

Anekant Education Society's
**TULJARAM CHATURCHAND COLLEGE OF ARTS,
SCIENCE & COMMERCE, BARAMATI, DIST – PUNE.
AUTONOMOUS**



POST GRADUATE DEPARTMENT OF ZOOLOGY

SYLLABUS

M.Sc. Zoology Part-II, SEMESTER-III

ACADEMIC YEAR 2020-21

Anekant Education Society's
**TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE &
 COMMERCE, BARAMATI.
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**Scheme of Course Structure (CBCS)
 Faculty of Science
 Post Graduate Department of Zoology
 SEMESTER IV**

Class: M.Sc. II

Pattern: 40 (IA) + 60 (EA)

Sr. No.	Code	Paper	Paper Title	Credit	Exam	Marks
1	ZOO: 5301	Theory	Entomology-I Animal Physiology-I Genetics-I	4	I / E	40 + 60
2	ZOO: 5302	Theory	Insect Physiology, Biochemistry and Ecology	4	I / E	40 + 60
3	ZOO: 5303	Theory	Mammalian Reproductive Physiology and Histology & Histochemistry	4	I / E	40 + 60
4	ZOO: 5304	Theory	Economic Zoology	4	I / E	40 + 60
5	ZOO: 5305	Zoology Practical-V	Practicals Corresponding to :ZOO:5301 and ZOO:5302	4	I / E	40 + 60
6	ZOO: 5306	Zoology Practical-VI	Practicals Corresponding to :ZOO:5303 and ZOO:5304	4	I / E	40 + 60
7	CC-23		Certificate Course	2	-	-
	SD-24		Skill Development II	2	-	-

IA* - Internal Assessment

EA*- External Assessment

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY Sem. IV (w. e. f. June, 2020)

Name of the Program: M.Sc. Zoology

Class: M.Sc. - II

Course Name: Entomology-I

Number of Credits: 04

Semester: III

Course Code: ZOO: 5301

Number of Lectures: 60

Course Objectives:-

- To understand the classification of Insecta.
- To be conversant with scientific literature, especially related to insect biology.
- To know and use fundamental concepts in Entomology.
- To articulate positive and negative impacts of insects on human society and economy.
- To Delve into the internal systems of insects, including the digestive, respiratory, circulatory, excretory, reproductive, and nervous systems, gaining insights into their functions.
- To gain insight into the mechanisms of light and sound production in insects, and their role in communication, mating, and species survival.
- To develop proficiency in insect collection and preservation methods, ensuring the proper handling and conservation of valuable entomological specimens.

Course Outcomes:-

After completion of this course students will be able to -

CO1: explain distinguishing characters of class Insecta.

CO2: get well prepared for research in Entomology under life sciences.

CO3: understand socio-economical interactions of insects with human

CO4: well-versed in insect tagmata, specifically the head, thorax, and abdomen, and comprehend their adaptations and modifications, gaining insights into the diversity of insect body plans.

CO5: explain insect internal systems and able to explain their functions within the context of insect biology.

CO6: gain insights into the mechanisms of light and sound production in insects.

CO7: develop the skills necessary for insect collection and preservation, ensuring proper handling and conservation of entomological specimens.

TOPICS:

Topic No.	TOPICS / CONTENTS	Lectures
1.	Introduction to Entomology: Definition, Origin, Evolution and Inter-relationship of insects with other arthropods.	03 L
2.	General outline of Classification and Phylogeny of insects: 2.1. Apterygote insects (1-4 orders), 2.2. Exopterygote insects (5-20 orders) and 2.3. Endopterygote insects (21-29 orders).	20L
3.	Integument and its derivatives.	02L
4.	Comparative study of insect appendages: 4.1. Head and its appendages; 4.2. Thorax and its appendages; 4.3. Abdomen and its appendages	08L
5.	Comparative and histological studies of the following systems: 5.1. Digestive system, 5.2. Respiratory system, 5.3. Circulatory system, 5.4. Excretory system,	20L

	5.5. Reproductive system and 5.6. Nervous system	
6.	Studies of the following systems: 6.1.The Sense organs, 6.2.Endocrine glands and 6.3.Exocrine glands	05L
7.	Light and sound producing organs.	02L

REFERENCES

1. Richards, O. W., & Davies, R. G. (2013). Imms' general textbook of Entomology: Volume I: Classification and biology. Springer Science & Business Media.
2. Snodgrass, R. E. (2018). Principles of insect morphology. Cornell University Press.
3. Fox, R. M., & Fox, J. W. (1964). Introduction to comparative entomology. Introduction to comparative entomology.
4. Nayar, K. K., Ananthakrishnan, T. N., & David, B. V. (1976). General and applied entomology.
5. Ross, H. H. (1948). A textbook of entomology. A Textbook of Entomology.
6. Chapman, R. F., & Chapman, R. F. (1998). The insects: structure and function. Cambridge university press.
7. Entomology, 2nd Ed. Plenum Press, New York, London.
8. Gullan, P. J., & Cranston, P. S. (2014). The insects: an outline of entomology. John Wiley & Sons.
9. Snodgrass, R. E. (2018). Principles of insect morphology. Cornell University Press.
10. Tembhare, D.B. 2000. Modern Entomology, Himalaya Publishing House, Mumbai.

Course Articulation Matrix of ZOO: 5301: Entomology I

Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	2	1	1	1	2	1	2
CO2	3	3	2	1	1	1	2	1	2
CO3	3	1	2	1	1	1	2	1	2
CO4	3	1	1	1	2	2	1	2	1
CO5	3	1	1	1	2	2	1	2	1
CO6	3	1	1	2	2	2	1	2	1
CO7	3	2	1	2	2	3	1	2	1

PO1: Disciplinary Knowledge

All of the COs are directly mapped to PO1. For example, CO1 requires students to have a deep understanding of insect diversity, which is a key component of disciplinary knowledge in entomology. CO2 requires students to have a sound knowledge of insect evolution, which is another key component of disciplinary knowledge in entomology.

PO2: Critical Thinking and Problem Solving

All of the COs are directly mapped to PO2. For example, CO1 requires students to have a deep understanding of insect diversity, which is a key component of critical thinking in entomology. CO2 requires students to have a sound knowledge of insect evolution, which is another key component of critical thinking in entomology.

PO3: Social Competence

CO5 is indirectly mapped to PO3 because they require students to interact with others in a professional and effective manner. For example, CO5 requires students develops communication skills to educate others about the fascinating adaptations and behaviours of insects during emergence.

PO4: Research-related skills and Scientific temper

All of the COs are directly mapped to PO4. For example, CO7 requires students to develop the skills necessary for insect collection and preservation, which are essential for conducting entomological research.

PO5: Trans-disciplinary knowledge

All of the COs are directly mapped to PO5. For example, CO1, CO2, CO3, CO4, and CO5, require students to apply their knowledge of insect biology to other disciplines, such as agriculture, ecology, and medicine.

PO6: Personal and professional competence

All of the COs are directly mapped to PO6 because all of the COs require students to develop personal and professional skills, such as time management, self-motivation, and responsibility.

