

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 - IV

तुळजाराम चतुरचंद महाविद्यालय, बारामती

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

**Scheme of Course Structure (CBCS)**

**Faculty of Science**

**Department of Zoology**

**SEMESTER- IV**

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

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

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

**SEMESTER- IV**

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

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**IA\* - Internal Assessment**  
**EA\* - 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: IV)

Paper code: ZOO: 2401

Paper: I

Title of Paper: Animal Systematics and Diversity-IV

Number of Lectures: 48

Credits: 03

### Learning Objectives:-

- Demonstrate an understanding of the general characteristics and classification of Reptilia, Aves, and Mammalia, including key features and two examples from each class and their sub-classes.
- Explain and analyze the adaptations of reptiles to desert environments, the structure of their poison apparatus, the composition and effects of snake venom, and the methods of antivenin administration for the treatment of snake bites.
- Investigate and comprehend the phenomenon of bird migration, the structural components of feathers, the principles behind birds as flying machines, and the mechanisms of flight.
- Explore the unique features of egg-laying mammals, aquatic mammals, and flying mammals, understanding the specialized adaptations that enable them to thrive in their respective environments.
- Analyze the systematic position, habit, and habitat of *Labeo rohita*, an important fish species.
- Examine the external characters and sexual dimorphism of *Labeo rohita*, emphasizing key morphological differences between males and females.
- Describe and compare the digestive system, food habits, feeding behaviors, and physiological aspects of digestion in *Labeo rohita*. Additionally, provide brief overviews of the circulatory and respiratory systems, nervous system, sense organs, and reproductive systems (male and female) of *Labeo rohita*.

### Learning Outcomes:-

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

CO1: identify and classify reptiles, birds, and mammals, and give two examples of each class.

CO2: describe the adaptations of reptiles to desert life, and explain the function of the poison apparatus, snake venom, and antivenin.

CO3: explain the phenomenon of bird migration, and describe the structure of feathers and their role in flight.

CO4: identify the different types of egg-laying mammals, aquatic mammals, and flying mammals.

CO5: describe the systematic position, habitat, and external characters of *Labeo rohita*.

CO6: explain the digestive system, food, feeding habits, and physiology of digestion of *Labeo rohita*.

CO7: describe the circulatory, respiratory, nervous, and reproductive systems of *Labeo rohita*.

### TOPICS:

Unit 1	<b>General characters and classification of following classes and their sub-classes with two examples of each:</b> 1.1 Reptilia1.2 Aves1.3 Mammalia	12
Unit 2	<b>General topics:</b> 2.1 Desert adaptations in reptiles, poison apparatus, snake venom, antivenin (cure of snake bite), First aid, treatment of snake bite.2.2 Bird migration, structure of feathers, Birds as flying machines, Mechanism of flight.2.3 Egg laying mammals, Aquatic mammals, Flying mammals.	16
Unit 3	<b>Study of <i>Labeo rohita</i>:</b> 3.1 Systematic position, Habit and habitat3.2 External characters and sexual dimorphism3.3 Digestive system, food, feeding and physiology of digestion3.4 Circulatory & Respiratory system in brief.3.5 Nervous system.3.6 Sense organs3.7 Reproductive systems (male & female)	20

