

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

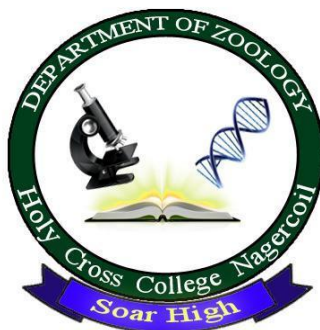


**DEPARTMENT OF ZOOLOGY
POST-GRADUATE PROGRAMME**



**TEACHING PLAN
EVEN SEMESTER 2024 – 2025**

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

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

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP232CC1	4	1	-	1	5	6	90	25	75	100

Pre-requisite

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

Learning Objectives

- To acquire knowledge on molecular organization of the cell and cell organelles, growth, and communications.
- 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 plan with Modules

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

Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/Evaluation
Unit I					
1.	General features of the cell: Cell theory; Diversity of cell size and shapes	3	K1 (R)	Collaborative Learning -Think – Pair - Share	Slip test, MCQ
2.	Protoplasm and deutoplasm – 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, Interactive PPT	Word splash, objective test
4.	membrane/channel proteins, diffusion, osmosis.	3	K4 (An)	Mind mapping, chalk and Board, lecture	Oral test, Mind Map

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5.	active transport, ion pumps (Sodium and potassium pump).	4	K5 (E)	Peer tutoring, jigsaw	Long essay test, oral test
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)	Interactive 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
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, You tube videos, team teaching	Quizziz, panel discussion
1	Cell communication and cell signaling-	2	K1 (R) K2 (U)	KWL, Inquiry based & Interactive PPT	Mind mapping Model making
2	Membrane- associated receptors for peptide and steroid hormones		K4 (An)	Flipped classroom, Socratic method (Tutorial)	Quiz

2	Signaling through G-protein coupled receptors.	4	K3 (Ap)	Collaborative Learning – group work to map the GPCR pathway for a specific signal molecule.	Mind mapping
3	Signal transduction pathways (RTK pathway and MAP kinase pathway).	4	K3 (Ap)	Inquiry-Based Learning: Online animations- pathway RTK and MAP kinase.	Role play
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 Collaborative learning Group discussion-	Short test
1	Cancer cells: Characteristic features of normal and cancer cells.	3	K2 (U)	Collaborative learning Peer group teaching Seminar,	
2	Carcinogens: types and cancer induction. Metastasis.	4	K2 (U) K4 (An)	Problem-Based Learning: Seminar, Jigsaw, Group Discussion	Quizzes, Summarisation
3	Oncogenes and tumor suppressor genes.	3	K2 (U)	Seminar, Index card Interactive PPT,	Short test with open ended question
4	Therapeutic interventions of uncontrolled cell growth.	4	K4 (An)	Interactive PPT, Jigsaw	Oral test
5	Apoptosis – mechanism and regulation. Ageing and senescence.	4	K4 (An)	Seminar & Index card, Chunking method	Mind mapping, Quizzes

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

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.

Course Instructor	Head of the Department
Dr. X. Venci Candida Dr. F. Brisca Renuga	Dr. A. Shyla Suganthi

Class : I M. Sc. Zoology Core Course – IV
 Semester : II
 Title of the Course : Developmental Biology
 Course Code : ZP242CC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP242CC1	4	1	-	1	5	6	90	25	75	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

Teaching plan with Modules

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)	Inquiry based learning, Group discussion	Quizzes, Oral test, Mind map

	2	Origin of germ cells, spermatogenesis - sperm morphology in relation to the type of fertilization	3	K1 (R) K2 (U)	Interactive PPT.	
	3	oogenesis - oogenesis in insects and amphibians; composition and synthesis of yolk in invertebrates (insects and crustaceans)	5	K1 (R) K2 (U)	Flipped learning, Brain storming	MCQ, Flow chart
	4	oogenesis - oogenesis in vertebrates; composition and synthesis of yolk in vertebrates	4	K1 (R) K2 (U)	Seminar, Blended learning	MCQ, Flow chart
	5	Genetic control of vitellogenin synthesis in amphibians.	4	K2 (U)	Peer group discussion, Brain storming	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)	Inquiry based learning, Group discussion Team-based learning	Quiz, Group discussion
	2	Sperm entry into the egg - egg activation - intracellular calcium release - cortical reaction	3	K1 (R) K2 (U)	Flipped learning, Brain storming	Flow chart, Peer review
	3	Physiological polyspermy - fusion of male and female pronuclei post fertilization metabolic activation	5	K2 (U)	Seminar, Blended learning	MCQ, Slip test
	4	parthenogenesis	6	K2 (U)	Peer group discussion, Brain storming	Slip test, Oral test
III	Cleavage and gastrulation (18 Hours)					
	1	Cleavage and gastrulation: Pattern of embryonic cleavage, mechanisms of cleavage	5	K4 (An)	Peer group discussion, Brain storming Didactic teaching	Diagnostic Assessment Dictation, Peer review
	2	Gastrulation - morphogenic movements - gastrulation in respective animal embryos - Sea urchin	5	K4 (An)	Flipped learning, Brain storming	Mind map, Slip test

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	3	Gastrulation - morphogenic movements - gastrulation in respective animal embryos - Amphibians	3	K4 (An)	Seminar, Blended learning	Mind map Class test
	4	Gastrulation - morphogenic movements - gastrulation in respective animal embryos - Mammals	2	K4 (An)	Inquiry based learning, Group discussion	Flow chart Self-Assessment
	5	Fate maps - (Amphibian and Chick),	2	K4 (An)	Inquiry based learning, Group discussion Team-based learning	Quizzes through menti-meter
	6	Epigenesis and preformation – Formation of primary germ layers	1	K4 (An)	Flipped learning, Brain storming	Quizzes through slido
IV	1	Embryonic Development; Embryonic development of fish	3	K2 (U) K3 (Ap)	Seminar, Blended learning	Illustration Open book test
	2	Embryonic Development; Embryonic development of birds,	2	K2 (U) K3 (Ap)	Cooperative learning, 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)	Collaborative learning, Interactive PPT	Quizzes
	5	Organogenesis (mammal): Development of ectodermal derivatives (nervous system). endodermal (digestive system), mesodermal (circulator system).	2	K2 (U)	Flipped learning, Brain storming	Conceptual puzzles,
	6	Gene and development: Anterior- posterior axis in determination in drosophila	2	K2 (U) K3 (Ap)	Seminar, Blended learning	Diagnostic Assessment
	7	Maternal effect genes - <i>Bicoid</i> and <i>Nanos</i> proteins;	2	K2 (U)	PPT Peer coaching	Online quiz: Slido Instant test polls
	8	Generation of dorsal - ventral polarity- Genetic control of segmentation – Gap genes	2	K2 (U)	PPT Jigsaw method	
	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)	Inquiry based learning, Group discussion Team-based learning	Seminar Models/ Charts
	7	Endocrine changes associated with normal pregnancy, Induced ovulation in humans	2	K1(R) K2 (U) K3(Ap)	Flipped learning, Brain storming	
	8	Cryopreservation of gametes/embryos - Ethical issues in cryopreservation	1	K3(Ap) K5 (E) K6 (C)	Collaborative learning Team-based 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.

Course Instructor	Head of the Department
Dr. A. Punitha Dr. S. Prakash Shoba	Dr. A. Shyla Suganthi

Class : M.Sc. Zoology Core Lab Course: VI
Semester : II
Course : Lab Course in Cell Biology and Developmental Biology
Course Code: ZP232CP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total hrs	Marks		
								CIA	External	Total
ZP232CP1	-	-	4	-	2	4	60	25	75	100

Pre-requisite

Students should have acquired basic knowledge relevant to this lab course.

Learning Objectives

1. To demonstrate significant cellular, molecular biological principles into practical understanding.
2. To gain theoretical knowledge and hands-on skills in developmental biology.

