonstrate immobilization of enzymes and their uses.
4. How could biotechnology help in the treatment of oil spills?
5. What are nanomaterials? Explain the types and applications of nanomaterials.

Part C

1. What is PCR? Explain the stages of PCR and its applications.
2. Appraise *in vitro* fertilization and embryo transfer in animals.
3. Elaborate hybridoma technology and monoclonal antibodies production.
4. Describe microbial biomass production with special reference to SCP
5. Microbes are used as nanofactories' - Justify.

Head of the Department
Dr. Shyla Suganthi

Course instructor
Dr. A. Punitha

Dr. Jeni Chandar Padua

Class : II M. Sc. Zoology
Semester : IV
Title of the Course : Immunology
Course Code : PZ2043

Core IVX

Hours/ Week	Credits	Total Hours	Marks
5	4	75	100

Objectives

1. To facilitate the students to appreciate the defense functions of the immune system.
2. To develop the skill to determine the immunomodulatory strategies used to enhance or suppress the immune response.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	recall the importance of immunity, immune response, MHC, BCR and TCR, antigen – antibody interaction.	PSO - 1	R
CO - 2	relate the evolution of immune molecules in different groups of animals, immunodeficiency diseases and immunotechniques.	PSO - 1	U
CO - 3	make use of immunization schedules, differentiate the types of hypersensitive allergic reactions and symptoms.	PSO - 2	Ap
CO - 4	analyse the immune response in relation to toxicants, vaccines, tumour, and infectious diseases.	PSO - 3	An
CO - 5	evaluate the role of immune cells and humoral factors in immune response	PSO - 3	E
CO - 6	predict immuno-nano materials for immunodiagnostic, therapeutic techniques and research.	PSO - 4	C

Teaching Plan with Modules

Total Hours: 75 (Incl. Assignment & Test)

Units	Modules	Topics	Hours	Cognitive level	Pedagogy	Assessment
I	Immune system in invertebrates and vertebrates (15 hrs.)					
	1	Immunity - Innate and acquired, Types	3	K1 (R) K4 (An)	PPT, Lecture Method, Flipped Class room, Group discussion	MCQ, Short test,

	2	Lymphoid organs and immune cells	2	K1 (R)	Peer teaching, you tube links, PPT, Lecture Method	Slip test Assignment
	3	Antigens, Immunoglobulins – characteristics Haptens and types.	3	K5 (E)	PPT, Blended learning, Lecture method, Group discussion	MCQ, Flow chart
	4	Immune Response: Humoral immune response, Cell mediated immune response	4	K5 (E)	PPT, Inquiry based learning, Lecture method	Mind map, MCQ, Oral test
	5	Immunological memory (Anamnesis).	2	K5 (E)	Flipped Class room, Group discussion	MCQ, Short test,
	6	Immunization: immunization schedule and vaccines.	1	K3 (Ap)	PPT, Inquiry based learning, Lecture method	Mind map, MCQ, Oral test
II	B and T cell (12 hrs.)					
	1	B cells – Development, Maturation, activation, differentiation, B cell receptor (BCR) and B cell co-receptor complex. Signal transduction from B cell antigen receptor and Major pathways of BCR signaling.	6	K1 (R) K2 (U)	Lecture, ppt, Group discussion, Role play	Flow chart, Mind map
	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.	6	K1 (R) K2 (U)	Lecture, Blended learning	MCQ - mentimeter Short answer test
	3	Antigen processing and presentation. Role of antigen presenting cells, cytosolic pathway and endocytic pathway	3	K1 (R) K2 (U)	Lecture, Reflective PPT	Model making

