

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 2023-2024**

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

**Class: M.Sc. II**

**Pattern: 40 (IA) + 60 (EA)**

Sr. No.	Code	Paper	Paper Title	Credit	Exam	Marks
1	PSZO 231A	Theory	Entomology-I	4	I / E	40 + 60
	PSZO 231B	Theory	Animal Physiology-I	4	I / E	40 + 60
	PSZO 231C	Theory	Genetics-I	4	I / E	40 + 60
2	PSZO 232	Theory	Physiology, Biochemistry and Ecology of Insects	4	I / E	40 + 60
3	PSZO 233	Theory	Reproductive Physiology, Histology and Histochemistry of Mammals	4	I / E	40 + 60
4	PSZO 234	Theory	Economic Zoology	4	I / E	40 + 60
5	PSZO 235A	Zoology Practical-V	Zoology Practical-V (Practicals Corresponding to : PSZO 231A , PSZO 232)	4	I / E	40 + 60
6	PSZO 235B		Zoology Practical-V (Practicals Corresponding to : PSZO 231B , PSZO 232)	4	I / E	40 + 60
7	PSZO 235C		Zoology Practical-V (Practicals Corresponding to : PSZO 231C , PSZO 232)	4	I / E	40 + 60
8	PSZO 236	Zoology Practical-VI	Zoology Practical-VI (Practicals Corresponding to : PSZO 233 , PSZO 234)	4	I / E	40 + 60
	SD-31		Skill Development	2	-	

**IA\* - Internal Assessment  
 EA\*- External Assessment**

## SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY Sem. III (w. e. f. June, 2023)

**Name of the Program: M.Sc. Zoology**

**Class: M.Sc. - II**

**Course Name: Entomology-I**

**Number of Credits: 04**

**Program Code: PSZO**

**Semester: III**

**Course Code: PSZO 231A**

**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-**

CO 1: know the Systematics of class insecta.

CO 2: get well prepared for research in Entomology under life sciences.

CO 3: understand socio-economical interactions of insects with human

CO 4: be 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.

CO 5: have a strong understanding of insect internal systems and able to explain their functions within the context of insect biology.

CO 6: 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:

UNIT	SUB UNIT	SYLLABUS	NO. OF LECTURES
<b>1. Taxonomy, origin, evolution and morphology</b>			03
<b>2. General outline of classification of insects</b>			20
	2.1	Apterygote insects (Protura, Diplura, Collembola and Thysanura)	
	2.2	Exopterygote insects (5-20 orders)	
	2.3	Endopterygote insects (21-29 orders)	
	2.4	Phylogenetics of insects	
<b>3. Integument and its derivatives</b>			02
<b>4. Comparative study of insect tagmata</b>			08
	4.1.	Head- Origin, structure and modification; Types of mouthparts and antennae, tentorium and neck sclerites	
	4.2.	Thorax- Areas and sutures of tergum, sternum and pleuron, pterothorax; Wings: structure and modifications, venation, wing coupling apparatus and mechanism of flight;	

		Legs: structure and modifications	
	4.3.	Abdomen- Segmentation and appendages; Genitalia and their modifications	
<b>5. Structure and modification of different systems:</b>			
	5.1.	Digestive system	18
	5.2.	Respiratory system	
	5.3.	Circulatory system	
	5.4.	Excretory system	
	5.5.	Reproductive system	
	5.6.	Nervous system	
<b>6. Specialised topics in Entomology</b>			
	6.1.	The Sense organs	05
	6.2.	Endocrine glands	
	6.3.	Exocrine glands	
<b>7. Light and sound producing organs in insects</b>			02
<b>8. Techniques used in insect collection and preservation</b>			02

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**Course Articulation Matrix of PSZO 231A: 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**

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.

CO3 requires students to have a comprehensive understanding of the insect integument and its derivatives, which is essential for understanding insect adaptation and survival.

CO4 requires students to be well-versed in insect tagmata and their adaptations and modifications, which is essential for understanding the diversity of insect body plans.

**PO2: Critical Thinking and Problem Solving**

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.

**PO4: Research-related skills and Scientific temper**

CO7 requires students to develop the skills necessary for insect collection and preservation, which are essential for conducting entomological research.

**PO5: Trans-disciplinary knowledge**

CO1, CO2, CO3, CO4, and CO5 all 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 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 require students to demonstrate ethical behavior in their research and to be aware of the social and environmental implications of their work.

**PO8: Environment and Sustainability**

CO1, CO2, CO3, CO4, and CO5 all 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**

The entire COs requires 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. III (w. e. f. June, 2023)

**Name of the Program: M.Sc. Zoology**

**Class: M.Sc. - II**

**Course Name: Animal Physiology -I**

**Number of Credits: 04**

**Program Code: PSZO**

**Semester: III**

**Course Code: PSZO 231B**

**Number of Lectures: 60**

### Course Objectives:

- To understand the factors affecting animal physiology, including both extrinsic and intrinsic factors.
- To explore the concept of homeostasis and its regulatory mechanisms, including tolerance, resistance, acclimatization, and acclimation.
- To examine the role of biological clocks in regulating physiological rhythms, such as circadian rhythms, lunar and tidal rhythms, and photoperiodism.
- 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 fibre
- 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:-**

- CO 1: understand functioning of Excretion via kidneys and other excretory organs of animals.
- CO 2: understand the physiology of membrane and physiological aspects of metabolism.
- CO 3: demonstrate knowledge of biological clocks and their role in regulating physiological rhythms in animals.
- CO 4: comprehend the physiology of digestion, including nutritional requirements, digestion and absorption processes, and the control mechanisms.
- CO 5: explain the different modes of respiration, gas exchange, and the neural control of respiration, as well as understand abnormalities in gas transport.
- CO 5: describe muscle physiology, including muscle structure, contraction mechanisms, and muscle fibre types.
- CO 6: explain the concept of homeostasis, its regulation, and the mechanisms involved in maintaining internal stability.
- CO 7: describe muscle physiology, including muscle structure, contraction mechanisms, and muscle fibre types.