PO7: Effective Citizenship and Ethics

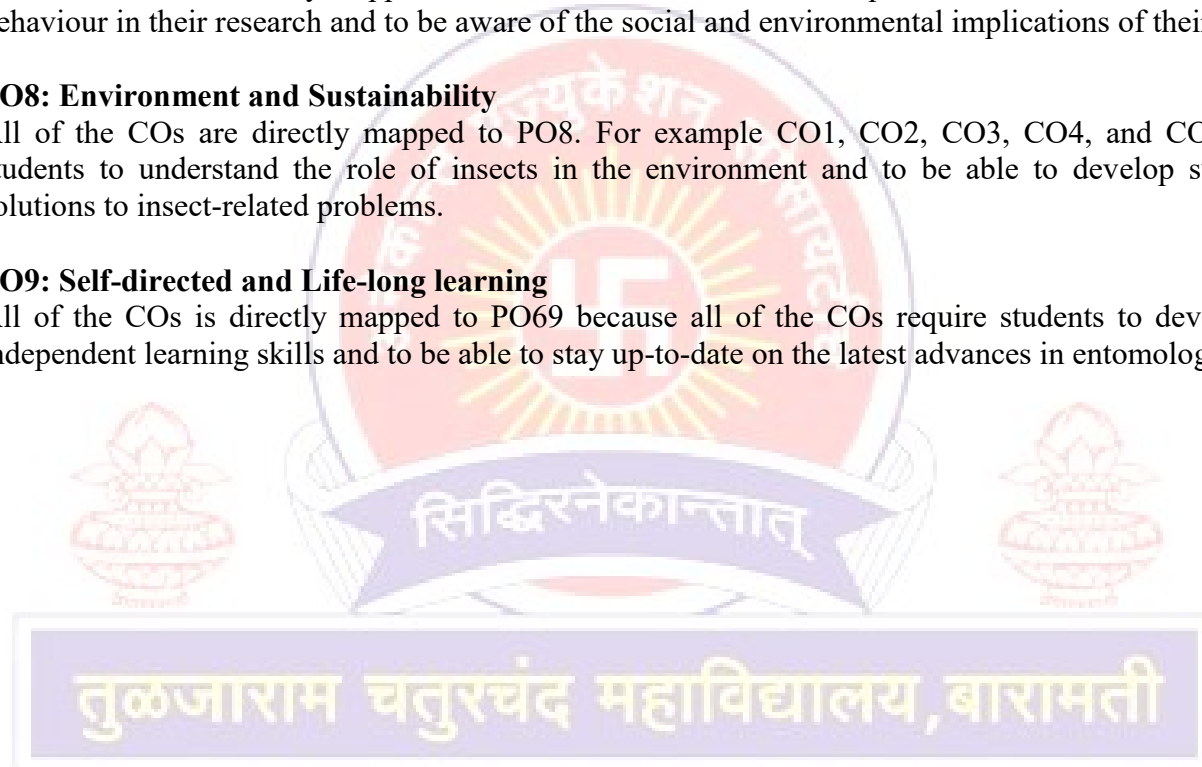
All of the COs are directly mapped to PO7 because all of the COs require students to demonstrate ethical behaviour in their research and to be aware of the social and environmental implications of their work.

PO8: Environment and Sustainability

All of the COs are directly mapped to PO8. For example CO1, CO2, CO3, CO4, and CO5 require students to understand the role of insects in the environment and to be able to develop sustainable solutions to insect-related problems.

PO9: Self-directed and Life-long learning

All of the COs is directly mapped to PO9 because all of the COs require students to develop their independent learning skills and to be able to stay up-to-date on the latest advances in entomology



SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY Sem. IV (w. e. f. June, 2020)

Name of the Program: M.Sc. Zoology

Class: M.Sc. - II

Course Name: Animal Physiology I

Number of Credits: 04

Semester: III

Course Code: ZOO: 5301

Number of Lectures: 60

Course Objectives:-

- To understand the bioluminescence and electricity physiology of animals.
- To understand the roles and functioning excretory organ systems and osmoregulation.
- To learn the biological membrane dynamics and energy metabolism in animals.
- To study the structure and dynamics of biological membranes and their role in cellular physiology.
- To understand the physiology of digestion, including nutritional requirements, digestion and absorption, and the neuronal and hormonal control of digestion.
- To investigate muscle physiology, including the structure of skeletal muscle, muscle contraction, and types of muscle fiber.
- To introduce students to clinical physiology, including its scope, techniques, and processes involved in clinical science.

Course Outcomes:-

After completion of this course students will be able to -

- CO1: demonstrate a comprehensive understanding of the mechanisms behind bioluminescence and electricity physiology in animals.
- CO2: explain functioning of Excretion via kidneys and other excretory organs of animals.
- CO3: explain the physiology of membrane and physiological aspects of metabolism.
- CO4: demonstrate knowledge of biological clocks and their role in regulating physiological rhythms in animals.
- CO5: comprehend the physiology of digestion, including nutritional requirements, digestion and processes, and the control mechanisms.
- CO6: explain the different modes of respiration, gas exchange, and the neural control of respiration, as well as understand abnormalities in gas transport.
- CO7: describe muscle physiology, including muscle structure, contraction mechanisms, and muscle fiber types.

TOPICS:

Topic No.	TOPICS / CONTENTS	Lectures
1.	Bioluminescence and Animal electricity: 1.1. Bioluminescence: Phyletic distribution, structure of luminescent organs, biochemical and molecular mechanism 1.2. Animal electricity: electro receptors electro organs and their structure	10 L
2.	Buoyancy: definition, density reduction, gas floats with examples swim bladder with example	07 L
3.	External and Internal environment: 3.1. External environment: the atmosphere, aquatic & terrestrial environment 3.2. Internal environment: Extracellular and intra cellular environment 3.3. Homeostasis and regulation: tolerance and resistance, acclimatisation and acclimation, regulatory mechanism. 3.4. Biological clock and their regulation: Circadian rhythms lunar and tidal rhythm, circa annual rhythm, photo periodism.	07 L

4.	Membrane physiology 4.1. Membrane structure, membrane permeation, diffusion mediated transport, dynamics of semi permeable membrane. 4.2. Resting membrane potential, diffusion, equilibrium potential, Goldman-Hodkin-Katz potential, conductance, current, capacitance 4.3. Excitable cell membrane: action potential, role of various ion channels, role of Na ⁺ K ⁺ pump, properties of action potentials	10 L
5.	Energy metabolism: 5.1. Metabolic rate 5.2. Energy storage: Fat and glycogen 5.3. Effect of O ₂ concentration: acclimation to low O ₂ level, anaerobic metabolism, lactic acid and glycolysis 5.4. Problem of diving and deep sea hydro thermal vent 5.5. Metabolic rate and body size: mammals, birds, marsupials & monotremes 5.6. Energy cost of locomotion: running, swimming, flying 5.7. Effect of high altitude	15 L
6.	Excretion: 6.1. Nitrogenous waste- ammonia and its excretion, urea, urea cycle, uric acid and its excretion, products of nucleoprotein metabolism, miscellaneous end product of nitrogen metabolism. 6.2. Organ of excretion and urine formation 6.3. Renal regulation and acid-base balance	06 L
7.	Osmoregulation: Maintaining water and electrolyte balance and its regulation in: 7.1. Fresh water: Invertebrates & vertebrates, 7.2. Terrestrial: Moist skinned animals, arthropods & vertebrates and 7.3. Marine: Invertebrates & vertebrates & air breathing vertebrates	05 L

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- Vernberg, F.J. & Vernberg, W B. Animal and the environment. Holt, Rienhart & Winston, NY.
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Course Articulation Matrix of ZOO: 5301: Animal Physiology I Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	1	1	2	1	1	1	1
CO2	3	1	1	3	1	1	1	1	1
CO3	2	2	1	2	1	1	1	1	1
CO4	2	2	1	3	1	1	1	1	1
CO5	2	1	1	1	1	1	1	1	1
CO6	2	1	2	2	1	1	1	1	2
CO7	2	1	3	2	1	3	2	2	2

PO1: Disciplinary Knowledge

CO1 aligns with PO1 as it involves comprehensive knowledge of animal physiology, including the factors influencing it. CO2 aligns with PO1 as it pertains to understanding the structure and importance of biological membranes in cellular physiology, reflecting discipline-specific knowledge. CO3 aligns with PO1 as it requires an in-depth understanding of the concept of homeostasis and its regulation, which is part of animal physiology. CO4 aligns with PO1 as it involves knowledge of biological clocks and their role in animal physiology.

