Anekant Education Society's

Tuljaram Chaturchand College

of Arts, Science & Commerce, Baramati

(Autonomous)

Four Year B.Sc. Degree Program in Zoology

(Faculty of Science & Technology)

CBCS Syllabus

S.Y. B.Sc. (Zoology) Semester -IV

For Department of Zoology

Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020 [NEP1.0])

To be implemented from Academic Year 2024-2025

Title of the Programme: S. Y. B. Sc. (Zoology)

Preamble

AES's Tuljaram Chaturchand College has made the decision to change the syllabus of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Zoology and related subjects, the Board of Studies in Zoology at Tuljaram Chaturchand College, Baramati - Pune, has developed the curriculum for the first semester of **S. Y. B. Sc. Zoology,** which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023.

After completion of B.Sc. in Zoology enrolled students will acquire complete disciplinary knowledge as well as allied branches of Zoology. At the end of programme, students may possess expertise which will provide them competitive advantage in pursuing higher studies within India or abroad; and seek jobs in academia, civil administration, research or industries. Students will be able to define and explain major concepts in the

biological sciences. They will be able to correctly use biological instrumentation and proper laboratory techniques; to communicate biological knowledge in oral and written form; to identify the relationship between structure and function at all levels: molecular, cellular, tissue, organ, system and organismal.

Students should be able to identify, classify and differentiate diverse non-chordates and chordates based on their basic morphological, anatomical biochemical and molecular characters. They will also be able to describe economic, ecological and medical significance of various animals in human life. This programme will create a curiosity and awareness among students to explore the animal diversity and take up wild life photography or wild life exploration as a career option. The procedural knowledge about identification and classification of animals will provide students professional advantages in seeking the jobs in fields of teaching, research and taxonomy in various private & public organizations; including Zoological Survey of India and National Parks/Sanctuaries. Students will be able to apply the scientific methods to answer questions in biology by formulating testable hypotheses, gathering data that address these hypotheses, and analyzing those data to assess the degree to which their scientific work supports their hypotheses. Students will be able to present scientific hypotheses and data both orally and in writing in the conventional formats that are in practice. Students will be able to access the primary literature, identify relevant works for a particular topic, and evaluate the scientific content of these works. Acquired practical skills in biotechnology, biostatistics, bioinformatics and molecular biology can be used to pursue career as a scientist in drug development industry in India or abroad.

The students will be acquiring basic experimental skills in various techniques in the fields of genetics; molecular biology; biotechnology; entomology, physiology, qualitative and quantitative microscopy; and analytical biochemistry. These methodologies will provide an extra edge to our students, who wish to undertake higher studies. Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped animal morphology, physiology, life history, and behavior. Students will be able to explain how organisms function at the level of the gene, genome, cell, tissue, organ and organ-system. Drawing upon this knowledge, they will be able to give specific examples of the physiological adaptations, development, reproduction and behaviour of different animals. Students will be able to analyse the ecological relationships of life on earth by tracing energy and nutrient flows through the ecosystems. They will be able to establish the relationship between the physical

features of the environment and the structure of populations, communities, and ecosystems. Students undertaking skill enhancement courses like aquaculture, sericulture and apiculture will inculcate skills involved in rearing fish, bees and silk moth which would help them to generate self-employment making them successful entrepreneurs. Acquired skills indiagnostic testing, haematology, histopathology, staining procedures etc. used in clinical and research laboratories will make them eligible to work in diagnostic or research laboratories. B.Sc. Zoology graduates will find opportunities in public services departments, NGOs, environmental agencies, universities, colleges, biotechnological, pharmaceutical, environmental / ecological fields.

There are numerous career opportunities for candidates completing their B.Sc., M.Sc. and Ph.D. in Zoology in public and private sector. Candidates may find jobs as Animal Behaviourist, Conservationist, Wildlife Biologist, Zoo Curator, Wildlife Educator, Zoology teacher, Forensic experts, Lab technicians, Veterinarians, etc. Overall, revising the Zoology syllabus in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

Programme Specific Outcomes (PSOs)

PSO1. Disciplinary Knowledge: Understand the basic concepts of various branches of Zoology like Cell Biology, Genetics, Taxonomy, Physiology, Biochemistry, Molecular Biology, Embryology, Developmental Biology, Immunology, Ecology and Applied Zoology.

PSO2. Critical thinking and problem solving: Analyze the relationships of animals with abiotic factors and different biotic factors like plants and microbes. They will able to interpret the pathogen based upon symptoms of disease.

PSO3. Individual and Teamwork: Sets up the experiments and performs the same as per laboratory standards in different fields of Zoology like Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, Clinical science, tools and techniques of Zoology, Toxicology, Entomology, Nematology, Sericulture, Biochemistry, Ichthyology, Animal biotechnology, Immunology, Physiology and research methodology.

PSO4. Research related skills and scientific temper: Propose hypothesis, formulate tests, use various modern instruments for biological analysis, data collection and field surveys and interprets the data and find answers.

PSO5. Critical Thinking: Recognizes the relationships between structure and functions at different levels of biological organization (e.g., molecules, cells, organs, organisms, populations, and species) for animals.

PSO6. Development of Observation Skills: Distinguishes different ecosystems (e.g., terrestrial, freshwater, marine) based on biological, chemical, and physical features; Correlates the morphology, physiology, behaviour with the properties of habitat.

PSO7. Ethics and Effective Citizenship: Contributes the knowledge for sustainable development and nation building.

PSO8. Management Skills: Exhibits management skills in applied branches of Zoology like Apiculture, Sericulture, Aquaculture and Agriculture.

PSO9. Environmental Ethics and Sustainability: Explains the broad understanding of ecosystems, biodiversity and their conservation.

PSO10. Identification of critical problems and issues: Detect the causes and consequences of biodiversity depletion.

Anekant Education Society's
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Board of Studies (BoS) in Zoology

From 2022-23 to 2024-25

Sr. No.	Name	Designation
1.	Dr. Sandip P. Chordiya	Chairman
2.	Dr. Vitthal B. Nale	Member
3.	Dr. Deepali M. Sangale	Member
4.	Dr. Sunil N. Pokale	Vice-Chancellor Nominee
5.	Dr. Gulab D. Khedkar	Expert from other University
6.	Dr. Sanjay K. Gaikwad	Expert from other University
7.	Dr. Yogesh A. Karpe	Industry Expert
8.	Mr. Kishor U. More	Member
9.	Dr. Sameer S. Jadhav	Member
10.	Miss. Sharvari S. Shah	Invitee member
11.	Miss. Shaheen M. Shaikh	Invitee member
12.	Mr. Bipin B. Jagtap	Meritorious Alumni
13.	Mr. Subodh M. Nikam	Student Representative
14.	Ms. Sana J. Sayyad	Student Representative

Course & Credit Distribution Structure for S.Y.B.Sc. –From A.Y. 2024-2025 (Zoology)

