

Anekant Education Society's

**TULJARAM CHATURCHAND COLLEGE**  
**OF ARTS, SCIENCE & COMMERCE, BARAMATI.**  
**(AUTONOMOUS INSTITUTE)**



**SYLLABUS**  
**SECOND YEAR B.Sc. ZOOLOGY**  
**ACADEMIC YEAR 2020 - 2021**  
**SEMESTER - III**

Anekant Education Society's  
**TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE &  
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AUTONOMOUS**

**Scheme of Course Structure (CBCS)**

**Faculty of Science**

**Department of Zoology**

**SEMESTER- III**

**Class: S.Y.B.Sc.**

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

<b>Sr. No.</b>	<b>Code</b>	<b>Paper</b>	<b>Paper Title</b>	<b>Credit</b>	<b>Exam</b>	<b>Marks</b>
1	ZOO 2301	<b>Theory</b>	<b>Animal Systematics and Diversity – III</b>	<b>3</b>	I / E	<b>40 + 60</b>
2	ZOO 2302	<b>Theory</b>	<b>Applied Zoology- I</b>	<b>3</b>	I / E	<b>40 + 60</b>
3	ZOO 2303	<b>Practical</b>	<b>Zoology Practical-III</b>	<b>2</b>	I / E	<b>40 + 60</b>

**SEMESTER- IV**

<b>Sr. No.</b>	<b>Code</b>	<b>Paper</b>	<b>Paper Title</b>	<b>Credit</b>	<b>Exam</b>	<b>Marks</b>
1	ZOO 2401	<b>Theory</b>	<b>Animal Systematics and Diversity - IV</b>	<b>3</b>	I / E	<b>40 + 60</b>
2	ZOO 2402	<b>Theory</b>	<b>Applied Zoology- II</b>	<b>3</b>	I / E	<b>40 + 60</b>
3	ZOO 2403	<b>Practical</b>	<b>Zoology Practical-IV</b>	<b>2</b>	I / E	<b>40 + 60</b>

**I A\* - Internal Assessment**

**E A\* - External Assessment**

# SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY (w. e. f. June, 2020)

Academic Year 2020 - 2021

Class: S.Y. B.Sc. (Semester: III)

Paper code: ZOO: 2301

Paper: I

Title of Paper: Animal Systematics and Diversity-III

Credits: 03

Number of Lectures: 48

## Learning Objectives:-

- Identify and classify major invertebrate phyla based on key morphological features.
- Explain the concept of metamorphosis and its significance in insect life cycles.
- Analyze the functional morphology of different mouthparts in insects and their correlation with feeding strategies.
- Understand the ecological role of mimicry in insects and their predators.
- Describe the process of bioluminescence in insects and its diverse functions.
- Analyze the economic importance of insects in agriculture, food production, and pest control.
- Apply the acquired knowledge about Housefly (*Musca domestica*) to understand its ecological and public health significance.

## Learning Outcomes:-

After completion of this course students will be able to -

- CO1: classify and characterize major invertebrate phyla: Students will be able to identify and describe the key morphological features of major invertebrate using taxonomic keys and diagrams.
- CO2: explain the concept and types of insect metamorphosis: Students will understand the different types of insect metamorphosis (e.g., complete, incomplete, hemimetabolic) and their significance in insect life cycles, including adaptation, survival, and resource utilization.
- CO3: analyze and correlate mouthpart morphology with feeding strategies: Students will be able to compare and contrast the morphology of different insect mouthparts (e.g., mandibles, maxillae, labrum) and relate them to diverse feeding strategies (e.g., herbivory, predation, parasitism).
- CO4: critically evaluate the role of mimicry in insect ecology: Students will analyze the ecological benefits and limitations of mimicry in insects (e.g., Batesian, Müllerian mimicry) and its impact on predator-prey interactions.
- CO5: describe and explain mechanisms of insect bioluminescence: Students will be able to explain the process of bioluminescence in fireflies and other insects, including the chemical reactions involved, and its diverse functions (e.g., mate attraction, defense, communication).
- CO6: assess the economic impact of insects on agriculture and pest control: Students will evaluate the economic benefits of insects as pollinators and food sources, as well as their detrimental role as crop pests, and the use of insect-based pest control strategies.
- CO7: apply knowledge of Housefly (*Musca domestica*) to its ecological and public health significance: Students will understand the ecological role of the Housefly (e.g., decomposition, nutrient cycling), its breeding habits, and its potential transmission of diseases, allowing them to evaluate its public health impact and control measures.