PO2: Critical Thinking and Problem Solving

All the COs are directly mapped to PO2, because understanding membrane-based processes, evaluating metabolic pathways, explaining rhythmic behaviours, investigating digestive control mechanisms, analysing gas exchange mechanisms, and comprehending muscle contraction require critical thinking and problem-solving skills.

PO3 - Social Competence

CO6 directly mapped with PO3, because they primarily focus on individual knowledge and comprehension of animal physiology concepts. Social interaction or collaboration might be involved in group projects or discussions

PO4: Research-related skills and Scientific temper

CO2 involves understanding the structure and dynamics of biological membranes, which is a fundamental aspect of scientific research in physiology. CO4 relates to understanding biological clocks and their role in physiology, which is a part of scientific temper and research-related skills.

PO5: Trans-disciplinary knowledge

CO1 aligns with PO5 as it involves knowledge of factors influencing animal physiology, which can transcend beyond the discipline of physiology.

PO6: Personal and professional competence

CO7 focuses on developing practical skills necessary for personal and professional competence, particularly in the context of specimen handling and conservation.

PO7: Effective Citizenship and Ethics

CO7 aligns with PO7 as it involves ethical considerations related to specimen collection and preservation in the context of entomology.

PO8: Environment and Sustainability

CO9 relates to understanding natural phenomena (bioluminescence and animal electricity) in animals, which can have relevance to environmental and ecological aspects.

PO9: Self-directed and Life-long learning

CO9 encourages self-directed learning by exploring complex topics related to bioluminescence and animal electricity.

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY Sem. IV (w. e. f. June, 2020)

Name of the Program: M.Sc. Zoology

Class: M.Sc. - II

Course Name: Genetics I

Number of Credits: 04

Semester: III

Course Code: ZOO: 5301

Number of Lectures: 60

Course Objectives:-

- To understand the genetics of model organisms.
- To understand the genetics behind evolution.
- To learn the molecular biology techniques and methods of genetic analysis.
- To explore the applications of molecular methodologies in genetic analysis, including gene localization on chromosomes and the use of chromosomal probes.
- To study microbial genetics, covering topics such as conjugation, transformation, and conjugational mapping.
- To gain an understanding of the molecular biology of viruses, including virus structure, classification, and the role of viroids and prions.
- To develop critical thinking and problem-solving skills in the field of genetics.

Course Outcomes:-

After completion of this course students will be able to –

CO1: explain genomics and genetics of model organisms.

CO2: explain the evolution from genetics point of view.

CO3: analyse the concepts of continuous variation, genetic polymorphism, and the genetics of speciation in both classical and modern contexts.

CO4: utilize molecular information to understand phylogenetic relationships and explore the role of molecular methodologies in genetic analysis.

CO5: describe the mechanisms of microbial genetics, including conjugation, transformation, and the concept of Hfr conjugation.

CO6: explain the molecular biology of viruses, including their classification, structure, and the role of viroids and prions.

CO7: develop critical thinking skills and problem-solving abilities by applying genetic principles to various biological systems.

TOPICS:

Topic No.	TOPICS / CONTENTS	Lectures
1.	Model Genetic System: Life cycles and advantages of the following organisms commonly used in genetic studies 1.1. T4 and T1 phages 1.2. Neurospora 1.3. E. coli 1.4. <i>Saccharomyces cerevisiae</i> and <i>Schizosaccharomyces pombe</i> 1.5. <i>Caenorhabditis</i> 1.6. <i>Drosophila</i> 1.7. Zebra fish 1.8. Mouse	08 L

2.	Advanced Population Genetics: 2.1. Recapitulation of basic concepts and H-W law 2.2. Estimation of gene frequencies in population through mutation, migration and selection, selection-mutation equilibrium, derivation and genetic equations for above. 2.3. Assortative matings, inbreeding, genetic drift	13 L
3.	Evolutionary genetics: Part - A: 3.1. Concept of continuous variation, phenotypic variance and its partitioning into subcomponents. 3.2. Co-variance, correlation and regression, degree of genetic determination, measurement of heritability, quantitative inheritance in humans	13 L
4.	Evolutionary Genetics: Part - B: 4.1. Genetic polymorphism 4.2. Selection strategies and effects 4.3. Genetics of speciation- classical and modern concepts 4.4. Use of molecular information in understanding phylogenetic relationship	13 L
5.	Applications of Molecular methodologies in genetic analysis: 5.1. Introduction to gene localization on chromosomes 5.2. Chromosomal Probes and Paints 5.3. Gene Therapy: Ex vivo and In vivo gene therapy and two examples of gene delivery system 5.4. Reverse Genetics	13 L

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3. Griffiths, A.J.F., Miller, J.H., Suzuki, D.T. Lewontin, R.C. and Gelbert, W.M. An introduction to Genetics analysis. W.H. Freeman and Co. NY,
4. Trends in genetics, Elsevier Publication, Amsterdam.
5. Genetics: Analysis of Genes and Genomes, D.L. Hartl, E .W Jones, Jones and Barlett Publ. 2009.
6. Genes X: Benjamin Lewin, Jones and Bartlett Publications 2014.

Course Articulation Matrix of ZOO: 5301: Genetics I

Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	1	2	1	1	1	1	1	1
CO2	2	3	1	1	1	1	1	1	1
CO3	2	2	2	1	3	1	1	1	1
CO4	2	2	2	3	1	1	1	1	1
CO5	2	2	1	3	1	1	1	1	1
CO6	2	1	1	1	1	1	1	1	1
CO7	2	3	3	1	1	2	2	2	2

PO1: Disciplinary Knowledge

CO1 aligns with PO1 as it involves acquiring comprehensive knowledge of genetic model systems and their life cycles, demonstrating a strong theoretical understanding in genetics.

CO6 aligns with PO1 as it involves acquiring comprehensive knowledge of virology and virus structure, reflecting discipline-specific knowledge in molecular biology.

PO2: Critical Thinking and Problem Solving

CO2 aligns with PO2 as it requires critical thinking and problem-solving skills in genetic calculations and understanding population genetics. CO7 aligns with PO2 as it focuses on developing critical thinking skills and problem-solving abilities in the context of genetics and biology.

PO3 - Social Competence:

CO7 involves skill development in a social context, reflecting the importance of social competence in collaborative problem-solving.

PO4: Research-related skills and Scientific temper

CO4 aligns with PO4 as it involves using molecular information and methodologies in genetics, demonstrating research-related skills and scientific temper. CO5 aligns with PO4 as it involves understanding mechanisms and techniques in microbial genetics, demonstrating research-related skills.

PO5: Trans-disciplinary knowledge

CO3 aligns with PO5 as it involves integrating genetic concepts with classical and modern perspectives, transcending beyond discipline-specific approaches.

PO6: Personal and professional competence

CO7 focuses on skill development, which is essential for personal and professional competence in the context of genetic problem-solving.