Sem	Course Category	Course Code	Course Title	Theory / Practical	Credits
III	Major mandatory	ZOO-201-MJM	Animal Systematics & Diversity-III	T	2
	Major mandatory	ZOO-202-MJM	Applied Zoology-I	T	2
	Major mandatory	ZOO-203-MJM	Ecology	T	2
	Major mandatory	ZOO-204-MJM	Zoology Practical-III	P	2
	Minor	ZOO-211-MN	Sericulture	T	2
	Minor	ZOO-212-MN	Sericulture Lab	P	2
	Open Elective	ZOO-216-OE	मधमाशापालन	T	2
	Vocational Skill Course (VEC)	ZOO-221-VSC	Toxicology	T	2
	Ability Enhancement Course (AEC)	MAR/HIN/SAN-231-AEC	भाषिक उपयोजन व लेखन कौशल्ये हिंदी भाषा : सृजन कौशल प्राथमिक संभाषणकौशल्यम्	T	2
	Field Project	ZOO-235-FP	Field Project	P	2
	Co-curricular course (CC)	YOG/PES/CUL/NSS/NCC-239-CC	To be selected from basket	T	2
	Generic IKS	GEN-245-IKS		T	2
			Total Credits (Semester-III)		24
IV					
	Major mandatory	ZOO-251-MJM	Animal Systematics & Diversity-IV	T	2
	Major mandatory	ZOO-252-MJM	Applied Zoology- II	T	2
	Major mandatory	ZOO-253-MJM	Environmental Biology	T	2
	Major mandatory	ZOO-254-MJM	Zoology Practical-IV	P	2
	Minor	ZOO-261-MN	Dairy Science	T	2
	Minor	ZOO-262-MN	Dairy Science Lab	P	2
	Open Elective	ZOO-266-OE	मधुमक्षिका पालन प्रात्यक्षिक	P	2
	Skill Enhancement Course (SEC)	ZOO-276-SEC	Toxicology Lab	P	2
	Ability Enhancement Course (AEC)	MAR/HIN/SAN-281-AEC	लेखन निर्मिती व परीक्षण कौशल्ये हिंदी भाषा : संप्रेषण कौशल प्रगत संभाषणकौशल्यम्	T	2
	Community Engagement Project	ZOO-285-CEP	Community Engagement Project	P	2
	Co-curricular course (CC)	YOG/PES/CUL/NSS/NCC-289-CC	To be selected from basket	T	2
			Total Credits (Semester-IV)		22
	Cumulative Credits- Semester III + IV				46

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2024)

Name of the Program: B.Sc. Zoology
Program Code: ZOO
Class: S.Y. B.Sc.
Semester: IV
Course Type: Major (Mandatory) Theory
Course Code: ZOO-251-MJM
Course Name: Animal Systematics & Diversity-IV
Number of Credits: 02
Number of Teaching hours: 30

Course Objectives:

- Understand the general characteristics and classification of Reptilia, Aves, and Mammalia
- Differentiate between poisonous and non-poisonous snakes
- Analyze bird migration and vocalization
- Examine the unique mammalian adaptations
- Study the biology of *Labeo rohita*
- Explore the digestive, circulatory, and respiratory systems of *Labeo rohita*
- Explore the nervous and reproductive systems of *Labeo rohita*

Course Outcomes:

Student will be able to-

CO1: classify and describe Reptilia, Aves, and Mammalia based on their general characteristics.
CO2: identify and distinguish between poisonous and non-poisonous snakes create awareness in society.
CO3: explain the mechanisms and patterns of bird migration and vocalization.
CO4: assess the unique adaptations of egg-laying, aquatic, and flying mammals.
CO5: detail the systematic position, habit, and habitat of *Labeo rohita*.
CO6: describe the anatomy and physiology of the digestive, circulatory, and respiratory systems in *Labeo rohita*.
CO7: explain the structure and function of the nervous and reproductive systems in *Labeo rohita*.

TOPICS:

Unit No.	Subunit No.	Details	Teaching Hours
1. General characters and classification of following classes and their sub-classes with two examples of each			**12**
	1.1	Reptilia	4
	1.2	Aves	4
	1.3	Mammalia	4
2. General topics			**07**
	2.1	Poisonous and non-poisonous snakes; first aid for snakebite	2
	2.2	Bird migration; Syrinx in birds	2
	2.3	Egg laying mammals, aquatic mammals and flying mammals.	3
3. Study of *Labeo rohita*			**11**
	3.1	Systematic position, habit and habitat	1
	3.2	External characters and sexual dimorphism	1
	3.3	Digestive system, food, feeding and physiology of digestion	2
	3.4	Circulatory & Respiratory system in brief.	3

	3.5	Nervous system.	2
	3.6	Reproductive system	2

REFERENCES

1. Blackwelder, R. E. (2019). Handbook of Animal Diversity. CRC Press.
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3. Kotpal, R. L. (2010). Modern text book of zoology: vertebrates. Rastogi Publications.
4. Mayr, E. (1997). This is biology: The science of the living world. Universities Press.
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Course Articulation Matrix of ZOO-251-MJM: Animal Systematics and Diversity-IV
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2	3	1	3	1	3	1	1	1	1	1	1
CO2	3	2	3	1	3	1	3	1	1	1	1	1	1
CO3	3	2	1	1	3	1	3	1	1	1	1	1	1
CO4	3	2	2	2	3	1	3	1	1	2	1	1	1
CO5	3	2	1	2	3	1	3	1	1	1	1	1	1
CO6	3	2	1	2	3	2	3	1	1	1	1	1	1
CO7	3	1	1	2	3	2	3	1	1	1	1	1	1

PO1: Comprehensive knowledge and understanding
CO1, CO3, CO4, CO5, CO6, CO7 contribute strongly due to the focus on detailed understanding of biological systems and classifications.

PO2: Practical, professional, and procedural knowledge
CO1, CO2, CO3, CO4, CO5, CO6 contribute moderately as they involve practical application of biological knowledge.

PO3: Entrepreneurial mindset and knowledge
CO1, CO3, CO4 contribute moderately too strongly as they might involve understanding unique traits and adaptations, relevant for entrepreneurial applications in biology.

PO4: Specialized skills and competencies
CO1 requires specialized knowledge in taxonomy to correctly classify and describe different animal classes. Understanding these classifications involves specific biological expertise, which is a part of specialized skills.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO1, CO3, CO4, CO5, CO6, CO7 contribute strongly due to the focus on analyzing and applying biological knowledge.

PO6: Communication skills and collaboration
CO1, CO3, CO4 contribute moderately as they involve explaining biological concepts, which can enhance communication skills.

PO7: Research-related skills
CO1, CO3, CO4, CO5, CO6, CO7 contribute strongly as they involve understanding and analyzing complex biological systems.

PO8: Learning how to learn skills
CO3, CO4 contribute moderately as they involve understanding biological mechanisms and adaptations, fostering self-directed learning.

PO9: Digital and technological skills
The entire COs are poorly maps with PO9 because, the COs are centered around traditional biological research and knowledge, which generally do not involve significant use of digital tools or technological applications. The COs focus on understanding and analyzing biological systems and species through direct, hands-on methods rather than leveraging digital technologies for data analysis, modeling, or research enhancements**.**

PO10: Multicultural competence, inclusive spirit, and empathy
CO4 contributes moderately through understanding diverse biological adaptations, which may foster a broader perspective.

PO11: Value inculcation and environmental awareness
CO4 contributes moderately as understanding unique adaptations of animals promotes awareness of biodiversity and environmental value.