III	Major and minor histocompatibility complex (15 hrs.)					
	1	MHC class I and II molecules, cellular distribution and regulation of MHC expression	5	K1 (R)	Blended learning, Lecture method, Group discussion, PPT	Quiz, Slip test
	2	MHC in immune responsiveness, MHC and susceptibility to infectious diseases.	4	K1 (R)	PPT, Lecture Method, Flipped Class room, Group discussion	Mind map, Flow chart
	3	Minor histocompatibility (H) antigens. Immune effector mechanisms:	2	K1 (R)	PPT, Inquiry based learning, Lecture method	Flow chart, Peer review
	4	Cytokines and their functions	2	K1 (R)	PPT, You tube Video, Collaborative learning.	Quiz, Group discussion
	5	Complement system – classical and alternative pathways, biological functions	2	K1 (R)	Lecture using PPT, Cooperative learning	MCQ, Flow chart
IV	Immune system in health and diseases (15 hrs.)					
	1	Tumour immunology- tumour antigens, immune response to tumour and immune surveillance. Immunodiagnosis of tumour antigens and immuno therapy of tumour.	4	K4 (An)	Lecture -ppt, Discussion	Assignment
	2	Hypersensitivity: factors causing hypersensitivity, Type I, II, III, and IV reactions	2	K3 (Ap)	Seminar, PPT/Video lecture	Preparation of chart
	3	Immunodeficiency – primary and secondary Autoimmune diseases - characteristics, causes, classification. Autoimmune diseases - localized (Diabetes mellitus); systemic (rheumatoid arthritis).	5	K3 (Ap) K4 (An) K5 (E)	Self-directed learning, Computer assisted learning Experiential learning through videos	Seminar

		Immune response to infectious diseases and treatment - Protozoan disease (Malaria), Bacterial disease (Tuberculosis) and Viral disease (AIDS).	4	K4 (An) K5 (E)	Seminar-PPT, Inquiry based learning	Mind map, Quiz through quizzes
V	Antigen-antibody interaction (15 hrs.)					
	1	Antigen-antibody interaction, Complement fixation test- precipitation reaction in fluids and precipitin curve.	1	K1 (R) K2 (U)	Seminar, Demonstration.	Oral test
	2	Radial immunodiffusion and Double immunodiffusion.	2	K2 (U) K3 (Ap)	Lecture, Demonstration PPT, Experimental learning	Practical
	3	Agglutination reaction–hemagglutination and bacterial agglutination. Agglutination reaction-coated particle agglutination and agglutination inhibition.	3	K2 (U) K3 (Ap)	Seminar, Lecture and Video	Video presentations Observe and deliver the concept
	4	Radio immuno assay, ELISA and Western blotting, Immunofluorescence. Flow cytometry.	4	K2 (U) K3 (Ap)	Seminar, Virtual demo, Experimental learning	
	5	Transplantation: classification of grafts, mechanism of graft rejection, graft versus host reaction, immunosuppressive therapy during transplantation	5	K3 and K4	Seminar, YouTube Lecture, Case studies	

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Skill Development

Activities (Em/ En/SD): Perform experiment to understand antigen antibody interaction and record the results

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Environmental sustainability

Activities related to Cross Cutting Issues: Analyze the impact of pathogens and other pollutants on the immune response of human beings and prepare a report.

Assignment: Complement system – classical and alternative pathways, biological functions

Seminar Topic:

1. Immunity - Innate
2. Immunity - acquired
3. Lymphoid organs – Primary
4. Lymphoid organs – Secondary
5. Immunotherapy of tumor
6. Autoimmune diseases - characteristics, causes, classification
7. Classification of Autoimmune diseases- localized (Diabetes mellitus)
8. Classification of Autoimmune disease - systemic (rheumatoid arthritis).
9. Structure – MHC – Class I
10. Structure – MHC – Class II
11. Structure – Minor Histocompatibility Antigen
12. Transplantation: classification of grafts
13. Hypersensitivity: factors causing hypersensitivity
14. Radial immunodiffusion and Double immunodiffusion
15. Radio immuno assay
16. ELISA
17. Western blotting
18. Immunofluorescence
19. Flow cytometry

Sample Questions:

Part A

1. Immunity by birth is innate immunity. (State **True or False**)
2. **Match the following:**
 1. T_H cells -a. Lethal to tissue cells.
 2. T_S cells -b. T-delayed type Hypersensitivity
 3. T_k cells -c. Immune tolerance
 4. T_D cells -d. Phagocytosis

a) 1a, 2b,3c, 4d b) 1b, 2c, 3d, 4a c) 1c, 2d, 3a, 4b d) 1d, 2c, 3a, 4b.
3. Which of the following cytokines promote the development and differentiation of T and B cells?
a) IL b) Interferon c) FADD d) TRADD.
4. Give an example for auto-immune disease.
5. An interlocking of antigen and Antibody is called _____.