PO7: Effective Citizenship and Ethics

CO7 involves critical thinking with ethical considerations, aligning with effective citizenship and ethical awareness.

PO8: Environment and Sustainability

CO7 may involve addressing biological problems related to environmental sustainability, reflecting the relevance to environmental and sustainability concerns.

PO9: Self-directed and Life-long learning

CO7 encourages self-directed learning and problem-solving, aligning with the development of self-directed and life-long learning skills.

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY Sem. IV (w. e. f. June, 2020)

Name of the Program: M.Sc. Zoology

Class: M.Sc. - II

Semester: III

Course Name: Insect Physiology, Biochemistry and Ecology

Course Code: ZOO: 5302

Number of Credits: 04

Number of Lectures: 60

Course Objectives:-

- To understand the physiology and biochemistry of insects organs and systems.
- To understand the processes like digestion, excretion and circulation of insects.
- To learn the ecological aspects of insects such as population dynamics and plant insect relationships.
- To understand the various hormones in insects.
- To understand the role of insects in ecosystem.
- To understand the different insect enemies.
- To understand the interaction of insects and climate.

Course Outcomes:-

After completion of this course students will be able to -

CO1: explain the insect physiology and biochemistry in depth.

CO2: describe insect population dynamics and behavioural adaptations.

CO3: explain the scope and importance of insect anatomy and physiology.

CO4: describe structure, modification and physiology of different system.

CO5: describe interaction of various climatic factors with insects.

CO6: describe feeding strategies of herbivorous insects.

CO7: describe in detail the plant defences mechanism.

Insect Physiology, Biochemistry		
Topic No.	TOPICS / CONTENTS	Lectures
1.	Integument: Structure, Chemistry, sclerotization, functions.	04 L
2.	Digestion and absorption of proteins, Carbohydrates and lipids.	04 L
3.	Fat body: Structure, physiology, biochemistry, functions. Integration of carbohydrate, fat and acid metabolism	04 L
4.	Ventilatory mechanisms and their control	04 L
5.	Haemolymph: Physico-chemical characteristics of plasma : types and structure of haemocytes, functions	03 L
6.	Muscle : structure, physiology and biochemistry of flight muscles	
7.	Excretion and water balance: Structure and function of Malpighian tubules. Water balance and nitrogen excretion.	04 L
8.	Microsomal and extramicrosomal enzymes insecticide degradation and detoxification.	03 L
9.	Endocrines, neurosecretory hormones, chemistry, function and mechanism of hormone action, moulting and juvenile hormones ; chemistry and physiology, other peptide and steroid hormones	04 L
Insect Ecology		
10.	Introduction to Insect ecology: History of ecology & Entomology	05 L

	Ecological associations, Insect and humans	
11.	Insect and Climate: Temperature Photoperiod Rainfall, Wind and Climate change	05 L
12.	Insect Herbivores: Feeding strategies of herbivorous insects Plant defense	05 L
13.	Natural enemies and insect population dynamics: The variety of Natural enemies Impact of enemies on insect populations The Concept of niche & competition among insects	05 L
14.	Insects in ecosystems: Fundamentals of ecosystem ecology, Leaf shredding insects, Insect defoliators & cycling of nutrients insect, plant Community: structure and successor	05 L
15.	Insect conservation: Threats to insects, Conservation and restoration, Prospects for insect conservation	05L

REFERENCES

1. Fundamentals of insect physiology, Blum N.S., John Wiley and sons, NY
2. An introduction to insect physiology, Bursell, e. academic press, NY
3. Insect biochemistry and function Candy D.J. and Kilby D.A. Chapman and hall, London
4. Comprehensive insect physiology, biochemistry and pharmacology, Kerkut G.A and Gilbert L.I., Vol. 1 to 13 Pergamum Press, Oxford, NY
5. Insect Ecology, M.S. Mani

Course Articulation Matrix of ZOO: 5302: Insect Physiology, Biochemistry and Insect Ecology Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	1	3	2	3	2	2	3
CO2	2	3	2	2	1	3	2	2	2
CO3	3	2	3	3	2	3	2	2	3
CO4	2	2	2	1	1	2	2	1	2
CO5	1	1	1	2	3	1	1	3	1
CO6	3	2	2	3	2	3	2	2	3
CO7	2	2	3	2	2	2	3	1	2

PO1: Disciplinary Knowledge

CO1: Understand the insect physiology and biochemistry in depth.

CO2: Have the knowledge of insect population dynamics and behavioural adaptations.

CO3: Understand the scope and importance of insect anatomy and physiology.

CO4: Describe structure, modification and physiology of different system.

PO2: Critical Thinking and Problem Solving

CO2: Have the knowledge of insect population dynamics and behavioural adaptations (analysing factors influencing population levels, predicting potential outbreaks).

CO4: Describe structure, modification and physiology of different system (Identifying physiological adaptations to environmental or dietary challenges).

CO6: Describe interaction of various climatic factors with insects (analysing impact of climate change on insect behaviour and distribution).

PO3: Social Competence

CO7: Describe feeding strategies of herbivorous insects (Understanding the impact of insect herbivory on agricultural yield and food security).

CO8: Describe in detail the Plant defense mechanism (Understanding the complex interactions between insects and their host plants).

PO4: Research-related skills and Scientific temper

CO1: Understand the insect physiology and biochemistry in depth (Formulating research questions, interpreting scientific data).

CO2: Have the knowledge of insect population dynamics and behavioural adaptations (Designing field experiments, collecting and analysing data).

CO3: Understand the scope and importance of insect anatomy and physiology (Understanding the limitations and biases of research methods).

PO5: Trans-disciplinary knowledge

CO6: Describe interaction of various climatic factors with insects (Understanding the connection between entomology, ecology, and climate science).

CO7: Describe feeding strategies of herbivorous insects (Understanding the interplay between entomology, agriculture, and pest management).

CO8: Describe in detail the Plant defense mechanism (Understanding the interdisciplinary field of chemical ecology).

PO6: Personal and professional competence

All COs: (Developing independent learning skills, effective communication through reports and presentations, time management through assignment deadlines).

PO7: Effective Citizenship and Ethics

CO3: Understand the scope and importance of insect anatomy and physiology (Recognizing the ethical implications of using insecticides).

CO7: Describe feeding strategies of herbivorous insects (Understanding the economic and social impact of insect pests).

PO8: Environment and Sustainability

CO6: Describe interaction of various climatic factors with insects (Understanding the impact of human activities on insect populations and ecosystems).

CO7: Describe feeding strategies of herbivorous insects (Developing sustainable pest management strategies).

PO9: Self-directed and Life-long learning

All COs: (Developing curiosity and a passion for entomology, continuous learning through scientific literature and conferences).

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY Sem. IV (w. e. f. June, 2020)

Name of the Program: M.Sc. Zoology

Class: M.Sc. - II

Semester: III

Course Name: Mammalian Reproductive Physiology
And Histology & Histochemistry

Course Code: ZOO: 5303

Number of Credits: 04

Number of Lectures: 60

Course Objectives:-

- To understand the concept of mammalian reproduction.
- To understand the role of hormones in reproduction.
- To understand the concept of pregnancy, parturition and lactation.
- To understand the causes of reproductive dysfunction and artificial control of reproduction
- To understand the different methods of microscopy and tissue preservation and the limits of magnification and resolution.
- To understand the structural organization the various types of muscles.
- Explain the scientific basis of tissue preparation and be able to apply that understanding to the practice of the subjects such as making films, spread and counting.