## TOPICS:

<b>Unit1</b>	<b>Salient features and classification upto classes of the following: (any two examples from each class):</b>	<b>12</b>
	1.1 Arthropoda :- Crustacea, Arachnida, Insecta, Myriapoda, Onychophora.	
	1.2 Mollusca:- Aplacophora, Gastropoda, Pelecypoda, Scaphopoda, Cephalopoda.	
	1.3 Echinodermata:- Asteroidea, Ophuroidea, Holothuria, Echinoidea, Crinoidea.	
<b>Unit2</b>	<b>General topics:</b>	

	2.1 Metamorphosis, Mouthparts, Mimicry, Bioluminescence and Economic importance w. r. t. Insects.	24
	2.2 Pearl formation in Bivalve, Pearl culture in India, Buoyancy modulation in Nautilus, Camouflage in Cephalopods.	
	2.3. Autotomy and regeneration in Echinoderms, Water vascular System and locomotion in Echinoderms.	
<b>Unit3</b>	<b>Study of Housefly:</b>	<b>12</b>
	3.1 Systematic position, Habits and habitat.	
	3.2 External Morphology.	
	3.3 Digestive system.	
	3.4 Reproductive system.	
	3.5 Nervous system and sense organs- Antenna, Compound eye and Halter. 3.6 Pest status, Control measures, Economic importance.	

### References:

1. Textbook of Invertebrate Zoology, by Kotpal, RL. Rastogi and Co., Meerut.
2. Phylum Arthropoda by Kotpal, RL., Rastogi and Co. Meerut.
3. Phylum Mollusca by Kotpal, RL., Rastogi and Co. Meerut.
4. Phylum Echinodermata by Kotpal, RL., Rastogi and Co. Meerut.
5. General Zoology by Goodnight and others IBH Publishing Co.
6. Invertebrate zoology By Jordan EL., and Verma PS., S. Chand and Co., NewDelhi.
7. Life of Invertebrates by Prasad,SN, Vikas Publishing House, New Delhi.
8. Zoology by S.A. Miller and J.P. Harley –Tata McGraw Hill Co.
9. Invertebrates, Richard Brusca, Sinauer Associates, Inc., Sunderland, USA.
10. Invertebrate Zoology by Dhami and Dhami.
11. Biology of the Invertebrates, Jan A. Pechenik, McGraw Hill Education.

### **Course Articulation Matrix of ZOO: 2301: Animal Systematics and Diversity – III** **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	2	1	3	1	2	2
<b>CO2</b>	3	3	2	2	1	3	2	1	2
<b>CO3</b>	2	3	3	3	1	2	2	2	2
<b>CO4</b>	2	3	3	2	2	2	2	2	2
<b>CO5</b>	1	3	1	3	2	2	2	1	2
<b>CO6</b>	3	3	2	2	2	3	2	2	3
<b>CO7</b>	2	3	3	2	1	2	2	2	2

#### **PO1 (Disciplinary Knowledge):**

COs 1-7 are directly related to understanding and applying knowledge of different aspects of invertebrate biology, including classification, metamorphosis, mouthpart morphology, mimicry, bioluminescence, and ecological significance.

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

All COs involve critical thinking and problem-solving skills, such as identifying key morphological features, understanding insect metamorphosis, analyzing mouthpart morphology, evaluating mimicry, explaining bioluminescence, and assessing economic impacts.

#### **PO3 (Social Competence):**

COs 1, 2, 3, 4, and 6 involve social competence as they require students to analyze and understand the ecological and social aspects of insects, including their roles, interactions, and impact on agriculture.

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

COs 1, 3, 4, 5, and 6 involve research-related skills and the development of a scientific temper, as they require students to analyze, explain, and evaluate various aspects of invertebrate biology.