### TOPICS:

UNIT	SUB UNITS	SYLLABUS	NO. OF LECTURES
<b>1. Study of extrinsic and intrinsic factors affecting animal physiology:</b>			<b>08</b>
	1.1	Extrinsic factors: <ul style="list-style-type: none"><li>• Atmosphere (Aquatic &amp; terrestrial environment)</li></ul>	
	1.2	Intrinsic factor (Extracellular and intra cellular environment)	
	1.3	Homeostasis and its regulation: Tolerance and resistance, acclimatisation and acclimation; Regulatory mechanism of homeostasis.	
	1.4	Biological clock and their regulation: Circadian rhythms	

		lunar and tidal rhythm, circa annual rhythm, photoperiodism	
<b>2. Membrane physiology:</b>			<b>09</b>
	2.1	Membrane structure and its dynamics	
	2.2	Resting membrane potential, Nernst equation, Goldman-Hodgkin- Katz potential, conductance, current and capacitance	
	2.3	Excitable cell membrane: Action potential, role of various ion channels, role of Na <sup>+</sup> K <sup>+</sup> pump	
<b>3. Physiology of Digestion:</b>			<b>09</b>
	3.1	Nutritional requirements (Concept of balanced diet), regulation of hunger, satiety	
	3.2	Digestion and absorption (Gastro-intestinal tract- Carbohydrate, lipids & protein- Scope)	
	3.3	Neuronal and hormonal control of digestion	
	3.4	Colorimetry and BMR	
<b>4. Respiration:</b>			<b>10L</b>
	4.1	Modes of respiration: Anatomy of respiratory system	
	4.2	Pulmonary respiration: Partial pressure, inspiration and expiration; Lung volume and capacities.	
	4.3	Gas exchange across the pulmonary and systemic capillaries	
	4.4	Gas transport: O <sub>2</sub> transport, CO <sub>2</sub> transport and abnormalities in the blood gas content	
	4.5	Neuronal control of respiration, role of central and peripheral receptors	
<b>5. Muscle physiology:</b>			<b>09L</b>
	5.1	Structure of skeletal muscle, twitch summation and tetanus, relation between muscle length and tension, velocity of contraction	
	5.2	Skeletal muscle fiber types, contractile machinery of smooth muscle	
	5.3	Molecular basis of skeletal muscle contraction, types of contraction	
<b>6. Bioluminescence and animal electricity:</b>			<b>07L</b>
	6.1	Bioluminescence: Phyletic distribution, structure of luminescent organs, biochemical and molecular mechanism.	
	6.2	Animal electricity: Electro receptors, electro organs and their structure and functions	
<b>7. Buoyancy:</b>			<b>05L</b>
	7.1	Definition & concept	
	7.2	Density reduction	
	7.3	Gas floats with examples	
	7.4	Swim bladder (Bottom dwelling and surface dwelling fish)	
<b>8. Introduction to clinical physiology:</b>			<b>03</b>

8.1	Concept and Scope	
8.2	Techniques in clinical physiology: Ultrasound, kidney functioning, liver functioning and various imaging techniques	
8.3	Processes involved in clinical science	

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### **Course Articulation Matrix of PSZO 231B: 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**

CO1 encourages critical thinking by examining the complex factors influencing animal physiology.

**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.



तुळजाराम चतुरचंद महाविद्यालय, बारामती

## SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY Sem. III (w. e. f. June, 2023)

**Name of the Program: M.Sc. Zoology**

**Class: M.Sc. - II**

**Course Name: Genetics - I**

**Number of Credits: 04**

**Program Code: PSZO**

**Semester: III**

**Course Code: PSZO 231C**

**Number of Lectures: 60**

### Course Objectives: -

- To understand the life cycles and advantages of model genetic systems used in genetic studies.
- To recapitulate the basic concepts of population genetics and explore the Hardy-Weinberg law.
- To delve into evolutionary genetics, including concepts of continuous variation, genetic polymorphism, and the genetics of speciation.
- 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 the life cycles and advantages of model genetic systems such as *Neurospora*, *E. coli*, and *Drosophila*.
- CO2: Apply the principles of the Hardy-Weinberg law and estimate gene frequencies in populations through mutation and genetic equations.
- CO3: Analyze 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:

UNIT	SUB UNITS	SYLLABUS	NO. OF LECTURES
<b>1. Model Genetic System: Life cycles and advantages of the following organisms commonly used in genetic studies</b>			08
	1.1	T4	
	1.2	<i>Neurospora</i>	
	1.3	<i>E. coli</i>	
	1.4	<i>Saccharomyces cerevisea</i> and <i>Schizosaccharomyces pombe</i>	
	1.5	<i>Caenorhabditis</i>	
	1.6	<i>Drosophila</i>	
	1.7	Zebra fish	
	1.8	Mouse	
<b>2. Advanced Population Genetics:</b>			10

