Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati

(Empowered Autonomous)

Three / Four Year Honours / Honours with Research B.Sc. Degree Program in Zoology (Faculty of Science)

CBCS Syllabus

SYBSc (Zoology) Semester-III

For Department of Zoology

Choice Based Credit System Syllabus

(2024 Pattern)

(As Per NEP-2020)

To be implemented from Academic Year 2025-2026

Title of the Programme: SYBSc (Zoology)

Preamble

AES's Tuljaram Chaturchand College has decided to change the syllabus of various faculties from June, 2023 by taking into consideration the guidelines and provisions given 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 outcomes for the development of the students. The credit structure and the courses framework provided in the NEP are nationally accepted and internationally comparable.

The rapid changes in science and technology and new approaches in different areas of Zoology and related subjects, Board of Studies in Zoology of Tuljaram Chaturchand College, Baramati - Pune has prepared the syllabus of FYBSc Zoology Semester - I under the Choice Based Credit System (CBCS) by following the guidelines of NEP 2020, NCrF, NHEQF, Prof. R.D. Kulkarni's Report, GR of Gov. of Maharashtra dated 20th April, 16th May 2023 and 13th March, 2024 and Circular of SPPU, Pune dated 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 behaviour. 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 toanalyse 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.

Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Empowered Autonomous)

Board of Studies (BoS) in Zoology

From 2025-26 to 2027-28

Sr.No.	Name of Member	Designation
1.	**Dr. Chordiya Sandip Popatlal**	**Chairperson**
2.	**Dr. Nale Vitthal Baban**	Member
3.	**Dr. Manoorkar Poojawati**	Member
4.	**Dr. Sangale Deepali Maruti**	Member
5.	**Mr. More Kishor U.**	Member
6.	**Dr. Jadhav Sameer Sadashiv**	Member
7.	**Mr. Kare Samadhan**	Member
8.	**Mr. Awaghade Yugandhar**	Member
9.	**Ms. Shah Sharvari Vishal**	Member
10.	**Ms. Shaikh Shaheen**	Member
11.	**Dr. Ravindra D. Chaudhari**	Vice-Chancellor Nominee Subject Expert from SPPU, Pune
12.	**Dr. Gaikwad Sanjay K.**	Subject Expert from Outside the Parent University
13.	**Dr. Deshmukh A. A.**	Subject Expert from Outside the Parent University
14.	**Dr. Karpe Yogesh**	Representative from Industry/Corporate Sector/Allied areas
15.	**Ms. Kumbhar Kamal**	Member of the College Alumni
16.	**Ms. Sakshi Sawant**	UG Student
17.	**Ms. Sanika Nikhale**	PG Student

Department of Zoology

S.Y.B.Sc. Semester-III

Course and Credit Distribution Structure for B.Sc. (Zoology) 2024Pattern

Level/ Difficulty	Sem	Subject DSC-1				Subject DSC-2	Subject DSC-3	GE/OE	SEC	IKS	AEC	VEC	CC	Total
4.5/100	I	2(T)+2(P)				2(T)+2(P)	2(T)+ 2(P)	2(T)	2 (T/P)	2(T) (Generic)	2(T)	2(T)	--	22
	II	2(T)+2(P)				2(T)+2(P)	2(T)+2(P)	2(P)	2 (T/P)	--	2(T)	2(T)	2(T)	22
Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/Internship OR Continue with Major and Minor **Continue option**: Student will select one subject among the (subject 1, subject 2 and subject 3) as major and other as minor and third subject will be dropped.														
Level/ Difficulty	**Sem**	**Credits Related to Major**				**Minor**	**--**	**GE/OE**	**SEC**	**IKS**	**AEC**	**VEC**	**CC**	**Total**
		Major Core	**Major Elective**	**VSC**	**FP/OJT/CEP/RP**									
5.0/200	III	4(T)+2(P)	--	2 (T/P)	2(FP)	2(T)+2(P)	--	2(T)	--	2(T)	2(T)	--	2(T)	22
	IV	4(T)+2(P)	--	2 (T/P)	2(CEP)	2(T)+2(P)	--	2(P)	2 (T/P)	--	2(T)	--	2(T)	22
Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4credits core NSQF course/Internship OR Continue with Major and Minor														
5.5/300	V	8(T)+4(P)	2(T)+2(P)	2 (T/P)	2(FP/CEP)	2(T)	--	--	--	--	--	--	--	22
	VI	8(T)+4(P)	2(T)+2(P)	2 (T/P)	4 (OJT)	--	--	--	--	--	--	--	--	22
Total 3Years		**44**	**8**	**8**	**10**	**18**	**8**	**8**	**6**	**4**	**8**	**4**	**6**	**132**
Exit option: Award of **UG Degree in Major** with 132 credits OR Continue with Major and Minor														
6.0/400	VII	6(T)+4(P)	2(T)+2 (T/P)	--	4(RP)	4(RM)(T)	--	--	--	--	--	--	--	22
	VIII	6(T)+4(P)	2(T)+2 (T/P)	--	6(RP)	--	--	--	--	--	--	--	--	22
Total 4Years		**64**	**16**	**8**	**22**	**22**	**8**	8	**6**	**4**	**8**	**4**	**6**	**176**
Four Year **UG Honours with Research Degree** in Major and Minor with 176 credits														
6.0/400	VII	10(T)+4(P)	2(T)+2 (T/P)	--	--	4(RM) (T)	--	--	--	--	--	--	--	22
	VIII	10(T)+4(P)	2(T)+2 (T/P)	--	4 (OJT)	--	--	--	--	--	--	--	--	22
Total 4Years		**72**	**16**	**8**	**14**	**22**	**8**	8	**6**	**4**	**8**	**4**	**6**	**176**
Four Year **UG Honours Degree** in Major and Minor with 176 credits														

*** T = Theory** *** P = Practical** *** DSC = Discipline Specific Course**

*** OE = Open Elective** *** SEC = Skill Enhancement Course** *** IKS = Indian Knowledge System**

*** AEC = Ability Enhancement Course** *** VEC = Value Education Course** *** CC = Co-curricular Courses**

***VSC= Vocational Skill Course** ***OJT = On Job Training** ***CEP = Community Engagement Project**

***FP = Field Project** ***RP = Research Project**

S.Y.B.Sc. Zoology NEP-2020

Course Structure for S.Y.B.Sc. Zoology (2024 Pattern)

Sem	Course Type	Course Code	CourseName	Theory / Practical	Credits
III	Major Mandatory	ZOO-201-MRM	Chordates	Theory	02
	Major Mandatory	ZOO-202-MRM	Applied Zoology-I	Theory	02
	Major Mandatory	ZOO-203-MRM	Zoology Practical – III	Practical	02
	Vocational Skill Course (VSC)	ZOO-204-VSC	Biological Techniques	Practical	02
	Field Project (FP)	ZOO-205-FP	Field Project	Practical	02
	Minor	ZOO-206-MN	Apiculture	Theory	02
	Minor	ZOO-207-MN	Practicals in Apiculture	Practical	02
	Open Elective (OE)	ZOO-208-OE	Crop Pests: Types & Management पिकावरील कीड: प्रकार व व्यवस्थापन	Theory	02
	Subject specific Indian Knowledge System (IKS)	ZOO-209-IKS	Animal Diversity & Conservation in Indian Culture	Theory	02
	Ability Enhancement Course (AEC)	MAR-210-AEC /HIN-210-AEC /SAN-210-AEC		Theory (Any one)	02
	Co-curricular Course (CC)	YOG/PES/CUL/ NSS/NCC -211-CC	To be continued from the semester-II		02
				Total Credits Semester-III	**22**
IV	Major Mandatory	ZOO-251-MRM	Introduction to Genetics	Theory	02
	Major Mandatory	ZOO-252-MRM	Applied Zoology-II	Theory	02
	Major Mandatory	ZOO-253-MRM	Zoology Practical – IV	Practical	02
	Vocational Skill Course (VSC)	ZOO-254-VSC	Medical Laboratory Techniques	Theory	02
	Community Engagement Project (CEP)	ZOO-255-CEP	Community Engagement Project	Practical	02
	Minor	ZOO-256-MN	Sericulture	Theory	02
	Minor	ZOO-257-MN	Practicals in Sericulture	Practical	02
	Open Elective (OE)	ZOO-258-OE	Crop pests: Types & management(Practical) (पिकावरील किड: प्रकार व व्यवस्थापन) (प्रात्यक्षिक)	Practical	02
	Skill Enhancement Course (SEC)	ZOO-259-SEC	Practicals in Dairy Science	Practical	02
	Ability Enhancement Course (AEC)	MAR-260-AEC /HIN-260-AEC /SAN-260-AEC		Theory (Any one)	02
	Co-curricular Course (CC)	YOG/PES/CUL/ NSS/NCC -261-CC	To be continued from the semester-III		02
				Total Credits Semester-IV	**22**
				Cumulative Credits Semester III + Semester IV	**44**