Course Outcomes:-

After completion of this course students will be able to -

CO1: create awareness about Sexual Transmitted diseases.

CO2: describe the changes that occur in the reproductive system over the lifetime of an individual.

CO3: identify the major hormones involved in reproduction and describe their role in regulating reproduction in males and females.

CO4: describe the processes that can lead to dysfunction of the reproductive system.

CO5: explain the general principles of Histochemistry.

CO6: explain the potential hazards of handling chemicals and chemical waste.

CO7: design an experimental procedure.

SECTION- I: Mammalian Reproductive Physiology (30 L)

Topic No.	TOPICS / CONTENTS	Lectures
1.	Reproductive organ: male and female gonads, duct systems and sex accessories, external sexual dimorphisms	03 L
2.	Reproductive patterns: Environmental factors and breeding, continuous and seasonal breeders	03 L
3.	Sexual cycles: puberty, oestrous and menstrual cycles. Ovarian event: follicular phase, cycling of non-pregnant uterus and vagina.	05 L
4.	Hormonal regulation: hypothalamus –pituitary and gonad axis; other hormones. Hypothalamic GnRH, pituitary gonadotropins, behavioural effects, testicular hormones, testosterone derivatives, inhibin, ovarian hormones: oestrogen, progesterone's feedback relationships	04 L
5.	Pregnancy: conception and blastocyst formation , implantation and delayed implantation, placenta: formation, types and functions, hormones in pregnancy	02 L
6.	Parturition: birth process and its neuroendocrine control, puerperium	03 L
7.	Lactation: mammary glands, milk synthesis, secretion. Hormonal regulation and suckling reflex.	03 L
8.	Reproductive dysfunctions: Aging and reproduction. Climacteric, anatomical, endocrine and genetic disorders.	03 L

9.	Artificial control of reproduction: increasing reproductive potential, Artificial insemination, <i>in vitro</i> fertilization and embryo transfer, induced breeding, synchronization of oestrus and ovulation, chemical and hormonal aspect, limiting reproductive potential, physical, physiological, surgical, chemical methods of contraception in male, female. Infertility: its causes and treatment, hormonal aspects	04 L
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SECTION-II: Histology and Histochemistry (30 L)

Topic No.	TOPICS / CONTENTS	Lectures
1.	Fundamentals of histology: Epithelial, connective, muscular, nervous and other specialized tissues.	05 L
2.	Tools in histology: Principles, design and functioning of microtomes, automated microtomes, ultra microtome, cryostat, problems and troubleshooting	03 L
3.	Techniques in histology: Sample preparation, obtaining tissue samples, handling reagents, fixatives (types of fixatives and effect on tissue), processing of fixed samples, dehydration(procedure and significance), embedding, block making, staining(staining methods histochemical and immunohistological methods), dyes and dye binding reactive groups, mordants and mordanting, temporary and permanent preparations, whole mount preparation	07 L
4.	Fundamentals of histochemical techniques: principle and practice, detection of glycogen, neutral and acid mucopolysaccharides, detection of basic proteins, detection of specific and nonspecific lipids, detection of nonspecific esterases, detection of acid /alkaline phosphatase.	15 L

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2. Histology: Roland lesson and Thomas Leesan WB Saunders company Co., Canada
3. Histochemistry Vol. I II III A G E Pearse Churchill Livingstone NY
4. Austin C.R. and short R V., reproduction in mammals Books 1-5, Univ. of Cambridge
5. Hogarth PH Biology of Reproduction, Blackie and Son, Glasgow, London.
6. Nalbandov, AV, Reproductive Physiology, Lea and Febiger, Philadelphia

Course Articulation Matrix of ZOO: 5303: Mammalian Reproductive Physiology And Histology & Histochemistry

Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	3	2	2	3	2	2
CO2	2	3	2	2	1	3	2	1	2
CO3	2	2	2	2	2	2	2	2	2
CO4	3	2	2	3	2	2	3	2	2
CO5	2	2	1	2	3	2	2	3	1
CO6	2	3	2	2	2	3	2	1	2
CO7	3	2	2	3	2	2	3	2	2

PO1: Disciplinary Knowledge

CO1: Describe the changes that occur in the reproductive system over the lifetime of an individual.

CO2: Identify the major hormones involved in reproduction and describe their role in regulating reproduction in males and females.

CO3: Describe the processes that can lead to dysfunction of the reproductive system.

CO4: Understand the general principles of Histochemistry.

PO2: Critical Thinking and Problem Solving

CO2: Identify the major hormones involved in reproduction and describe their role in regulating reproduction in males and females (analysing the complex hormonal interactions in maintaining reproductive health).

CO3: Describe the processes that can lead to dysfunction of the reproductive system (Identifying potential causes of reproductive disorders and exploring treatment options).

CO5: Able to design an experimental procedure (Formulating research questions, analysing data, and drawing conclusions).

PO3: Social Competence

CO1: Create awareness about Sexual Transmitted diseases (Promoting public health education and responsible sexual behaviour).

CO4: Understand the general principles of Histochemistry (Applying knowledge to diagnose and understand human diseases).

PO4: Research-related skills and Scientific temper

CO4: Understand the general principles of Histochemistry (Developing laboratory skills, interpreting stained tissue samples).

CO5: Able to design an experimental procedure (Following scientific methods, conducting ethical research).

PO5: Trans-disciplinary knowledge

CO1: Create awareness about Sexual Transmitted diseases (Connecting reproductive health with social and cultural norms).

CO3: Describe the processes that can lead to dysfunction of the reproductive system (Understanding the interplay between reproductive health and environmental factors).

PO6: Personal and professional competence

CO5: Able to design an experimental procedure (Developing critical thinking, time management, and communication skills).

CO6: Explore career opportunities and participate in career and graduate school planning through organization and activities (Developing self-awareness, career planning skills, and professional networking).

PO7: Effective Citizenship and Ethics

CO1: Create awareness about Sexual Transmitted diseases (Promoting sexual health awareness and responsible choices).

CO4: Understand the general principles of Histochemistry (Ensuring proper and ethical handling of biological samples).

PO8: Environment and Sustainability

CO3: Describe the processes that can lead to dysfunction of the reproductive system (Understanding the potential impact of environmental toxins on reproductive health).

PO9: Self-directed and Life-long learning

CO1: Create awareness about Sexual Transmitted diseases (Maintaining an inquisitive attitude towards reproductive health issues).

CO6: Explore career opportunities and participate in career and graduate school planning through organization and activities (Developing self-motivation, continuous learning, and career adaptability).



SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY Sem. IV (w. e. f. June, 2020)

Name of the Program: M.Sc. Zoology

Class: M.Sc. - II

Course Name: Economic Zoology

Number of Credits: 04

Semester: III

Course Code: ZOO: 5304

Number of Lectures: 60

Course Objectives:-

- To know the role of protozoans in human welfare.
- To understand various cultivation methods.
- To understand different industries with their roles.
- To study and understand animals used in pharmaceuticals.
- To provide students with a comprehensive understanding of the diversity, ecology, and economic importance of invertebrates and lower chordates.
- To equip students with the knowledge and skills necessary to identify, classify, and control important parasites and pests.
- To raise awareness of the importance of wildlife conservation and the sustainable use of natural resources.

Course Outcomes:-

After completion of this course students will be able to -

CO1: explain the role of different cultures in day to day life.

CO2: understand the different industries with economic profit.

CO3: start up their farms.