	2.1	Recapitulation of basic concepts and Hardy-Weinberg law.	
	2.2	Estimation of gene frequencies in population through mutation, derivation and genetic equations	
	2.3	Assortative mating, inbreeding and genetic drift	
<b>3. Evolutionary genetics:</b>			
	3.1	Concept of continuous variation, phenotypic variance and its partitioning into subcomponents. -Genetic polymorphism -Genetics of speciation: Classical and modern concepts -Use of molecular information in understanding phylogenetic relationship	10
	3.2	Quantitative inheritance in humans	
<b>4. Applications of Molecular methodologies in genetic analysis:</b>			
	4.1	Introduction to gene localization on chromosomes	12
	4.2	Chromosomal probes and paints	
	4.3	Introduction to reverse genetics	
<b>5. Microbial Genetics:</b>			
	5.1	Conjugation	12
	5.2	Conjugation by <i>Escherichia coli</i> F Factor	
	5.3	Fertility Factor or F Factor	
	5.4	Hfr Conjugation and Chromosomal Transfer	
	5.5	The F' (F Prime) Factor	
	5.6	Interrupted Mating and Conjugational Mapping Transformation: Discovery of Transformation; Competence; Natural and artificial transformation	
<b>6. Molecular biology of viruses:</b>			
	6.1	Introduction to virology	8
	6.2	Baltimore classification and nomenclature of viruses; function of the virion, Structure of virus; Icosahedral symmetry (Triangulation numbers); Viruses with Envelopes: Viral Envelope components, simple enveloped viruses; Viroid's and prions.	

## तुळजाराम चतुरचंद महाविद्यालय, बारामती

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**Course Articulation Matrix of PSZO 231C: 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 Se. III (w. e. f. June, 2023)

**Name of the Program: M.Sc. Zoology**

**Program Code: PSZO**

**Class: M. Sc. - II**

**Semester: III**

**Course Name: Physiology, Biochemistry and Ecology of Insects**

**Course Code: PSZO 232**

**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, plant insect relationships etc.
- 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:-**

CO 1: understand the insect physiology and biochemistry in depth.

CO 2: gain knowledge of insect population dynamics and behavioural adaptations.

CO 3: understand the scope and importance of insect anatomy and physiology.

CO 4: describe structure, modification and physiology of different system.

CO 5: describe interaction of various climatic factors with insects.

CO 6: describe feeding strategies of herbivorous insects.

CO 7: describe in detail the plant defense mechanism.

### TOPICS:

UNIT	SUB UNITS	SYLLABUS	NO. OF LECTURES
<b>1. Integument:</b>			
	1.1	Structure and chemistry of integument	04
	1.2	Sclerotization	
	1.3	Functions of integument	
	1.4	Pigmentation in insects	
<b>2. Digestion and absorption:</b>			
	2.1	Carbohydrates	04
	2.2	Lipids	
	2.3	Proteins	
<b>3. Fat body:</b>			
	3.1	Structure, physiology and functions	04
	3.2	Integration of carbohydrate, fat and amino acid metabolism	
<b>4. Ventilatory mechanisms and their control:</b>			03
<b>5. Haemolymph:</b>			
	5.1	Physico-chemical characteristics of plasma	04
	5.2	Haemocytes: Structure, types and functions	
	5.3	Physiology of circulatory system	
<b>6. Muscles:</b>			
	6.1	Structure, physiology and biochemistry of flight	03



		muscles	
<b>7. Osmoregulation and excretion</b>			04
	7.1	Structure and function of Malpighian tubules	
	7.2	Mechanism of osmoregulation and nitrogen excretion.	
<b>8. Insecticide degradation and resistance</b>			03
	8.1	Role of microsomal and extramicrosomal enzymes in degradation	
<b>9. Moulting: Mechanism and regulation</b>			03
<b>10. Insect Ecology</b>			15
	10.1	Insect and Climate: Temperature, photoperiod, rainfall, wind and climate change	
	10.2	Insect Herbivores: Leaf shredding insects and insect defoliators; Feeding strategies of herbivorous insects; Plant defense mechanisms	
<b>11. Natural enemies and insect population dynamics</b>			08
	11.1	Natural enemies	
	11.2	Impact of enemies on insect populations	
	11.3	Concept of niche & competition among insect Lotka-Volterra model	
<b>12. Insect conservation</b>			05
	12.1	Threats to insects	
	12.2	Conservation and restoration, prospects for insect conservation	
	12.3	Artificial breeding techniques	

## REFERENCES

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### Course Articulation Matrix of PSZO 232: Physiology, Biochemistry and Ecology of Insects Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
<b>CO1</b>	3	2	1	3	2	3	2	2	3
<b>CO2</b>	2	3	2	2	1	3	2	2	2
<b>CO3</b>	3	2	3	3	2	3	2	2	3
<b>CO4</b>	2	2	2	1	1	2	2	1	2
<b>CO5</b>	1	1	1	2	3	1	1	3	1
<b>CO6</b>	3	2	2	3	2	3	2	2	3
<b>CO7</b>	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 understands 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 (Analyzing 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 (Analyzing 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 analyzing 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 Se. III (w. e. f. June, 2023)

**Name of the Program: M.Sc. Zoology**

**Program Code: PSZO**

**Class: M. Sc. - II**

**Semester: III**

**Course Name: Reproductive Physiology, Histology and Histochemistry of Mammals**

**Course Code: PSZO 233**

**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
- Mention and describe the different types of tissue.

### 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: gather information of hazardous materials and will recognize and respond properly to potential hazards of handling chemicals and chemical waste.