### REFERENCES



1. Animal Diversity by Kershaw, DR., Redwood Burn Ltd., Trowbridge
2. Textbook of Zoology by Parker J. and Haswell, W., ELBS Edition
3. Functional Organization of chordates (part I and II) by Nigam HC. And Sobti, R., S. Chand and Co., New Delhi
4. Textbook of Vertebrate Zoology by Prasad, SN., Kashyap, V., New Age India Publishers, New Delhi
5. Modern Textbook of Zoology, Vertebrates by Kotpal, RL., Rastogi and Co. Meerut
6. Biology of Animals by Ganguly, BB., Sinha, A.K., Adhikari, S., New Central Book Agency, Kolkata
7. General Zoology by Goodnight and others IBH Publishing Co.
8. Life of Vertebrates by Young, JZ, III Edition, Clarendon Press, London.
9. Animal Diversity by Kershaw, DR., Redwood Burn Ltd., Trowbridge
10. Textbook of Zoology by Vidyarthi, Agrasia Publishers, Agra.
11. Chordate Zoology by Jordan EL., and Verma PS., S. Chand and Co., New Delhi.
12. Functional Organization of chordates (part I and II) by Nigam HC. And Sobti, R., S. Chand and Co., New Delhi.
13. This is Biology: The Science of Living world, Mayr, M. Universities Press Ltd.
14. J.R.B. Alfred and Ramakrishna Collection, Preservation and Identification of animals Zoological Survey of India Publications.

**Course Articulation Matrix of ZOO2401: Animal Systematics & Diversity-IV**  
**Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related**

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

**PO1: Disciplinary Knowledge**

All the Course Outcomes (CO1 to CO6) are explicitly designed to enhance disciplinary knowledge in the field of biology. Whether it's taxonomic proficiency, ecological knowledge application, avian biology understanding, comparative analysis of reproductive strategies, in-depth study of a specific species, or practical application of taxonomic knowledge, each CO directly contributes to deepening understanding within the discipline.

**PO2: Critical Thinking and Problem Solving**

Each Course Outcome emphasizes critical thinking and problem-solving skills. For example, taxonomic proficiency, ecological knowledge application, avian biology understanding, comparative analysis of reproductive strategies, and practical application of taxonomic knowledge all require students to engage in analytical thinking and problem-solving, thereby aligning with PO2.

**PO3: Social Competence**

While not all Course Outcomes directly address social competence, certain aspects such as avian biology understanding and the application of ecological knowledge have social relevance. Understanding bird biology and ecosystems contributes to social competence, though it might not be the primary focus of the course.

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

All Course Outcomes involve aspects of research-related skills and the cultivation of a scientific temper. Whether it's conducting taxonomic studies, ecological applications, avian biology research, or in-depth species studies, students engage in scientific inquiry and the development of research skills.

**PO5: Trans-disciplinary knowledge**

While the primary focus is on disciplinary knowledge in biology, there are moderate connections to trans-disciplinary knowledge. For instance, ecology (CO2) and avian biology understanding (CO3) can bridge into various disciplines, providing a broader understanding that goes beyond the traditional boundaries of biology.

**PO6: Personal and professional competence**

All Course Outcomes contribute to personal and professional competence. Mastery of taxonomic knowledge, practical applications, and in-depth studies enhances the professional competence of individuals interested in fields such as ecology, ornithology, and taxonomy. Additionally, the continuous learning aspect (PO9) contributes to personal growth and professional development.

**PO7: Effective Citizenship and Ethics**

Effective citizenship and ethical considerations are addressed, particularly in CO2 (Application of Ecological Knowledge), CO3 (Avian Biology Understanding), and CO4 (Comparative Analysis of Reproductive Strategies). These aspects highlight the societal implications of ecological decisions, bird conservation, and ethical considerations in biological research.

**PO8: Environment and Sustainability**

Environmental considerations and sustainability are addressed in various Course Outcomes, especially in CO2 (Application of Ecological Knowledge), CO3 (Avian Biology Understanding), and CO5 (In-depth Study of *Labeo rohita*). These outcomes contribute to understanding the impact of biological practices on the environment.

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

Every Course Outcome, from taxonomic proficiency to practical applications and in-depth studies, necessitates a commitment to continuous learning. The evolving nature of biological sciences demands a self-directed and life-long learning approach, aligning well with PO9.