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	recall the principles of using a micrometer for cell size determination and the stages of mitosis & meiosis and their characteristics.	K1
2.	comprehend the steps involved in preparing blood smears and mounting the muscle fibres using microscopy.	K2
3.	develop handling - skills through the wet-lab course.	K3
4.	interpret observations & make connections between reproductive processes and the ecological context of the organisms studied	K4
5.	evaluate and compare different developmental stages in chick embryos.	K5

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

Teaching plan with Modules

Total hours 30 (Including instructions, practical, assessments)

Units	Contents	Hours	Cognitive Level	Pedagogy	Assessment
1	Determination of cell size using micrometer.	2	K3 (Ap) K4 (An)	Hands on activity	Calculate the cell size
2	Identification of Mitotic stages in onion root tips. Dr. S. Prakash Shoba	2	K3 (Ap) K4 (An)	Hands on activity	Identify the mitotic stages
3	Identification of various stages of meiosis in the testes of grasshopper.	2	K3 (Ap) K4 (An)	Hands on activity	Identify the meiotic stages
4	Observation of polytene chromosome in salivary gland cells of Chironomus larva.	2	K3 (Ap) K4 (An)	Hands on activity	Identification of polytene chromosomes

5	Detection of sex chromatin in squamous epithelium.	2	K3 (Ap) K4 (An)	Hands on activity	Identification of squamous epithelium
6	Identification of blood cells in the haemolymph of the cockroach.	2	K3 (Ap) K4 (An)	Hands on activity	Identification of blood cells
7	Identification of blood cells in human blood.	2	K3 (Ap) K4 (An)	Hands on activity	Identification of blood cells
8	Mounting of the coxal striated muscle fibers of cockroach.	2	K3 (Ap) K4 (An)	Hands on activity	Identification of striated muscle fibres
9	Observation of adipocytes - fat body of cockroach.	2	K3 (Ap) K4 (An)	Hands on activity	Identification of adipocytes
10	Isolation of total RNA from bacterial cells/ tissues. (Demonstration)	2	K1 (R)	Virtual Learning	Isolation of total RNA
Spotters					
	Spotters Fluid mosaic model, Golgi complex, Cancer cell, Cadherins, Karyotype, Haemocytometer.	10	K1 (R) K2 (U)	Observation	Identify the Spotters

Developmental Biology

Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
Developmental Biology (30 hrs)					
Gametogenesis - Observation of gametes from gonadal tissue sections					
1	Oogenesis: Section through ovary of shrimp, fish, frog and mammals	4	K4 (An) K5 (E)	Experiential and demonstration	Identification of structures in ovary
2	Spermatogenesis: Section through testis of shrimp, fish, calottes and mammals.	4	K4 (An) K5 (E)	Hands-on Demonstration	Dissection, Report in Observation Note, Practical Assessment
3	Fertilization: Induced spawning in fish.	4	K4 (An) K5 (E)	Step-by-step guidance, Visual learning	Demonstration
4	Embryogenesis: Observation and whole mount preparation of	4	K4 (An) K5 (E)	Experiential learning,	Mounted specimen,

	the I. Chick blastoderm - 18 hours of development II. Chick embryonic stage - 24 hours of development II. Chick embryonic stage - 48 hours of development V. Chick embryonic stage - 72 hours of development V. Chick embryonic stage - 96 hours of development			Inquiry-based investigation,	report in observation note.
5	Histological observation: Section through various developmental stages in chick embryo	3	K4 (An) K5 (E)	Observation and hands-on identification	Mounting of specimen Report,
6	Experimental Embryology: Regeneration in Frog Tadpoles - Blastema formation.	3	K4 (An) K5 (E)	Experiential learning, Inquiry-based investigation,	Mounting of specimen Report submission
7	Metamorphosis: Demonstration of metamorphosis in Frog Tadpole using exogenous Iodine	4	K4 (An) K5 (E)	Experiential learning, Inquiry-based investigation,	Mounting of specimen Report submission
8	Cryopreservation: Demonstration of cryopreservation of gametes of fin fish/shell fish	4	K4 (An) K5 (E)	Experiential learning, Inquiry-based investigation,	Dissection, Report in Observation Note,

Course Instructor	Head of the Department
Dr. Venci Candida, X. Dr. S. Prakash Shoba	Dr. A. Shyla Suganthi

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

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP232EC1	2	1		1	3	4	60	25	75	100

Learning 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:	CL
1	recall the features of various insect orders and describe the life history, social organization, and management practices of insects.	K1
2	understand the biology of insects associated with medical, household, and veterinary/public health importance.	K2
3	apply their knowledge of pest biology to assess damage and beneficial insect life cycles to practical rearing.	K3
4	analyze the causes of pest outbreaks and the economic threshold levels.	K4
5	synthesize knowledge to propose effective control measures for vectors associated with medical, household, and veterinary/public health importance.	K5

Teaching plan with modules

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

Module	Topic	Hours	Cognitive level	Pedagogy	Assessment
Unit I: Overview of insects and insect taxonomy (12 hrs)					
1	Insects and their biological success	3	K2 (U)	Lecture and Group discussion	Slip Test, MCQ
2	Salient features of Class Insecta and orders	3	K2 (U)	Interactive PPT, Peer Teaching	Seminar
3	Basic concepts in Insect Taxonomy	3	K2 (U), K3 (AP)	Flipped learning, Collaborative teaching	Class Test, Oral Test, Essay writing,

4	Classification of insects	3	K3 (Ap)	Interactive PPT, Group Discussion	Class Note
Unit II: Beneficial insects (12 hrs)					
1	Silkworms: Types, life cycle, diseases, rearing methods	3	K1 (R), K2 (U)	Brainstorming, PPT (GC)	Mind Map Summary Writing
2	Honey bees: Types, life history, social organization	3	K2 (U), K3 (Ap)	Inquiry based Learning, Peer-instruction	Short Essay, Online assignment Seminar
3	Lac insects: Life history, cultivation	3	K2 (U)	Online Videos, Illustrative lecture, Case Study based discussion, Quiz	MCQ, Rapid Fire and Slip Test
4	Pollinators, predators, parasitoids, scavengers	3	K2 (U), K3 Ap)	Interactive Lecture, Reasoning	Vocabulary test, Seminar
Unit 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, etc.	3	K4 (An)	Blended learning, Lecture, Demonstration	seminar, preparation of question bank
Unit 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 of pest control methods	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, Slip Test
5	Integrated pest management: Concepts and practice	2	K1 (R), K3 (Ap)	Illustrative lecture, Group Discussion	Discussion, Seminar
Unit 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 – Peer Review
2	Insects associated with medical importance	3	K4 (An)	Illustration, Flipped learning, Ms-PPT	Class Notes, Short Essay
3	Insects associated with household insects	3	K2 (U), K3 (Ap)	Illustrative Lecture, Peer teaching	Summary Writing, Oral Test
4	Vectors of veterinary and public health importance	3	K5 (E)	Brainstorming, PPT, Interactive Lecture	MCQ Seminar Short answers

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

Activity related to Skill Devt.: Debate on “The most beneficial insect : Silk Worm or Honey Bee?

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human

Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activity: Field visit

Activities related to Cross Cutting Issues : -

Assignment : 1. Flow Chart: Classification of insects

Assignment: 2 . Mind Map: Classification of pollinators

Seminar Topics:

1. Salient features of Class Insecta and orders
2. Classification of insects
3. Silkworms: Types,
4. Honey Bee-Social Organisation
5. Lac insects: Life history,
6. Pollinators, predators,
7. Parasitoids, scavengers
8. Economic threshold level
9. Biology of the insect pests
10. Pests of paddy, cotton,
11. Pests of sugarcane, vegetables
12. Principles of pest control
13. Natural control, Artificial control
14. Merits and demerits of pest control methods

15. Development of pest resistant plant varieties
16. Integrated pest management
17. Stable fly, cattle fly,
18. Fowl-shaft louse, chicken flea
19. Vectors of veterinary animals

ii) Assignment Topics and Type:

Flow Chart: Classification of insects

Mind Map: Classification of pollinators

Sample questions:

Section 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) A) Coleoptera i. Complete metamorphosis
 - B) B) Lepidoptera ii. Forewings modified into hard elytra
 - C) C) Diptera iii. Two pairs of membranous wings
 - D) 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
 - 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 _____.

Section B

Describe two adaptations that contribute to the success of insects in diverse environments.

1. Explain the concept of "metamorphosis" and its significance in the life cycle of insects.
2. Discuss the economic importance of insects belonging to the order Hymenoptera.
3. Explain how the structure of elytra in Coleoptera is related to their ecological roles.
4. Compare and contrast the Linnaean and cladistic systems of insect classification.