CO6: able to design an experimental procedure.

CO7: explore career opportunities and participate in career and graduate school planning through organization and activities.

### TOPICS:

UNIT	SUB UNITS	SYLLABUS	NO. OF LECTURES
<b>1. Reproductive Systems:</b>			
	1.1	Anatomy of Male and female Reproductive System, Accessory organs and their function	04
	1.2	Spermatogenesis, Function of Sertoli cells, Blood-testis barriers, Leydig cell; Capacitation	
	1.3	Sexual dimorphisms	
<b>2. Reproductive patterns:</b>			
	2.1	Environmental factors and breeding	03
	2.2	Continuous and seasonal breeders	
<b>3. Sexual cycles:</b>			
	3.1	Puberty, oestrous and menstrual cycles	05
	3.2	Ovarian event: Follicular phase	
	3.3	Uterine Events: Cycling of non-pregnant uterus and vagina	
<b>4. Hormonal regulation:</b>			
			05

	4.1	Hypothalamus –pituitary and gonad axis; other hormones	
	4.2	Hypothalamic GnRH, pituitary gonadotropins, testicular hormones, testosterone derivatives and inhibin	
	4.3	Ovarian hormones: Oestrogen and progesterone; Feedback relationships	
	4.4	Prostaglandins and their role in reproduction	
<b>5. Gamete transportation and pregnancy:</b>			
	5.1	Conception and blastocyst formation, implantation and delayed implantation	04
	5.2	Hormonal regulation of pregnancy	
<b>6. Parturition: Birth process and its neuroendocrine control; Puerperium</b>			03
<b>7. Lactation: Mammary glands, milk synthesis and secretion; Hormonal regulation and suckling reflex</b>			03
<b>8. Reproductive dysfunctions:</b>			
	8.1	Climacteric, anatomical, endocrine and genetic disorders	03
	8.2	Aging and reproduction	
<b>9. Artificial control of reproduction:</b>			
	9.1	Increasing reproductive potential	
	9.2	Artificial insemination, in-vitro fertilization and embryo transfer, induced breeding, synchronization of oestrus and ovulation	04
	9.3	Chemical and hormonal aspect, physical, physiological, surgical, chemical methods of contraception in male and female	
	9.4	Infertility: Causes and treatment	
<b>10. Fundamentals of histology:</b>			
	10.1	Scope and importance of Histology and Histochemistry	04
	10.2	Epithelial, connective, muscular, nervous and other specialized tissues	
<b>11. Techniques in histology:</b>			
	11.1	Procurement of tissue samples and fixation	
	11.2	Fixatives: Types of fixatives and its effects on tissue	
	11.3	Processing of fixed tissue samples: Dehydration, clearing, infiltration, embedding and block making	10
	11.4	Principles, design and functioning: Automated microtomes, ultra-microtome and cryostat; Problems and troubleshooting	
	11.5	Staining: Histochemical and immunohistological methods	
	11.6	Mordants and mordanting, temporary and permanent preparations, whole mount preparation	
<b>12. Fundamentals of histochemical techniques</b>			
	12.1	Detection of glycogen, neutral and acid mucopolysaccharides and basic proteins	08
	12.2	Detection of nonspecific esterases, specific and nonspecific lipid.	
	12.3	Detection of acid and alkaline phosphatase	
<b>13. Histology of mammalian tissue:</b>			
	13.1	Histological organization of stomach, intestine, lung, kidney, spleen, thymus, bone and bone marrow	04

## REFERENCES

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### **Course Articulation Matrix of PSZO 233: Reproductive Physiology, Histology and Histochemistry of Mammals**

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
<b>CO1</b>	3	2	2	3	2	2	3	2	2
<b>CO2</b>	2	3	2	2	1	3	2	1	2
<b>CO3</b>	2	2	2	2	2	2	2	2	2
<b>CO4</b>	3	2	2	3	2	2	3	2	2
<b>CO5</b>	2	2	1	2	3	2	2	3	1
<b>CO6</b>	2	3	2	2	2	3	2	1	2
<b>CO7</b>	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 (Analyzing 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, analyzing 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. III (w. e. f. June, 2023)

**Name of the Program: M.Sc. Zoology**

**Class: M.Sc.-II**

**Course Name: Economic Zoology**

**Number of Credits: 04**

**Program Code: PSZO**

**Semester: III**

**Course Code: PSZO 234**

**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: understand the role of different cultures in day to day life.

CO2: understand the different industries with economic profit.

CO3: 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. such as 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.

CO7: critically assess the ecological importance and conservation needs of wildlife populations. Examining coral reefs, amphibians, reptiles, birds, and mammals will enable students to understand the crucial role these creatures play in ecosystems and the challenges they face, fostering awareness of conservation efforts.