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

Academic Year 2020 - 2021

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

Paper code: ZOO: 2402

Paper: II

Credits: 03

Title of Paper: Applied Zoology - II

Number of Lectures: 48

### Learning Objectives:-

- To identify and describe the different species of bees used in apiculture, including *Apis dorsata*, *Apis indica*, *Apis floreae*, *Apis mellifera*, and *Trigona* species.
- To compare and contrast the advantages and disadvantages of traditional and modern methods of apiculture.
- To explain the life cycle of a honey bee, including the different stages of development (egg, larva, pupa, adult) and the roles of the different castes (queen, worker, drone).
- To describe the different ways in which bees communicate with each other, such as through dances, pheromones, and sounds.
- To identify and use the different beekeeping equipment, such as bee boxes, honey extractors, smokers, bee veils, gloves, hive tools, bee brushes, queen excluders.
- To describe the different bee products and their uses, such as honey, wax, bee venom, propolis, royal jelly, and pollen grains.
- To identify and control the different diseases and enemies of bees, such as bee diseases (protozoan, bacterial, fungal), bee pests (wax moth, wax beetle), and bee enemies (bee eater, king crow, wasp, lizard, bear, man).

### Learning Outcomes:-

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

- CO1: gain the foundational knowledge and skills to start and manage their own beekeeping or silk farming business. They understand factors like equipment costs, product marketing, and economic viability.
- CO2: appreciate the role of bees and silkworms in sustainable agriculture practices, including pollination for food crops and soil enrichment through sericulture waste.
- CO3: develop a deeper understanding of bee and silkworm ecology, recognizing their roles in ecosystem health and the potential threats they face from habitat loss and climate change.
- CO4: able to learn about honey production and its significance in food security and dietary diversification, particularly in rural areas.
- CO5: grasp the potential of beekeeping and sericulture to create income and livelihood opportunities in rural communities, fostering entrepreneurship and economic empowerment.
- CO6: develop basic scientific skills through studying bee and silkworm biology, life cycles, and disease management, promoting critical thinking and research abilities.
- CO7: develop an ethical understanding of animal welfare in beekeeping and sericulture, considering factors like hive management, pest control, and sustainable practices.

Unit No.	Title and Contents	No. of Lectures
Unit-I	<b>Apiculture :</b>  1.1 An introduction to Apiculture, Study of habit, habitat and nesting behavior of <i>Apis dorsata</i> , <i>Apis indica</i> , <i>Apis floreae</i> , <i>Apis mellifera</i> And <i>Trigona</i> species 1.2 Advantages and disadvantages of traditional and modern methods of apiculture.  1.3 Life cycle, Colony organization and division of labour, Polymorphism 1.4 Bee behaviour and bee communication.	24



	<p>1.5 Bee keeping equipments : a) Bee box (Langstroth type) b)Honey extractor c) Smoker d) Bee-veil e) Gloves f) Hivetool g) Bee Brush h) Queen excluder</p> <p>1.6 Bee keeping and seasonal management.</p> <p>1.7 Bee products (collection methods, composition and uses:a) Honey b) Wax c) Bee Venom d) Propolis e) Royal jellyf) Pollen grains</p> <p>1.8 Diseases and enemies of Bees:<b>a)</b> Bee diseases – Protozoan, Bacterial, Fungal – with two examples.<b>b)</b> Bee pests – Wax moth (Greater and Lesser), Wax beetle.<b>c)</b> Bee Enemies – Bee eater, King crow, Wasp, Lizard, Bear, Man.</p> <p>1.9 Bee pollination, Selection of flora and bees for apiculture</p>	
<p><b>Unit - II</b></p>	<p><b>Sericulture:</b></p> <p>2.1 An Introduction and its scope , Study of different types of silk moths, their distribution and varieties of silk produced by Mulberry, Tassar, Eri and Muga silk worms in India.</p> <p>2.2 External morphology and life cycle of <i>Bombyx mori</i>.</p> <p>2.3 Cultivation of mulberry (moriculture): a) Varieties for cultivation,b) Rainfed and irrigated mulberry cultivation – Fertilize schedule, Pruning.</p> <p>2.4 Harvesting of mulberry: a) Leaf plucking b) Branch cutting c) Whole shoot cutting.</p> <p>2.5 Quality of silk, factors influencing the quality of silk, market value, commercial aspects</p> <p>2.6 Silk worm rearing: a) Types of rearing b) Rearing house c) Rearing techniques d) Important diseases and pests.</p> <p>2.7 Post harvest processing of cocoons: a) Harvesting and Preparation of cocoons for marketing b) Stiffling, Sorting, Storage, Deflossing and Riddling c) Cocoon cooking, Reeling and Rereeling, Washing and Polishing.</p> <p>2.8 Prospects of Sericulture in India</p>	<p>24</p>