5. Provide examples of two insect species that were initially misclassified but later corrected through molecular analysis.
6. Illustrate the hierarchical levels used in classifying insects, giving examples at each level.
7. Discuss the challenges associated with classifying insects solely based on morphological characteristics.
8. Evaluate the role of honey bees in pollination and its impact on crop production.
9. Compare the life history and cultivation methods of lac insects with silkworms.

Section 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.

Course Instructor	Head of the Department
Dr. Jeni Chandar Padua Dr. A. Shyla Suganthi	Dr. A. Shyla Suganthi

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

Course Code	L	T	P	S	Credits	Inst. Hours	Total hours	Marks		
								CIA	External	Total
ZP232EC4	2	1		1	3	4	60	25	75	100

Pre-requisite

Students should have a good understanding of the fundamental methods used in experimental biology.

Learning 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
1	recall the principles of laboratory equipment, research techniques and the process of scientific report writing.	K1
2	explain the procedures involved in operating laboratory equipment, applying research techniques, and engaging in scientific writing.	K2
3	apply biological techniques in laboratory settings to gain practical experience in research processes and scientific report writing.	K3
4	analyze the principles and techniques to make wise choices in experimental design, data interpretation, and research reports in biological sciences.	K4
5	evaluate the quality, reliability, and limitations of data generated by research techniques and obtained from literature for specific research goals.	K5

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

Teaching Plan with Modules

Total Hours 60 (Incl. Assignment & Test)

Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/Evaluation
Unit 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, 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	Slip Test, Flow chart
4	FTIR spectrometry	2	K1 (R), K2 (U), K4 (An)	Interactive lecture, Demonstration, YouTube Videos	Class note, Preparation of MCQs
Unit 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)	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)	Blended learning, Illustrative lecture, YouTube Videos	Illustrative Diagrams, Online Assignment
3	Histology – Fixation, Sectioning and Staining.	2	K1 (R), K2 (U), K3 (Ap) K4 (An)	Ms-PPT, Prezi video, Peer teaching	Quiz, Experiment – staining & presentations
4	Histochemistry for carbohydrates, proteins, lipids.	3	K1 (R), K2 (U), K3 (Ap) K5 (E)	Brainstorming, Reasoning, Demonstrations, Quizlet	Class test - MCQ, Preparation of Questions
Unit 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 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),	PPT	Oral questioning

			K3 (Ap) K4 (An)		
4	Electrophoresis - Principle, Agarose gel electrophoresis and PAGE.	4	K1 (R), K2 (U), K3 (Ap) K4 (An)	Virtual demo of electrophoresis, Interactive lecture	Seminar
Unit IV: Tracer techniques (12 Hrs.)					
1	Radioactive isotopes.	2	K1 (R), K2 (U), K3 (Ap) K4 (An)	Discussion on radioisotopes	Quiz using Mentimeter
2	Radiolabelling.	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, Experiential learning	Quiz Short test
Unit 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	Assignment: Write a research proposal
2	Research report – Abstract, Tables - Figures - Formatting and typing.	3	K1 (R), K4 (An) K5 (E)	Preparation of a report using MS-word	Assignment: Write an article 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	MCQ, Peer Discussion
4	Impact factor, Citation index, H-index, Plagiarism, Copy Right.	4	K4 (An) K5 (E) K3 (Ap)	Illustrative lecture, Theme based Interaction	Group Discussion

1. Course Focusing on Employability/ Entrepreneurship/ Skill Development: **Skill Development**
2. **Activities for Skill development**
 - i) Operation of pH meter, Colorimeter, UV-Vis Spectrophotometer,

Microscope, Centrifuge.

ii) Group discussion: Open access journals and Predatory journals

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

- Principle, Working mechanism and applications of pH meter
- Principle, Working mechanism and applications of Colorimeter
- Principle, Working mechanism and applications of Bright field microscope
- Principle, Working mechanism and applications of Phase contrast microscope
- Principle, Working mechanism and applications of Electron microscope
- Fixation and Fixatives
- Sectioning and Microtome
- Staining and Stains
- Types of centrifuges
- Affinity chromatography
- Agarose gel electrophoresis
- Geiger Muller Counter
- Essential steps in research

2. 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

Sample questions

Part A (1 mark)

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? _____

4. Paraffin embedded sections of tissues are cut by Laser. (State **True** or **False**)

5. Which of the following statements is correct?

- i) Centrifugation works on the principle of sedimentation.
- ii) Large particles settle faster.

- iii) The unit is rpm.
- iv) 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?
 - a) pH b) Electrophoresis c) Affinity chromatography d) 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)

1. Appraise good laboratory practice.
2. Evaluate FTIR spectrometry.
3. Explain the structure and function of the confocal microscope.
4. Elucidate the histochemistry for carbohydrates.
5. Differentiate density from differential centrifugation.
6. Clarify the principle of centrifugation.
7. Comment on the principle and procedure of affinity chromatography.
8. How is the molecular weight of DNA identified using AGE?
9. Highlight on the methods of review of literature.
10. Discuss Open access journals and Predatory journals.

Part C (12 marks)

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

Course Instructor	Head of the Department
Dr. S. Mary Mettilda Bai Dr. J. Vinoliya Josephine Mary	Dr. A. Shyla Suganthi

Class : I M.Sc. Zoology **Elective Lab Course II**
Title of the Course : Economic Entomology & Research Methodology
Semester : II
Course Code : ZP232EP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP232EP1	-	-	2		3	2	30	25	75	100

Pre-requisite:

Students should have knowledge relevant to economic entomology & research methodology.

Learning Objectives:

1. To equip students with skills in both the practical aspects of economic entomology and the essential research methodology.
2. To acquire skills necessary for conducting meaningful studies in these field.

Course Outcomes

On the successful completion of the course, student will be able to:		
CO1	comprehend the principles and concepts of economic entomology & research methodology.	K1
CO2	summarize the economic impact of insect pests. explain the principles behind different techniques & research designs	K2
CO3	utilize appropriate methodologies to collect and analyze data of insects and apply statistical techniques to interpret and draw conclusions.	K3
CO4	interpret practical solutions to address challenges in economic entomology, incorporating research methodology principles.	K4
CO5	evaluate research methodologies and experimental designs used in economic entomology studies.	K5

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

Teaching plan with Modules

Total hours 30 (Including instructions, practical, assessments)

Unit	Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I	Economic Entomology (15 hours)					
	1	Collect and identify common insect pests in your local environment.	4	K1 (R), K3 (Ap) K4 (An) K5 (E)	Experiential and Collaborative Learning	Field visit – Collection, Identification Test, Group Presentation.
	2	Dissection: Silk glands of silkworm.	2	K1 (R), K2 (U),	Hands-on Demonstration, Guided inquiry	Dissection, Report in Observation Note, Assessment
	3	Mounting: Mouth parts of honey bee. Mosquito.	2	K2 (U), K4 An)	Step-by-step guidance, Visual learning	Assessment, Oral inquiry
	4	Photo-tactic behaviour of insect pests.	2	K2 (U), K3 (Ap)	Experiential learning,	Lab report in observation note,

				K4 (An) K5 (E)	Inquiry-based investigation, Collaborative Data Analysis	presentation of insects.
	5	Collection and Identification of insect pests in the mulberry plants.	3	K1 (R), K3 (Ap) K5 (E)	Field research, Observation and hands-on identification	Collection Report, Practical identification test
Specimen/ Spotters/ Models:						
	6	Silk worm: larva, pupa Adult, Honey bee colony, Rhinoceros beetle, Red Palm Weevil, Banana Stem Weevil	2	K1 (R), K2 (U), K3 (Ap) K4 (An) K5 (E)	Observation, Hands-on Analysis and Identification	Specimen Analysis, Spotter exercises, Diagrams in Observation note
II	Research Methodology (15 hours)					
	1	Whole mount preparation of two specimens.	5	K1 (R), K2 (U), K3 (Ap) K4 (An)	Practice with Supervision & Video based learning	Slide Submission
	2	Separation of amino acids using thin layer chromatography.	3	K1 (R), K2 (U), K3 (Ap) K4 (An)	Hands-on Training & Video based learning	Performance & Observation Note
	3	Sectioning and staining of a tissue.	2	K2 (U), K3 (Ap) K4 (An) K5 (E)	Hands-On Practice & Video based learning	Performance
	4	Separation of pigments by column chromatography using plant extract	2	K2 (U), K3 (Ap) K4 (An) K5 (E)	Demonstration & Video based learning	Observation Note
	5	Agarose Gel electrophoresis	2	K3 (Ap) K4 (An) K5 (E)	Demonstration & Video based learning	Observation Note
	6	Instruments/ Charts/ Models: Phase contrast & fluorescent microscope, spectrophotometer, HPLC, Flame photometer, Microtome, Electrophoretic apparatus	1	K1, K2	Object & Video based learning	Observation Note
Course Instructor			Head of the Department			
Dr. S. Mary Mettilda Bai Dr. Jeni Chandar Padua			Dr. A. Shyla Suganthi			