Part B

1. Discuss Immunization schedule.
2. Illustrate B cell receptor (BCR) and B cell co-receptor complex.
3. Differentiate the structure of class I and II MHC molecules.
4. How does our immune system respond to protozoan disease?
5. Explain the principle and procedure of flow cytometry.

Part C

1. Analyse Humoral and cell-mediated immune response with example each.
2. Correlate the development of B and T cells.
3. Discuss minor histocompatibility antigen.
4. Explain the characteristics and types of autoimmune disease.
5. Discuss the types of agglutination reaction.
6. Explain the mechanism of graft rejection and immunosuppressive therapy adopted during
7. transplantation.

Head of the Department

Dr, A. Shyla Suganthi

Course Instructor

Dr. J. Vinoliya Josephine Mary

Dr, C. Josephine Priyatharshini

Class : II M. Sc. Zoology
Semester : IV
Title of the Course : Medical Laboratory Technology
Course Code : ZC2051

Core XV

Credits	Inst. Hours	Total Hours	Marks
4	75	75	100

Learning Objectives

1. To impart knowledge on laboratory principles, clinical analysis and safety measures in handling samples.
2. To develop skills on laboratory investigations adopted in medical diagnostic laboratories

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	Cognitive level
CO - 1	outline the laboratory principles applied in diagnosis of disease and methods of biomedical waste disposal.	PSO - 1	K1 (R)
CO - 2	explain the type of specimens, collection, and use of appropriate diagnostic techniques.	PSO - 2	K2 (U)
CO - 3	prepare reagents, handle instruments, and perform clinical analysis.	PSO - 3	K3 (Ap)
CO - 4	interpret and validate the results.	PSO - 4	K4 (An)

Teaching Plan with modules

Total Contact hours: 75 (Including lecture, assignment, seminar assignment & test)

Units	Modules	Topics	Hours	Cognitive level	Pedagogy	Assessment
I	Laboratory instruments and safety measures (15 Hrs.)					
	1	Scope of Medical laboratory technology. Laboratory principles - Organization of clinical laboratory - Role of medical laboratory technician.	3	K1 (R), K2 (U), K3 (Ap)	PPT, Lecture Method, Flipped Classroom, Demonstration	Slip test Assignment
	2	Laboratory instruments: Common glass wares in clinical laboratory - Centrifuges - Water bath – Refrigerator – Autoclave - Hot air oven.	5	K1 (R), K3 (Ap)	Lecture, PPT, Flow Chart, Demonstration	MCQ, Quiz, Oral test
	3	Mixer – Laminar air flow – Microscope – Analyser – Spectrometer – Cell counter -	4	K2 (U), K3 (Ap)	Lecture,	Mind map, MCQ,

	Blood bank.			PPT, Blended learning, Demonstration	Open Book test	
4	Safety measures - Cleaning and sterilization methods - antiseptics and disinfectants - hospital and clinic borne infection and personnel hygiene.	3	K2 (U), K3 (Ap)	Lecture, PPT, Inquiry based learning, Demonstration	Flow chart, Oral test	
Clinical sample collection, processing and storage (15 Hrs.)						
II	1	Specimen collection and processing of blood, urine and cerebrospinal fluid, separation of serum and plasma.	4	K2 (U), K3 (Ap)	Lecture, PPT, Group discussion, Flipped Classroom	Flow chart MCQ
	2	Handling of specimens for testing, preservation and transport of specimen, factors affecting the clinical results, effect of storage on sample.	3	K2 (U), K3 (Ap)	Cooperative learning, Blended learning, Lecture method, Group discussion, PPT	Oral test Assignment, mind map
	3	Anticoagulants: EDTA, Dipotassium salts of EDTA, oxalate, sodium citrate and sodium fluoride.	4	K3 (Ap), K4 (An)	Lecture, PPT Inquiry based learning,	Mind map True or False
	4	Techniques of sample processing: Throat Swab, Sputum, blood, urine, stool, pus, CSF, other body fluids, other swabs like from wounds, skin clipping, spore strips.	4	K3 (Ap), K4 (An)	Lecture, PPT, Collaborative learning	Slip test Assignment
Body fluid analysis (15 Hrs.)						
	1	Physical, chemical and microscopical examination of cerebrospinal fluid, pleural fluid, synovial fluid.	4	K1 (R), K2 (U), K3 (Ap)	Lecture, PPT, Interactive class	Mind map, MCQ, Oral test
	2	Haematological techniques - Haemoglobin estimation, Erythrocyte Sedimentation Rate.	3	K2 (U), K3 (Ap), K4 (An)	Interactive Class, PPT, Demonstration	Flow chart, Oral test
	3	Differential count, Total Red Blood cell count, Total White blood cell count, Platelet count.	4	K3 (Ap), K4 (An)	Lecture method, Demonstrative learning	Slip test, Peer review
	4	Blood banking technology - Blood typing, collection and storage and	4	K2 (U), K3 (Ap)	Brain storming,	Brain storming,