### REFERENCES

1. Destructive and useful Insects, their habit and Control, 1973. C.L. Metcalf and W. p. Flint, Tata McGraw Hill Publications, New Dehli.
2. A Text Book Of Entomology, 1974. V.K. Mathur and K.D. Upadhayay, Goel Printing Press, Barani.
3. Imm's Text Book of Entomology, Vol I & II, Richard and Owen.
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Bombay, Calcutta.

5. Bee and Bee Keeping, 1978, Roger A. Morse, Conell University Press, London.
6. The Behaviour & Social Life of Honey Bees, C.R. Ribbandas, Dover Publication inc. New York.
7. Principal of Sericulture, 1994. Hisao Arguo, Oxford & Co.
8. An Introduction of Sericulture, 1995. G.Ganga, J. Sulochana, Oxford & IBH Publication Co. Bambay.
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10. Biology of Insects- 1992 SaxenaS. C. Oxford and IBH Publishing CoNew Delhi. Bombay. Calcutta
11. A Text Book of Entomology- 1974Mathur V. K. and Upadhayay KGoel Printing press, Barani.
12. Bee and Bee Keeping- Roger A. Morse, Conell University PressLondon

**Course Articulation Matrix of ZOO2402: APPLIED ZOOLOGY - II**  
**Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related**

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

**PO1: Disciplinary Knowledge**

All Course Outcomes are designed to provide a comprehensive understanding of apiculture principles, critical evaluation of methods, proficiency in bee life cycle and colony dynamics, understanding bee behavior and communication, practical knowledge of beekeeping equipment, and the application of seasonal beekeeping management. These collectively contribute significantly to disciplinary knowledge in apiculture.

**PO2: Critical Thinking and Problem Solving**

Each Course Outcome involves critical thinking and problem-solving skills. For instance, critical evaluation of apiculture methods, understanding bee behavior and communication, and application of seasonal beekeeping management all require students to engage in analytical thinking and decision-making, aligning well with the critical thinking outcome.

**PO3: Social Competence**

While the direct link to social competence is limited in this context, aspects like effective citizenship and ethics are addressed to some extent in Course Outcomes such as critical evaluation of apiculture methods, where ethical considerations may be involved.

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

All Course Outcomes involve research-related skills, scientific temper, and a systematic approach to understanding apiculture. Whether it's critically evaluating methods, understanding bee behavior, or applying seasonal beekeeping management, students engage in research-oriented practices.



**PO5: Trans-disciplinary knowledge**

The primary focus of the course is on disciplinary knowledge in apiculture. While there might be connections to related fields, the direct link to trans-disciplinary knowledge is limited in this specific context.

**PO6: Personal and professional competence**

The Course Outcomes contribute indirectly to personal and professional competence. For example, a comprehensive understanding of apiculture principles and practical knowledge of beekeeping equipment directly enhances personal and professional competence.