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

Course Code	L	T	P	S	Credits	Inst. Hours	Total hours	Marks		
								CIA	External	Total
ZP232SE1	2	1		1	2	4	60	25	75	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:	CL
1	recall the key components of a poultry house to ensure optimal living conditions for poultry.	K1
2	explain the different methods of rearing and the significance of proper vaccination programs in poultry farming.	K2
3	develop a practical feeding plan for a specific stage of poultry considering their nutritional requirements.	K3
4	analyze the impact of different housing systems on poultry welfare and productivity,	K4
5	critically assess the effectiveness of poultry feeds and the disease control measures in poultry farming,	K5
6	design a comprehensive waste management and recycling system for poultry farms.	K6

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

Teaching plan with Modules

Total Contact hours: 60 (Including lectures, assignments and tests)

Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/Evaluation
Unit 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
Unit 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
Unit 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
Unit 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
Unit 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): Preparation of a project report for banking and insurance.

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

21. Past and present scenario of poultry industry in India
22. Principles of poultry housing
23. Poultry houses – Deep litter system.
24. Management of Broilers
25. Management of layers
26. Nutrient requirements for Broilers
27. Methods of feeding in poultry birds
28. Viral diseases of poultry birds
29. Fungal diseases of poultry birds
30. Sexing of chicks
31. Farm and water hygiene
32. Recycling of poultry waste
33. Vaccination programme in poultry birds

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

6. List the factors to be considered while selecting a site for a poultry farm.
7. 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?
8. Identify the different methods of feeding poultry birds.
9. Elaborate on the key components of an effective poultry vaccination program.
10. Explain the steps involved in the selection, care, and handling of hatching eggs for successful incubation.

Part C

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

Course Instructor	Head of the Department
Dr. P.T. Arokya Glory Dr. C. Anitha	Dr. A. Shyla Suganthi

Class : II M. Sc. Zoology **Core Course VII**
Title of the Course : Immunology
Semester : IV
Course Code : ZU234CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP234CC1	3	2	-	1	5	6	90	25	75	100

Pre-requisite:

Students would have basic knowledge in animal science, particularly functional anatomy, cell biology and developmental biology.

Learning Objectives:

1. To impart conceptual understanding of functional organization of immune system and its responsiveness in health and disease.
2. To enable a successful performance in Immunology component of CSIR-UGC NET.

Course Outcomes

Upon completion of this course the students will be able to:		
1	recall the importance of immunity, immune response, MHC, BCR and TCR, antigen –antibody interaction.	K1
2	relate the evolution of immune molecules in different groups of animals, immunodeficiency diseases and immunotechniques.	K2
3	make use of immunization schedules, differentiate the types of hypersensitive allergic reactions and symptoms.	K3
4	analyse the immune response in relation to toxicants, vaccines, tumour, and infectious diseases.	K4
5	evaluate the role of immune cells and humoral factors in immune response	K5

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

Teaching Plan with Modules

Total Hours: 90 (Incl. Assignment & Test)

Topics	Hours	Cognitive level	Pedagogy	Assessment/Evaluation	
Unit I: Immune system in invertebrates and vertebrates (18 hrs.)					
1	Immunity - Innate and acquired, Types	4	K1 (R)	PPT, Lecture Method, Flipped Classroom, Group discussion	MCQ, Short test,
2	Lymphoid organs and immune cells	3	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 Classroom, Group discussion	MCQ, Short test,
6	Immunization: immunization schedule and vaccines.	2	K3 (Ap)	PPT, Inquiry based learning, Lecture method	Mind map, MCQ, Oral test
Unit II: B and T cell (18 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.	7	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.	7	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	4	K1 (R) K2 (U)	Lecture, Reflective PPT	Model making
Unit III: Major and minor histocompatibility complex 18 hrs.)					
1	MHC class I and II molecules, cellular distribution and regulation of MHC expression	6	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:	3	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	3	K1 (R)	Lecture using PPT, Cooperative learning	MCQ, Flow chart
Unit IV: Immune system in health and diseases (18 hrs.)					
1	Tumour immunology- tumour antigens, immune response to tumour and immune surveillance. Immunodiagnosis of tumour antigens and immuno therapy of tumour.	5	K4 (An)	Lecture -ppt, Discussion	Assignment
2	Hypersensitivity: factors causing hypersensitivity, Type I, II, III, and IV reactions	3	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
4	Immune response to infectious diseases and treatment - Protozoan disease (Malaria), Bacterial disease Tuberculosis) and Viral disease (AIDS).	5	K4 (An) K5 (E)	Seminar-PPT, Inquiry based learning	Mind map, Quiz through quizzes
Unit V: Antigen-antibody interaction (18 hrs.)					

1	Antigen-antibody interaction, Complement fixation test- precipitation reaction in fluids and precipitin curve.	2	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.	4	2 (U) 3 (Ap)	Seminar, Lecture and Video	Video presentations Observe and deliver the concept
4	Radio immuno assay, ELISA and Western blotting, Immunofluorescence. Flow cytometry.	5	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 (Ap) 4 An)	Seminar, YouTube Lecture, Case studies	Group discussion

Course Focussing 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

Part A (1 mark)

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.
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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

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

Course Instructor	Head of the Department
Dr, C. Josephine Priyatharshini	Dr. A. Shyla Suganthi
Dr. J. Vinoliya Josephine Mary	

Class : II M. Sc. Zoology **Core Course VII**
Title of the Course : Microbiology
Semester : IV
Course Code : ZU234CC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP234CC2	5	-	-	1	5	6	90	25	75	100

Pre-requisite:

Students should have fundamental knowledge of Microorganisms.

Learning 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

On the successful completion of the course, students will be able to:		
1.	recall the structure, distribution and life cycle of microorganisms and their role in human welfare.	K1
2.	explain culture techniques, growth, fermentation and microbial products.	K2
3.	apply the microbiological laboratory skills in clinical research, food industries and environmental management.	K3
4.	analyze beneficial and harmful microbes	K4
5.	evaluate the microbial importance and applications in various fields.	K5

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

Teaching plan with Modules

Total Hours: 90 (Incl. Seminar & Test)

Mod ule	Topic	Hours	Cognitiv e level	Pedagogy	Assessment/ Evaluation
Unit 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), K3 (Ap)	Brainstorming, Inquiry based Learning, PPT	Class test, Flow chart, Seminar
2	Virus - General properties, viral taxonomy.	2	K1 (R), K3 (Ap)	Brainstorming, Discussion, PPT	Assignment, Flow chart,

3	Bacteriophages – life cycle – Lytic and Lysogenic.	4	K1 (R), K3 (Ap), K4 (An), K5 (E)	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), K5 (E)	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
6	Fungi: classification – morphology - filamentous, non-filamentous and dimorphic fungus. <i>Apicomplexa</i> – <i>Toxoplasma</i> .	3	K1 (R), K2 (U), K3 (Ap)	Interactive teaching, PPT, Partnering teaching	MCQ, Seminar, Online assignment, Class interaction
Unit II: Bacteria and culture techniques (18 hrs)					
1.	Bacteria - classification – Bergey's system.	2	K1 (R), K3 (Ap), K4 (An)	Collaborative teaching, Peer teaching, 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), K4 (An), K5 (E)	Interactive lecture, Group discussion,	Diagrams - Online Assignment, Seminar, MCQ
3.	Fine structure of <i>Escherichia coli</i> .	2	K1 (R), K3 (Ap)	Illustrative lecture, Peer teaching, YouTube videos	Diagrams, Seminar
4.	Bacterial nutrition - nutrient requirements, nutritional classes, uptake of nutrients.	3	K3 (Ap), K4 (An), K5 (E)	Brainstorming, Mind map, peer teaching	Seminar, Flow chart
5.	Bacterial growth and measurements.	3	K3 (Ap), K4 (An)	Video teaching, Demonstration, Interactive class	Discussion, Case study analysis
6	Types of culture media	2	K2 (U), K3 (Ap)	Partnering, Collaborative learning	Seminar Class test