		plasma separation. Diagnosis of Covid-19.			Lecture using videos	MCQ
IV	Histopathology (15 Hrs.)					
	1	Introduction of histopathology, labelling and transportation of tissue specimens.	4	K1 (R), K3 (Ap)	Flipped classroom	Open Book test, Slido - MCQ
	2	Tissue processing - fixation, sectioning, staining, and mounting, manual and automated method.	5	K3 (Ap), K4 (An)	Demonstrative learning	MCQ, mind mapping
	3	Cryostat, frozen sections of fresh, fixed and unfixed tissue.	3	K3 (Ap), K4 (An)	Cooperative learning, Lecture using videos	Oral test, Summarization
	4	Freeze drying, rapid frozen sections and staining for emergency diagnosis.	3	K3 (Ap), K4 (An)	Blended learning	
V	Clinical sample analysis and biomedical waste management (15 Hrs.)					
	1	Physical, chemical and microscopical examination of sputum, urine and stool.	4	K3 (Ap), K4 (An)	Mind mapping, Inquiry based	Short test with open ended question
	2	Routine examination of urine and their clinical significance. Pregnancy test.	3	K3 (Ap), K4 (An)	PPT & lecture	Quiz using Mentee meter
	3	Semen: Sample collection and microscopic examination for count and morphology.	3	K3 (Ap), K4 (An)	Brain storming, Flipped classroom	Socratic, Collaborative
	4	Bio-medical waste – waste generation, segregation, disposal. Management of Bio-medical Waste, Technologies for Treatment for Bio-medical waste, Legal Aspects and Environment Concern.	5	K3 (Ap), K4 (An)	Lecture using videos	Oral test, Summarization

Course Focusing on Employability/ Entrepreneurship/ Skill Development: Skill Development

Activities (Em/ En/SD): Handle laboratory instruments and perform clinical analysis.

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Professional Ethics

Activities related to Cross Cutting Issues: Debate on “Professional ethics of a lab technician”

Assignment: ECG and Blood pressure, Legal Aspects and Environment Concern related to Biomedical wastes. (Online Assignment).

Seminar Topic:

- | | |
|---|--|
| 1. Centrifuges | 14. Frozen Section Technique. |
| 2. Water bath and Refrigerator | 15. Physical, chemical and microscopical examination of sputum. |
| 3. Autoclave and Hot air oven | 16. Physical, chemical and microscopical examination of Urine. |
| 4. Mixer and Laminar air flow | 17. Physical, chemical and microscopical examination of stool. |
| 5. Microscope | 18. Routine examination of urine and their clinical significance. |
| 6. Analyser and Spectrometer | 19. Semen: Sample collection and microscopic examination for count and morphology. |
| 7. Cell counter – Blood bank | 20. Technologies for Treatment for Biomedical Waste. |
| 8. Haemoglobin estimation | |
| 9. Erythrocyte Sedimentation Rate | |
| 10. Blood typing | |
| 11. Diagnosis of Covid-19. | |
| 12. tissue processing- fixation, sectioning. | |
| 13. tissue processing- staining and mounting. | |