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: Analyse 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.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2025)

Name of the Program: B.Sc. Zoology
Program Code: USZOO
Class: S.Y.B.Sc.
Semester: III
Course Type: Major (Mandatory) Theory
Course Code: ZOO-201-MRM
Course Name: Chordates
Number of Credits: 02
Number of Teaching hours: 30

Course Objectives:-

- To understand the general characteristics and classification of Hemichordata, Urochordata, and Cephalochordata up to the class level.
- To explore the distinctive features and representative examples of Cyclostomata, emphasizing their evolutionary significance.
- To classify and differentiate various classes of vertebrates, including Pisces, Amphibia, Reptilia, Aves, and Mammalia, along with their notable sub-classes and examples.
- To study the systematic position, habitat, and external morphology of the Indian Bullfrog (*Hoplobatrachus tigerinus*), highlighting its ecological adaptations.
- To analyze the anatomical and physiological aspects of the digestive system, feeding mechanisms and digestion in *Hoplobatrachus tigerinus*.
- To examine the circulatory, nervous, reproductive, and sensory systems of *Hoplobatrachus tigerinus*, understanding their functional significance.
- To develop comparative knowledge of chordate groups by integrating morphological, anatomical, and physiological aspects of vertebrates.

Course Outcomes:-

Student will be able to-

CO1: accurately describe the general characteristics and classification of Hemichordata, Urochordata, and Cephalochordata, demonstrating a foundational understanding of primitive chordates.
CO2: identify and explain the key features and representative examples of Cyclostomata, evaluating their evolutionary significance within the chordate lineage.
CO3: classify and distinguish between different vertebrate classes, including Pisces, Amphibia, Reptilia, Aves, and Mammalia, based on their structural and functional adaptations.
CO4: systematically describe the habitat, external morphology, and ecological adaptations of the Indian Bullfrog (Hoplobatrachus tigerinus), establishing its role in the ecosystem.
CO5: analyze the anatomy and physiology of the digestive system, explaining the feeding mechanisms and digestion process in Hoplobatrachus tigerinus.
CO6: examine and compare the circulatory, nervous, reproductive, and sensory systems of Hoplobatrachus tigerinus, correlating their structure with function.
CO7: apply comparative knowledge of chordate groups by integrating morphological, anatomical, and physiological traits to understand vertebrate evolution and diversity.

TOPICS:

UNIT	SUB UNITS	SYLLABUS	NO. OF LECTURES
1	**General characters and classification up to class level**		
	1.1	Hemichordata	6
	1.2	Urochordata	
	1.3	Cephalochordata	
2	2.1	Cyclostomata: General characters with examples	2

3	**General characters and classification of following classes and their sub-classes with two examples of each**		
	3.1	Pisces	10
	3.2	Amphibia	
	3.3	Reptilia	
	3.4	Aves	
	3.5	Mammalia	
4	**Study of Frog (*Hoplobatrachus tigerinus*)**		
	4.1	Systematic position, habit and habitat	12
	4.2	External characters and sexual dimorphism	
	4.3	Digestive system, food, feeding and physiology of digestion	
	4.4	Circulatory system	
	4.5	Central Nervous System.	
	4.6	Reproductive system	
	4.7	Sense organs	

REFERENCES

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Course Articulation Matrix of ZOO-201-MRM: Chordates
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	3	3	1	2	2	1	2	2	2	2
CO2	3	3	1	3	3	1	2	2	1	2	2	2	2
CO3	3	2	2	2	3	2	3	2	1	3	2	2	3
CO4	3	1	2	2	3	2	3	2	1	2	2	2	2
CO5	3	2	1	3	3	2	3	2	1	2	2	2	2
CO6	3	2	2	2	3	3	3	2	1	2	2	2	2
CO7	3	2	2	1	2	2	3	3	1	2	1	1	2

PO1: Comprehensive knowledge and understanding
All COs are directly mapped to PO1 because understanding the classification, anatomy, morphology, and physiology of chordates is fundamental to mastering vertebrate biology.

PO2: Practical, professional, and procedural knowledge
CO1, CO2, CO3, CO5, CO6, and CO7 are mapped to PO2 as they involve practical knowledge of taxonomy, anatomical studies, physiological processes, and evolutionary traits of chordates.

PO3: Entrepreneurial mind-set and knowledge
CO3, CO4, and CO7 are mapped to PO3 as knowledge of vertebrate classification, adaptations, and ecological significance can be applied in fields such as wildlife conservation, zoological research, and eco-tourism.

PO4: Specialized skills and competencies
CO1, CO2, CO3, CO5, and CO6 are mapped to PO4 because classifying vertebrates, analyzing anatomical structures, and understanding physiological mechanisms require specialized zoological knowledge.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO1, CO2, CO4, CO5, and CO6 are mapped to PO5 as they involve critical thinking in identifying evolutionary relationships, ecological adaptations, and physiological functions.

PO6: Communication skills and collaboration
CO4, CO6, and CO7 are mapped to PO6 because presenting comparative anatomical observations, discussing physiological findings, and engaging in group-based zoological studies require effective communication.

PO7: Research-related skills
CO2, CO3, CO4, CO5, CO6, and CO7 are mapped to PO7 as studying vertebrate classification, morphology, and physiology contributes to zoological research, biodiversity studies, and evolutionary biology.

PO8: Learning how to learn skills
CO1, CO2, CO5, CO6, and CO7 are mapped to PO8 because developing expertise in chordate classification, anatomy, and physiology encourages independent learning and continuous knowledge enhancement.

PO9: Digital and technological skills
CO7 is mapped to PO9 because understanding vertebrate classification and physiological adaptations can involve the use of digital tools, evolutionary databases, and anatomical imaging software.

PO10: Multicultural competence, inclusive spirit, and empathy
CO1, CO2, CO3, CO4, CO5, and CO6 are mapped to PO10 as studying vertebrate diversity promotes an understanding of ecological roles, biodiversity conservation, and ethical considerations in zoological studies.

PO11: Value inculcation and environmental awareness
CO1, CO2, CO4, CO5, and CO6 are mapped to PO11 because learning about vertebrate biodiversity fosters a sense of responsibility towards conservation and ecological balance.

PO12: Autonomy, responsibility, and accountability
CO1, CO2, CO4, CO5, and CO6 are mapped to PO12 as zoological studies involve responsible handling of biological specimens, ethical research practices, and maintaining data accuracy.

PO13: Community engagement and service
CO1, CO2, CO3, CO4, CO5, CO6, and CO7 are mapped to PO13 because knowledge of vertebrate biology can be applied in wildlife conservation programs, biodiversity awareness campaigns, and zoological education initiatives.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2025)

Name of the Program: B.Sc. Zoology
Program Code: USZOO
Class: S.Y.B.Sc.
Semester: III
Course Type: Major (Mandatory) Theory
Course Code: ZOO-202-MRM
Course Name: Applied Zoology-I
Number of Credits: 02
Number of Teaching hours: 30

Course Objectives:-

- Understand the fundamentals of fisheries and aquaculture.
- Gain comprehensive knowledge of freshwater pearl culture.
- Develop an understanding of Lamellidans spp. morphology, anatomy, and their role in pearl formation.
- Master the different implantation techniques in pearl culture.
- Gain knowledge of post-operative care and marketing in pearl culture.
- Develop an understanding of fish preservation techniques.
- Gain knowledge of fishery ponds

Course Outcomes:-

Student will be able to-

CO1: demonstrate comprehensive knowledge of the foundational principles and practices in fisheries and aquaculture.
CO2: attain mastery in freshwater pearl culture techniques.
CO3: develop a comprehensive understanding of *Lamellidans* spp., exploring their morphology, anatomy, and their pivotal role in the formation of pearls.
CO4: acquire proficiency in various implantation methods used in pearl culture.
CO5: gain an understanding of post-operative care for mollusk post-implantation and knowledge of marketing strategies for cultured pearls.
CO6: develop comprehensive understanding fish preservation techniques.
CO7: attain proficiency and comprehensive knowledge in aquaculture ponds.