7	Pure culture and isolation techniques - Streak plate and pour-plate technique.	3	K2 (U), K3 (Ap)	Interactive class, Video class, Demonstration	Quiz, Seminar
Unit III: Industrial Microbiology (18 hrs)					
1	Fermentation - microbial products - alcohol (ethanol), antibiotics (penicillin),	3	K3 (Ap)	Collaborative learning - Group Discussion, Interactive PPT videos on ethanol production process	Quiz on fermentation techniques,
2	Production of vitamin B ₂ and Vitamin B ₁₂ .	3	K2 (U)	Collaborative learning Role reversal, Group presentation	Peer review
3	Biofertilizers - steps for preparing bacterial biofertilizers	3	K2 (U)	Collaborative learning Jigsaw, Debate	Slip test
4	Mass cultivation of <i>Cyanobacteria</i> , <i>Azolla</i> and <i>Trichoderma</i>	3	K3 (Ap)	Flipped classroom, Video, Peer group teaching	Summarisation
	Production of mycorrhizal fungi– Vesicular Arbuscular Mycorrhiza (VAM) and yeast.	3	K2 (U)	Personalised learning, Seminar,	Presentation assessment
	Industrial uses of yeast and moulds. Probiotics- <i>Lactobacillus</i> and <i>Saccharomyces</i> .	2	K2 (U)	Flipped classroom. Seminar	Listing out important steps
	Bacterial insecticides – <i>Bacillus</i> species.	1	K2 (U)	Peer group teaching Listing out important terms.	Oral test
Unit IV: Environmental Microbiology (18 Hrs)					
1	Microbiological analysis of water - Coliform test, Most Probable Number (MPN) test, and Membrane Filter (MF) test	4	K4 (An) K5 (E)	Inquiry based learning - KWL, Interactive PPT	Poster presentation
2	Sewage treatment – small scale and large-scale treatment. Biogas production – solubilization,	3	K4 (An)	Seminar, flipped classroom, Model making	Model making Presentation

	acetogenesis and methanogenesis				
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, Summarisation, Oral test
5	Microbes as biofilms, biosensors, nanomaterials.	3	K4 (An)	KWL, Interactive PPT	Think and pair, Oral test
Unit V: Medical Microbiology (18 hrs)					
1	Gnotobiotic animals, distribution of normal microbiota of the human body	2	K2 (U)	Seminar, Collaborative learning	Model making & presentation
2	Nosocomial infections. Fungal diseases - Candidiasis and Aspergillosis	3	K2 (U))	Seminar, Jigsaw, Group Discussion	Quizzes, Oral test, Summarisation
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 – Gonorrhea, 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,
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Activities (Em/ En/SD):

Employability – Culture techniques of microbes.

Entrepreneurship: Visit to a clinical laboratory /

Industry relevance discussion on culture techniques

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

Course Focusing 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/ Debate on “Ethics in Microbial Research and Human Impact”

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

Seminar Topics

1. History and Scope of Microbiology.
2. Viruses - General properties. Structure of viruses.
3. Viruses and cancer.
4. Viroids 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 & Covid -19
15. Fungal diseases- Candidiasis and Aspergillosis.
16. Bacterial diseases - Streptococcal pneumonia, typhoid and Tetanus.
17. Classification of Drug administration.
18. Current problems of antibiotic resistance in man.
19. Sexually Transmitted Diseases

Assignment

1. Exhibition on Protozoan, Bacterial, Fungal and Viral diseases sexually transmitted

2. Mind map on Classifications of microorganisms/ Culture of bacteria and measurement of growth.
3. Model making on - distribution of normal microbiota of the human body, Sewage treatment in small- and large-scale mechanism of antimicrobial agent

Sample Questions

Part A

1. Virus is a living material. (State **True** or **False**)
2. Choose the dimorphic fungus from the following.
 - a. Basidiomycota b. Afflatoxin c. *Toxoplasma gondii* d. *Histoplasma capsulatum*
3. The purpose of using fermenter is _____?
 - a) To cook raw materials b) To provide a controlled environment c) To filter fermentation products d) To speed up the fermentation process
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. Hydrgen 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. Evaluate the role of Lactobacillus and Saccharomyces as probiotics in promoting human health.
4. Apply the Coliform test to assess the microbiological quality of a given water sample.
5. Apply principles of drug administration to outline best practices for using microbial drugs

Part C

6. Explain the culture methods of viruses. Add a note on its purification assay.
7. Explain the culture and isolation techniques of bacteria. How will you measure their growth?
8. Elaborate the steps involved in the production of Vitamin B12 through fermentation. Include the microorganisms and key processes.
9. Design a small-scale sewage treatment system suitable for a rural community, considering local environmental conditions.
10. Analyze the differences in bacterial diseases, comparing Streptococcal pneumonia, Typhoid, and Tetanus.

Course Instructor	Head of the Department
Dr. F. Brisca Renuga	Dr. A. Shyla Suganthi
Dr. S. Mary Mettilda Bai	

Class : II M.Sc. Zoology **Core Lab Course**
Semester : IV
Course name : Lab on Immunology and Microbiology
Course Code : ZP234CP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP234CP1	-	-	6	-	5	6	90	25	75	100

Pre-requisite:

Students should have knowledge relevant to Immunology and Microbiology.

Learning Objectives:

1. To demonstrate competency in routine microbiological and Immunological techniques.
2. To develop skills in cell culture and analytical techniques for procuring employability in research laboratories.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall Immunological and Microbiological experiment protocols.	K1
2.	identify tools and techniques relevant to Immunology and Microbiology	K2
3.	perform Immunological and Microbiological experiments pertaining to the welfare of the environment and society.	K3
4.	analyse the impact of microbiological products and genetically modified organisms in bioremediation and Immunology.	K4
5.	explore the role of agglutination in serological testing and blood typing.	K5

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

Teaching plan with Modules

Total Hours: 90 (Incl. Seminar & Test)

Immunology

Units	Modules	Hours	Cognitive Level	Pedagogy	Assessment/Evaluation
1	Identification of Lymphoid organs in rat	3	K1 (R)	Virtual Learning	Identify the lymphoid organs
2	Identification of various types of immune cells in peripheral blood smear	3	K1 (R)	Virtual Learning	Identify the immune cells
3	Separation of RBC as intact cellular antigen	3	K3 (Ap) K4 (An)	Hands on activity	Presentation of RBCs
4	Agglutination reaction: Qualitative analysis of antigen-antibody reaction	3	K1 (R), K3 (Ap)	Hands on activity	Presentation of agglutination

	using human blood group system				
5	Agglutination reaction: Determination of hemagglutination titer	3	K3 (Ap) K4 (An)	Hands on activity	Presentation of haemagglutination
6	Single Radial Immuno Diffusion	3	K3 (Ap) K4 (An)	Hands on activity	Presentation of Radial Immunodiffusion
7	Double Immuno Diffusion	3	K3 (Ap) K4 (An)	Hands on activity	Presentation of Double Immunodiffusion
8	Detection of IgG by precipitation Ring test	3	K3 (Ap) K4 (An)	Hands on activity	Detection of IgG
9	Separation of T cells	3	K3 (Ap) K4 (An)	Hands on activity	Separation of T cells
10	Separation of B cells	3	K3 (Ap) K4 (An)	Hands on activity	Separation of B cells
Charts/ Slides/ Models/ Bookplates/ Instruments					
	Specimen/ Models/ Charts Agglutination, Precipitation, Immune response curve, Haemagglutination, HIV, Malaria, Tuberculosis, Vaccination chart – human, ELISA	15	K1 (R), K2 (U)	Observation	Identify the Specimen, Model and Chart

Microbiology

Unit s	Modules	Hour s	Cognitive Level	Pedagogy	Assessment / Evaluation
1	Preparation of culture media.	3	K3 (Ap) K4 (An)	Group work- Hands on training	Presentation of cultured plates
2	Isolation of bacteria from soil and water (Streak plate method).	3	K3 (Ap) K4 (An)	Practice streak plate method using sterilized tools.	Identify and describe the isolated colonies
3	Serial dilution technique.	3	K3 (Ap) K4 (An)	Guided learning serial dilutions and plating aliquots	Calculating the dilution factor and CFU
4	Measurement of growth of bacteria (turbidimetric method).	3	K3 (Ap) K4 (An)	Guided learning to measure bacterial growth at specific time intervals.	Observation and Presentation of results