PO12: Autonomy, responsibility, and accountability
CO6, CO7 contribute strongly as they involve detailed understanding of systems, which requires responsibility and accountability in research.

PO13: Community engagement and service
CO2 poorly maps with PO13 because, while identifying and distinguishing between poisonous and non-poisonous snakes can enhance community safety and awareness.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2024)

Name of the Program: B.Sc. Zoology
Program Code: ZOO
Class: S.Y. B.Sc.
Semester: IV
Course Type: Major (Mandatory) Theory
Course Code: ZOO-252-MJM
Course Name: Applied Zoology - II
Number of Credits: 02
Number of Teaching hours: 30

Course Objectives:

- To disseminate information on economic aspects of zoology like apiculture, sericulture.
- To encourage young learners for self-employment.
- To comprehend the functioning of apiculture sericulture industry and its scope in India.
- To study the honey bee species and bee products
- To study the varieties of silk-worms and host plants.
- To critically study the life history and rearing of *Bombyx mori*.
- To study the post harvesting processes in sericulture

Course Outcomes:

Student will be able to-

CO1: acquire sound knowledge on different components of sericulture & bee keeping industry
CO2: identify different honey bee & silkworm species.
CO3: explain the tools & techniques used in apiculture & sericulture.
CO4: illustrate the diseases of honey bee & silkworm.
CO5: explain the economic importance of apiculture & sericulture.
CO6: get acquaint about communication system among the casts in the colony.
CO7: gain insights of post harvesting processes in sericulture and startup their small business.

TOPICS:

Unit No.	Subunit No.	Details	Teaching Hours
1. Apiculture	1.1	Study of habit, habitat and nesting behaviour of *Apis dorsata, Apis indica, Apis florae* and *Apis mellifera* species	**02**
	1.2	Life cycle, colony organization and division of labour, Polymorphism	**02**
	1.3	Bee behaviour and bee communication.	**03**
	1.4	Bee keeping equipments: a) Bee box (Langstroth type) b) Honey extractor c) Smoker d) Bee-veil e) Gloves f) Hive tool g) Bee Brush h) Queen excluder	**02**
	1.5	Bee products (collection methods, composition and uses: a) Honey b) Wax c) Bee Venom d) Propolis e) Royal jelly f) Pollen grains	**03**
	1.6	Diseases and enemies of Bees: a) Bee diseases – Protozoan, Bacterial, Fungal – with one example. b) Bee pests – Wax moth (Greater and Lesser), Wax beetle. c) Bee Enemies – Bee eater, King crow, Wasp, Lizard,	**03**

		Bear, Man.	
2. Sericulture	2.1	Study of different types of silk moths, their distribution and varieties of silk produced by Mulberry, Tassar, Eri and Muga silk worms in India.	**02**
	2.2	External morphology and life cycle of *Bombyx mori*.	**02**
	3.3	Cultivation of mulberry (moriculture): a) Varieties for cultivation, b) Rain-fed and irrigated mulberry cultivation – Fertilize schedule, Pruning.	**02**
	3.4	Harvesting of mulberry: a) Leaf plucking b) Branch cutting c) Whole shoot cutting.	**02**
	3.5	Silk worm rearing: a) Types of rearing b) Rearing house c) Rearing techniques d) Important diseases and pests	**04**
	3.6	Post-harvest processing of cocoons: a) Harvesting and Preparation of cocoons for marketing b) Stifling, Sorting, Storage, De-flossing and Riddling c) Cocoon cooking, Reeling and Re-reeling, Washing and Polishing.	**03**

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11. Biology of Insects- 1992 Saxena C. Oxford and IBH Publishing Co. New Delhi. Bombay. Calcutta
12. A Text Book of Entomology- 1974Mathur V. K. and Upadhayay K Goel Printing press, Barani.
13. Bee and Bee Keeping- Roger A. Morse, Conell University Press London

Course Articulation Matrix of ZOO-252-MJM: Applied Zoology-II
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2	2	2	2	1	2	2	1	1	2	1	2
CO2	3	2	2	2	2	1	2	2	1	1	2	1	2
CO3	2	3	2	2	2	1	2	2	2	1	2	1	2
CO4	3	3	2	2	3	1	3	2	1	1	2	1	2
CO5	2	2	3	3	3	1	2	2	1	2	2	2	2
CO6	2	2	2	2	2	3	2	2	1	2	2	2	2
CO7	3	2	3	3	3	2	3	3	2	2	2	3	2

PO1: Comprehensive knowledge and understanding
All COs strongly map with PO1 as each outcome requires a solid foundational understanding of concepts in apiculture and sericulture.

PO2: Practical, professional, and procedural knowledge
CO3, CO4, and CO7 strongly map with PO2 as they involve hands-on techniques and practical applications essential to apiculture and sericulture.

PO3: Entrepreneurial mindset and knowledge
CO5 and CO7 strongly map with PO3 since they focus on the economic importance and the potential for starting a small business in the field.

PO4: Specialized skills and competencies
CO4 and CO7 map strongly with PO5 as they require applying knowledge to solve problems and make informed decisions, particularly in disease management and post-harvesting processes.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO6 maps strongly with PO6 because understanding the communication system among honey bee casts can enhance collaborative efforts in beekeeping.

PO6: Communication skills and collaboration
CO4 and CO7 have a strongly connection with PO7 as they involve critical analysis and potentially research-oriented tasks related to disease control and business development.

PO7: Research-related skills
CO4 and CO7 have a strongly connection with PO7 as they involve critical analysis and potentially research-oriented tasks related to disease control and business development.

PO8: Learning how to learn skills
All COs map moderately with PO8 because the course encourages students to independently acquire new knowledge and skills related to apiculture and sericulture.

PO9: Digital and technological skills
This PO maps poorly with all COs, as the course does not heavily emphasize digital skills or technology**.**

PO10: Multicultural competence, inclusive spirit, and empathy
This PO has a moderate mapping, particularly in CO5 and CO6, as the subjects may relate to community-based agricultural practices, though not directly focused on multicultural aspects.

PO11: Value inculcation and environmental awareness
COs map moderately with PO11 since understanding species and environmental conservation are inherent to the course.

PO12: Autonomy, responsibility, and accountability
CO7 maps strongly with PO12 because starting a business or managing post-harvesting processes requires a high level of responsibility and independence.

PO13: Community engagement and service
Most COs have a moderate mapping to PO13, as aspects of the course could involve community interactions, especially in educating or engaging with local beekeepers or farmers.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2024)

Name of the Program: B.Sc. Zoology
Program Code: ZOO
Class: S.Y. B.Sc.
Semester: IV
Course Type: Major (Mandatory) Theory
Course Code: ZOO-253-MJM
Course Name: Environmental Biology
Number of Credits: 02
Number of Teaching hours: 30

Course Objectives:

- Gain the knowledge of foundational concepts and scope of Environmental Biology.
- Describe the components, types, and energy flow models of ecosystems.
- Identify different types of environmental pollution and assess their sources and effects.
- Analyze the environmental challenges in India, including the roles of bioindicators and monitoring.
- Differentiate between renewable and non-renewable resources and evaluate methods for soil and forest conservation.
- Examine the importance of wildlife management in India and explore methods of biodiversity conservation.
- Gain the knowledge of basic concepts of carbon credits, including the emission market and allowances.