TOPICS:

UNIT	SUB UNITS	SYLLABUS	NO. OF LECTURES
1.Fisheries:			12
	1.1	Introduction to fisheries	
	1.2	Different types of ponds used in fish farming: Nursery pond, rearing pond and grow out ponds	
	1.3	Introduction to composite fish farming of Indian major carps - Biology of fish Rohu, Catla and Mrigal, seed rearing, nutrition and feeding habits	

	1.4	**Fish transport and preservation:** a) Salting b) Chilling (Use of insulated containers, etc.) c) Freezing d) Canning	
2.Freshwater Pearl Culture:			
	2.1	**Introduction to pearl culture** • Global and national status of pearl culture • Significance of pearl culture	
	2.2	**Morphology and biology of *Lamellidans* spp.** • Morphology • Anatomy: Alimentary canal and associated structures	
	2.3	Formulation and preparation of artificial feeds for larval rearing	
	2.4	**Implantation techniques in Pearl Culture** • Surgical procedures in pearl culture • Beads insertion • Nucleus implantation • Graft tissue preparation	**18**
	2.5	**Post-operative care and marketing** • Post-operative care, Precautionary measures of pearl culture • Quality improvement • Caring of implanted bivalve • Harvesting of pearl • Sorting of pearl • Marketing and economics concerned with pearl culture	

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Course Articulation Matrix of ZOO-202-MRM Applied Zoology-I
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	1	3	3	3	3	3	2	1	3	3	2
CO2	3	3	1	3	3	3	3	3	2	1	3	3	2
CO3	3	3	1	3	3	3	3	3	2	1	3	3	2
CO4	3	3	1	3	3	3	3	3	2	1	3	3	2
CO5	3	3	1	3	3	3	3	3	2	1	3	3	2
CO6	3	3	1	3	3	3	3	3	2	1	3	3	2
CO7	3	3	1	3	3	3	3	3	2	1	3	3	2

PO1: Comprehensive knowledge and understanding
All of the course outcomes (COs) are directly mapped to PO1. For example, CO1 aims to demonstrate comprehensive knowledge of fisheries and aquaculture principles and practices, which directly aligns with the goal of PO1, which emphasizes the acquisition of comprehensive knowledge and understanding in various domains.

PO2: Practical, professional, and procedural knowledge
All of the course outcomes (COs) are directly mapped to PO2. For example CO2aims to attaining mastery in freshwater pearl culture techniques necessitates practical, professional, and procedural knowledge, which directly aligns with the objective of PO2.

PO3: Entrepreneurial mind-set and knowledge
All of the course outcomes (COs) are indirectlymappedtoPO3.Forexample, theprimaryfocusofCO2 is on mastering specific techniques rather than fostering an entrepreneurial mindset while proficiency in pearl culture techniques may indirectly relate to identifying entrepreneurial opportunities.

PO4: Specialized skills and competencies
All of the course outcomes (COs) are directly mapped to PO4. For example, CO2 aims to develop specialized skills and competencies in freshwater pearl culture, directly aligning with the objective of PO4, which emphasizes the acquisition of specialized skills in specific areas.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO3 is directly mapped to PO5 because; capacity for application, problem-solving, and analytical reasoning are necessary for studying *Lamellidans* spp.

PO6: Communication skills and collaboration
CO3 is directly mapped to PO6 because; communication skills and collaboration are necessary for sharing and applying knowledge about *Lamellidans* spp.

PO7: Research-related skills
CO4 is directly mapped to PO7 because; research-related skills are crucial for acquiring proficiency in implantation methods.

PO8: Learning how to learn skills
CO4 directly mapped to PO8 because; learning how to learn skills aid in acquiring and updating knowledge in pearl culture practices.

PO9: Digital and technological skills
CO4 directly mapped to PO9 because; digital and technological skills may support data management and analysis in marketing strategies.

PO10: Multicultural competence, inclusive spirit, and empathy
All of the COs are indirectly mapped to PO10 because, multicultural competence, inclusive spirit, and empathy may indirectly relate to understanding diverse perspectives in aquaculture pond management.

PO11: Value inculcation and environmental awareness
All of the CO's are directly mapped to PO10. For example; CO1 aims to understand and apply sustainable practices in fisheries and aquaculture, aligning directly with the objective of PO11, which emphasizes the inculcation of values and environmental awareness.

PO12: Autonomy, responsibility, and accountability
All of the CO's are directly mapped to PO10. For example; CO1 involves independent practice and decision-making in fisheries and aquaculture contexts, which directly aligns with the objective of PO12, emphasizing the development of autonomy, responsibility, and accountability.

PO13: Community engagement and service
All of the CO's are moderately mapped to PO10. For example; while sharing knowledge and practices with the community may involve aspects of fisheries and aquaculture, CO1 primarily focuses on individual competence rather than community engagement and service, hence the moderate relation.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2025)

Name of the Program: B.Sc. Zoology
Program Code: USZOO
Class: S.Y.B.Sc.
Semester: III
Course Type: Major (Mandatory) Practical
Course Code: ZOO-203-MRM
Course Name: Zoology Practical - III
Number of Credits: 02
Number of Teaching hours: 60

Course Objectives:-

- Classify and identify key vertebrate groups (Hemichordata to Mammalia) based on distinguishing features and evolutionary traits.
- Examine external morphology and adaptations of vertebrates, including sexual dimorphism in frogs and identification of poisonous vs. non-poisonous snakes.
- Analyze vertebrate anatomy by studying the digestive, reproductive, and nervous systems of frogs using models and charts.
- Identify fish species and their economic significance by studying the taxonomy, feeding habits, and role of Rohu, Catla, and Mrigal in aquaculture.
- Perform biochemical analysis of fish by estimating protein, lipid, and carbohydrate content for nutritional assessment.
- Apply aquaculture management skills by assessing stocking density, feed requirements, and sustainable fishery practices.
- Enhance field-based learning through visits to aquatic ecosystems or aquaculture sites, followed by report preparation on ecological or economic aspects.

Course Outcomes:-

Student will be able to-

CO1: accurately classify and identify key vertebrate groups from Hemichordata to Mammalia, demonstrating an understanding of their evolutionary relationships.
CO2: describe external morphology and adaptations of vertebrates, distinguishing sexual dimorphism in frogs and identifying poisonous vs. non-poisonous snakes.
CO3: explain vertebrate anatomical structures by analyzing the digestive, reproductive, and nervous systems of frogs using models and charts.
CO4: identify and evaluate fish species like Rohu, Catla, and Mrigal, explaining their taxonomy, feeding habits, and economic importance in aquaculture.
CO5: conduct biochemical analysis of fish, accurately estimating protein, lipid, and carbohydrate content for nutritional assessment.
CO6: apply aquaculture management techniques by determining stocking density, feed requirements, and best practices for sustainable fisheries.
CO7: demonstrate field-based research skills by compiling ecological or economic reports based on visits to aquatic ecosystems or aquaculture sites.

PRACTICALS:

Practical No.	Name of the practical	E/D	Teaching Hours
1.	To study the classification with reasons of the following: Hemichordata- *Balanoglossus* Urochordata- *Hardmania* Cephalochordata- *Amphioxus* Cyclostomata- *Petromyzon and Myxine*	D	4

2.	To study the classification with reasons of the following: Cartilaginous fish- *Scoliodon* Bony fish- Seahorse Amphibia: Toad and salamander	D	8
3.	To study the classification with reasons of the following: Class: Reptilia- Cobra, Garden lizard, Turtle, Rat snake and *Draco*	D	8
4.	To study the classification with reasons of the following: Class: Aves- Sparrow, Wood pecker, Parrot Class: Mammalia- Rabbit, Mongoose, Kangaroo	D	4
5.	Identification of poisonous and non-poisonous snakes	D	4
6.	Study of external characters and sexual dimorphism of frog	D	4
7.	Study of digestive system of frog with the help of model/ charts	D	4
8.	Study of reproductive system of frog with the help of model/ charts	D	4
9.	Study of brain of frog with the help of model/ charts	D	4
10.	Taxonomic identification, feeding habit and economic importance of Rohu, Catla and Mrigal	D	4
11.	Estimation of Protein/Lipid/ Carbohydrate in Fish.	E / D	4
12.	Determination of stocking density and feed assessment in fishery.	E	4
13.	Study of morphology and digestive system of mussel	D	4
14.	Visit to a forest/ aquatic ecosystem/Aquaculture and submission of report	-	4
15.	Submission of short project report on Economics of Aquaculture / Pearl culture (Activity based practical)	-	4

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Course Articulation Matrix of ZOO-203-MRM: Zoology Practical - III
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	3	3	1	2	2	1	2	2	2	2
CO2	3	3	1	3	3	1	2	2	1	2	2	2	2
CO3	3	2	2	2	3	2	3	2	1	3	2	2	3
CO4	3	1	2	2	3	2	3	2	1	3	2	2	3
CO5	3	2	1	3	3	2	3	2	2	2	2	2	2
CO6	3	2	2	2	3	3	3	3	3	2	2	2	2
CO7	3	2	2	1	2	2	3	3	1	2	1	1	2

PO1: Comprehensive knowledge and understanding
All COs are mapped to PO1, as they involve classification, anatomy, taxonomy, and physiology of vertebrates, fundamental to zoological studies.