5	Bacterial count by plate count method.	3	K3 (Ap) K4 (An)	Demonstration - spreading samples from serial dilutions	Evaluate interpretation of results
6	Observation of bacterial motility by Hanging Drop method.	3	K3 (Ap) K4 (An)	Hands on activity	Performance, Observation and report writing
7	Gram staining of bacteria.	3	K3 (Ap) K4 (An)	Hands on activity	Performance, Observation and report writing
8	Negative staining of bacteria.	3	K3 (Ap) K4 (An)	Hands on activity	Performance, Observation and report writing
9	Methylene blue reduction test to assess the quality of milk.	3	K3 (Ap) K4 (An)	Hands on activity	Performance, Observation and report writing
10	Antibiotic susceptibility test by disc-diffusion method.	3	K3 (Ap) K4 (An)	Group work- Hands on training	Presentation
Charts/ Slides/ Models/ Bookplates/ Instruments					
	Specimen/ Models/ Charts <i>Salmonella, Clostridium, Rabies virus, hepatitis – B, Entamoeba, Azolla,</i> ocular and stage micrometer, inoculation loop, autoclave, laminar airflow chamber.	15	K1 (R), K2 (U),	Observation	Identification, submission of records

Course Focusing on Employability/ Entrepreneurship/ Skill Development: **Employability, Entrepreneurship and Skill Development**

Activities for Employability, Entrepreneurship and Skill Development:

Hands on activity of all practical.

Course Focusing on Cross Cutting Issues: **Professional ethics**

Activities related to Cross Cutting Issues:

1. Emphasis on Accuracy and Honesty in Data Handling.
2. Responsibility in Laboratory Practices
3. Adherence to Standards and Protocols

Course Instructor	Head of the Department
Dr. F. Brisca Renuga Dr. S. Mary Mettilda Bai	Dr. A. Shyla Suganthi

Class : II M.Sc. Zoology **ELECTIVE COURSE VI: b)**
Semester : IV
Course name : Forensic Biology
Course Code : ZP234EC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP234EC2	3	-	-	1	3	4	60	25	75	100

Pre-requisite:

Students should know the fundamentals of natural science and have a curiosity of criminology.

Learning Objectives:

- Students should emphasize the importance of scientific methods in crime detection and disseminate information on the advancements in the field of forensic science.
- Derive skills to identify crime through various forensic techniques

Course Outcomes

On the successful completion of the course, student will be able to		
1	recall the fundamentals of forensic biology, psychology, and criminal profiling.	K1
2	outline the use of scientific evidence in a legal context using basic facts, fundamental principles, and functions of forensic science.	K2
3	apply the knowledge to render forensic service during real-time crime scenes.	K3
4	analyze fingerprints, personal identification evidence, bite marks and pug marks.	K4
5	evaluate information to find strategies to resolve problems in forensic biology.	K5

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

Teaching plan with Modules

Total Hours: 60 (Incl. Seminar & Test)

Module	topic	Hours	Cognitive Level	Pedagogy	Assessment
Unit I (12 hrs)					
1	Concepts and scope, functions, and historical aspects of forensic science.	2	K 1 (R) K 2 (U)	Didactic Teaching PPT	MCQ Seminar
2	Importance, nature, location, collection and preservation of biological exhibits and crime scene	4	K 2 (U) K3 (Ap) K4 (An)	Cooperative learning Socratic Questioning	Seminar

	investigation of biological evidence.				
3	Forensic dermatoglyphics - biological basis of fingerprints, formation of ridges, fundamental principles of fingerprinting	4	K 2 (U) K3 (Ap) K4 (An)	Visualization, Experiential learning, Index card	Class test Assignment
4	Types of fingerprints, fingerprint patterns, automated fingerprint identification system.	2	K4 (An) K5 (E)	Inquiry-Based Learning,	Assignment Identification of fingerprint
UNIT II (12 hrs.)					
1	Forensic examination of hair - importance, nature, location. .	2	K2 (U) K4 (An)	Interactive presentation	Short test Seminar
	Hair: structure, growth phases of hair, collection, evaluation, and tests for their identification	2	K1 (R) K2 (U) K5 (E)	Flipped Classroom	Seminar
2	Forensic Serology - identification of body fluids	3	K2 (U) K3 (Ap)	Cooperative learning, Storytelling Method	Traffic lights. MCQ
3	Collection and preservation of blood evidence, distinction between human and non-human blood	2	K2 (U) K4 (An) K5 (E)	Interactive PPT, YouTube Video	Seminar
4	Semen - forensic significance	2	K2(U) K4(An) K5 (E)	Narrative-Based Teaching	Exhibition
5	Forensic significance of saliva, sweat, milk and urine.	3	K4 (An) K5 (E)	Interactive PPT, videos	Case study
Unit III (12 hrs.)					
	Structural variation, types of teeth - human and non-human teeth	3	K2 (U)	Illustrative lectures	MCQ, charts/posters on types of teeth and
	Determination of age from teeth, eruption sequence,	3	K2 (U) K4 (An)	case-study-based lectures	Short test Time line charts
	Dental anomalies, their significance in personal identification	1	K3 (Ap) K4 (An) K5 (E)	Lecture with clinical images, group discussion	Quizzes
	Bite marks -forensic significance, collection and preservation of bite	2	K2 (U) K3 (Ap) K5 (E)	live demos, recorded videos, Role-play	Models of bite marks, Seminar

	marks, photography and evaluation of bite marks				
	Lip prints in forensic investigations		K2 (U) K4 (An)	images and video tutorials.	Hands-on activity to collect and analyze lip prints
Unit IV (12 hrs)					
1	Forensic Entomology - insects of forensic importance	4	K2 (U) K3 (Ap)	Photographs, YouTube videos	Short test, MCQ
2	Collection of ant evidence during death investigations.	4	K3 (Ap) K4 (An)	Interactive PPT, Mock crime scene	Performance based, Seminar
3	The role of aquatic insects in forensic investigations	3	K2 (R)	Seminar, Interactive PPT	Open book test, MCQ
4	Insect succession on carrion and its relationship to determine time since death, factors influencing insect succession on carrion, its application to forensic entomology	4	K2 (U) K3 (Ap)	Case study, Video class, Discussion, field visit	Assignment - Poster
5	Forensic Microbiology - types and identification of microbial organisms of forensic significance.	3	K3 (Ap) K4 (An)	Interactive PPT, seminar	Mind map, Draw the organ test
Unit V (12 hrs)					
1	Importance of Wildlife Protection Act-1972- Schedules in the protection of endangered species of flora and fauna	3	K1 (R) K2 (U) K3 (Ap)	Flipped classroom, Lecture based, group discussion	Short quiz,
2	Schedules in the protection of endangered species of flora and fauna	3	K2 (U) K3 (Ap)	Jigsaw, Field visit	Mind map, Report of field visit
3	Identification of wildlife materials such as skin, fur, bones, nails, horn, teeth, plants, plant parts and products by conventional and modern methods	2	K2 (U) K3 (Ap) K4 (An)	Interactive PPT, Visual identification techniques	Quizzes, Prepare an identification guide
4	Identification of pug marks of various animals	4	K2 (U) K4 (An) K5 (E)	Seminar, PPT, gamification identification of pug marks	MCQ, Poster making
5	DNA techniques in wildlife investigations.	4	K3(Ap)	Interactive PPT, Group discussion	Subjective test

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

Activities (Em/ En/SD): Preparation of identification guide for pug marks, Hands-on activity to collect and analyze lip prints

Course Focussing on Cross Cutting Issues: Survey to study **local awareness** of the Wildlife Protection Act and its importance, Posters showcasing the use of DNA techniques in solving wildlife crimes

Professional Ethics/ Human Values/ Environment Sustainability/ Gender Equity Professional Ethics/ Human Values/ Environment Sustainability:

Activities: Mock crime scene, Debate: Ethical Limits of DNA Testing in Wildlife

Assignment: Identification of finger print, Case study of a crime with special focus on women