**PO5 (Trans-disciplinary knowledge):**

COs 1, 3, 4, and 6 have trans-disciplinary knowledge elements as they involve understanding the ecological, economic, and social aspects of invertebrates beyond just biological concepts.

**PO6 (Personal and professional competence):**

COs 2, 3, 4, 5, and 6 contribute to personal and professional competence by enhancing students' understanding of insect biology and its applications.

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

COs 4, 5, 6, and 7 involve ethical considerations and understanding the impact of insects on agriculture, ecology, and public health, contributing to effective citizenship.

**PO8 (Environment and Sustainability):**

COs 1, 2, 6, and 7 have direct relevance to understanding the environmental and sustainability aspects related to invertebrate biology.

**PO9 (Self-directed and Life-long learning):**

COs 2, 4, 5, 6, and 7 contribute to the development of self-directed and life-long learning skills, as they involve understanding diverse aspects of invertebrate biology and its applications.

## SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY (w. e. f. June, 2020)

Academic Year 2020 - 2021

**Class: S.Y. B.Sc. (Semester: III)**

**Paper code: ZOO: 2302**

**Paper: II**

**Credits: 03**

**Title of Paper: Applied Zoology –I**

**Number of Lectures: 48**

### **Learning Objectives:-**

- Knowledge of Fisheries: Students will gain a thorough understanding of fisheries, including different types of ponds, habitat and culture methods for freshwater fish like Rohu, Catla, and Mrigal, and fish preservation techniques like chilling, freezing, salting, and canning.
- Aquarium Maintenance Skills: Students will develop the skills necessary for successful aquarium maintenance, including choosing appropriate species, understanding their biology (Guppy, Molly, Goldfish), identifying common characteristics and sexual dimorphism in marine fish like Anemonefish and Butterflyfish, and managing food and feeding with live and formulated fish feed.
- Pest Management Understanding: Students will be equipped with knowledge about agricultural pests, including their types (agricultural, household, stored grain, etc.) and control methods (physical, mechanical, chemical, and biological). They will learn about major insect pests like Jowar stem borer and Rice weevil, and non-insect pests like rats, crabs, snails, and birds.
- Dairy Science Knowledge: Students will gain insights into dairy development in India, its role in rural economy and employment generation, and the various processes involved in dairy processing like filtration, cooling, chilling, clarification, pasteurization, and freezing.
- Milk and Milk Products Understanding: Students will learn about the composition of milk, different types of milk (buffalo, cow, whole, toned), and various milk products.
- Indian Cattle Breeds Familiarity: Students will be introduced to prominent Indian cattle breeds like Malvi, Hariyana, Deoni, Red Sindhi, and Khillari, and their characteristics.
- Exotic Cattle Breeds Awareness: Students will gain basic knowledge about popular exotic cattle breeds like Jersey and Holstein.

### **Learning Outcomes:-**

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

- CO1: successfully manage and maintain an aquarium environment for both freshwater and marine fish species. (Combines knowledge from Aquarium Maintenance Skills)
- CO2: develop and implement sustainable pest management strategies for agricultural crops, considering various pest types and control methods. (Combines knowledge from Pest Management Understanding)
- CO3: analyze the economic and social significance of dairy development in India, and describe the key processes involved in milk production and processing. (Combines knowledge from Dairy Science Knowledge and Milk and Milk Products Understanding)
- CO4: differentiate between common Indian cattle breeds (Malvi, Hariyana, Deoni, Red Sindhi, Khillari) based on their characteristics and identify their suitability for different purposes. (Combines knowledge from Indian Cattle Breeds Familiarity)
- CO5: evaluate the potential benefits and drawbacks of incorporating exotic cattle breeds (Jersey, Holstein) into Indian dairy farming practices. (Combines knowledge from Exotic Cattle Breeds Awareness and Dairy Science Knowledge)
- CO6: design and implement an effective fish farming system, including pond selection, habitat management, fish culture techniques for Rohu, Catla, and Mrigal, and appropriate fish preservation methods. (Combines knowledge from Knowledge of Fisheries)
- CO7: explain the nutritional value and composition of various milk types (buffalo, cow, whole, toned) and discuss the production processes of common milk products. (Combines knowledge from Milk and Milk Products Understanding).