PO2: Practical, professional, and procedural knowledge
CO1, CO2, CO3, CO5, CO6, and CO7 align with PO2 as they include practical aspects of vertebrate classification, anatomical studies, biochemical analysis, and field-based research.

PO3: Entrepreneurial mind-set and knowledge
CO3, CO4, and CO7 relate to PO3 as they focus on taxonomic classification, economic significance of fish species, and aquaculture, which are essential for entrepreneurship in zoology.

PO4: Specialized skills and competencies
CO1, CO2, CO3, CO5, and CO6 are mapped to PO4 due to their emphasis on specialized zoological knowledge, including vertebrate classification, physiological analysis, and biochemical assessment.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO1, CO2, CO4, CO5, and CO6 are strongly mapped to PO5 as they require analytical skills to understand evolutionary relationships, ecological adaptations, and physiological functions.

PO6: Communication skills and collaboration
CO6 and CO7 contribute to PO6 by involving report writing, field visits, and data interpretation in aquatic ecosystems and aquaculture.

PO7: Research-related skills
CO3, CO4, CO5, CO6, and CO7 align with PO7 as they involve systematic data collection, taxonomic research, biochemical assessments, and project-based learning.

PO8: Learning how to learn skills
CO1, CO2, CO3, CO4, CO5, CO6, and CO7 support PO8 by encouraging independent learning, field-based observations, and scientific exploration.

PO9: Digital and technological skills
CO6 and CO7 relate to PO9 as they involve data interpretation, experimental techniques, and use of technology in aquaculture management and biochemical analysis.

PO10: Multicultural competence, inclusive spirit, and empathy
CO3 and CO4 support PO10 by promoting awareness of biodiversity, conservation, and the role of vertebrates in ecological balance.

PO11: Value inculcation and environmental awareness
CO1 to CO7 contribute to PO11 by fostering conservation ethics, sustainability in aquaculture, and the ecological importance of vertebrates.

PO12: Autonomy, responsibility, and accountability
CO1 to CO7 align with PO12 by developing independent research skills, responsibility in handling specimens, and ethical practices in zoology.

PO13: Community engagement and service
CO3, CO4, and CO7 map to PO13 as they emphasize field-based learning, economic aspects of aquaculture, and outreach activities in conservation and fisheries.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2025)

Name of the Program: B.Sc. Zoology
Program Code: USZOO
Class: S.Y.B.Sc.
Semester: III
Course Type: Vocational Skill Courses (Practical)
Course Code: ZOO-204-VSC
Course Name: Biological Techniques
Number of Credits: 02
Number of Teaching hours: 30

Course Objectives:-

- Understand and apply Good Laboratory Practices (GLP) to ensure safety, accuracy, and reliability in laboratory work.
- Develop the skills necessary for laboratory sterilization procedures to maintain aseptic conditions.
- Gain knowledge of basic laboratory tools and glassware and learn to select and use them appropriately.
- Demonstrate proficiency in the sterilization of laboratory glassware and equipment to prevent contamination.
- Acquire the ability to prepare normal (N) solutions with precise concentrations for various laboratory applications.
- Master the techniques for preparing molar (M) solutions to work with different chemicals effectively.
- Learn to prepare and work with percent solutions for specific laboratory experiments.

Course Outcomes:-

Student will be able to-

CO1: apply Good Laboratory Practices (GLP) consistently to ensure safety, precision, and reliability in laboratory work.
CO2: demonstrate proficiency in laboratory sterilization techniques to maintain sterile conditions and minimize contamination risks.
CO3: identify, select, and effectively utilize basic laboratory tools and glassware, adhering to best practices for their care and maintenance.
CO4: successfully sterilize laboratory glassware and equipment, creating a contamination-free environment for experiments.
CO5: prepare and work with normal (N) and molar (M) solutions, accurately calculating concentrations and volumes for specific applications.
CO6: create and utilize percent solutions, showing a sound understanding of their preparation and application in laboratory experiments.
CO7: perform serial dilution methods and conduct acid-base titrations with precision, achieving accurate results in chemical analyses.

PRACTICALS:

PRACTICAL NO	TITLE OF PRACTICAL	E/D	TEACHING HOURS
1.	Good Laboratory Practices (GLP)	D	04
2.	To perform laboratory sterilization	D	04
3.	To study the basic tools and glassware's of laboratory	D	04
4.	Sterilization of laboratory glassware and equipment	D	08
5.	Preparation of normal (N) solution	E	04

6.	Preparation of molar (M) solution	E	04
7.	Preparation of percent solution	E	04
8.	Study of serial dilution method	E	04
9.	Preparation of PPM and PPB solutions	E	04
10.	Acid-base titration	E	04
11.	To study the Camera Lucida	D	04
12.	To study the working mechanism of laminar air flow	D	04
13.	To Study the principle and working of pH meter	E	04
14.	To Study the principle and working of Centrifugation	D	04
15.	To Study the principle and working of Colorimeter	E	04
D- Demonstration; E- Experiment.			

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8. Principles and Techniques of Biochemistry and Molecular Biology, 6th edition (2008), Keith Wilson and John Walker, Publisher–Cambridge University Press

Course Articulation Matrix of ZOO-204-VSC: Biological Techniques
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Comprehensive knowledge and understanding
CO1, CO2, CO3, CO5, CO6 & CO7 are mapped to PO1 because mastering GLP, sterilization, laboratory tools, and solution preparation ensures a strong theoretical and conceptual foundation in laboratory sciences, which is essential for a well-rounded understanding of biological techniques.

PO2: Practical, professional, and procedural knowledge
CO1, CO2, CO3, CO4, CO5, CO6 & CO7 are mapped to PO2 because applying Good Laboratory Practices (GLP), sterilization techniques, laboratory tool handling, solution preparation, and titration methods ensures safety, precision, and reliability in biological experiments. These hands-on skills are crucial for professional and procedural competency in laboratory settings.

PO3: Entrepreneurial mindset and knowledge
CO4 & CO7 are mapped to PO3 because expertise in sterilization techniques, serial dilutions, and titration methods has potential applications in biotechnology startups, chemical industries, and healthcare sectors, fostering an entrepreneurial mindset.

PO4: Specialized skills and competencies
CO1, CO2, CO3, CO4 & CO6 are mapped to PO4 as they focus on chemical handling, biomolecule isolation, microscopy, histological procedures, and staining techniques, which require precision and specialized laboratory skills for accurate biological experimentation.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO1, CO2, CO4, CO5 & CO6 are mapped to PO5 as they involve troubleshooting laboratory errors, ensuring solution accuracy, and analyzing experimental results, requiring strong problem-solving and analytical reasoning skills in biological research.

PO6: Communication skills and collaboration
CO4, CO6 & CO7 are mapped to PO6 because presenting findings, interpreting experimental results, and collaborating on research studies are essential communication and teamwork skills in scientific investigations.

PO7: Research-related skills
CO2, CO3, CO4, CO6 & CO7 are mapped to PO7 because chromatography, microscopy, histological processing, staining, and PCR techniques require analytical thinking, experimental validation, and research-oriented approaches.

PO8: Learning how to learn skills
CO1, CO2, CO5, & CO6 are mapped to PO8 because adapting to new laboratory methods, refining experimental techniques, and self-learning through hands-on experience enhance lifelong learning abilities in scientific disciplines.

PO9: Digital and technological skills
CO3, CO5 & CO6 are mapped to PO9 as they involve handling digital instruments, calculating solution concentrations, and using laboratory software for analysis, which are essential in modern biological research.

PO10: Multicultural competence, inclusive spirit, and empathy
CO1, CO2 & CO4 are mapped to PO10 because working in diverse laboratory teams, following ethical practices, and respecting collaborative efforts in research enhance multicultural competence and inclusivity.

PO11: Value inculcation and environmental awareness
CO1, CO2 & CO3 are mapped to PO11 because following Good Laboratory Practices (GLP), proper waste disposal, and ethical experimentation techniques instills scientific integrity and environmental consciousness.

PO12: Autonomy, responsibility, and accountability
CO1, CO2, CO4, & CO6 are mapped to PO12 because laboratory work requires independent decision-making, responsibility for results, and accountability in performing safe and ethical experiments.

PO13: Community engagement and service
CO1, CO2, CO3, CO4, CO5, CO6 & CO7 are mapped to PO13 as laboratory skills contribute to public health, environmental safety, and educational outreach programs, fostering engagement in community-based scientific initiatives.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2025)

Name of the Program: B.Sc. Zoology
Program Code: USZOO
Class: S.Y.B.Sc.
Semester: III
Course Type: Field Project
Course Code: ZOO-205-FP
Course Name: Field Project
Number of Credits: 02
Number of Teaching hours: 60

Course Objectives:-

- To develop field-based research skills by conducting surveys, specimen collection, and ecological assessments.
- To analyze biodiversity and ecosystem dynamics through species identification and habitat evaluation.
- To apply taxonomic principles in identifying and classifying local fauna and flora.
- To assess environmental factors affecting wildlife and ecosystem health.
- To enhance practical skills in zoological research methodologies such as population sampling and behavioural studies.
- To promote conservation awareness by evaluating threats to biodiversity and proposing management strategies.
- To integrate theoretical knowledge with real-world applications by preparing field reports and presentations.