**PO7: Effective Citizenship and Ethics**

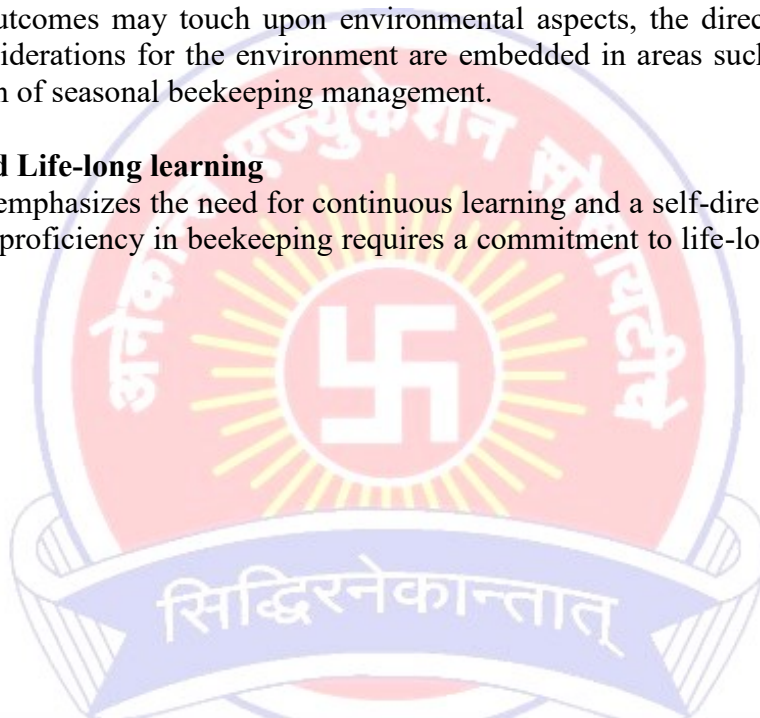
Effective citizenship and ethics are addressed, particularly in Course Outcomes such as critical evaluation of apiculture methods, where ethical considerations in beekeeping practices may be discussed.

**PO8: Environment and Sustainability**

While some Course Outcomes may touch upon environmental aspects, the direct link to sustainability is limited. However, considerations for the environment are embedded in areas such as critical evaluation of methods and application of seasonal beekeeping management.

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

Each Course Outcome emphasizes the need for continuous learning and a self-directed approach. Apiculture is a dynamic field, and proficiency in beekeeping requires a commitment to life-long learning, aligning well with PO9.



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

Academic Year 2020 - 2021

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

Paper code: ZOO: 2403

Paper: I

Credits: 03

Title of Paper: Zoology Practical -IV

Number of Practicals: 10

### Learning Objectives:-

- To understand and classify various animals, including reptiles and birds into their respective taxonomic classes based on their characteristics and features.
- To examine and analyze the adaptations in birds' beaks and feet, as well as external characters, digestive system, and brains of fish.
- To explore the life cycles and unique characteristics of important insects like the honey bee and silk moth.
- To gain the practical knowledge of the beekeeping.
- To gain the practical knowledge of the sericulture.
- To conduct a hands-on project that investigates the economics of beekeeping and sericulture, and creates a short project report with visuals.

### Learning Outcomes:-

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

- CO1: Gain practical experience in classifying animals based on physical characteristics and applying biological knowledge to real-world specimens.
- CO2: Develop a deeper understanding of internal organ systems and their functions in different animals.
- CO3: use microscopes to observe minute structures and gain insights into cellular morphology.
- CO4: Visit biodiversity spots, apiaries, or sericulture farms allows students to observe organisms in their natural habitat and gain practical experience in field-based data collection and analysis.
- CO5: Complete the project on beekeeping/sericulture economics encourages students to research, analyze data, and present findings in a structured report, developing project management and communication skills.
- CO6: Gain insights into the economic potential of beekeeping and sericulture, recognizing their contributions to rural livelihoods and sustainable agriculture.
- CO7: Study bee life cycles and sericulture processes can instill an understanding of the delicate balance of ecosystems and the interdependence of organisms, promoting environmental awareness.