Course Outcomes:

Student will be able to-

CO1: explain the foundational concepts and scope of Environmental Biology.
CO2: identify and describe the components, types, and energy flow within ecosystems.
CO3: classify and evaluate various types of environmental pollution, including their sources and impacts.
CO4: assess the environmental challenges facing India and utilize bioindicators for effective environmental monitoring.
CO5: distinguish between renewable and non-renewable resources and propose effective soil and forest conservation strategies.
CO6: demonstrate the significance of wildlife management in India and apply methods of biodiversity conservation.
CO7: articulate the basic principles of carbon credits and analyze the structure of the emission market and allowances.

TOPICS:

Unit No.	Subunit No.	Details	Teaching Hours
1	**Environmental Biology**		**02**
	1.1	Introduction- Definition, basic concepts and scope	
2	**The Ecosystem**		**04**
	2.1	Definition, components and types	
	2.2	Energy flow in ecosystem and flow models	
3	**Environmental Pollution:**		**11**
	3.1	Definition and types of pollution	
	3.2	Pollutants: Definition and types	
	3.3	Air pollution: Definition, sources of air pollution and their effects: Acid rain; Greenhouse effect	

	3.4	Water pollution: Definition, sources of water pollution and their effects on ecosystem.	
	3.5	Land / Soil pollution: definition, sources of land / soil pollution and their effects	
	3.6	Noise pollution: definition, sources of noise pollution and their effects	
4	**Environment and Development**		**04**
	4.1	Bioindicators and environmental monitoring	
	4.2	Environmental challenges in India: Population explosion, urbanization & industrialization.	
5	**Natural Resources and Conservation:**		**03**
	5.1	Renewable and non-renewable resources	
	5.2	Soil conservation	
	5.3	Forest conservation	
6	**Wildlife Management:**		**04**
	6.1	Definition, causes of wildlife depletion	
	6.2	Importance of wildlife management in India Methods of biodiversity conservation; *in-situ* and *ex-situ* modes of biodiversity conservation. *In-vitro* conservation: Gene bank, pollen and spore bank	
	6.3	Endangered species, vulnerable species, rare species and threatened species	
7	**Introduction to Carbon credit:**		**02**
	7.1	Basic concept of Carbon credit	
	7.2	Emission market and Emission allowances	

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7. Concepts of Ecology, 1996, E.J. Kormondy, Prentice Hall of India. New Delhi
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Course Articulation Matrix of ZOO-253-MJM: Environmental Biology
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2	1	2	1	1	1	2	1	1	2	1	1
CO2	3	2	1	2	2	1	2	2	1	1	3	2	1
CO3	3	3	1	2	3	2	2	2	1	1	3	2	1
CO4	3	3	1	3	3	2	3	2	1	2	3	2	1
CO5	3	3	1	2	3	2	2	2	1	1	3	2	2
CO6	3	2	2	3	3	2	2	2	1	2	3	2	2
CO7	2	2	3	3	2	1	2	2	1	1	3	2	1

PO1: Comprehensive knowledge and understanding
CO1, CO3, CO4, CO5, CO6, CO7 strongly maps with PO1 as they all require an in-depth understanding of Environmental Biology, ecosystems, pollution, conservation strategies, and carbon credits..

PO2: Practical, professional, and procedural knowledge
CO1, CO2, CO6, and CO7 moderately maps as these involve a procedural understanding of biology, environmental monitoring, and biodiversity.

PO3: Entrepreneurial mindset and knowledge
CO6 and CO7 moderately maps since wildlife management, biodiversity conservation, and carbon credits have some entrepreneurial potential.

PO4: Specialized skills and competencies
CO4, CO6, and CO7 strongly maps as require advanced skills in environmental monitoring, biodiversity conservation, and understanding carbon credits.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO2, CO3, CO4, CO5, and CO6 strongly maps as they require problem-solving and analytical skills to address environmental challenges, pollution, and conservation efforts.

PO6: Communication skills and collaboration
CO3, CO4, CO5, and CO6 moderately maps since these COs involve tasks that may require collaboration and effective communication.

PO7: Research-related skills
CO4 strongly maps as it involves the use of bioindicators and environmental monitoring, which are research-intensive tasks.

PO8: Learning how to learn skills
All COs moderately maps as they all contribute to the continuous learning process in Environmental Biology, fostering the ability to learn and adapt.

PO9: Digital and technological skills
All COs poorly maps as they involves more traditional methods and knowledge rather than digital technological applications**.**

PO10: Multicultural competence, inclusive spirit, and empathy
CO4 and CO6 moderately maps as they involve understanding biodiversity and conservation, which can indirectly foster empathy and inclusivity.

PO11: Value inculcation and environmental awareness
All COs strongly maps as they all promote environmental awareness and the inculcation of values related to conservation and sustainability.

PO12: Autonomy, responsibility, and accountability
All COs moderately maps as they foster a sense of responsibility and accountability in applying knowledge to real-world environmental issues.

PO13: Community engagement and service
CO5 and CO6 moderately maps as conservation efforts and biodiversity management can involve community participation.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2024)

Name of the Program: B.Sc. Zoology
Program Code: ZOO
Class: S.Y. B.Sc.
Semester: IV
Course Type: Major (Mandatory) Practical
Course Code: ZOO-254-MJM
Course Name: Zoology Practical - IV
Number of Credits: 02
Number of Teaching hours: 60

Course Objectives:

- Classify selected species of Reptilia, Aves, and Mammalia, providing reasoning for their classification.
- Examine the external characteristics and digestive system of *Labeo rohita*.
- Study the brain structure of *Labeo rohita*.
- Analyze the life cycle and anatomical features of the Honey bee, including mouthparts, thoracic appendages, and sting apparatus.
- Explore the tools and techniques involved in beekeeping and sericulture, including equipment and lifecycle studies.
- Investigate the characteristics and importance of freshwater plankton through field collection and laboratory observation.
- Assess the physico-chemical properties of water and soil samples, including temperature, pH, hardness, and dissolved oxygen levels.

Course Outcomes:

Student will be able to-

CO1: demonstrate the ability to classify selected species of Reptilia, Aves, and Mammalia, and justify their classification.
CO2: identify and describe the external features and digestive system of *Labeo rohita*.
CO3: explain the structure and function of the brain in *Labeo rohita*.
CO4: explain the life cycle and anatomical structures of the Honey bee, including its mouthparts, thoracic appendages, and sting apparatus.
CO5: utilize beekeeping and sericulture tools and techniques, demonstrating their application in lifecycle studies.
CO6: collect, preserve, and analyze freshwater plankton, recognizing their significance in aquatic ecosystems.
CO7: evaluate the physico-chemical properties of water and soil samples, including their temperature, pH, hardness, and dissolved oxygen content.