Course Outcomes:-

Student will be able to-

CO1: demonstrate proficiency in field-based research techniques, including surveys, specimen collection, and ecological assessments.
CO2: identify and analyze biodiversity patterns and ecosystem dynamics by evaluating species diversity and habitat characteristics.
CO3: apply taxonomic principles to classify and document local fauna and flora accurately.
CO4: assess the impact of environmental factors on wildlife and ecosystem health using observational and analytical methods.
CO5: utilize zoological research methodologies such as population sampling and behavioral studies to collect and interpret data.
CO6: develop conservation strategies based on an understanding of biodiversity threats and propose sustainable management solutions.
CO7: synthesize field observations with theoretical knowledge to prepare comprehensive reports and deliver presentations on research findings.

Guidelines for Field Project (FP)

UG (Year-II Semester-III)

In NEP 2020 (2023 Pattern) we are offering to UG (Second Year-Third Semester) students **Field Project (FP) for TWO (2) credits** i.e. **50 Marks**. The total time allocation for the student to carry out field project is **60 hours.** The actual field work should be carried out after college hours or on holidays.

To carry out the field project work following guidelines should be used:

1. Field-based learning: Students should participate in field-based learning/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)

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.
9. The typed project report should be with font size 12 and line spacing of 1.5. Submit the project report with the Guide's signature to the department (To the Departmental FP coordinator).
10. The Oral presentation for all the projects in the department should be arranged in the department.
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 the scheme of examination for field project is given in the table.
12. The departmental FP coordinator / HoD should submit the marks as per regular procedure to the examination section. **Since it is a compulsory subject in our syllabus, passing students in this field project is MUST to complete their degree**.

Typical Time and marks allocation for the different stages of the field 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**

Course Articulation Matrix of ZOO-205-FP: Filed Project
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	3	2	3	2	2	2	3	2	3
CO2	3	2	1	3	3	2	3	2	2	2	3	2	2
CO3	3	2	1	3	3	1	3	2	2	2	2	1	1
CO4	3	2	2	3	3	2	3	2	2	3	3	2	2
CO5	3	3	2	3	3	3	3	3	2	2	3	2	2
CO6	3	2	3	3	3	2	3	3	2	3	3	3	3
CO7	3	2	2	2	3	3	3	3	2	2	3	3	3

PO1: Comprehensive Knowledge and Understanding
All COs are mapped to PO1 because they contribute to a deep understanding of zoological research techniques, species identification, environmental assessments, and conservation strategies. This ensures students develop a strong theoretical foundation in biological sciences.

PO2: Practical, Professional, and Procedural Knowledge
CO1, CO2, CO3, CO4, CO5, and CO6 are directly related to PO2 since they involve field-based research, species classification, ecosystem evaluation, and conservation planning, requiring hands-on expertise and procedural competence.

PO3: Entrepreneurial Mindset and Knowledge
CO4, CO5, CO6, and CO7 contribute to PO3 as they involve skills such as data analysis, research-driven decision-making, and conservation planning, which can be applied in entrepreneurial ventures such as eco-tourism, wildlife conservation startups, and biodiversity consulting.

PO4: Specialized Skills and Competencies
CO1, CO2, CO3, CO4, CO5, and CO6 are mapped to PO4 since they require mastery of specific techniques such as taxonomic classification, behavioral studies, environmental impact assessment, and population sampling—essential for high-level zoological research.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
All COs contribute to PO5 by requiring students to analyze biodiversity patterns, assess ecological factors, and apply taxonomic principles to real-world challenges in conservation and wildlife management.

PO6: Communication Skills and Collaboration
CO1, CO5, and CO7 map to PO6 as they involve report writing, teamwork in fieldwork, data presentation, and collaboration with conservation agencies, requiring effective communication and cooperative skills.

PO7: Research-Related Skills
All COs are aligned with PO7 as they involve research methodologies such as field surveys, behavioral analysis, biodiversity monitoring, and conservation planning, all of which are essential components of zoological research.

PO8: Learning How to Learn Skills
CO1, CO5, CO6, and CO7 contribute to PO8 as they encourage students to integrate field experiences with theoretical concepts, fostering lifelong learning skills and adaptability in scientific research.

PO9: Digital and Technological Skills
CO1, CO2, CO3, CO4, and CO5 relate to PO9 since students utilize GIS mapping, statistical software, data collection tools, and digital microscopy for species identification and ecological assessments.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy
CO4 and CO6 align with PO10 as they involve understanding the impact of environmental changes on diverse ecosystems, promoting cultural awareness and empathy toward global conservation efforts.

PO11: Value Inculcation and Environmental Awareness
All COs contribute to PO11 as they instill ecological responsibility, ethical research practices, and awareness of biodiversity conservation, ensuring students develop a strong sense of environmental stewardship.

PO12: Autonomy, Responsibility, and Accountability
CO1, CO5, CO6, and CO7 align with PO12 as they require independent research, responsible data collection, and ethical decision-making in zoological fieldwork.

PO13: Community Engagement and Service
CO1, CO4, CO6, and CO7 contribute to PO13 as they emphasize conservation initiatives, public awareness campaigns, and research dissemination to local communities, fostering a commitment to environmental service.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2025)

Name of the Program: B.Sc. Zoology
Program Code: USZOO
Class: S.Y.B.Sc.
Semester: III
Course Type: Minor (Theory)
Course Code: ZOO-206-MN
Course Name: Apiculture
Number of Credits: 02
Number of Teaching hours: 30

Course Objectives:-

- To disseminate information on economic aspects of zoology like apiculture.
- To encourage young learners for self-employment.
- To comprehend the functioning of apiculture industry and its scope in India.
- To study the honey bee species and bee products.
- To study the bee keeping industry.
- To encourage adoption of scientific Apiculture by supply of disease free bee colonies, bee health management, quality honey production and other bee products.
- To critically study the life history and rearing of honey bees, bee behavior and communication, bee diseases and enemies.

Course Outcomes:-

Student will be able to-

CO1: identify different honey bee species.
CO2: explain the tools & techniques used in apiculture.
CO3: illustrate the diseases of honey bee.
CO4: enumerate the methods of collecting, processing, and utilizing bee products, including honey, wax, bee venom, propolis, royal jelly, and pollen grains and thereby understands the economic importance of apiculture.
CO5: get acquaint about communication system among the casts in the colony.
CO6: understand the seasonal management of bees for bee keeping.
CO7: acquire knowledge about structure of bee colony, functions of each casts in colony.

TOPICS:

UNIT	SUB UNITS	SYLLABUS	NO. OF LECTURES
1. Introduction, habit, habitat and nesting behavior	1.1	An introduction to Apiculture	05
	1.2	Study of habit, habitat and nesting behavior of *Apis dorsata*, *Apis indica*, *Apis florae* *Apis mellifera*	
2.Honey bee life cycle, behaviour and Communication.	2.1	Life cycle of honey bee	06
	2.2	Colony organization and division of labour, polymorphism	
	2.3	Bee behaviour	
	2.4	Bee communication	
3.Bee keeping equipments	3.1	Bee box (Langstroth type)	04
	3.2	Honey extractor	
	3.3	Smoker	
	3.4	Bee-veil	
	3.5	Gloves	

	3.6	Hive tool	
	3.7	Bee Brush	
	3.8	Comb foundation Sheet	
4.Bee products (collection methods, composition and uses)	4.1	Honey	06
	4.2	Wax	
	4.3	Bee Venom	
	4.4	Propolis	
	4.5	Royal jelly	
	4.6	Pollen grains	
5.Diseases and enemies of Bees	5.1	Bee diseases – Protozoan, Bacterial, Fungal – with two examples	07
	5.2	Bee pests – Wax moth (Greater and Lesser), Wax beetle	
	5.3	Bee Enemies – Bee eater, King crow, Wasp, Lizard, Bear, Man	
6. Bee keeping and seasonal management.			02

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5. Bee and Bee Keeping, 1978, Roger A. Morse, Conell University Press, London.
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Course Articulation Matrix of ZOO-206-MN: Apiculture
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Comprehensive Knowledge and Understanding
CO1, CO2, CO3, CO4, CO5, CO6 & CO7 are mapped to PO1 because they provide a broad understanding of bee biology, species classification, colony structure, seasonal management, and apicultural techniques. This promotes a strong theoretical foundation in applied entomology and ecological biology.