Sample questions

Part A

- Formaldehyde is an example for sterilizing agent in clinical laboratory technology.
(State **True or False**)
- Assertion (A):** Stool examination is a basic method for getting clues of illness.
Reason (R): It used to get the health issues like inflammation, bleeding, obstruction, tumor and parasitic infections in GIT.
 - Both A and R are correct
 - Both A and R are wrong
 - A is correct and R is wrong
 - A is wrong and R is correct
- Match and choose the correct answer:**

A. Cerebrospinal fluid	1) Arthritis
B. Synovial fluid	2) Transudate and exudate
C. Pleural fluid	3) Pericardial and peritoneal fluids
D. Serous fluid	4) Meningitis

	A	B	C	D
a)	2	3	4	1
b)	1	4	3	2
c)	3	2	1	4
d)	4	1	2	3

4. Xylene is used as the clearing agent in tissue processing. (State **True or False**)
5. Which of the following is not a biomedical waste?
 - a) Animal waste
 - b) Microbiological waste
 - c) Chemical waste
 - d) Domestic waste

Part B

1. Describe the scope and importance of medical laboratory technology.
2. Enumerate the factors affecting the clinical test results.
3. How will you estimate the haemoglobin content of blood?
4. What is the role of histology laboratory in clinical diagnosis?
5. Examine urine and their clinical significance

Part C

1. Enumerate the hospital and clinical borne infection.
2. Explain the specimen collection and processing of blood
3. Describe the physical, chemical and microscopic examination of synovial fluid.
4. Discuss the major steps in the processing of tissues in histopathology.
5. Explain the different technologies for the treatment of biomedical waste management.

Head of the Department

Dr. A. Shyla Suganthi

Course Instructor

Dr. P.T. Arokya Glory
Dr. S. Prakash Shoba

Class : II M. Sc. Zoology
Title of the Course : (a) - Parasitology
Semester : IV
Course Code : PZ2045

Elective IV

Credits	Inst. Hours	Total Hours	Marks
3	4	75	100

Objectives

1. To enable the students to be aware of the cosmopolitan distribution of parasites, vectors and their control measures.
2. To develop skills for employment in clinical laboratories and health departments.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO - 1	define the basic biology and life cycle of parasites including epidemiology, diagnosis and treatment.	PSO - 1	K1(R)
CO - 2	explain morphological characters of parasites, developmental stages and their infestation.	PSO - 1	K2(U)
CO - 3	identify appropriate techniques and develop basic skills for detection of parasites.	PSO - 3	K3(Ap)
CO - 4	analyse the medical and public health aspects of human parasitic infections.	PSO - 2	K4(An)
CO - 5	compare the diagnostic methods of parasitic infestation in veterinary hospitals, clinics and research laboratories.	PSO - 4	K5(E)

Teaching plan with modules

Total Hours: 75 (Including lectures, assignments and tests)

Unit	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
I	Introduction: (12 hrs)					
	1	Taxonomy and classification of parasites.	2	K1 (R)	Brainstorming Lecture, PPT (GC)	Mind map
	2	Origin and evolution of parasitism.	2	K1 (R)	Demonstrative Lecture, Peer Teaching	Seminar
	3	Host parasite relationship, classification of parasites and hosts.	3	K1 (R) K3 (Ap)	Flipped learning, Collaborative teaching	Flow Chart