### Practicals:

PRACTICAL NO. / TITLE OF PRACTICAL		
1.	To study the classification with reasons the following animals: Class: Reptilia- Cobra, Garden lizard, Turtle, Rat snake, Draco	(D)
2.	To study the classification with reasons the following animals: Class: Aves- Sparrow, Crow, Wood pecker, Parrot, Class: Mammalia- Rabbit, Mongoose, Kangaroo	(D)
3.	Study of External characters and digestive system of <i>Labeo rohita</i>	(E)
4.	Study of Brain of <i>Labeo rohita</i> :	(E)
5.	Temporary preparation of- a) Cycloid scales from <i>Labeo rohita</i> b) Eye ball muscles	(E)
6.	Study of life cycle of Honey bee (D)	(D)
7.	Study of mouth parts, thoracic appendages (legs and wings) and sting apparatus of Honey bee (E)	(E)
8.	Study of various bee keeping equipments (Any five equipments) (D)	(D)
9.	Study of: a) bee products, b) bee pests, d) bee enemies (D)	(D)
10.	a) Study of life cycle of <i>Bombyx mori</i> . (D) b) Study of any five equipments in Sericulture.	(D)

11.	Submission of short project report on Economics of Bee keeping/sericulture (Activity based practical) (with necessary pictures).	(E)
12.	Compulsory visit to biodiversity spot/sea shore/apiculture/sericulture farm and submit report of the same.	(E)

**Course Articulation Matrix of ZOO2403: ZOOLOGY PRACTICAL - III**  
**Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related**

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

**PO1: Disciplinary Knowledge**

All Course Outcomes contribute directly to disciplinary knowledge in biology, anatomy, neuroanatomy, histology, entomology, and practical skills in apiculture and sericulture. The comprehensive coverage of taxonomic proficiency, anatomical understanding, neuroanatomical analysis, histological proficiency, and entomological analysis ensures a strong foundation in disciplinary knowledge.

**PO2: Critical Thinking and Problem Solving**

Each Course Outcome emphasizes critical thinking and problem-solving skills. Whether it's taxonomic proficiency, anatomical understanding, neuroanatomical analysis, histological proficiency, or entomological analysis, students are required to analyze information, interpret data, and solve problems, aligning well with PO2.

**PO3: Social Competence**

The direct link to social competence is limited in this context. However, aspects of effective citizenship and ethics are addressed in Course Outcomes related to taxonomic proficiency and practical skills in apiculture and sericulture, where ethical considerations in biological research and beekeeping practices may be discussed.

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

Each Course Outcome involves research-related skills and promotes a scientific temper. From taxonomic proficiency to neuroanatomical analysis and histological proficiency, students engage in systematic observation, analysis, and interpretation of biological structures and phenomena.

**PO5: Trans-disciplinary knowledge**

While the primary focus is on disciplinary knowledge, the connection to trans-disciplinary knowledge is limited. However, elements of trans-disciplinary knowledge may emerge in the application of skills and principles across different biological disciplines, especially in courses related to taxonomic proficiency and practical skills in apiculture and sericulture.

**PO6: Personal and professional competence**

Each Course Outcome indirectly contributes to personal and professional competence. The acquisition of taxonomic proficiency, anatomical understanding, neuroanatomical analysis, and practical skills in apiculture and sericulture enhances students' competence in biological research and applications.

**PO7: Effective Citizenship and Ethics**

The direct link to effective citizenship and ethics is limited, but some aspects are addressed in Course Outcomes related to taxonomic proficiency and practical skills in apiculture and sericulture. Ethical



considerations in biological research and beekeeping practices may be discussed, contributing to ethical awareness.

**PO8: Environment and Sustainability**

While some Course Outcomes may touch upon environmental aspects, the direct link to sustainability is limited. However, considerations for the environment are embedded in areas such as taxonomic proficiency and practical skills in apiculture and sericulture.

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

Each Course Outcome emphasizes the need for continuous learning and a self-directed approach. Whether it's staying updated with taxonomic classifications, understanding new findings in neuroanatomy, or keeping abreast of developments in apiculture and sericulture, students are encouraged to engage in life-long learning.



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