CO4: analyze the diverse roles of invertebrates and lower chordates in human health, agriculture, and industry.

CO5: apply taxonomic principles to classify and identify key animal groups..

CO6: evaluate the economic significance of various animal commodities and resources.

CO7: assess the economic impact of poultry, piggery, dairy, animal-based sectors and their relationship to sustainable practices.

CO8: critically assess the ecological importance and conservation needs of wildlife populations.

Topic No.	TOPICS / CONTENTS	Lectures
1.	Parasitic protozoans and their role in human welfare, soil protozoans and their role in agriculture.	04L
2.	Sponge culture and its importance in industry	02L
3.	Concept of Coral reef and its significance	04L
4.	Helminthes as human and animal parasites	02L
5.	Nematodes- parasitic roundworms of animals and plants	02L
6.	Vermiculture industry in India	04L
7.	Household insects, Apiculture, Lac culture, Sericulture, Prawn culture, Pearl Culture, Fish Culture, Insects of commercial value and stored grain pests	18 L
8.	Economic importance of amphibian, reptiles, birds and mammals	04L
9.	Poultry, Piggery, Dairy industry, wool industry and fur industry, fish industry and byproducts of fishing industry.	14L
10.	Model animals in pharmaceutical industry	04L
11.	Wild Life in India and its conservation	02L

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1. Shukla, G. S., & Upadhyay, V. B. (2010). Economic zoology. Rastogi Publications.
2. Yadav, M. (2003). Economic Zoology. Discovery Publishing House.
3. Ravindranathan, K. R. (2003). Economic zoology. Dominant Publishers & Distributors.
4. Venkitaraman, P. R. (1983). Textbook of Economic Zoology. Sudasan publication, Cochin, 155-156.

Course Articulation Matrix of ZOO: 5304: Economic Zoology

Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	2	3	2	2	2	2
CO2	3	3	2	2	3	2	2	2	2
CO3	2	2	3	2	2	3	2	2	2
CO4	3	2	2	3	3	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2
CO6	2	2	2	2	2	3	2	2	2
CO7	3	2	2	3	3	2	3	2	2

PO1: Disciplinary Knowledge

CO2: Develop ability to start their farms.

CO4: Analyze the diverse roles of invertebrates and lower chordates in human health, agriculture, and industry.

CO5: Apply taxonomic principles to classify and identify key animal groups.

CO6: Evaluate the economic significance of various animal commodities and resources.

CO7: Studying poultry, piggery, dairy, and other animal-based industries alongside insects with commercial value will equip students to assess the economic impact of these sectors and their relationship to sustainable practices.

PO2: Critical Thinking and Problem Solving

CO4: Analyze the diverse roles of invertebrates and lower chordates in human health, agriculture, and industry (Evaluating the benefits and potential risks associated with different animal groups).

CO5: Apply taxonomic principles to classify and identify key animal groups (Critically analyzing morphological characteristics and using dichotomous keys for identification).

CO6: Evaluate the economic significance of various animal commodities and resources (Assessing the environmental, ethical, and social implications of animal industries).

CO7: Studying poultry, piggery, dairy, and other animal-based industries alongside insects with commercial value will equip students to assess the economic impact of these sectors and their relationship to sustainable practices (Examining potential solutions for balancing economic viability with environmental responsibility).

PO3: Social Competence

CO1: Understand the role of different cultures in day to day life (Appreciating the diverse ways humans interact with animals across cultures).

CO3: Develop ability to start their own farms (Communicating effectively with stakeholders and building collaboration within agricultural communities).

PO4: Research-related skills and Scientific temper

CO4: Analyze the diverse roles of invertebrates and lower chordates in human health, agriculture, and industry (Gathering and interpreting scientific data, formulating research questions).

CO5: Apply taxonomic principles to classify and identify key animal groups (Utilizing scientific literature and databases for reference).

CO7: Studying poultry, piggery, dairy, and other animal-based industries alongside insects with commercial value will equip students to assess the economic impact of these sectors and their relationship to sustainable practices (Evaluating research studies on sustainable practices in animal agriculture).

PO5: Trans-disciplinary knowledge

CO1: Understand the role of different cultures in day to day life (Connecting cultural practices with animal husbandry and environmental conservation).

CO6: Evaluate the economic significance of various animal commodities and resources

CO7: Studying poultry, piggery, dairy, and other animal-based industries alongside insects with commercial value will equip students to assess the economic impact of these sectors and their relationship to sustainable practices (Bridging the gap between economic development and environmental responsibility in animal agriculture).

PO6: Personal and professional competence

CO3: Demonstrating entrepreneurial skills, time management, and problem-solving abilities.

CO5: Apply taxonomic principles to classify and identify key animal groups (Developing observation skills, analytical thinking, and critical decision-making).

PO7: Effective Citizenship and Ethics

CO1: Understand the role of different cultures in day to day life (Promoting cultural sensitivity and respect for diverse perspectives on animal interactions).

CO6: Evaluate the economic significance of various animal commodities and resources (Examining ethical considerations in animal welfare and resource management).

CO7: Critically assess the ecological importance and conservation needs of wildlife populations (Understanding the importance of responsible pet ownership and advocating for wildlife conservation).

PO8: Environment and Sustainability

CO4: Analyze the diverse roles of invertebrates and lower chordates in human health, agriculture, and industry (Understanding the importance of biodiversity and natural ecosystems).

CO7: Studying poultry, piggery, dairy, and other animal-based industries alongside insects with commercial value will equip students to assess the economic impact of these sectors and their relationship to sustainable practices (Evaluating the environmental impact of animal industries and exploring sustainable alternatives).

PO9: Self-directed and Life-long learning

CO1: Understand the role of different cultures in day to day life (Fostering curiosity about animal-human relationships and cultural practices).

CO3: Develop ability to start their farms (Encouraging self-initiative and lifelong learning in agricultural practices).

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY Sem. IV (w. e. f. June, 2020)

Name of the Program: M.Sc. Zoology

Class: M.Sc. - II

Semester: III

Course Name: ZOOLOGY PRACTICAL - V

Course Code: ZOO: 5305

Number of Credits: 04

Number of Practicals: Any 10

Course Objectives:-

- Develop comprehensive knowledge and practical skills in insect collection, preservation, and presentation techniques. This includes understanding various collecting methods, proper preservation techniques based on specimen type, and effective presentation methods for research and education.
- Gain in-depth understanding of the anatomy and morphology of a generalized insect. Through dissection and analysis, students will be able to identify and describe key morphological features, digestive, nervous, and reproductive systems, and the unique structure of the retro-cerebral complex.
- Analyze the structure and function of specialized head structures and appendages. This learning objective focuses on detailed study of the head capsule, various mouthpart types and their modifications, and antenna morphology and adaptations.
- Develop a comprehensive understanding of various physiological processes in living organisms, ranging from metabolic activities such as carbohydrate and protein metabolism to the impact of environmental factors on organisms, as exemplified by the effects of temperature, salinity, and osmotic stress.
- Develop a solid understanding of the principles underlying the analysis of metric traits and the estimation of phenotypic variance.
- Conduct kymographic studies to analyze ventilatory movements in beetles, gaining insights into the respiratory mechanisms of insects
- Estimate oxygen consumption in dragonfly nymphs to explore the metabolic demands during different stages of development