PO2: Practical, Professional, and Procedural Knowledge
CO2, CO3, CO4, CO5 & CO6 contribute to PO2 as they involve handling beekeeping tools, identifying bee diseases and pests, applying techniques of bee product extraction, and managing apiaries across seasons, all of which foster procedural skills needed in apiculture and allied sectors.

PO3: Entrepreneurial Mindset and Knowledge
CO3, CO4, CO6 & CO7 are mapped to PO3 because disease management, bee product utilization, seasonal beekeeping practices, and understanding of colony dynamics form a base for entrepreneurship in apiculture, enabling opportunities like organic honey farming and rural enterprise.

PO4: Specialized Skills and Competencies
CO1, CO2, CO3, CO4, CO6 & CO7 are mapped to PO4 as they develop precision in identification, demonstrate understanding of bee tools and diseases, and build competence in apiary management—all necessary for advanced apicultural operations and extension services.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO3, CO4, CO5 & CO6 are mapped to PO5 since managing diseases, understanding colony communication, and dealing with seasonal stress require diagnostic skills and analytical reasoning to ensure effective beekeeping practices.

PO6: Communication Skills and Collaboration
CO5, CO6 & CO7 contribute to PO6 because understanding intra-colony communication, working in team-based apiary management, and reporting observations from field visits help build collaboration and scientific communication skills.

PO7: Research-Related Skills
CO2, CO3 & CO6 are mapped to PO7 as studying bee diseases, evaluating tools, and season-wise maintenance contribute to data collection, experimentation, and application of scientific techniques relevant to apicultural research.

PO8: Learning How to Learn Skills
CO2, CO4, CO6 & CO7 contribute to PO8 because they promote self-directed learning about tools, bee products, and colony behavior—encouraging continuous skill development in the evolving field of beekeeping.

PO9: Digital and Technological Skills
CO2 & CO4 are mapped to PO9 as documenting hive data, honey composition analysis, and tech-based honey processing methods foster the integration of digital tools in modern apiculture.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy
CO4 & CO7 contribute to PO10 by helping students appreciate the cultural and ecological relevance of apiculture, fostering empathy toward biodiversity and rural livelihoods.

PO11: Value Inculcation and Environmental Awareness
CO1, CO4 & CO5 are mapped to PO11 as they highlight species conservation, colony function, and the ecological role of bees, thus nurturing environmental ethics.

PO12: Autonomy, Responsibility, and Accountability
CO3, CO4, CO6 & CO7 are mapped to PO12 because disease management, bee product handling, and independent field visits cultivate responsibility and decision-making in field practices.

PO13: Community Engagement and Service
CO4 & CO7 contribute to PO13 as they promote awareness of apiculture's role in rural development and encourage students to engage in knowledge dissemination and community training on beekeeping.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2025)

Name of the Program: B.Sc. Zoology
Program Code: USZOO
Class: S.Y.B.Sc.
Semester: III
Course Type: Minor (Practical)
Course Code: ZOO-207-MN
Course Name: Practicals in Apiculture
Number of Credits: 02
Number of Teaching hours: 60

Course Objectives:-

- To acquaint students with different species and castes of honey bees, their morphology, and roles in the colony.
- To impart knowledge about the life cycle and social organization of honey bees.
- To familiarize students with the structure and components of the modern bee hive (Langstroth box) and essential beekeeping equipment.
- To develop understanding of seasonal management practices in apiary to ensure optimal hive health and productivity.
- To train students in the identification of bee pests, predators, and diseases affecting honey bee colonies.
- To provide hands-on experience in dissecting and preparing temporary mounts of honey bee anatomical structures and analyzing honey quality through sugar estimation.
- To highlight the economic importance of various bee products and encourage the experiential learning through visits to apiculture units.

Course Outcomes:-

Student will be able to-

CO1: identify different species and castes of honey bees and describe their morphological features and roles within the colony.
CO2: explain the life cycle stages of honey bees and understand their complex social behavior and colony organization.
CO3: demonstrate knowledge of the components and functioning of modern bee hives (Langstroth box) and proper usage of beekeeping equipment.
CO4: outline and apply seasonal management practices necessary for maintaining healthy and productive bee colonies.
CO5: identify and describe common diseases, pests, and predators of honey bees, along with suitable preventive and control measures.
CO6: perform practical skills in mounting anatomical structures of bees and conduct basic biochemical tests such as sugar estimation in honey.
CO7: recognize the economic value of honey bee products and reflect on practical aspects of apiculture through field visits and report writing.

Practicals:

Sr. No.	Name of the Practical	E/D	Teaching hours
1.	Study of honey bee species - *Apis dorsata, Apis indica, Apis florae, Apis mellifera*	D	01
2.	Study of life cycle of honey bee.	D	01
3.	Study and identification of castes in honey bee	D	01

	a) Queen b) Workers c) Drones		
4.	Study of Langstroth bee box. (Modern bee hive)	D	01
5.	Study of bee keeping equipments. a) Honey extractor b) Bee veil c) Smoker d) Hive tool e) Bee brush f) Queen excluder g) Comb foundation sheet h) Gloves	D	02
6.	Study of the seasonal management of apiary a) Rainy season b) Winter season c) Spring season d) Summer season	D	01
7.	Temporary mounting of legs, sting apparatus , wings, mouth parts of worker bee.	E	01
8.	Estimation of reducing sugars from honey.	E	01
9.	Study of honey bee diseases. a) Protozoan (*Nosema*), b)Bacterial (American foul brood), c)Viral (Sac brood), d)Fungal (Chalk brood).	D	01
10.	Study of honey bee pests a) Wax moths – greater and lesser b) Wax beetles	D	01
11	Specimen study of honey bee predators and enemies: a) Wasps, b) Toads, c) Garden lizard c) Green bee eater d) King crow e) Bear.		01
12.	Study of economic importance of honey bee products: Honey, pollen, propolis, bee wax, royal jelly, bee venom.	D	02
13.	A visit to apiculture unit and submission of report		01

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Course Articulation Matrix of ZOO-207-MN: Practicals in Apiculture
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Comprehensive knowledge and understanding
CO1, CO2, CO3, CO4, CO5, CO6 & CO7 are mapped to PO1 because understanding the diversity, anatomy, and life cycle of honey bees, along with diseases and products, provides a foundational theoretical base in apiculture. This knowledge supports the broader understanding of insect biology and ecological roles essential in zoological and environmental sciences.

PO2: Practical, professional, and procedural knowledge
CO1, CO3, CO4, CO5, CO6 & CO7 are mapped to PO2 because identification of castes, operation of beekeeping tools, seasonal management practices, dissection skills, and biochemical tests like sugar estimation involve hands-on procedural knowledge. These practical aspects of beekeeping develop professional competence in managing apiaries and handling bee-related equipment safely and efficiently.

PO3: Entrepreneurial mindset and knowledge
CO3, CO4, CO5 & CO7 are mapped to PO3 because knowledge of hive maintenance, disease and pest control, and the economic value of bee products contribute to entrepreneurial skill development. These outcomes are highly relevant for students aspiring to explore self-employment or business ventures in apiculture and agro-based industries.

PO4: Specialized skills and competencies
CO1, CO3, CO4, CO5 & CO6 are mapped to PO4 as they involve precise observation and handling techniques in identifying honey bee species and castes, using specialized beekeeping equipment, managing seasonal changes in colonies, and performing anatomical mountings and sugar analysis. These activities cultivate refined laboratory and field skills necessary for accurate biological practices.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO3, CO4, CO5 & CO6 are mapped to PO5 because students apply diagnostic and management strategies in apiary health, identify symptoms of diseases, analyze honey quality, and solve colony-related issues. These activities strengthen analytical thinking, logical reasoning, and problem-solving capabilities in biological contexts.

PO6: Communication skills and collaboration
CO4, CO5, CO6 & CO7 are mapped to PO6 as they require students to interpret and present findings from field visits, collaborate during practical work, and report observations. These outcomes enhance teamwork, scientific communication, and interpersonal effectiveness essential for fieldwork and academic settings.

PO7: Research-related skills
CO3, CO4, CO5 & CO6 are mapped to PO7 because the practicals involve observational analysis, specimen study, biochemical testing, and documentation — all of which are fundamental research skills. These practices support evidence-based learning and prepare students for research in biological sciences.

PO8: Learning how to learn skills
CO3, CO4, CO5, CO6 & CO7 are mapped to PO8 because continuous learning is required to adapt to seasonal management, understand evolving pest control methods, and apply new techniques in apiculture. Hands-on exposure during field visits and self-reflection through report writing encourage independent learning and adaptability.