### TOPICS:

UNIT	SUB UNITS	SYLLABUS	NO. OF LECTURES
<b>1. Role of protozoa in improving agriculture soil:</b>			04
	1.1	<b>Soil protozoans:</b> a. Fungal-dominated soils b. Bacterial-dominated soils c. High clay-content soils <b>Role in agriculture-</b> a. Mineralizing nutrients b. Regulating Bacteria Population c. Fungi Controlling	
<b>2. Sponge culture and its economic importance:</b>			02
	2.1	Methods of sponge culture	
	2.2	Economic importance	
<b>3. Importance of coral reef:</b>			03

	3.1	Concept of coral reef	
	3.2	Formation of coral reefs	
	3.3	Types of coral reefs	
	3.4	Use of corals in • Medicine • Jewelry Ecotourism	
<b>4. Role of helminthes in human welfare:</b>			02
<b>5. Nematodes:</b>			
	5.1	Parasitic Nematodes of soil, plants and animals	03
	5.2	Methods of isolation, collection and identification	
<b>6. Vermiculture in India:</b>			
	6.1	Introduction to vermiculture	04
	6.2	Important species	
	6.3	Small and large scale vermiculture and precautions	
	6.4	Products	
<b>7. Insects and human welfare:</b>			
	7.1	Apiculture	10
	7.2	Sericulture	
	7.3	Lac culture	
<b>8. Aquaculture:</b>			
	8.1	Prawn farming	14
	8.2	Pearl culture	
	8.3	Fish farming and production of fish byproducts	
<b>9. Animal Husbandry:</b>			
	9.1	Introduction to poultry industry	10
	9.2	Introduction to dairy industry	
<b>10</b>	10.1	<b>Model organisms in pharmaceutical industry</b>	04
<b>11</b>	11.1	<b>Ethics and sustainable use of animals as an economic enterprise</b>	04

## REFERENCES

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### Course Articulation Matrix of PSZO 234: 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**

CO1 understand the role of different cultures in day-to-day life.CO2 understand the different industries with economic profit.CO3 develop ability to start their own 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.

**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).

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

**PO5: Trans-disciplinary knowledge**

CO1 understand the role of different cultures in life (Connecting cultural practices with animal husbandry and environmental conservation).CO6 evaluate the economic significance of various animal commodities and resources (Understanding the interplay between animal industries, economics, and public health).

**PO6: Personal and professional competence**

CO3 develop ability to start their own farms (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 life (Promoting cultural sensitivity and respect for diverse perspectives on animal interactions).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 analyse the diverse roles of invertebrates and lower chordates in human health, agriculture, and industry (Understanding the importance of biodiversity and natural ecosystems).

**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 own farms (Encouraging self-initiative and lifelong learning in agricultural practices).

## SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY Sem. III (w. e. f. June, 2023)

**Name of the Program: M.Sc. Zoology**

**Class: M. Sc. II**

**Course Name: Zoology Practical-V** (Practicals Corresponding to PSZO 231A and PSZO 232)

**Number of Credits: 04**

**Program Code: PSZO**

**Semester: III**

**Course Code: PSZO 235A**

**Number of Practicals: 10**

### Course Objectives:-

- Develop comprehensive knowledge and practical skills in insect collection, preservation, and presentation techniques.
- 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.
- Analyse 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.
- Conduct kymographic studies to analyse ventilatory movements in beetles, gaining insights into the respiratory mechanisms of insects
- Acquire expertise in the dissection of laboratory-cultured insects, specifically focusing on the digestive, nervous, and reproductive systems to understand their anatomical structures and functions.
- Assess the impact of temperature on water loss in cockroaches, gaining insights into the physiological responses of insects to environmental conditions
- Use the quadrat method to study insect populations, demonstrating proficiency in ecological techniques for assessing and analyzing insect communities in a given area.

### Course Outcomes:-

**After completion of this course, students will be able to:-**

- CO1: demonstrate advanced knowledge and practical skills in insect collection, preservation, and presentation, employ various collecting methods, apply appropriate preservation techniques for different specimen types, for research and educational purposes.
- CO2: understand 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: analyse 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.
- Demonstrate Proficiency in Insect Collection and Preservation:**
- CO4: acquire expertise in the dissection of laboratory-cultured insects, with a specific focus on the digestive, nervous, and reproductive systems. This outcome aims to ensure a deep understanding of anatomical structures and functions in insect biology.
- CO 5: comprehend the impact of temperature on water loss in cockroaches, gaining insights into the physiological responses of insects to environmental conditions. also student will able to understand how insects adapt to varying temperatures.
- CO6 demonstrate proficiency in ecological techniques for assessing and analyzing insect communities in a given area.
- CO7: focuses on the practical application of ecological methods for studying insect populations in their natural habitats.



**PRACTICALS:**

<b>Section I –PSZO 231A Entomology-I (05)</b>			
<b>Sr. No.</b>	<b>Title of the Practical</b>		<b>E/D</b>
1.	Methods of collection, preservation & presentation of insect	1P	E
2.	Dissection of digestive, nervous and reproductive system of laboratory cultured insect	2P	E
3.	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)	4P	D
4.	Temporary mounting of mouth parts, antenna, wings and appendage of laboratory cultured insect	1P	E
<b>Section II – PSZO 232 Physiology, Biochemistry and Ecology of Insects (05)</b>			
1.	Estimation of oxygen consumption in dragon fly nymph	1P	E
2.	Study of heart and haemocytes of cockroach	1P	E
3.	Estimation of the trehalase activity in haemolymph of any insect	1P	E
4.	Determination of amino acid in haemolymph of any insect by chromatographic technique	1P	E
5.	Effect of temperature on water loss in cockroach	1P	E
6.	Von Wieselings test for presence of chitin in insect cuticle	1P	E
7.	Study of insect population by quadrat method	1P	E

**Course Articulation Matrix of PSZO 235A: Zoology practical-V corresponding to PSZO 231A and PSZO 232**

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

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

**PO1: Disciplinary Knowledge (PO1)**

CO 1 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 (PO2)**

CO2 consist of 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 (PO3)**

CO3 involve analyzing specialized head structures and appendages often involve collaboration and discussion within groups, fostering communication and teamwork skills, contributing to PO3 development.