Course Outcomes:-

After completion of this course students will -

- CO1: demonstrate advanced knowledge and practical skills in insect collection, preservation, and presentation. They will be able to employ various collecting methods, apply appropriate preservation techniques for different specimen types, and effectively present insect specimens for research and educational purposes.
- CO2: gain in-depth understanding of the anatomy and morphology of a generalized insect. They will be able to identify and describe key morphological features, including the digestive, nervous, and reproductive systems, as well as the unique structure of the retro-cerebral complex through dissection and analysis.
- CO3: analyze the structure and function of specialized head structures and appendages. They will gain detailed knowledge of the head capsule, various mouthpart types and their modifications, and antenna morphology and adaptations, enhancing their understanding of insect biology and ecology.
- CO4: develop a comprehensive understanding of various physiological processes in living organisms. This includes metabolic activities such as carbohydrate and protein metabolism, as well as the impact of environmental factors on organisms, illustrated by the effects of temperature, salinity, and osmotic stress.
- CO5: develop a solid understanding of the principles underlying the analysis of metric traits and the estimation of phenotypic variance.
- CO6: capable of conducting kymographic studies to analyze ventilatory movements in beetles, gaining insights into the respiratory mechanisms of insects.
- CO7: able to estimate oxygen consumption in dragonfly nymphs, providing insights into the metabolic demands during different developmental stages.

Section I: Practical based on: ZOO: 5301– Entomology- I (Any 10)

Practical No.	Title of Practical	No. of Practicals
1.	Methods of collection, preservation & presentation of insect.	01P
2.	Study of generalized insect including Systematic position, Habit and Habitat, Important morphological features and Dissection of so as to study: Digestive. Nervous and Reproductive system and Retro- cerebral complex.	03P
3.	Study of head capsule, mouthparts and antenna and their modification.	02P
4.	Study of generalized wing and their modification with significance.	01P
5.	Study of insect orders; (i) Apterygote insects, (ii) Exopterygote insects and (iii) Endopterygote insects inclusive of Taxonomy and diagnostic features upto family (at least one insect from each order).	06P
6.	Dissection of an insect pest (Plant bug or any insect pest as per local availability and legal permissibility) so as to study Taxonomy, Diagnostic features and Anatomy pertaining to Digestive, Nervous and Reproductive systems	03P
7.	Temporary mounting of Mouth parts, Antenna, Wings and Appendage of the insect pest used in practical number 4.	01P

Section I: Practical based on: ZOO: 5301–Animal Physiology I (Any 10)

Practical No.	Title of Practical	No. of Practicals
1.	Estimation serum uric acid	01P
2.	Study the correlation between body size and oxygen consumption in aquatic animals	01P
3.	Effect of salinity on oxygen consumption in aquatic animals	01P
4.	Absorption spectra of blood pigment	01P
5.	Study of Osmotic stress and volume change in earthworm	01P
6.	Effect of temperature on water loss in cockroach	01P
7.	Estimation of Carbohydrates in mammalian gut	01P
8.	Detection of allantoin in mammalian urine	01P
9.	Determination of Glomerular filtration rate by creatinine clearance	01P
10.	Effect of starvation on liver and muscle glycogen in mouse	02P
11.	Induction of heat shock puff in salivary gland chromosomes of Drosophila	01P
12.	Estimation of blood Sodium, potassium, Calcium	01P
13.	Estimation of blood alkaline & acid phosphatases	01P
14.	Normal & abnormal constituents of human urine	01P

Section I: Practical based on: ZOO: 5301 – Genetics I (Any 10)

Practical No.	Title of Practical	No. of Practicals
1.	Analysis of metric trait and estimation of phenotypic variance.	01P
2.	Partitioning of phenotypic variance in genetic and nongenetic components in a simulated population. Estimation of DGD.	01P
3.	Detection of polymorphism in a population – Biochemical	01P

	(Enzyme, protein etc.)	
4.	To study population cage experiments using <i>Drosophila</i> : a) Genetic Drift b) Artificial selection- Experimental simulation and modeling.	01P
5.	Extraction of Genomic DNA from <i>Drosophila</i> .	02P
6.	Microbial genetics: Basic methodology, colony count, growth curve	02P
7.	Microbial genetics: Isolation of Auxotroph (Estimation of frequency), Replica plate technique.	02P
8.	Bacterial transformation and blue white selection. Calculation of transformation efficiency.	01P
9.	Study of conventions of nomenclature of genes and gene products in different model systems.	02P

Section II: Practical based on: ZOO: 5302 – Insect Physiology and Biochemistry & Ecology

Practical No.	Title of Practical	No. of Practicals
1.	Kymographic study of ventilatory movement in beetle.	01 P
2.	Estimation of Oxygen consumption in dragon fly nymph	01 P
3.	Study of heart and haemocytes of cockroach	01 P
4.	Estimation of the trehalase activity in haemolymph of any insect.	01 P
5.	Determination of Amino acid in haemolymph of any insect by chromatographic technique.	02 P
6.	Study of fat body glycogen of cockroach and effect of starvation	01 P
7.	Assay of amylase in midgut of cockroach	01 P
8.	Effect of temperature on water loss in cockroach	01 P
9.	Von Wisselings test for presence of chitin in insect cuticle	01

Course Articulation Matrix of ZOO: 5305: ZOOLOGY PRACTICAL - V
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	2	2	3	2	2	1	2	2
CO2	3	3	2	2	2	2	2	2	2
CO3	3	3	2	2	2	2	2	2	2
CO4	3	2	2	3	3	2	2	2	2
CO5	3	3	2	3	3	2	2	2	2
CO6	3	2	1	2	1	3	2	2	2
CO7	3	3	3	3	3	3	3	3	3

PO1: Disciplinary Knowledge

CO1: This course dives deep into specific entomology techniques, demonstrating advanced knowledge and practical skills in insect collection, preservation, and presentation. This directly contributes to PO1 by building expertise within the discipline.

PO2: Critical Thinking and Problem Solving

CO2: Dissecting and analyzing insect anatomy requires critical thinking to differentiate structures, understand their functions, and identify morphological variations. This strengthens PO2 through practical application of problem-solving skills in a scientific context.

PO3: Social Competence

CO3: Analyzing specialized head structures and appendages often involves collaboration and discussion within groups, fostering communication and teamwork skills, contributing to PO3 development

PO4: Research-related skills and Scientific temper

CO4: Understanding physiological processes requires research-oriented approaches like analyzing data, drawing conclusions, and critically evaluating information. This strengthens PO4 by developing scientific temper and research skills.

PO5: Trans-disciplinary knowledge

CO5: Applying quantitative genetics techniques connects entomology with broader concepts in genetics and statistics, enriching understanding beyond discipline boundaries and contributing to PO5.

PO6: Personal and professional competence

CO6: Conducting kymographic studies equips students with technical skills like operating instruments and analyzing complex data. This builds competence in scientific research and contributes to PO6 development.

PO7: Effective Citizenship and Ethics

CO7: Understanding the physiological adaptations of aquatic insects to environmental changes raises awareness of ecological issues and the importance of environmental stewardship, contributing to responsible citizenship (PO7).

PO8: Environment and Sustainability

CO1, 4, 5: By understanding insect-environment interactions, metabolic demands, and genetic variations, students gain insights into the crucial role of insects in ecosystems and the potential impact of environmental changes. This contributes to PO8 by highlighting the importance of sustainability.

PO9: Self-directed and Life-long learning

CO1, 2, 3, 5: Mastering insect collection, dissection, and analysis techniques instills self-directed learning habits and equips students with the skills to independently explore entomological concepts, contributing to PO9.