Seminar topics

1. Historical aspects of forensic science.
2. Importance, nature, location, collection and preservation of biological exhibits
3. Crime scene investigation of biological evidence.
4. Hair - importance, nature, location, structure, growth phases.
5. Identification of body fluids, collection and preservation of blood evidence
6. Semen - forensic significance
7. Forensic significance of saliva, sweat, milk and urine.
8. Structural variation, types of teeth
9. Dental anomalies, their significance in personal identification.
10. Bite marks - forensic significance, collection and preservation of bite marks.
11. Lip prints in forensic investigations.
12. Insects of forensic importance
13. Collection of entomological evidence during death investigations.
14. The role of aquatic insects in forensic investigations
15. Types and identification of microbial organisms of forensic significance.
16. Importance of Wildlife Protection Act-1972
17. Schedules in the protection of endangered species of flora and fauna
18. Identification of wildlife materials such as skin, fur, bones, nails, horn, teeth.
19. Identification of pug marks of various animals

Sample questions

Part A

1. The study of fingerprints is known as _____.
2. The most crucial step in the collection of biological exhibits is:
a) Documentation b) Location c) Preservation d) Testing
3. Human and non-human blood can be differentiated using forensic serology. **True or False**
4. **Assertion:** Hair analysis can determine the age of an individual.
Reason: The structure and growth pattern of hair are species-specific.
a) Statement A is correct, but B is wrong
b) Statement A is wrong and B is correct
c) Statement A and B are wrong
d) Statement A and B are correct
5. The study of bite marks in forensics is referred to as _____.

6. **Assertion:** Bite marks are admissible as evidence in court.
Reason: Bite mark patterns are always consistent and error-free.
 - a) Statement A is correct, but B is wrong
 - b) Statement A is wrong and B is correct
 - c) Statement A and B are wrong
 - d) Statement A and B are correct
7. The eruption sequence of teeth can provide information about:
 - a) Age of an individual
 - b) Dietary habits
 - c) Genetic disorders
 - d) All of the above
8. Which of the following insects is commonly used in forensic entomology?
 - a) Blowfly
 - b) Ant
 - c) Butterfly
 - d) Mosquito
9. The Wildlife Protection Act protects only endangered animals.
10. **Assertion:** DNA techniques are highly reliable in wildlife crime investigations.
Reason: DNA profiling ensures accurate species identification.
 - a) Statement A is correct, but B is wrong
 - b) Statement A is wrong and B is correct
 - c) Statement A and B are wrong
 - d) Statement A and B are correct

Part B

1. Explain the importance of biological exhibits in reconstructing a crime scene.
2. Describe how fingerprint patterns can be used in personal identification.
3. Outline the structure and growth phases of hair and their forensic relevance.
4. Explain the methods used to distinguish between human and non-human blood in forensic investigations.
5. List the types of teeth and their structural variations in humans and non-humans.
6. Explain the process of determining age using teeth eruption sequences.
7. Illustrate the role of insect succession on carrion in determining the postmortem interval.
8. Analyze the factors influencing the succession of insects on carrion in forensic investigations.
9. Summarize the importance of the Wildlife Protection Act-1972 in the conservation of flora and fauna.
10. Describe how pug marks can be used to identify species and individual animals.

Part C

1. Compare and contrast the different types of fingerprint patterns and their forensic significance.
2. Analyze the role of forensic science in locating, collecting, and preserving biological evidence during a crime scene investigation.
3. Analyze the forensic significance of body fluids such as semen and saliva in crime scene investigations.
4. Evaluate the challenges and limitations in using hair as evidence in forensic investigations.
5. Discuss the forensic significance of bite marks, including their collection and evaluation.
6. Design a systematic approach for investigating a crime scene involving bite mark evidence.
7. Evaluate the contribution of aquatic insects in solving death investigations.

8. Propose a step-by-step method for collecting and analyzing entomological evidence at a crime scene.
9. Analyze the role of conventional and modern methods in identifying wildlife materials like skin, bones, and fur.
10. Evaluate the effectiveness of DNA techniques in wildlife crime investigations.

Course In-charge	Head of the Department
Dr. A. Shyla Suganthi	Dr. A. Shyla Suganthi
Dr. Jeni Chandar Padua	

Class : II M. Sc. Zoology Elective Course VII: c)
 Semester : IV
 Title of the Course : Medical Lab Technology
 Course Code : ZP234EC6

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP234EC6	3	-	-	1	3	4	60	25	75	100

Pre-requisite:

Students should have fundamentals of medical lab technology.

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

On the successful completion of the course, students will be able to:		
1.	outline the laboratory principles applied in diagnosis of disease and methods of biomedical waste disposal.	K1
2.	explain the type of specimens, collection and use of appropriate diagnostic techniques.	K2
3.	prepare reagents, handle instruments and perform clinical analysis.	K3
4.	systematically analyze complex laboratory data, identifying patterns, trends, and anomalies	K4
5.	critically evaluate and assess various laboratory methodologies and techniques in medical diagnostics	K5

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

Teaching Plan with modules

Total Contact hours: 60 (Including lecture, assignment, seminar assignment & test)

Modules	Topics	Hours	Cognitive level	Pedagogy	Assessment
Unit I: Laboratory instruments and safety measures (12 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 Class room, Demonstration	Slip test Assignment
2	Laboratory instruments: Common glass wares in clinical laboratory - Water bath – Refrigerator – Hot air oven	2	K1 (R), K3 (Ap)	Lecture, PPT, Flow Chart, Demonstration	MCQ, Quiz, Oral test
3	Mixer – Microscope – Analyser –	4	K2 (U),	Lecture,	Mind map,

	Spectrometer – Cell counter – Blood bank		K3 (Ap)	PPT, Blended learning, Demonstration	MCQ, 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
Unit II: Clinical sample collection, processing and storage (12 Hrs.)					
1	Specimen collection and processing of blood, urine and cerebrospinal fluid, separation of serum and plasma.	3	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.	3	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, spore strips	3	K3 (Ap), K4 (An)	Lecture, PPT, Collaborative learning	Slip test
Unit III: Body fluid analysis (12 Hrs.)					
1	Physical, chemical and microscopical examination of cerebrospinal fluid, pleural fluid, synovial fluid.	3	K2 (U), K3 (Ap) K5 (E)	Lecture, PPT, Interactive class	Mind map, MCQ, Oral test
2	Haematological techniques - Haemoglobin estimation, Erythrocyte Sedimentation Rate.	3	K3 (Ap), K4 (An) K5 (E)	Interactive Class, PPT, Demonstration	Flow chart, Oral test
3	Differential count, Total Red Blood cell count, Total White blood cell count, Platelet count.	3	K3 (Ap), K4 (An) K5 (E)	Lecture method, Demonstrative learning	Slip test, Peer review

4	Blood banking technology, collection and storage and plasma separation. Diagnosis of Covid-19.	3	K2 (U), K3 (Ap) K5 (E)	Brain storming, Lecture using videos	Brain storming, MCQ
Unit IV: Histopathology (12 Hrs.)					
1	Introduction of histopathology, labelling and transportation of tissue specimens.	3	K1 (R), K3 (Ap)	Flipped classroom	Open Book test, Slido - MCQ
2	Tissue processing - fixation, sectioning, staining, and mounting, manual and automated method.	3	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) K5 (E)	Blended learning	
Unit V: Clinical sample analysis and biomedical waste management (12 Hrs.)					
1	Physical, chemical and microscopical examination of sputum, urine and stool.	3	K3 (Ap), K4 (An) K5 (E)	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) K5 (E)	PPT & lecture	Quiz using Mentee meter
3	Semen: Sample collection and microscopic examination for count and morphology.	3	K3 (Ap), K4 (An) K5 (E)	Brain storming, Flipped classroom	Socratic, Collaborative
4	Bio-medical waste generation, segregation, disposal, incineration. Legal Aspects and Environment Concern.	3	K3 (Ap), K4 (An)	Lecture using videos	Oral test, Summarization Online Assignment

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

Activities (Em/ En/SD): Handling 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:

1. Legal Aspects and Environment Concern related to Biomedical wastes. (Online Assignment).
2. Mind map on Tissue processing in Histopathology

Seminar Topic:

1. Centrifuges
2. Water bath and Refrigerator
3. Autoclave and Hot air oven
4. Mixer and Laminar air flow
5. Microscope
6. Analyser and Spectrometer
7. Cell counter – Blood bank
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.
14. Physical, chemical and microscopical examination of sputum.
15. Physical, chemical and microscopical examination of Urine.
16. Physical, chemical and microscopical examination of stool.
17. Routine examination of urine and their clinical significance.
18. Semen: Sample collection and microscopic examination for count and morphology.
19. Technologies for Treatment for Biomedical Waste.