**TOPICS:**

<b>Unit No.</b>	<b>Title and Contents</b>	<b>No. of Lectures</b>
<b>Unit-I</b>	<b>Fisheries:</b>	
	1.1 An introduction to fisheries	1
	1.2 Different types of ponds used in fishery : Nursery pond, Rearing pond, Stock pond	2
	1.3 Habit, habitat and culture methods of following freshwater forms : a) Rohu ( <i>Labeo rohita</i> ) b) Catla ( <i>Catla catla</i> ) c) Mrigal ( <i>Cirrhinus mrigala</i> )	
	1.4 Fish preservation technique : a) Chilling b) Freezing c) Salting d) Canning	3
	<b>1.5 Aquarium maintenance</b>	
	1.5.1 Introduction and scope	
	1.5.2 Exotic and Endemic species	2
	1.5.3 <b>Biology of Aquarium Fishes-</b> • Guppy • Molly • Gold fish	2 2
	Common characters and sexual dimorphism Marine fishes - • Anemone fish • Butterfly fish	2
Food and feeding- • Live fish feed • Formulated fish feed	2	
General Aquarium maintenance- budget for setting up an aquarium Fish Farm.	3	





- HillPublication, 1988.
12. Agricultural Insect Pests of India and their Control, Dennis S.Hill, CambridgeUniversity Press.
  13. Applied Entomology. Vol. I & II. K.P. Srivastava. Kalyani Publication, Ludhiyana,New Dehli.
  14. Principles of Insect Pest Management. G.S. Dhaliwal and Ramesh Arora, KalyaniPublications, Ludhiyana.
  15. Pest Management and Pesticides: Indian Scenario. Editor- B. Vasantaraj David,Namrutha Publications, Madras (Chennai).
  16. Concepts of Insect Control. Ghosh M.R. Wiley Eastern Ltd. New Dehli.
  17. Candler, W., & Kumar, N. (1998). India: The dairy revolution: The impact of dairy development in Indiaand the World Bank's contribution. World Bank Publications.
  18. Park, Y. W., & Haenlein, G. F. (Eds.). (2013). Milk and dairy products in human nutrition: production,composition and health. John Wiley & Sons.
  19. Venkatasubramanian, V., Singh, A. K., & Rao, S. V. N. (2003). Dairy development in India: Anappraisal of challenges and achievements. Concept Publishing Company.
  20. Shrivastava, J. S. M. (2008). Dairy Development In The New Millennium (The Second White Revolution). Deep and Deep Publications.

**Course Articulation Matrix of ZOO 2302: APPLIED ZOOLOGY I**  
**Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related**

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

**PO1: Disciplinary Knowledge:**

All Cos directly mapped to PO1. For example, CO1 combines knowledge from Aquarium Maintenance Skills to successfully manage and maintain an aquarium environment for diverse fish species. CO2 combines knowledge from Pest Management Understanding to develop and implement sustainable pest management strategies for various crops and pest types.

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

All Cos directly mapped to PO2. For example, CO1: Requires critical thinking to analyse aquarium water parameters, identify potential problems, and implement appropriate solutions for maintaining a healthy environment. CO2 demands critical analysis of different pest management strategies to choose the most effective and sustainable method for specific crops and pest types.

**PO3: Social Competence:**

CO3, CO5, and CO7 involve understanding the social and economic implications of dairy development and milk production, demonstrating social awareness.

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

CO2, CO3, CO5, and CO6 require research skills to gather information, analyze data, and draw conclusions. They also promote scientific temper through evidence-based decision making.

**PO5: Trans-disciplinary knowledge:**

CO3, CO5, and CO6 integrate knowledge from various disciplines like agriculture, economics, environment, and biology for comprehensive understanding and decision making.

**PO6: Personal and professional competence:**

All COs contribute to personal and professional development through acquiring practical skills, knowledge, and problem-solving abilities relevant to various careers.