PO9: Digital and technological skills
CO3 & CO6 are mapped to PO9 as the use of modern beekeeping tools like honey extractors, observation aids, and analysis of sugar content involves the application of technological skills and modern instrumentation used in apiculture and laboratory settings.

PO10: Multicultural competence, inclusive spirit, and empathy
CO2, CO4, CO5 & CO7 are mapped to PO10 because understanding the community-based and culturally embedded practices in apiculture, as well as ethical considerations in handling bee colonies and promoting sustainable practices, fosters inclusivity, environmental empathy, and awareness of rural livelihoods.

PO11: Value inculcation and environmental awareness
CO3, CO4, CO5, CO6 & CO7 are mapped to PO11 as students learn about the ecological roles of honey bees, importance of biodiversity, and sustainable beekeeping practices. These outcomes promote conservation ethics, environmental responsibility, and appreciation for pollinator ecosystems.

PO12: Autonomy, responsibility, and accountability
CO3, CO4, CO5, CO6 & CO7 are mapped to PO12 because conducting field visits, maintaining hive health, and preparing practical reports involve personal initiative, responsibility for handling equipment and organisms, and accountability in data recording and safety procedures.

PO13: Community engagement and service
CO4, CO5 & CO7 are mapped to PO13 as students interact with local apiculture units, learn from community experts, and explore how apiculture supports livelihoods. These experiences foster community involvement and appreciation for socially relevant biological practices.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2023 (w. e. f. June, 2025)

Name of the Program: B.Sc. Zoology
Program Code: USZOO
Class: S.Y.B.Sc.
Semester: III
Course Type: Open Elective Theory
Course Code: ZOO-208-OE
Course Name: Crop Pest: Types and Management (पिकावरील कीड: प्रकार व व्यवस्थापन)
Number of Credits: 02
Number of Teaching hours: 30

Course Objectives:-

- Identify and classify major pests affecting different crops such as cereals, pulses, oilseeds, fruits, and stored grains, along with their damage patterns and life cycles.
- Demonstrate proficiency in implementing effective pest control measures for various crops, including cereals, sugarcane, pulses, oilseeds, and fruit crops.
- Analyze the impact of stored grain pests such as rice weevils, flour beetles, and pulse beetles, and apply suitable control methods to minimize post-harvest losses.
- Evaluate the life cycle and behavior of major agricultural pests, including locusts, termites, and rodents, to recommend appropriate preventive and curative control measures.
- Apply knowledge of pest control techniques to protect crops from non-insect pests such as nematodes, crabs, birds, wild boars, bats, and antelopes.
- Develop and implement integrated pest management (IPM) strategies, incorporating biological, cultural, mechanical, and chemical methods to control pests effectively.
- Interpret and apply pest management principles to ensure sustainable and environmentally friendly practices while minimizing pest-related damage to crops.

Course Outcomes:-

Student will be able to-

CO1: classify and distinguish between different types of crop pests, including insects and non-insect pests, affecting cereals, pulses, oilseeds, and fruit crops.

CO2: identify and apply appropriate pest control methods for stored grains, including management of weevils, grain borers, and other storage pests.

CO3: analyze the life cycle, behavior, and control strategies of locusts and grasshoppers to minimize their destructive impact on crops.

CO4: demonstrate knowledge of damage assessment and implement preventive and control measures for termites and rodent management in agricultural fields.

CO5: evaluate the threats posed by non-insect pests such as worms, crabs, birds, wild boars, bats, and deer, and apply appropriate management strategies.

CO6: implement integrated pest management (IPM) techniques effectively to control pests while maintaining ecological balance and minimizing environmental impact.

CO7: develop and apply practical strategies for rodent control by understanding their habitat, feeding habits, and life cycles to reduce agricultural damage

TOPICS:

UNIT	SUB UNITS	SYLLABUS	NO. OF LECTURES
1.	**Different crops grown in the field and their pest control methods.**		14
	1.1	Cereals: Pest management in sorghum, pearl millet, and wheat.	
	1.2	Sugarcane: Pest management in sugarcane.	
	1.3	Pulses: Pest management in pigeon pea, chickpea, and sweet pea	
	1.4	Oilseeds: Pest management in groundnut and sunflower crops.	
	1.5	Fruit Crops: Pest management in mango, pomegranate, guava, grapes, and coconut crops.	
2.	**Pest management in stored grains.**		4
	2.1	Control of rice weevil & grain borer	
	2.2	Management of grain weevil, flour beetle, and long-headed flour beetle	
	2.3	Management of pulse beetle	
3.	**Locusts and Grasshoppers.**		3
	3.1	Locusts and Grasshoppers	
	3.2	Locust swarm and Life cycle	
	3.3	Control measures for Locust swarms	
4.	**Termite:**		1
	4.1	Damage caused by termites and its control.	
5.	**Rodents:**		2
	5.1	Types	
	5.2	Habitat and Habits	
	5.3	Food and Life Cycle	
	5.4	Damage, Control and Preventive measures	
6.	**Other Enemies of Crops:**		2
	6.1	Worms	
	6.2	Crabs	
	6.3	Birds	
	6.4	Wild Boar	
	6.5	Bat	
	6.6	Chinkara (Indian Gazelle)	
7.	**Integrated Pest Management**		4
	7.1	Introduction and Methodology	

UNIT	SUBUNIT	SYLLABUS	NO. OF LECTURES
1.	**शेतामध्ये घेतली जाणारी वेगवेगळी पिके आणि त्यावरील कीड नियंत्रणाच्या पद्धती**		14
	1.1	तृणधान्य: ज्वारी, बाजरी आणि गहू या पिकांवरील कीड नियंत्रण	
	1.2	ऊसावरील कीड नियंत्रण.	
	1.3	कडधान्य : तूर, हरभरा आणि वाटाणा या पिकांवरील कीड नियंत्रण	
	1.4	तेलबिया : भुईमूग आणि सुर्यफुल या पिकांवरील कीड नियंत्रण.	
	1.5	फळझाडे: आंबा, डाळिंब, पेरू, द्राक्षे आणि नारळ या पिकांवरील कीड नियंत्रण	
2.	**साठविलेल्या धान्यातील कीड नियंत्रण.**		04
	2.1	तांदळामधील सोंडा व कोठारातील सोंडा नियंत्रण.	
	2.2	धान्य पोखरणारा भुंगेरा, पिठातील भुंगेरा, पिठातील लांबशीर्ष भुंगेरा	
	2.3	कडधान्याचा भुंगेरा नियंत्रण.	
3.	**टोळ आणि गवती टोळ:**		03
	3.1	टोळ व गवती टोळ	
	3.2	टोळधाड आणि जीवनक्रम	
	3.3	टोळधाडीच्या नियंत्रणाचे उपाय.	

4.	**वाळवी:**		01
	4.1	वाळवीमुळे होणारे नुकसान आणि त्याचे नियंत्रण.	
5.	**उंदीर:**		02
	5.1	प्रकार	
	5.2	वास्तव्य आणि सवयी	
	5.3	खाद्य व जीवनक्रम	
	5.4	नुकसान, बंदोबस्त आणि प्रतिबंधात्मक उपाय.	
6.	**पिकांचे इतर शत्रू:**		02
	6.1	कृमी	
	6.2	खेकडे	
	6.3	पक्षी	
	6.4	रानडुक्कर	
	6.5	वटवाघूळ	
	6.6	चिंकारा	
7.	**एकात्मिक कीड व्यवस्थापन**		04
	7.1	परिचय व पद्धती	

REFERENCES

1. भाजीपाला पिकावरील कीड व्यवस्थापन- डॉ. बस्वराज भेदे.
2. पिकांवरील कीड-कीटक- डॉ. पुरुषोत्तम जोशी.
3. कीटक निरीक्षकाचा सोबती- डॉ. पुरुषोत्तम जोशी.

Course Articulation Matrix of ZOO-208-OE: Crop Pest: Types and Management

(पकावरील कीड: प्रकार व व्यवस्थापन)

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	3	1	2	1	1	2	3	1	1
CO2	3	3	2	2	3	1	1	1	2	1	3	2	1
CO3	3	3	2	3	3	2	2	1	2	2	3	2	2
CO4	3	2	1	3	3	2	2	1	1	2	3	2	1
CO5	3	2	1	3	3	2	2	1	1	2	3	2	2
CO6	3	3	2	3	3	3	2	2	3	3	3	3	2
CO7	3	3	2	3	3	2	2	1	2	2	3	2	1

PO1: Comprehensive Knowledge and Understanding

All COs are directly mapped to PO1 because understanding crop pest classification, pest control techniques, life cycle analysis, damage assessment, non-insect pest management, integrated pest management (IPM), and rodent control provides a solid foundation for comprehensive knowledge in pest management.