Sample questions

Part A

1. Formaldehyde is an example for sterilizing agent in clinical laboratory technology.
(State **True or False**)
2. **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.
 - 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
3. **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.

Course In-charge	Head of the Department
Dr. P.T. Arokya Glory Dr. A. Punitha	Dr. A. Shyla Suganthi

Class : II M.Sc. Zoology **Skill Enhancement Course III**
Title of the Course : Animal Food Processing and Quality Control
Semester : IV
Course Code : ZP234SE1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
ZP234SE1	2	-	1	1	2	4	60	25	75	100

Prerequisite

Students should have a foundational understanding of basic nutrition principles and the nutritional composition of animal-derived food.

Learning Objectives:

- To develop a skill on recognize different types of animal food and their nutritional importance.
- To apply the principles of Good Manufacturing Practices (GMPs) and sanitation protocols to prevent contamination and ensure food safety.

Course Outcomes:

On the successful completion of the course, students will be able to:		
1.	recall different processing techniques used in the animal food industry.	K1
2.	explain the principles behind various processing methods used in animal food production.	K2
3.	demonstrate the use of quality control tools and techniques in monitoring and maintaining product quality.	K3
4.	analyze the impact of processing methods on the nutritional value of animal food products.	K4
5.	evaluate the effectiveness of quality control of processed foods.	K5

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

Teaching plan with modules

Total Contact hours: 60 (Including lectures, assignments and tests)

Module	Topic	Hours	Cognitive level	Pedagogy	Assessment/Evaluation
Unit I: Introduction to Animal Food Processing (12 Hrs)					
1.	Overview of animal food processing industry.	3	K1 (R)	Collaborative Learning, Interactive Lecture	Quiz, Assignment
2.	Importance of processing in animal food production.	3	K2 (U)	Inquiry-Based Learning, Brainstorming, Debate.	Think-Pair-Share, Seminar
3.	Basic principles of food preservation and processing.	3	K4 (An)	Reflective thinking, Hands-on Activity, Seminar	Class Test

4.	Regulations and standards in animal food processing.	3	K2 (U)	Seminar, Role Play	Role Play
Unit II: Raw Material Handling and Preparation (12 Hrs)					
1.	Selection and sourcing of raw materials for animal food production.	3	K2 (U)	Video Demonstration, Seminar.	Group Discussion
2.	Cleaning, sorting, and grading of raw materials.	3	K3 (Ap) K4 (An)	Demonstration with visuals, Practical	Assignment
3.	Pre-processing techniques for different animal food products - meats.	3	K3 (Ap) K4 (An)	Group Discussion, Seminar	Class test
4.	Pre-processing techniques for different animal food products - dairy, eggs.	3	K3 (Ap) K4 (An)	Inquiry based Learning, Brainstorming	Short Test
Unit III: Processing Techniques for Animal Food Products (12 Hrs)					
1	Thermal processing methods - pasteurization, sterilization.	3	K3 (Ap) K5 (E)	Video Demonstration, Collaborative Learning	Group Discussion, Open Book Test
2	Mechanical processing techniques - grinding, extrusion.	3	K3 (Ap) K4 (An)	Cooperative Learning, Seminar	Oral Test
3	Chemical processing methods - curing, fermentation.	3	K3 (Ap) K4 (An)	Hands-On Activity, Cooperative Learning.	Summarization
4	Novel processing technologies in animal food industry.	3	K3 (Ap)	Inquiry-Based Learning, Brainstorming	Assignment
Unit IV: Quality Control and Assurance (12 Hrs)					
1	Principles of quality control in animal food processing.	3	K2 (U) K4 (An)	Collaborative Learning	Short Test
2	Testing methods for assessing quality attributes - texture, flavor, shelf-life.	3	K4 (An)	Practical Demonstration, Inquiry-Based Activity.	Quiz
3	Monitoring and controlling factors affecting product quality.	3	K3 (Ap)	Collaborative Learning – group work	Mind mapping

4	Implementation of HACCP (Hazard Analysis and Critical Control Points) in animal food processing.	3	K3 (Ap)	Inquiry-Based Learning:	Role play
Unit V: Packaging, Storage, and Distribution (12 Hrs)					
1	Packaging materials and techniques for animal food products.	3	K2 (U)	Collaborative learning, Peer group teaching, Seminar	Class Test
2	Storage conditions and facilities for maintaining product quality.	3	K2 (U) K4 (An)	Problem-Based Learning, Seminar, Jigsaw	Quizzes, Summarisation
3	Transportation and distribution considerations.	3	K2 (U)	Seminar, Index card Interactive PPT, Group Discussion	Short test with open ended question
4	Consumer awareness and labeling requirements.	3	K4 (An)	Interactive PPT, Jigsaw	Oral test

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

Activities (Em/ En/SD): Types of Pasteurization (PPT Presentation)

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

Activities related to Cross Cutting Issues: -

Assignment: 1. Overview of animal food processing industry.

Assignment: 2. Transportation of food products (Group Discussion)

Seminar Topics:

1. Importance of processing in animal food production.
2. Basic principles of food preservation and processing.
3. Regulations and standards in animal food processing.
4. Selection and sourcing of raw materials for animal food production.
5. Cleaning, sorting, and grading of raw materials.
6. Pre-processing techniques for different animal food products - meats.
7. Pre-processing techniques for different animal food products – dairy and eggs
8. Thermal processing methods - pasteurization, sterilization.
9. Mechanical processing techniques - grinding, extrusion.
10. Chemical processing methods - curing, fermentation.
11. Novel processing technologies in animal food industry.
12. Principles of quality control in animal food processing.
13. Testing methods for assessing quality attributes - texture, flavor, shelf-life.

14. Factors affecting product quality
15. Hazard analysis in food processing
16. Packaging techniques for food processing
17. Storage conditions and facilities for maintaining product quality.
18. How labels help in identifying good products.
19. Challenges and Innovations in food product distribution

Sample questions

Part A

1. What is the main purpose of the animal food processing industry?
 - a) To increase waste
 - b) To improve the safety, quality, and shelf-life of animal foods
 - c) To create plant-based foods
 - d) To remove nutrition from food
2. **Assertion (A):** Processing of animal food products increases their safety for consumption.
Reason (R): Heat treatment kills harmful pathogens in animal-based foods.
 - a) Both A and R are true, and R is the correct explanation of A.
 - b) Both A and R are true, but R is not the correct explanation of A.
 - c) A is true, but R is false.
 - d) A is false, but R is true.
3. Pasteurization is used to kill pathogens in animal food products. **State True or False**
4. Which of the following is a primary consideration in the transportation of perishable goods?
 - a) Packaging aesthetics
 - b) Environmental impact reports
 - c) Maintaining a cold chain system
 - d) Increasing product price
5. The _____ system is essential for transporting temperature-sensitive products like dairy and meat to maintain their quality.

Part B

11. What are the major sectors within the animal food processing industry?
12. What could happen if animal food is not properly processed?
13. Compare thermal processing with freezing for preserving animal food.
14. Discuss the factors affecting the transportation and distribution of perishable animal food products. How can these factors influence product quality and shelf life?
15. Explain the importance of consumer awareness in product labeling. How do accurate labels contribute to ensuring food safety and consumer trust?

Part C

11. Assess the impact of technological advancements on the growth of the animal food processing industry.
12. Explain how pasteurization helps in extending the shelf life of animal food products.

13. Compare thermal processing methods used in meat versus dairy products.
14. Explain the key principles of HACCP (Hazard Analysis and Critical Control Points) in animal food processing. Discuss how HACCP ensures product safety and quality at various stages of production.
15. Describe the packaging materials and techniques used for animal food products. Explain how proper packaging, storage conditions, and distribution strategies contribute to maintaining product quality and extending shelf life.

Course In-charge	Head of the Department
Dr. C. Anitha Dr. X. Venci Candida	Dr. A. Shyla Suganthi