Practicals:

Practical No.	Name of the practical	E/D
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	D
3	To study the classification with reasons the following animals: Class: Mammalia- Rabbit, Mongoose, Kangaroo	D
4	Study of External characters and digestive system of *Labeo rohita*	D

5	Study of brain of *Labeo rohita*	E
6	Study of life cycle of Honey bee	D
7	Study of mouth parts, thoracic appendages (legs and wings) and sting apparatus of Honey bee	E
8	Study of various bee keeping equipments (Any five equipments)	D
9	Study of: a) bee products b) bee pests c) bee enemies	E
10	a) Study of life cycle of *Bombyx mori* b) Study of any five equipments in sericulture	D
11	Study of fresh water plankton (Field collection, preservation and observation).	E
12	Study of physico-chemical properties of water sample (Temperature, pH and Hardness)	E
13	Study of physico-chemical properties of soil sample	E
14	Estimation of dissolved oxygen in water by Winkler's method.	E
15	To study population density and percentage frequency of different plant / insect species of a given area by quadrat method.	E
16	Visit to biodiversity spot/sea shore/apiculture/sericulture farm and submit report of the same.	E
***D- Demonstration; E- Experiment.**		

Course Articulation Matrix of ZOO-254-MJM: Zoology Practical - IV
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2	1	2	2	1	2	2	1	1	1	2	1
CO2	3	3	1	2	2	1	2	2	1	1	1	2	1
CO3	3	3	1	3	3	1	2	2	1	1	1	2	1
CO4	3	3	1	3	3	1	2	2	1	1	1	2	1
CO5	3	3	2	3	3	2	2	2	1	2	2	2	2
CO6	3	2	1	2	3	1	2	2	1	2	2	2	1
CO7	3	3	1	3	3	1	2	2	1	2	3	2	2

PO1: Comprehensive knowledge and understanding
All COs strongly maps as they require a solid foundation in biological classification, anatomy, physiology, and environmental studies.

PO2: Practical, professional, and procedural knowledge
CO2, CO3, CO4, CO5, and CO7 strongly maps since these COs involve practical knowledge of anatomy, physiology, beekeeping, sericulture, and environmental analysis.

PO3: Entrepreneurial mindset and knowledge
CO5 moderately maps since where the practical application of beekeeping and sericulture techniques could have entrepreneurial implications.

PO4: Specialized skills and competencies
CO3, CO4, CO5, and CO7 strongly maps where specialized knowledge and skills in anatomy, lifecycle studies, and environmental analysis are crucial.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO3, CO4, CO5, CO6, and CO7 strongly maps where application and problem-solving skills are essential in analyzing structures, lifecycles, and environmental data.

PO6: Communication skills and collaboration
All COs poorly maps as communication and collaboration are not explicitly emphasized in these outcomes.

PO7: Research-related skills
All COs moderately maps as research skills are required to classify species, understand anatomical structures, and conduct environmental analyses.

PO8: Learning how to learn skills
All COs moderately maps as reflecting the continuous learning process in acquiring new knowledge and skills in biology and environmental science.

PO9: Digital and technological skills
All COs poorly maps as these outcomes do not heavily rely on digital or technological competencies**.**

PO10: Multicultural competence, inclusive spirit, and empathy
CO5, CO6, and CO7 moderately maps as there is a slight emphasis on understanding ecological balance and conservation, which can foster empathy.

PO11: Value inculcation and environmental awareness
CO6 and CO7 strongly maps as these COs directly relate to environmental awareness and conservation values.

PO12: Autonomy, responsibility, and accountability
All COs moderately maps as these outcomes encourage independent learning, practical application, and responsible conduct in scientific practices.

PO13: Community engagement and service
CO5 and CO7 moderately maps as there is a potential link to community service through environmental conservation and awareness activities.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2024)

Name of the Program: B.Sc. Zoology
Program Code: ZOO
Class: S.Y. B.Sc.
Semester: IV
Course Type: Minor Theory
Theory Course Code: ZOO-261-MN
Course Name: Dairy Science
Number of Credits: 02
Number of Teaching hours: 30

Course Objectives:

- Examine the role of dairy development in enhancing rural economies and generating employment.
- Identify key Indian cattle breeds and their unique traits.
- Describe the characteristics of prominent exotic cattle breeds in India.
- Differentiate between major Indian buffalo breeds and their dairy significance.
- Gain insights of inbreeding and crossbreeding systems in dairy livestock.
- Learn the techniques for calf weaning, castration, and dehorning in cattle.
- Understand dairy processing techniques and the composition and types of milk products.

Course Outcomes:

Student will be able to-

CO1: evaluate the impact of dairy development on rural economies and employment generation.
CO2: accurately identify and distinguish key Indian cattle breeds and their specific traits.
CO3: detail the characteristics and advantages of prominent exotic cattle breeds in India.
CO4: classify major Indian buffalo breeds and assess their significance in dairy production.
CO5: explain the principles and applications of inbreeding and crossbreeding in dairy livestock.
CO6: demonstrate proficiency in calf weaning, castration, and dehorning techniques.
CO7: apply knowledge of dairy processing methods and differentiate between various milk types and products.

TOPICS:

Unit No.	Subunit No.	Details	Teaching Hours
1.Dairy development in India	1.1	Role of dairy development in rural economy, employment opportunities	**02**
2. Indian Cattle breeds	2.1	Malvi	**03**
	2.2	Hariyana	
	2.3	Deoni	
	2.4	Red sindhi	
	2.5	Khillari	
3. Exotic cattle breeds	3.1	Jersey	**02**
	3.2	Holstein	
4. Indian buffalo breeds	4.1	Nagpuri	**03**
	4.2	Bhadawari	
	4.3	Murrah	
	4.4	Jafrabadi	
5. Systems of inbreeding and crossbreeding			**03**
6. Weaning of calf, castration and dehorning			**03**
7. Diseases and control (Any three)			**03**
8. Dairy Processing	8.1	Filtration	**06**
	8.2	Cooling	

	8.3	Chilling	
	8.4	Clarification	
	8.5	Pasteurization	
	8.6	Freezing	
9. Milk and milk products	9.1	Composition of milk	**05**
	9.2	Types of milk: A. Buffalo milk B. Cow milk (A1 and A2) C. Whole milk and toned milk	
	9.3	Milk products	

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3. Venkatasubramanian, V., Singh, A. K., & Rao, S. V. N. (2003). Dairy development in India: An appraisal of challenges and achievements. Concept Publishing Company.
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Course Articulation Matrix of ZOO-261-MN: Dairy Science
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	2	3	2	3	2	2	2	1	2	2	2	3
CO2	3	3	2	3	2	1	2	2	1	1	2	2	1
CO3	3	3	2	3	2	1	2	2	1	1	2	2	1
CO4	3	3	2	3	2	1	2	2	1	1	2	2	1
CO5	3	3	2	3	3	1	2	2	1	1	2	2	1
CO6	3	3	2	3	3	1	2	2	1	1	2	2	1
CO7	3	3	3	3	3	1	2	2	1	1	3	2	2

PO1: Comprehensive knowledge and understanding
All COs strongly maps as they require a deep understanding of dairy development, cattle breeds, breeding principles, and dairy processing.

PO2: Practical, professional, and procedural knowledge
All COs strongly maps as strongly maps since they involves practical identification of cattle breeds, proficiency in animal handling techniques, and dairy processing methods.

PO3: Entrepreneurial mindset and knowledge
All COs moderately maps as knowledge in dairy development, cattle breeding, and processing methods can foster entrepreneurial opportunities, particularly in rural economies.