**PO4: Research-related skills and Scientific temper**

CO 4 involves 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**

CO 5 consists of 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**

CO 6 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 involve 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 (PO8)**

CO2, CO5 involve 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 (PO9)**

CO 1, CO3 involve mastering insect collection, dissection, and analysis techniques in stills self-directed learning habits and equips students with the skills to independently explore entomological concepts, contributing to PO9.

## SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY Sem. III (w. e. f. June, 2023)

**Name of the Program: M.Sc. Zoology**

**Class: M. Sc. II**

**Course Name: Zoology Practical-V** (Practicals Corresponding to PSZO 231B and PSZO 232)

**Number of Credits: 04**

**Program Code: PSZO**

**Semester: III**

**Course Code: PSZO 235B**

**Number of Practicals: 10**

### Course Objectives:-

- Develop proficiency in laboratory techniques for the accurate estimation of serum uric acid, enhancing skills in biochemical analysis and understanding the clinical significance of uric acid levels.
- Gain a comprehensive understanding of absorption spectra principles and their application in analyzing blood pigments, fostering knowledge about the optical properties of biological molecules in blood.
- Explore the physiological responses of earthworms to osmotic stress, specifically focusing on changes in volume. Develop practical skills in studying the impact of environmental factors on organismal physiology.
- Acquire practical skills in estimating carbohydrates in the mammalian gut, emphasizing the importance of carbohydrate analysis in the context of digestive processes and nutrient absorption.
- Acquire expertise in the dissection of laboratory-cultured insects, specifically focusing on the digestive, nervous, and reproductive systems to understand their anatomical structures and functions.
- Understand the impact of temperature on water loss in cockroaches, gaining insights into the physiological responses of insects to environmental conditions
- Use the quadrat method to study insect populations, demonstrating proficiency in ecological techniques for assessing and analyzing insect communities in a given area.

### Course Outcomes:

**After completion of this course, students will be able to:-**

- CO1: develop proficiency in laboratory techniques for accurately estimating serum uric acid levels.
- CO2: gain a comprehensive understanding of absorption spectra principles and their application in analyzing blood pigments. This outcome aims to foster knowledge about the optical properties of biological molecules in blood, enabling a thorough interpretation of spectroscopic data.
- CO3: develop practical skills in studying the physiological responses of earthworms to osmotic stress, with a specific focus on changes in volume.
- CO4: acquire practical skills in estimating carbohydrates in the mammalian gut, emphasizing the importance of carbohydrate analysis in the context of digestive processes and nutrient absorption.
- CO5: comprehend the impact of temperature on water loss in cockroaches, gaining insights into the physiological responses of insects to environmental conditions. also student will able to understand how insects adapt to varying temperatures.
- CO6: demonstrate proficiency in ecological techniques for assessing and analyzing insect communities in a given area.
- CO7: focuses on the practical application of ecological methods for studying insect populations in their natural habitats.

### PRACTICALS:

Section I –PSZO 231B Animal Physiology-I (05)			
Sr. No.	Title of the Practical		E/D
1.	Estimation serum uric acid	1P	E
2.	Absorption spectra of blood pigment	1P	E
3.	Study of osmotic stress and volume change in earthworm	1P	E
4.	Estimation of carbohydrates in mammalian gut	1P	E

5.	Effect of starvation on liver and muscle glycogen in mouse	2P	E
6.	Measurement of lung capacity	1P	E
7.	Effect of pH, temperature and incubation on human salivary amylase activity	1P	E
8.	Effect of exercise on breathing rate, pulse rate and blood lactate of man	1P	D
9.	Mapping of taste areas on human tongue	1P	E
10.	Preparation of glycerinated muscle fibers and study of its properties	1P	E
11.	Introduction to Clinical Trials Registry- India (CTRI) database	1P	D
<b>Section II – PSZO 232 Physiology, Biochemistry and Ecology of Insects (05)</b>			
1.	Estimation of Oxygen consumption in dragon fly nymph	1P	E
2.	Study of heart and haemocytes of cockroach	1P	E
3.	Estimation of the trehalase activity in haemolymph of any insect	1P	E
4.	Determination of Amino acid in haemolymph of any insect by chromatographic technique	1P	E
5.	Effect of temperature on water loss in cockroach	1P	E
6.	Von Wisselings test for presence of chitin in insect cuticle	1P	E
7.	Study of insect population by quadrat method	1P	E

**Course Articulation Matrix of PSZO 235B: Zoology practical-V corresponding to PSZO 231B and PSZO 232**

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

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

**PO1: Disciplinary Knowledge**

CO1 directly aligns with PO1 the objective by ensuring that students not only gain theoretical knowledge but also practical proficiency in the laboratory techniques necessary for accurate serum uric acid estimation.

**PO2: Critical Thinking and Problem Solving (PO2)**

CO2 aligns with the objective by ensuring that students not only grasp the theoretical principles of absorption spectra but also apply this knowledge to analyze blood pigments. This strengthens PO2 through practical application of problem-solving skills in a scientific context.