	4	Parasitic zoonoses – pathogenesis.	3	K2 (U)	Interactive Lecture, PPT (GC), Group Discussion	Seminar, Class Note
	5	Clinical manifestations of parasitic diseases.	2	K1 (R) K4 (An)	Illustrative Lecture, Collaborative learning	Oral test
II	Protozoan parasites: (12 hrs)					
	1	Introduction and classification.	2	K1 (R) K2 (U)	Brainstorming, Explicit Instruction, PPT (GC)	Mind Map
	2	Intestinal Amoeba - Pathogenic free-living amoeba.	2	K2 (U) K3 (Ap)	Inquiry based Learning, Peer-instruction	Online assignment Seminar
	3	Intestinal flagellates - Trypanosomiasis, Leishmaniasis, Balantoidiasis, Malaria, Isosporiasis, Toxoplasmosis, Cryptosporidiosis, Pneumocystis.	6	K2 (U)	Illustrative lecture, Case Study based discussion, Quizlet	Quiz (Google Form)
	4	Protozoans of minor medical importance.	2	K2 (U) K3 (Ap)	Interactive Lecture, Reasoning, Case study – sharing.	Vocabulary test, Seminar
III	Helminth parasites (12 hrs)					
	1	Trichuriasis, Trichinellosis, Strongyloidiasis, Ascariasis, Enterobiasis, Filariasis, hookworm diseases, Dracunculiasis, Onchocerciasis, Loiasis - Larva migrants.	5	K2 (U) K4 (An)	Collaborative Learning, Group discussion, Review of the diseases.	Open Book Test - Quiz, Seminar
	2	Nematodes of lesser medical importance - Diphyllbothriasis, Taeniasis, Echinococcosis, Sparganosis, Schistosomiasis, Fascioliasis, Fasciolopsiasis, Paragonimiasis, Clonorchiasis	5	K2 (U) K4 (An) K5 (E)	Reflective thinking, Peer teaching	Slip test Seminar

	3	Trematodes of minor medical importance.	2	K2 (U) K3 (Ap)	Illustrative lecture, PPT, WordPress	Class Note, Seminar
IV	Parasitic Insects (12 hrs)					
	1	Prevalence, transmission and control of parasitic infections.	3	K3 (Ap) K5 (E)	Demonstrative Lecture, PPT (GC), Case study-based Learning.	Online assignment, Slip Test, Seminar
	2	Parasitic infection in a compromised host.	2	K2 (U) K3 (Ap) K4 (An)	Inquiry based Learning, PPT (GC), Peer teaching, Prezi Video	
	3	Applied Parasitology - Eosinophilia in parasitic infections, Nosocomial parasitic infections.	2	K3 (Ap) K4 (An) K5 (E)	Illustrative lecture, Reflective thinking	Home Assignment
	4	Evasion and parasitic mode of life - morphological, biochemical and ethological adaptations.	3	K2 (U) K3 (Ap) K4 (An)	Brainstorming, PPT, Peer teaching	Short test, Quiz
	5	Quality assurance and laboratory safety.	2	K1, K3	Illustrative lecture, Group Discussion	Discussion
V	Diagnostic methods in parasitology (12 hrs)					
	1	General rules for microscopical examination. Microscopical examination of blood, stool, urine, sputum, and biopsy material for parasites.	3	K1 (R) K3 (Ap) K4 (An)	Illustrative Lecture, Prezi presentation PPT-Video	Online assignment - Quizlet, Seminar,
	2	Cultural examination - preparation of media - techniques for cultivation of <i>E. histolytica</i> , Leishmania, Plasmodium.	3	K2 (U) K5 (E)	Illustration, Flipped learning, Ms-PPT	Class Note
	3	Immunodiagnostic methods - IFA, AGD, IHA, IFAT, CFT, DAT, BF, DFAT.	3	K3 (Ap) K4 (An)	Illustrative Lecture, Peer teaching	Quizzes

	4	Molecular characterization of stage specific antigen nucleotide probes for diagnosis of protozoan diseases.	3	K2 (U) K4 (An) K5 (E)	Brainstorming, PPT, Interactive Lecture	MCQ Seminar Short answers
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Course Focusing on / Entrepreneurship/ Skill Development: Skill Development & Employability

Activities (Em/ En/SD): Handle laboratory instruments and perform clinical analysis.

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Human values

Activities related to Cross Cutting Issues: Awareness on Health aspects of human parasitic infections.

Assignment: ECG and Blood pressure, Legal Aspects and Environment Concern related to Biomedical wastes. (Online Assignment).