PO4: Specialized skills and competencies
All COs strongly maps as each outcome involves acquiring specialized skills and competencies, such as identifying cattle breeds, applying breeding techniques, and mastering dairy processing.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO1, CO5, CO6, and CO7 strongly maps as they involves problem-solving and application skills, such as analyzing breeding strategies, evaluating dairy processing methods, and assessing rural economic impacts.

PO6: Communication skills and collaboration
All COs poorly maps as s communication and collaboration are not the primary focus of these outcomes.

PO7: Research-related skills
All COs moderately maps as they require a research-oriented approach to understanding and applying knowledge in dairy science and cattle breeding.

PO8: Learning how to learn skills
All COs moderately maps as continuous learning required to stay updated with advancements in dairy science, breeding techniques, and rural development.

PO9: Digital and technological skills
All COs are poorly maps as these outcomes do not heavily rely on digital or technological competencies.

PO10: Multicultural competence, inclusive spirit, and empathy
CO1 moderately maps where rural development might involve understanding diverse communities and promoting inclusivity.

PO11: Value inculcation and environmental awareness
CO1 and CO7 moderately maps where environmental awareness and value inculcation are crucial in understanding the impact of dairy development on ecosystems and promoting sustainable practices.

PO12: Autonomy, responsibility, and accountability
All COs moderately maps as these outcomes encourage independent learning and responsible practices in dairy science and cattle breeding.

PO13: Community engagement and service
CO1 strongly maps where the impact of dairy development on rural economies directly relates to community service.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2024)

Name of the Program: B.Sc. Zoology
Program Code: ZOO
Class: S.Y.B.Sc.
Semester: IV
Course Type: Minor Practical
Course Code: ZOO-262-MN
Course Name: Dairy Science Lab
Number of Credits: 02
Number of Teaching hours: 60

Course Objectives:

- Classify and describe various cattle breeds relevant to the dairy industry.
- Conduct sensory evaluations of milk and ghee to assess quality.
- Perform experiments to measure milk density and detect adulterants such as cane sugar, starch, cellulose, and urea.
- Isolate casein from milk and conduct confirmatory tests to verify its presence.
- Evaluate the efficiency of sterilization processes in dairy products using turbidity tests.
- Learn the operation of dairy equipment, including cream separators, and design layouts for dairy plants.
- Analyze the impact of diseases in cattle and understand the economics of the dairy industry through field visits and project reports.

Course Outcomes:

Student will be able to-

CO1: identify and describe key dairy cattle breeds and their characteristics.
CO2: evaluate the quality of milk and ghee through sensory analysis.
CO3: measure milk density and detect adulterants, including cane sugar, starch, cellulose, and urea, using specified experiments.
CO4: isolate casein from milk and confirm its presence through appropriate tests.
CO5: assess the effectiveness of sterilization methods in dairy products using turbidity tests.
CO6: demonstrate proficiency in operating dairy equipment and designing efficient dairy plant layouts.
CO7: analyze cattle diseases and their impact on the dairy industry, and evaluate industry economics through field visits and project reports.

Practicals

Sr. No.	Title of the Practical	E/D
1	Study of cattle breeds	D
2	Sensory evaluation of milk	E
3	Measurement of milk density using Lactometer	E
4	Isolation of casein from milk and its confirmatory tests	E
5	Detection of cane sugar in milk	E
6	Detection of starch in milk	E
7	Detection of cellulose in milk	E
8	Detection of added urea in milk	E
9	Sensory evaluation of ghee	E
10	Determination of sterilization efficiency by turbidity test	E
11	Study of cream separator	D
12	Design and layout of a dairy plant	D
13	Study of diseases in cattles (Brucellosis, Lumpy skin disease,	D

	Dermatophytosis)	
14	Visit to a dairy industry and submission of the report	E
15	Submission of short project report on economics of dairy industry	E
***D- Demonstration; E- Experiment.**		

Course Articulation Matrix of ZOO-262-MN: Dairy Science Lab
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	3	2	3	2	1	2	2	1	1	2	2	2
CO2	3	3	2	3	3	1	2	2	1	1	2	2	2
CO3	3	3	2	3	3	1	2	2	2	1	2	2	2
CO4	3	3	2	3	3	1	2	2	2	1	2	2	2
CO5	3	3	2	3	3	1	2	2	2	1	2	2	2
CO6	3	3	3	3	3	1	2	2	2	1	2	2	2
CO7	3	3	2	3	3	2	3	3	1	1	3	3	3

PO1: Comprehensive knowledge and understanding
All COs strongly maps as these outcomes require a thorough understanding of dairy cattle breeds, milk quality, adulteration detection, casein isolation, dairy equipment operation, and cattle disease analysis.

PO2: Practical, professional, and procedural knowledge
All COs strongly maps as performing sensory analysis, detecting adulterants, isolating casein, and operating dairy equipment, which demand hands-on skills and professional knowledge.

PO3: Entrepreneurial mindset and knowledge
All COs moderately maps as where designing dairy plant layouts aligns with entrepreneurial skills.

PO4: Specialized skills and competencies
All COs strongly maps as each outcome involves acquiring specialized skills like evaluating milk quality, detecting adulterants, isolating casein, operating dairy equipment, and analyzing cattle diseases.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
All COs strongly maps as they require analytical reasoning, problem-solving, and application of knowledge in practical settings, such as evaluating milk quality, detecting adulterants, and analyzing cattle diseases.

PO6: Communication skills and collaboration
All COs poorly maps as communication and collaboration are not the primary focus of these outcomes.

PO7: Research-related skills
All COs moderately maps as they involves research through field visits and project reports on cattle diseases and dairy industry economics.

PO8: Learning how to learn skills
All COs moderately maps as indicating the need for continuous learning, especially in dairy science, equipment operation, and disease analysis.

PO9: Digital and technological skills
CO3, CO4, and CO5 moderately maps as where detecting adulterants and isolating casein might involve some technological skills.

PO10: Multicultural competence, inclusive spirit, and empathy
All COs poorly maps as these outcomes do not explicitly involve multicultural competence or empathy.

PO11: Value inculcation and environmental awareness
CO7 moderately maps where understanding cattle diseases and their impact on the dairy industry aligns with environmental awareness.

PO12: Autonomy, responsibility, and accountability
All COs moderately maps as these outcomes require independent learning, responsibility in practical tasks, and accountability in dairy industry practices.

PO13: Community engagement and service
CO7 strongly maps where field visits and project reports directly contribute to community engagement and service.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2024)

Name of the Program: B.Sc. Zoology
Program Code: ZOO
Class: S.Y.B.Sc.
Semester: IV
Course Type: Open Elective
Course Code: ZOO-266-OE
Course Name: मधुमक्षिका पालन प्रात्यक्षिक
Number of Credits: 02
Number of Teaching hours: 60

Course Objectives:

- मधमाश्यांच्या विविध प्रजातींचा परिचय आणि वर्णन समजून घेणे.
- मधमाश्यांच्या जीवनचक्राचा तपशीलवार अभ्यास करणे.
- मधमाशीचे तोंडाचे भाग, पाय आणि पंख यांचा अभ्यास करणे.
- मधमाशीच्या डंक अवयवाचा संरचना आणि कार्यांचा अभ्यास करणे.
- विविध मधमाशी पालन उपकरणे आणि मधमाशी उत्पादने समजून घेणे.
- मधमाश्यांच्या शरीराचा आकार, शरीराची लांबी आणि पंखांचा आकार मोजणे.
- मधमाशी वसाहतीची दैनंदिन आणि मौसमी देखभाल करा आणि मधमाशीपालन प्रकल्पाला भेट देऊन अहवाल तयार करणे.