**PO3: Social Competence**

CO3 directly align with PO3 fulfil the objective by emphasizing the development of practical skills in studying physiological responses to osmotic stress. The focus on changes in volume ensures that students can apply their knowledge to real-world scenarios, demonstrating a practical understanding of organismal physiology.

**PO4: Research-related skills and Scientific temper**

CO 4 aligns with PO4 by emphasizing the acquisition of practical skills in carbohydrate estimation. Understanding the importance of carbohydrate analysis in digestive processes and nutrient absorption ensures that students can apply their knowledge to investigate dietary contributions to metabolic health.

**PO5: Trans-disciplinary knowledge**

CO 5 directly supports the PO4 by ensuring that students acquire expertise in the dissection of laboratory-cultured insects. Focusing on the digestive, nervous, and reproductive systems enhances their understanding of insect anatomy and function, aligning with the overall goal of the objective.

**PO6: Personal and professional competence**

CO6 provides insights into the physiological responses of cockroaches to temperature variations, especially in terms of water loss. This aligns with the objective's focus on understanding how insects adapt to environmental conditions.

**PO7: Effective Citizenship and Ethics (PO7)**

CO7 involve 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 (PO8)**

CO2, CO5 involve 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 (PO9)**

CO 1, CO3 involve mastering insect collection, dissection, and analysis techniques in stills self-directed learning habits and equips students with the skills to independently explore entomological concepts, contributing to PO9.





## SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY Sem. III (w. e. f. June, 2023)

**Name of the Program: M.Sc. Zoology**

**Class: M. Sc. II**

**Course Name: Zoology Practical-V** (Practicals Corresponding to PSZO 231C and PSZO 232)

**Number of Credits: 04**

**Program Code: PSZO**

**Semester: III**

**Course Code: PSZO 235C**

**Number of Practicals: 10**

### Course Objectives:-

- Develop a solid understanding of the principles and methods involved in the analysis of metric traits. Gain proficiency in the estimation of phenotypic variance to evaluate and interpret the variation present within a population.
- Acquire knowledge and practical skills in partitioning phenotypic variance into genetic and nongenetic components in a simulated population
- Gain expertise in the detection of variation within a population using biochemical methods, such as enzyme and protein analysis. Understand the principles and techniques involved in assessing population diversity at the biochemical level.
- Explore Population Cage Experiments and Genetic Manipulation in *Drosophila* and develop practical skills in manipulating and analyzing genetic factors within a controlled environment.
- Acquire expertise in the dissection of laboratory-cultured insects, specifically focusing on the digestive, nervous, and reproductive systems to understand their anatomical structures and functions.
- Understand the impact of temperature on water loss in cockroaches, gaining insights into the physiological responses of insects to environmental conditions.
- Use the quadrat method to study insect populations, demonstrating proficiency in ecological techniques for assessing and analyzing insect communities in a given area.

### Course Outcomes:

**After completion of this course, students will be able to:-**

- CO1: demonstrate proficiency in the analysis of metric traits, including the ability to measure and analyze phenotypic variance. They will develop skills in statistical methods for assessing variability within a population.
- CO2: gain a comprehensive understanding of the process of partitioning phenotypic variance into genetic and nongenetic components. They will be able to estimate Dominance Genetic Deviation (DGD) and interpret its implications for genetic variation in populations.
- CO3: acquire expertise in using biochemical methods, such as enzyme and protein analysis, to detect and quantify variation within a population.
- CO4: develop practical skills in conducting population cage experiments using *Drosophila*. Additionally, they will become proficient in genetic manipulation, including the extraction of genomic DNA, to study and modify genetic factors in *Drosophila* populations.
- CO5: comprehend the impact of temperature on water loss in cockroaches, gaining insights into the physiological responses of insects to environmental conditions. also student will be able to understand how insects adapt to varying temperatures.
- CO6 demonstrate proficiency in ecological techniques for assessing and analyzing insect communities in a given area.
- CO7: focuses on the practical application of ecological methods for studying insect populations in their natural habitats.

### PRACTICALS:

Section I –PSZO 231C Genetics-I (Any 05)			
Sr. No.	Title of the Practical		E/D
1.	Analysis of metric trait and estimation of phenotypic variance.	1P	E

2.	Partitioning of phenotypic variance in genetic and nongenetic components in a simulated population. Estimation of DGD	1P	D
3.	Detection of extent of variation in a population – Biochemical (Enzyme, protein etc.)	1P	E
4.	To study population cage experiments using <i>Drosophila</i> : a) Genetic Drift b) Artificial selection- Experimental simulation and modeling	1P	D
5.	Extraction of Genomic DNA from <i>Drosophila</i> .	2P	E
6.	Microbial genetics: Basic methodology, colony count, growth curve	2P	E
7.	Microbial genetics: Isolation of Auxotroph (Estimation of frequency), Replica plate technique.	2P	E
8.	Bacterial transformation and blue white selection. Calculation of transformation efficiency.	2P	E
9.	Study of conventions of nomenclature of genes and gene products in different model systems.	2P	D
10.	Extraction of genomic DNA of bacteria	2P	E
11.	Gene mapping by interrupted mating in bacteria	1P	D
12.	Isolation of mutant bacteria by UV Exposure	2P	E

### Section II – PSZO 232 Physiology, Biochemistry and Ecology of Insects (05)

1.	Estimation of Oxygen consumption in dragon fly nymph	1P	E
2.	Study of heart and haemocytes of cockroach	1P	E
3.	Estimation of the trehalase activity in haemolymph of any insect	1P	E
4.	Determination of Amino acid in haemolymph of any insect by chromatographic technique	1P	E
5.	Effect of temperature on water loss in cockroach	1P	E
6.	Von Wisselings test for presence of chitin in insect cuticle	1P	E
7.	Study of insect population by quadrat method	1P	E

### Course Articulation Matrix of PSZO 235C: Zoology practical-V corresponding to PSZO 231C and PSZO 232

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

CO1 demonstrate proficiency in the analysis of metric traits, including the ability to measure and analyze phenotypic variance. Align with PO1 to develop skills in statistical methods for assessing variability within a population.