**PO7: Effective Citizenship and Ethics:**

CO2, CO3, and CO5 encourage responsible resource management, sustainable practices, and ethical considerations in agricultural and animal husbandry practices.

**PO8: Environment and Sustainability:**

CO2, CO6, and CO7 promote environmental awareness and sustainable practices in agricultural pest management, fish farming, and milk production.

**PO9: Self-directed and Life-long learning:**

All COs encourage self-directed learning through research, problem-solving, and continuous knowledge acquisition in various fields related to agriculture, animal husbandry, and environmental sustainability.

## SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY (w. e. f. June, 2020)

Academic Year 2020 - 2021

Class: S.Y. B.Sc. (Semester: III)

Paper code: ZOO: 2303

Paper: III

Credits: 02

Title of Paper: Zoology Practical-III

No. of Practicals: Any 10

### Learning Objectives:-

- Classify common invertebrates up to class level: This objective emphasizes understanding the taxonomic hierarchy and key features of Phyla Arthropoda, Mollusca, and Echinodermata using examples like Butterfly, Scorpion, Pila, Octopus, Sea Star, and Feather Star.
- Dissect and analyse the external morphology of Housefly: This objective focuses on developing dissection skills and identifying key anatomical structures of the Housefly, including mouthparts, antenna, and haltere.
- Prepare temporary and permanent mounts of Housefly structures: This objective emphasizes practical skills in specimen preparation for microscopic examination and long-term preservation of Housefly mouthparts, antenna, and haltere.
- Understand the digestive and reproductive systems of Housefly: This objective focuses on internal anatomy and function, including the digestive tract and reproductive organs of male and female Housefly.
- Identify and classify commercially important fish: This objective emphasizes economic significance and taxonomic knowledge of Rohu, Catla, and Mrigal fish species.
- Recognize agricultural insect pests and their impact: This objective focuses on identifying Jowar stem borer and Rice weevil based on their morphology, damage patterns, and economic impact on crops.
- Apply knowledge of dairy products and aquarium management: This objective emphasizes practical skills in extracting casein from milk, measuring milk density, preparing dairy products like paneer, falooda, or ice cream, and understanding aquarium maintenance with different equipment, filtration types, gravel, air pumps, lighting, plants, and fish varieties.

### Learning Outcomes:-

After completion of this course students will be able to -

- CO1: classify invertebrates into Phyla Arthropoda, Mollusca, and Echinodermata based on key features and examples (butterfly, scorpion, snail, octopus, sea star).
- CO2: dissect and identify major anatomical structures of the Housefly (mouthparts, antenna, haltere) using proper dissection techniques.
- CO3: prepare temporary and permanent mounts of Housefly structures (mouthparts, antenna, haltere) for microscopic examination and preservation.
- CO4: explain the function and structure of the Housefly's digestive system (mouth, crop, gizzard, midgut, hindgut) and reproductive system (male and female organs).
- CO5: identify commercially important fish species like Rohu, Catla, and Mrigal based on their physical characteristics and economic significance.
- CO6: Differentiate agricultural insect pests like Jowar stem borer and Rice weevil based on morphology, damage patterns, and their impact on crop yield.
- CO7: apply knowledge of dairy product preparation (paneer, falooda, ice cream) by extracting casein, measuring milk density, and practicing hygienic methods.

### TOPICS:

PRACTICAL NO. / TITLE OF PRACTICAL		
1.	To study the classification up to class with reasons of the following: Phylum Arthropoda- <i>Butterfly, Scorpion</i> . Phylum Mollusca- <i>Pila, Octopus</i> . Phylum Echinodermata – <i>Sea star, Feather star</i> .	(D)
2.	Study of External Morphology of Housefly.	(D)