तुळजाराम चतुरचंद महाविद्यालय, बारामती

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY Sem. IV (w. e. f. June, 2020)

Name of the Program: M.Sc. Zoology

Class: M.Sc. - II

Semester: III

Course Name: ZOOLOGY PRACTICAL - VI

Course Code: ZOO: 5306

Number of Credits: 04

Number of Practicals: Any 10

Course Objectives:-

- Develop a thorough knowledge of the anatomy of the male and female reproductive systems in rats/mice, including the identification and description of major structures and their functions.
- Gain proficiency in histological techniques to study and analyze the microstructure of male reproductive organs in rats/mice, understanding the cellular composition and organization.
- Acquire skills in histological examination to explore the microstructure of female reproductive organs in rats/mice, including the histology of the ovaries, fallopian tubes, uterus, and other relevant structures.
- Develop proficiency in detecting enzymes, including acid phosphatase, alkaline phosphatase, and esterases. Understand the principles of enzyme detection methods and their applications in biological research.
- Gain practical skills in nucleic acid staining using methyl green, pyronine, and Feulgen stain. Understand the specificity of these stains and their utility in visualizing nucleic acids in different cellular contexts.
- Study various types of tissues using permanent slides. Develop the ability to identify and analyze different tissue structures, including epithelial, connective, muscular, and nervous tissues.
- Develop practical skills and theoretical knowledge in the laboratory culture of prawns in aquarium settings.

Course Outcomes:-

After completion of this course students will be able to -

- CO1: students will demonstrate a thorough knowledge of the anatomy of the male and female reproductive systems in rats/mice. They will be able to identify and describe major structures and understand their functions in the context of reproductive physiology.
- CO2: graduates will acquire proficiency in histological techniques, specifically in studying the microstructure of male reproductive organs in rats/mice. They will understand the cellular composition and organization of these organs at the microscopic level.
- CO3: students will acquire skills in histological examination to explore the microstructure of female reproductive organs in rats/mice. This includes a detailed understanding of the histology of the ovaries, fallopian tubes, uterus, and other relevant structures.
- CO4: graduates will develop proficiency in detecting enzymes, including acid phosphatase, alkaline phosphatase, and esterases. They will understand the principles of enzyme detection methods and their applications in biological research.
- CO5: students will gain practical skills in nucleic acid staining using methyl green, pyronine, and Feulgen stain. They will understand the specificity of these stains and their utility in visualizing nucleic acids in different cellular contexts.
- CO6: graduates will study various types of tissues using permanent slides and develop the ability to identify and analyze different tissue structures, including epithelial, connective, muscular, and nervous tissues. They will become proficient in tissue analysis techniques.
- CO7: students will develop practical skills and theoretical knowledge in the laboratory culture of prawns in aquarium settings. They will understand the key principles of prawn culture, including water quality management, feeding regimes, and breeding techniques.

PRACTICALS:

Section I: Practical based on: ZOO: 5303– Mammalian reproductive physiology		
Practical No.	Title of Practical	No. of Practicals
1.	Anatomy of male and female reproductive system in rat/mouse	01P
2.	Histology of male reproductive organs	01P
3.	Histology of female reproductive organs	01P
4.	Vaginal smear technique in mice.	01P
5.	Ovarectomy in white rats	01P
6.	Study of placental type	01P
7.	Archeotomy in white rat	01P
8.	Study of uterine smooth muscles	01P
9.	Study of contraceptive devices	01P
10.	Visit to artificial insemination centre and family planning clinic	01P

Section I: Practical based on: ZOO: 5303 – Histology and Histochemistry		
Practical No.	Title of Practical	No. of Practicals
1.	Enzyme detection: acid phosphatase, alkaline phosphatase, esterases	01P
2.	Nucleic acid staining: methyl green, pyronine, feulgen stain	01P
3.	Study of different types of tissue with help of permanent slides	02P
4.	Effect of fixatives, fixation of tissues	01P
5.	Block preparation and sectioning	02P
6.	Mucopolysaccharide staining, AB pH 1.5, 2.5	01P
7.	Proteins (basic mellrg) and lipid staining by Sudan black	01P
8.	Comparative study of effect of fixative on a given tissue	01P
9.	Effect of fixatives on tissue sections- liver	01P

Section II: Practical based on: ZOO: 5304 – Economic Zoology		
Practical No.	Title of Practical	No. of Practicals
1.	Prawn culture in laboratory aquarium	01P
2.	Apiculture equipments: Bee Box and Tools.	01P
3.	Poultry breeds, feeding utensils in poultry	02P
4.	A visit to piggery/poultry/pearl culture centre/ apiculture centre/sericulture centre.	01P
5.	Fishing tools, crafts and gear.	01P
6.	Morphology of Edible marine and freshwater fishes-	02P
7.	Collection and identification of locally available/cultured fishes.	02P

Course Articulation Matrix of ZOO: 5306: ZOOLOGY PRACTICAL - VI
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	3	2	3	1	3	2	2	3
CO2	3	3	2	3	1	3	2	2	3
CO3	3	3	2	3	1	3	2	2	3
CO4	3	3	2	3	1	3	2	2	3
CO5	3	3	2	3	1	3	2	2	3
CO6	3	3	2	3	1	3	2	2	3
CO7	3	3	2	3	1	3	2	2	3

PO1: Disciplinary Knowledge

CO1: The course delves into the anatomy and microstructure of the male and female reproductive systems in rats/mice, providing in-depth knowledge within the discipline of reproductive physiology and histology. This directly contributes to PO1 by building expertise in these specific areas.

PO2: Critical Thinking and Problem Solving

CO2: Histological analysis requires critical thinking to differentiate cell types, interpret tissue organization, and troubleshoot technical challenges. Applying enzyme detection and nucleic acid staining techniques further strengthens PO2 through problem-solving in a laboratory setting.

PO3: Social Competence

CO3: Collaboration and communication skills are crucial for discussing lab observations, interpreting results, and preparing reports. Working in groups on prawn culture projects also fosters teamwork and effective communication, contributing to PO3 development.

PO4: Research-related skills and Scientific temper

CO4: Mastering histological techniques equips students with essential research skills like sample preparation, data analysis, and drawing scientific conclusions. Understanding enzyme functions and interpreting nucleic acid staining patterns also contribute to PO4 by nurturing a scientific approach to research.

PO5: Trans-disciplinary knowledge

CO5: The course connects reproductive physiology and histology with broader concepts in biology, chemistry, and environmental science. Analyzing prawn culture practices bridges the gap between laboratory work and real-world applications, contributing to PO5 development.

PO6: Personal and professional competence

CO6: Gaining proficiency in various laboratory techniques, including tissue preparation, staining, and microscopy, builds technical competence and prepares students for professional careers in research or related fields. This contributes to PO6 development.

PO7: Effective Citizenship and Ethics

CO7: Understanding the ethical implications of animal research and responsible laboratory practices fosters responsible citizenship. Additionally, studying prawn culture raises awareness of sustainable aquaculture practices, contributing to PO7 development.

PO8: Environment and Sustainability

CO1, 5, 6: Understanding the reproductive biology of prawns and the principles of their culture contributes to the development of sustainable aquaculture practices, essential for environmental sustainability. This alignment with PO8 highlights the importance of responsible resource management.

PO9: Self-directed and Life-long learning

CO2, 3, 4, 5, 6: Mastering various practical skills and theoretical knowledge in reproductive physiology and histology equips students with the ability to independently learn and adapt to new techniques and technologies. This contributes to PO9 by fostering self-directed learning and a lifelong learning mind set.