#### PO2: Critical Thinking and Problem Solving

CO2 align with PO1 in estimating Dominance Genetic Deviation (DGD) requires critical thinking skills to interpret complex genetic data, contributing to the development of problem-solving abilities.

**PO3: Social Competence**

CO 3 acquires expertise in using biochemical methods, such as enzyme and protein analysis, to detect and quantify variation within a population contributing to PO3 development.

**PO4: Research-related skills and Scientific temper**

CO 4 able to Develop practical skills in conducting population cage experiments using *Drosophila*. Additionally, they will become proficient in genetic manipulation, including the extraction of genomic DNA, to study and modify genetic factors in *Drosophila* populations. This strengthens PO4 by developing scientific temper and research skills.

**PO5: Trans-disciplinary knowledge**

CO 5 applying quantitative genetics techniques connects entomology with broader concepts in genetics and statistics, enriching understanding beyond discipline boundaries.

**PO6: Personal and professional competence**

CO 6 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**

CO 7 able to understand the physiological adaptations of aquatic insects to environmental changes raises awareness of ecological issues and the importance of environmental stewardship, contributing to responsible citizenship.

**PO 8: Environment and Sustainability**

CO1, CO4 and CO5 able to understand 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, CO2, CO3 and CO 4 contributing mastering insect collection, dissection, and analysis techniques instils self-directed learning habits and equips students with the skills to independently explore entomological concepts.



तुळजाराम चतुरचंद महाविद्यालय, बारामती

## SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY Sem. III (w. e. f. June, 2023)

**Name of the Program: M.Sc. Zoology**

**Program Code: PSZO**

**Class: M. Sc. II**

**Semester: III**

**Course Name: Zoology Practical-VI** (Practicals Corresponding to PSZO 233 and PSZO 234)

**Course Code: PSZO 236**

**Number of Credits: 04**

**Number of Practicals: 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 analyse 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: 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: 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: 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: develop proficiency in detecting enzymes, including acid phosphatase, alkaline phosphatase, and esterase. They will understand the principles of enzyme detection methods and their applications in biological research.
- CO5: 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: study various types of tissues using permanent slides and develop the ability to identify and analyse different tissue structures, including epithelial, connective, muscular, and nervous tissues. They will become proficient in tissue analysis techniques.
- CO7: 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 –PSZO 233 Reproductive Physiology, Histology and Histochemistry of Mammals (05)			
Sr. No.	Title of the Practical		E/D
1.	Anatomy of male and female reproductive system in rat/mice	1P	D
2.	Histology of male and female reproductive organs	1P	D
3.	Vaginal smear technique in mice	1P	E
4.	Ovarectomy in white rats	1P	D
5.	Study of placenta	1P	D
6.	Study of sperm morphology	1P	E
7.	Study of sperm count	1P	E
8.	Study of types tissue (Permanent slides)	1P	D
9.	Study of histology	2P	E
10.	Detection of acid phosphatase, alkaline phosphatase and esterases	1P	E
11.	Nucleic acid staining: Methyl Green Pyronine and Feulgen stain	1P	E
12.	Staining of Mucopolysaccharides	1P	E
13.	Staining of lipids by Sudan Black B	1P	E
Section II – PSZO 234 Economic Zoology (05)			
1.	Study of apiculture equipments	1P	D
2.	Temporary mounting of silk gland from silk moth larva	1P	E
3.	Study of poultry breeds and equipments used in poultry farm	1P	D
4.	A visit to pearl farming centre / apiculture centre / sericulture centre / poultry farm	1P	E
5.	Study of fishing crafts and gears	1P	E
6.	Collection and identification of locally available / cultured fishes	1P	E
7.	Sample collection, isolation, preservation and identification of soil / plant / animal nematodes	1P	E
8.	Setting and maintenance of bee box in college garden (activity based)		

### Course Articulation Matrix of PSZO 236: Zoology Practical-VI Corresponding to PSZO 233 and PSZO 234) 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

#### PO 1: Disciplinary Knowledge

CO1 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 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 align with PO3 in 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.

**PO4: Research-related skills and Scientific temper**

CO4 involves 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 connects reproductive physiology and histology with broader concepts in biology, chemistry, and environmental science. Analysing prawn culture practices bridges the gap between laboratory work and real-world applications, contributing to PO5 development.

**PO6: Personal and professional competence**

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 involve ethical implications of animal research and responsible laboratory practices foster responsible citizenship. Additionally, studying prawn culture raises awareness of sustainable aquaculture practices, contributing to PO7 development.

**PO8 Environment and Sustainability**

CO 1, CO5, CO 6, involve 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, CO 3, CO 4, CO5, and CO 6 align with PO 9 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.