PO2: Practical, Professional, and Procedural Knowledge

CO1, CO2, CO3, CO5 & CO7 are directly mapped to PO2 because practical skills in identifying pest species, applying storage pest management techniques, controlling locust and grasshopper outbreaks, assessing rodent damage, and executing rodent management strategies are essential for professional pest control.

PO3: Entrepreneurial Mind-set and Knowledge

CO4 & CO6 are directly mapped to PO3 because knowledge of damage assessment, rodent control, and implementation of IPM techniques has potential applications in agriculture-based entrepreneurship and sustainable pest management businesses.

PO4: Specialized Skills and Competencies
CO1, CO2, CO3, CO4 & CO6 are directly mapped to PO4 because mastering pest classification, storage pest control, locust management, termite and rodent control, and applying IPM techniques requires specialized skills essential for effective pest management practices.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning
CO1, CO2, CO4, CO5 & CO6 are directly mapped to PO5 because identifying crop pest types, applying pest control methods, assessing pest damage, managing non-insect pests, and implementing IPM techniques require critical thinking, analytical reasoning, and problem-solving abilities.

PO6: Communication Skills and Collaboration
CO4, CO6 & CO7 are directly mapped to PO6 because interpreting pest damage results, presenting IPM strategies, and collaborating on rodent control programs require effective communication and teamwork skills in pest management.

PO7: Research-related Skills
CO2, CO3, CO4, CO6 & CO7 are directly mapped to PO7 because research in storage pest control, locust behaviour analysis, termite management, IPM application, and rodent control involves data analysis, validation, and experimentation, enhancing research skills.

PO8: Learning How to Learn Skills
CO1, CO2, CO5 & CO6 are directly mapped to PO8 because gaining expertise in pest classification, improving pest control techniques, understanding non-insect pest threats, and adapting to new IPM methods contribute to lifelong learning in pest management.

PO9: Digital and Technological Skills
CO6 & CO7 are directly mapped to PO9 because using pest monitoring technologies in IPM and implementing digital tools in rodent management enhances digital literacy and technical proficiency.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy
CO1, CO2, CO3, CO4, CO5 & CO6 are directly mapped to PO10 because pest management practices often require understanding diverse ecological environments, collaborating with multicultural farming communities, and promoting inclusive, sustainable pest management.

PO11: Value Inculcation and Environmental Awareness
CO1, CO2, CO4, CO5 & CO6 are directly mapped to PO11 because ensuring safe pest management practices, using eco-friendly pest control methods, reducing pesticide use, and promoting IPM contribute to environmental sustainability and ethical pest management.

PO12: Autonomy, Responsibility, and Accountability
CO1, CO2, CO4, CO5 & CO6 are directly mapped to PO12 because conducting pest management independently, ensuring accuracy in pest control techniques, and taking responsibility for implementing sustainable pest control measures reflect autonomy and accountability.

PO13: Community Engagement and Service
All COs are directly mapped to PO13 because practical pest management knowledge, research in pest control methods, and sustainable pest management practices contribute to agricultural sustainability and benefit local farming communities.

SYLLABUS (CBCS) FOR S. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2025)

Name of the Program: B.Sc. Zoology
Program Code: USZOO
Class: S.Y. B.Sc.
Semester: III
Course Type: Indian Knowledge System (Theory)
Course Code: ZOO-209-IKS
Course Name: Animal Diversity & Conservation in Indian Culture
Number of Credits: 02
Number of Teaching hours: 30

Course Objectives:-

- Basic information on animals in Indian culture.
- Classification of some animals by Indian ascetics.
- Habitat and behavioral diversity of animals in perspective of Indian culture.
- Correlation between Indian culture and animal conservation.
- Role of animals in ecosystem.
- Domestication of animals
- Animal taming in Indian culture.

Course Outcomes:-

Student will be able to-
CO1: Recall facts about animals in Indian culture.
CO2: Classify animals as per Indian tradition.
CO3: Compare habitat and behavioral diversity of animals.
CO4: Analyze role of Indian culture in animal conservation.
CO5: Explain role of animals in ecosystem.
CO6: Predicts correlation between Indian culture and animal domestication.
CO7: Explain the concept of animal taming in Indian culture

TOPICS:

UNIT NO.	SUBUNIT NO.	DETAILS	TEACHING HOURS
1. Study of following animals with special reference to their conservation strategies in Ancient Indian Literature (Non-chordates)	1.1	Introduction	06
	1.2	Ants & Bees	
	1.3	Praying Mantis	
	1.4	Butterflies	
	1.5	Spider	
2. Study of following animals with special reference to their conservation strategies in Ancient Indian Literature (Chordates)	2.1	Fish	12
	2.2	Frog	
	2.3	Tortoise & Snakes	
	2.4	Eagle, Peacock, Owl	
	2.5	Cow, Elephant, Horse	
3. Introduction to Animal Classification in Ancient India	3.1	Eagle	12
	3.2	Owl	
	3.3	Crow	
	3.4	Cow	
	3.5	Buffalo	
	3.6	Horse	

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2. Krishna N., Amrithalingam M. and Godbole A., (2006). 'Sacred Animals of Maharashtra', Ecological Traditions of Maharashtra, C.P.R. Environment Education Centre, Chennai.
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4. Ramanujam, Geetha, (2006). Environmental Awareness in Jainism, Department of Jainology, University of Madras, Chennai.
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Course Articulation Matrix of ZOO-209-IKS: Animal Diversity & Conservation in Indian Culture

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

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

PO1: Comprehensive knowledge and understanding

CO1, CO2, CO3, CO4, CO5 & CO7 are mapped to PO1 because they involve recalling cultural facts, classifying animals in traditional contexts, and understanding behavioral and ecological roles, which help in building a strong theoretical base on the relationship between Indian culture and animals.

PO2: Practical, professional, and procedural knowledge

CO2, CO3, CO4 & CO6 are mapped to PO2 as they involve interpreting animal classification, comparing habitats, and understanding conservation strategies within the framework of Indian tradition — essential for applying cultural insights in real-world environmental practices.

PO3: Entrepreneurial mindset and knowledge

CO4, CO6 & CO7 are mapped to PO3 because knowledge about domesticated animals, their cultural significance, and traditional uses fosters innovative thinking in livestock management, eco-tourism, sustainable agriculture, and cultural heritage-based entrepreneurship.

PO4: Specialized skills and competencies

CO2, CO3, CO4 & CO6 are mapped to PO4 because comparing traditional knowledge with scientific data, understanding species diversity, and linking cultural practices to animal domestication require analytical skills and specialized understanding of zoological and ethno-biological domains.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning

CO3, CO4, CO5 & CO6 are mapped to PO5 as they demand higher-order thinking skills such as comparing ecological roles, analyzing conservation practices, and predicting outcomes of cultural practices, which encourage scientific reasoning and interdisciplinary problem-solving.

PO6: Communication skills and collaboration

CO4, CO5 & CO7 are mapped to PO6 because discussing the cultural, ecological, and historical importance of animals enhances students' ability to communicate complex ideas and collaborate on community-based or interdisciplinary conservation projects.

PO7: Research-related skills
CO3, CO4 & CO6 are mapped to PO7 because analyzing traditional conservation approaches and investigating animal behavioral patterns through cultural narratives promote critical thinking, inquiry, and qualitative research aptitude in socio-ecological studies.

PO8: Learning how to learn skills
CO2, CO3, CO4, CO5 & CO6 are mapped to PO8 because integrating traditional knowledge with modern ecological understanding promotes independent thinking, reflection, and continuous learning in cultural biology and conservation ethics.

PO9: Digital and technological skills
CO4 & CO5 are mapped to PO9 as researching conservation models, accessing digital archives, and using media to explore animal behavior and habitats require basic digital literacy and data handling skills relevant to current educational practices.

PO10: Multicultural competence, inclusive spirit, and empathy
CO1, CO2, CO4, CO5 & CO7 are mapped to PO10 as they involve understanding and respecting the roles of animals across diverse Indian communities, enhancing empathy toward animals and cultural practices, and encouraging inclusive perspectives in education and conservation.

PO11: Value inculcation and environmental awareness
CO1, CO3, CO4, CO5 & CO6 are mapped to PO11 because studying the cultural reverence and ecological roles of animals in Indian traditions promotes ethical values, environmental sensitivity, and awareness about biodiversity protection.

PO12: Autonomy, responsibility, and accountability
CO4, CO5 & CO6 are mapped to PO12 since reflecting on traditional animal-human relationships and conservation ethics promotes responsibility in preserving cultural and biological diversity, and encourages informed and accountable action.

PO13: Community engagement and service
CO3, CO4, CO5, CO6 & CO7 are mapped to PO13 as they promote awareness of community-based conservation, traditional knowledge systems, and animal management practices, inspiring students to participate in outreach, cultural documentation, and biodiversity stewardship.