Activities: Seminar, Assignment, Quizlet

i) Seminar (Invitation, Study material with reference, PPT/ Video, Possible questions, Attendance) **Topics:**

- | | |
|--------------------|---|
| 1. Trypanosomiasis | 12. Microscopical examination of blood |
| 2. Leishmaniasis | 13. Microscopical examination of stool |
| 3. Malaria | 14. Microscopical examination of sputum |
| 4. Trichuriasis | 15. Microscopical examination of urine |
| 5. Trichinellosis | 16. Parasitic zoonoses |
| 6. Ascariasis | 17. Pathogenic free-living amoeba |
| 7. Enterobiasis, | 18. Control of parasitic infections |
| 8. Filariasis | 19. Techniques for cultivation of <i>E. histolytica</i> |
| 9. Dracunculiasis | |
| 10. Taeniasis | |
| 11. Fascioliasis | |

ii) Assignment Topics and Type:

Flow Chart: Classification of parasites and hosts

Mind Map: Classification of parasitic protozoans

iii) Quizlet Topic:

Microscopical examination of blood, stool, urine, sputum and biopsy material for parasites
Sample questions:

Part A (1 mark)

- How are parasites classified based on their location within the host?
 - Intracellular and extracellular
 - Small and large
 - Surface and internal
 - Fast and slow

2. What term is used to describe the process by which a parasite causes disease in its host?
a) Transmission b) Pathogenesis c) Evolution d) Classification
3. Mosquito bite is the primary mode of transmission for malaria. (State **True** or **False**)
4. Which vector is responsible for the transmission of Leishmania parasites? _____
5. **Assertion (A):** *Enterobius vermicularis* is the causative agent of enterobiasis.
Reason (R): *Enterobius vermicularis* primarily infects liver of the human body.
 - a) Assertion (A) is correct and Reason (R) is wrong
 - b) Assertion (A) is wrong and Reason (R) is correct
 - c) Both Assertion (A) and Reason (R) is wrong
 - d) Both Assertion (A) and Reason (R) is correct
6. **Match the following:**

a) Whipworm	- Taeniasis
b) Pinworm	- Ascariasis
c) Roundworm	- Trichuriasis
d) Tapeworm	- enterobiasis
7. Eosinophilia is commonly associated with Parasitic infections. (State **True** or **False**)
8. **Assertion (A):** Evasion adaptation is commonly observed in parasitic organisms.
Reason (R): Hyperactivity is to avoid the host's immune system?
 - a) Assertion (A) is correct and Reason (R) is wrong
 - b) Assertion (A) is wrong and Reason (R) is correct
 - c) Both Assertion (A) and Reason (R) is wrong
 - d) Both Assertion (A) and Reason (R) is correct
9. Expand IFA and AGD
10. In immunofluorescence assays (IFA), the detection of antibodies is based on

Part B

1. List the key characteristics used in the classification of parasites.
2. Analyze the impact of environmental factors on the transmission of waterborne parasites.
3. Classify protozoan parasites.
4. Describe two protozoans of minor medical importance.
5. Examine the life cycle of *Ascaris lumbricoides*.
6. Discuss the different clinical manifestations associated with filariasis.
7. Assess the role of quality assurance and laboratory safety in parasitology laboratories.
8. Interpret nosocomial parasitic infections.
9. Highlight the importance of using stained slides in parasitology.
10. Explain the preparation of media and techniques for cultivating Leishmania.

Part C

1. Evaluate the role of parasitic zoonoses in public health.
2. Discuss how the evolution of parasitism might be influenced by ecological factors, host specificity, and the diversity of host organisms.
3. Compare the life cycles and epidemiological factors associated with trypanosomiasis, leishmaniasis, and balantoidiasis.
4. Appraise the specific challenges in the diagnosis and treatment of the protozoan diseases.
5. Describe the epidemiology, pathogenesis, and treatment options for Trichuriasis.
6. Analyse the characteristics, epidemiology, and control strategies of *Ancylostoma duodenale*.
7. Identify parasitic infections carried by insects, covering aspects of prevalence, transmission, and control strategies.
8. Pinpoint the morphological, biochemical, and ethological adaptations of parasites that contribute to their success as parasites.
9. Illustrate the specific parasites that can be identified in blood, stool, urine, sputum, and biopsy material.
10. Interpret the various immunodiagnostic methods such as IFA, AGD, IHA, IFAT, CFT, DAT, BF, and DFAT.

Head of the Department

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