Course Outcomes:

या अभ्यासक्रमाद्वारे वद्यार्थी-

CO1: मधमाश्यांच्या विविध प्रजातींचा सुसंगत परिचय देऊ शकता आणि त्यांचे वर्णन करु शकतील.

CO2: मधमाश्यांच्या जीवनचक्राचे तपशीलवार विश्लेषण करु शकतील.

CO3: मधमाशीचे तोंडाचे भाग, पाय आणि पंख यांचा सुसंगत माहिती विषद करु शकतील.

CO4: मधमाशीच्या डंक-अवयवाची संरचना आणि कार्य स्पष्टपणे समजावून सांगू शकतील.

CO5: विविध मधमाशी पालन उपकरणे आणि मधमाशी उत्पादने यांची माहिती सांगू शकतील.

CO6: मधमाश्यांच्या शरीराचा आकार, शरीराची लांबी आणि पंखांचा आकार अचूकपणे मोजू शकतील.

CO7: मधमाशी वसाहतीची दैनंदिन आणि मौसमी देखभाल प्रभावीपणे करु शकतील आणि मधमाशीपालन प्रकल्पाला भेट देऊन अहवाल तयार करु शकतील.

प्रात्यक्षिके:

अनु. क्र.	प्रात्यक्षिकाचे नाव	E/D
1	मधमाश्यांच्या विविध प्रजातींचा अभ्यास करणे	D
2	मधमाश्यांच्या जीवनचक्राचा अभ्यास करणे	D
3	मधमाशीचे तोंडाचे भाग, पाय आणि पंख यांचा अभ्यास करणे	E
4	मधमाशीच्या डंक अवयवाचा अभ्यास करणे	E
5	विविध मधमाशी पालन उपकरणांचा अभ्यास करणे	D
6.	विविध मधमाशी उत्पादने व त्यातील घटक अभ्यासणे	D
7.	मधमाश्यांच्या विविध शत्रूंचा अभ्यास करणे	D
8.	मधमाशी शरीराचा आकार (शरीराची लांबी आणि पंखांचा आकार) मोजणे	E
9.	मधमाशी पेटीचे घटक अभ्यासाने व स्थापना करणे	E

10.	विविध मध भेसळीचा अभ्यास करणे	E/D
11.	मधमाश्यांच्या विविध रोगांचा अभ्यास करणे	D
12	मधमाशी वसाहतीची दैनंदिन देखभाल अभ्यासणे	D
13	मधमाशी वसाहतीची मौसमी देखभाल अभ्यासणे	D
14	मधमाशीपालन प्रकल्पाला भेट देणे व अहवाल तयार करणे	D
15	मधमाशी पालनासाठी विविध सरकारी योजना अभ्यासणे	D
***D- Demonstration; E- Experiment.**		

Course Articulation Matrix of ZOO-266-OE: मधुमक्षिका पालन प्रात्यक्षिक

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	3	2	2	2	2	2	2	1	1	1	2	1
CO2	3	3	2	2	3	2	2	2	1	1	1	2	1
CO3	3	3	2	3	3	2	2	2	1	1	1	2	1
CO4	3	3	2	3	3	2	2	2	1	1	1	2	1
CO5	3	3	2	2	2	2	2	2	2	1	1	2	1
CO6	3	3	2	3	3	2	2	2	2	1	1	2	1
CO7	3	3	2	3	3	2	3	2	2	2	2	3	2

PO1: Comprehensive knowledge and understanding
All COs strongly maps as they require a deep understanding of various aspects of apiculture, including species identification, life cycle, anatomy, and maintenance, which directly contribute to comprehensive knowledge.

PO2: Practical, professional, and procedural knowledge
All COs strongly maps as they involves practical and procedural knowledge essential for effective beekeeping, such as the use of equipment, understanding bee anatomy, and maintaining colonies.

PO3: Entrepreneurial mindset and knowledge
All COs moderately maps as the knowledge and skills gained in apiculture could potentially be applied in entrepreneurial endeavors, such as starting a beekeeping business, but the focus is not predominantly on entrepreneurship.

PO4: Specialized skills and competencies
CO3, CO4, CO6, and CO7 strongly maps due to the due to the specialized nature of the skills involved, such as anatomical analysis and colony maintenance.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO2, CO3, CO4, CO6, and CO7 moderately maps as they involve significant problem-solving and analytical reasoning, particularly in analyzing the life cycle, anatomy, and maintenance of bee colonies.

PO6: Communication skills and collaboration
All COs moderately maps as communication is essential in collaborative beekeeping projects and reporting findings.

PO7: Research-related skills
All COs moderately maps as research skills are moderately involved in understanding and analyzing the life cycle and anatomical structures, as well as maintaining colonies.

PO8: Learning how to learn skills
All COs moderately maps as they encourage continuous learning, particularly as students engage with the complex processes involved in beekeeping.

PO9: Digital and technological skills
All COs moderately maps as digital tools may be used in beekeeping, such as for data collection or analysis.

PO10: Multicultural competence, inclusive spirit, and empathy
All COs poorly maps as they do not heavily focus on multicultural competence or empathy, as they are more technical and procedural in nature.

PO11: Value inculcation and environmental awareness
CO7 moderately maps as it may touch on environmental awareness through colony maintenance and the importance of bees in ecosystems.

PO12: Autonomy, responsibility, and accountability
All COs moderately maps as they demonstrate accountability in managing bee colonies, using equipment, and maintaining accurate records.

PO13: Community engagement and service
CO7 moderately maps as it involve some community engagement through project reports and field visits.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2024)

Name of the Program: B.Sc. Zoology
Program Code: ZOO
Class: S.Y.B.Sc.
Semester: IV
Course Type: Minor Practical
Course Code: ZOO-276-SEC
Course Name: Toxicology Lab
Number of Credits: 02
Number of Teaching hours: 60

Course Objectives:

- Identify and interpret standardized hazard symbols for safety in laboratory settings.
- Demonstrate the safe handling procedures for hazardous chemicals, solutions, reagents, and biological samples.
- Identify the model organisms in toxicity testing and their significance.
- Learn proper techniques for animal handling and maintenance in research settings.
- Examine the various routes of drug administration and their effects in mice or rats.
- Evaluate the toxicity of local anesthetics and cosmetic products using appropriate methods.
- Monitor the water quality by measuring dissolved oxygen, biological oxygen demand, chemical oxygen demand, and turbidity from polluted locations.

Course Outcomes:

Student will be able to-

CO1: accurately identify and interpret standardized hazard symbols to ensure safety in laboratory environments.
CO2: demonstrate effective and safe handling procedures for hazardous chemicals, solutions, reagents, and biological samples.
CO3: recognize and explain the role of model organisms in toxicity testing and their relevance to research.
CO4: apply proper techniques for the handling and maintenance of animals in research settings.
CO5: describe and compare the effects of various drug administration routes in mice or rats.
CO6: assess the toxicity of local anesthetics and cosmetic products using established testing methods.
CO7: measure and analyze water quality parameters, including dissolved oxygen, biological oxygen demand, chemical oxygen demand, and turbidity, from various polluted locations.