3.	Temporary/Permanent Mountings of housefly- a) Mouthparts, b) Antenna c) Halter	(E)
4.	Study of Digestive system of Housefly:	(D)
5.	Study of Male & Female Reproductive system of Housefly.	(D)
6.	Identification, Classification and study of habit, habitat and economic importance of the following: • Rohu, Catla, Mrigal	(D)
7.	Study of insect pests with respect to marks of identification, nature of damage and economic importance : • Jowar stem borer • Rice weevil	(D)
8.	Extraction of Casein from Milk and its confirmatory test.	(E)
9.	Measurement of density of milk using different samples by Lactometer	(E)
10.	Preparation of paneer/ falooda /icecream from given milk sample.	(E)
11.	Aquarium maintenance –equipments required to set up –Types of filter, type of gravel, air pump, type of bulb, net, varieties of aquarium plants, varieties of fishes.	(D)
12.	Submission of short project report on Economics of Fishery/Agricultural pests/Aquarium setting/Dairy (Activity based practical) (with necessary pictures).	(E)
13.	Compulsory visit to biodiversity spot/fishery farm/dairy farm /aquaculture and submit report of the same.	(E)

**\*D=Demonstration, E=Experiment.**

- **Maintenance of good laboratory record (Journal) along with visit report by the student is mandatory.**

### **REFERENCES:**

1. Practical Zoology of Invertebrates by S. S. Lal.
2. Practical Zoology of Vertebrates by S. S. Lal.
3. Practical Zoology Vol-3 by N Arumugamm and A. Mani.
4. Practical Zoology of Invertebrates by Jordan and Verma.
5. Practical Zoology of Vertebrates by Jordan and Verma.
6. Practical Zoology of Cell Biology by S. S. Lal.
7. *i* Genetics- Molecular Approach, 3rd Ed. by Peter J. Russell, Pearson.

**Course Articulation Matrix of ZOO: 2303: ZOOLOGY PRACTICAL- III**  
**Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related**

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

#### **PO1: Disciplinary Knowledge:**

- All Cos are directly mapped to PO1. For example, CO1 requires in depth knowledge for classifying invertebrates into phyla requires understanding key features and distinguishing characteristics, demonstrating knowledge within zoology. CO7 requires knowledge of dairy product preparation shows comprehension of dairy science concepts like casein extraction, milk properties, and hygiene practices.

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

CO1: Analysing and applying criteria for classifying invertebrates requires critical thinking to differentiate and categorize. CO2 and CO3: Dissecting, identifying, and mounting structures involve careful planning, observation, and problem-solving skills. CO4: Explaining the function of systems necessitates critical analysis of structure and function relationships.

**PO3: Social Competence:**

CO2 and CO3: Dissecting and preparing mounts often involve teamwork and collaboration, fostering communication and social skills. CO7: Working in a hygienic environment and practicing safe food handling techniques demonstrate awareness of social responsibility and ethical conduct.

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

CO2, CO3, and CO4 requires skills for dissecting, mounting, and analysing structures, involves observation, data collection, and interpretation, fostering research skills.

**PO5: Trans-disciplinary knowledge:**

CO1: Understanding the classification of invertebrates connects zoology to evolutionary biology and ecology. CO4: Explaining the Housefly's digestive and reproductive systems connects insect biology to human physiology and health.

**PO6: Personal and professional competence:**

CO4 and CO5: Explaining complex systems and identifying species require effective communication and presentation skills. CO6 and CO7: Differentiating pests and applying dairy science principles demonstrate problem-solving skills and the ability to apply knowledge in practical settings.

**PO7: Effective Citizenship and Ethics:**

CO2 and CO3: Practicing proper dissection techniques and waste disposal demonstrates awareness of environmental responsibility and ethical conduct in scientific research. CO7: Emphasizing hygiene and safe food handling practices in dairy preparation demonstrates ethical considerations for public health and safety.

**PO8: Environment and Sustainability:**

CO1: Understanding the role of invertebrates in ecosystems connects zoological knowledge to environmental awareness. CO6: Identifying and managing agricultural pests demonstrates awareness of sustainable agricultural practices and environmental protection.

**PO9: Self-directed and Life-long learning:**

CO2, CO3, and CO4: Independent research and analysis of Housefly structures and systems encourage self-directed learning and a questioning approach. CO5, CO6, and CO7: Applying knowledge in diverse contexts and seeking solutions to agricultural and food-related challenges promote lifelong learning and adaptability.