Practicals:

Sr. No.	Title of the Practical	E/D
1	Study of types of standardized hazard symbols	D
2	Study of handling of hazardous chemicals, solutions, reagents and biological samples	D
3	Study of model organisms in toxicity testing	D
4	Animal handling and its maintenance	D
5	Study of different routes of drug administration in mice / rats	D
6	Study of local anaesthetics by different methods	D
7	Study of cosmetic toxicity	D
8	Study of heavy metals toxicity- Mercury (Minamata disease), Cadmium (itai-itai)	D
9	Water quality monitoring by measuring levels of dissolved oxygen from different polluted locations	E

10	Water quality monitoring by measuring levels of Biological oxygen demand from different polluted locations	E
11	Water quality monitoring by measuring levels of chemical oxygen demand from different polluted locations	E
12	Water quality monitoring by measuring levels of turbidity from water samples from different locations.	E
13	Study of bioindicators	D / E
14	Hypothetical problem to determine LC_{50} and LD_{50}	E
15	Milk quality analysis by MBRT & RRT test for milk	E
16	Analysis of total solids / total dissolved solids / total suspended solids in water samples	E
17	Study of effect of toxicant / drug on the digestive organs / reproductive organs / glands (Histology).	D
18	Blood collection methods from mice	D / E

Course Articulation Matrix of ZOO-276-SEC: Toxicology Lab
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	3	3	2	2	2	2	2	2	1	1	1	1	1
CO2	3	3	2	2	2	2	2	2	1	1	1	1	1
CO3	3	3	2	2	2	2	3	2	1	1	1	1	1
CO4	3	3	2	3	2	2	2	2	1	1	1	1	1
CO5	3	3	2	2	3	2	2	2	1	1	1	1	1
CO6	3	3	2	2	3	2	3	2	1	1	1	1	1
CO7	3	3	2	2	3	2	2	2	2	1	2	2	2

PO1: Comprehensive knowledge and understanding
All COs strongly maps as they require a deep understanding of laboratory safety, handling procedures, toxicity testing, and water quality analysis.

PO2: Practical, professional, and procedural knowledge
All COs strongly maps as they involve practical application of safety procedures, handling hazardous materials, and performing complex tests in a professional setting.

PO3: Entrepreneurial mindset and knowledge
All COs moderately maps as laboratory safety and procedures, handling, and analyzing samples contribute to a foundational understanding useful in entrepreneurial contexts, though the direct application of entrepreneurial skills is less prominent.

PO4: Specialized skills and competencies
CO4, CO5, and CO6 strongly maps due to the specialized techniques involved in animal handling, drug administration, and toxicity testing.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO5, CO6, and CO7 moderately maps as they require significant application and problem-solving skills for analyzing toxicity and measuring water quality.

PO6: Communication skills and collaboration
CO3 moderately maps as it involves explaining roles of model organisms which may involve collaboration in research contexts.

PO7: Research-related skills
CO3, CO4, CO6, and CO7 moderately maps as they involve research-related skills, including understanding model organisms, assessing toxicity, and analyzing water quality.

PO8: Learning how to learn skills
All COs moderately maps as they require learning and applying complex techniques and methods, reflecting the necessity of continuous learning in the field.

PO9: Digital and technological skills
All COs moderately maps as they involve traditional laboratory techniques with minimal reliance on digital skills.

PO10: Multicultural competence, inclusive spirit, and empathy
All COs poorly maps as they do not heavily focus on multicultural competence or empathy, as they are more technical and procedural in nature.

PO11: Value inculcation and environmental awareness
CO7 moderately maps as it contributes environmental awareness through water quality analysis.

PO12: Autonomy, responsibility, and accountability
All COs moderately maps as they require a degree of autonomy and responsibility, particularly in applying safety procedures, handling hazardous materials, and performing analyses.

PO13: Community engagement and service
All COs moderately maps as are primarily focused on technical skills and procedural knowledge, with less emphasis on direct community engagement and service.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2024)

Name of the Program: B.Sc. Zoology
Program Code: ZOO
Class: S.Y.B.Sc.
Semester: IV
Course Type: Community Engagement Project
Course Code: ZOO-285-CEP
Course Name: Community Engagement Project
Number of Credits: 02
Number of Project hours: 60

In NEP 2020 (2023 Pattern) we are offering to UG (Second Year -Fourth Semester) students **Community Engagement Project (CEP)** for **TWO (2)** credits i.e. **50 Marks**. The total time allocation for the student to carry out Community Engagement Project is **60 hours**. The actual field work should be carried out after college hours or on holidays or during summer vacation.
To carry out the Community Engagement Project work following guidelines should be used:

1. Community based learning: Students should participate in community based Community based field projects under the supervision of faculty.
2. A minimum of **30 hours of learning per credit** in a semester is required.
3. Assignment of project topics to individual student or groups of students (2 or 3 students in one group/ Commerce faculty can have 5 students per group) and one faculty member from the department will act as GUIDE for the student or group of students.
4. Preparation of a questionnaire (20 -30 questions or more) related to their project topic (in Marathi or English). If the project is related to work that does not involve SURVEY work, then the questionnaire part can be replaced accordingly.
5. The departmental coordinator/guide should check the questions and finalize the questionnaire. The question that may create unnecessary complications should be avoided. The questions should be qualitative as well as quantitative.
6. Students should go to their chosen field with the questionnaire and collect the information regarding the questions asked to the concerned people. Collect as much information as possible by collecting 25 or more questionnaires or related data. The more the data, the better it will be for analysis.
7. The student should compile all the relevant data and carry out its analysis.
8. Write a project report in the standard format (2 Copies): Index, Chapter-1, Chapter-2, ….. Conclusion, References etc. The report should mention the clear **OUTPUT** drawn from the study. The typed project report should have minimum 25 pages, with font size 12 and line spacing of 1.5.
9. Submit the project report with the Guide's signature to the department (To the Departmental CEP coordinator).
10. The Oral presentation for all the projects in the department should be arranged in the department. To evaluate the project, TWO examiners from the department should be appointed by HoD. There will be NO external examiner appointed for the evaluation of projects. Also, there will be NO internal and external marks.
11. The total project work including preparation of questionnaire to oral presentation should be evaluated for 2 credits (50 Marks). The details about the allocation of time, marks and scheme of examination for Community Engagement Project is given in Table. The departmental CEP coordinator/HoD should submit the marks as per regular procedure to the examination section.
12. Since it is a compulsory subject in our syllabus, passing students in this **Community Engagement Project** is **MUST** to complete their degree.

Typical Time and marks allocation for the different stages of the Community Engagement Project is:

Typical Time and marks allocation for the different stages of the Community Engagement Project is: Step of Project	Individual students work in hours	Marks
Topic Selection/ Study Design	5	5
Survey preparation / Fieldwork	25	20
Analysis	10	5
Report writing	20	10
Oral Presentation		10
Total	**60**	**50**