



**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**

**F.Y. B.Sc. (Zoology) Semester -I**

**For Department of Zoology**

**Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati**

**Choice Based Credit System Syllabus (2023 Pattern)**

**(As Per NEP 2020)**

**To be implemented from Academic Year 2023-2024**

**Title of the Programme: F. 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 **F. 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 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 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 in diagnostic 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:*** Analyse the relationships of animals with abiotic factors and different biotic factors like plants and microbes. They will be 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  
Tuljaram Chaturchand College  
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**Board of Studies (BoS) in Zoology**

From 2022-23 to 2024-25

Sr. No.	Name	Designation
1.	<b>Mr. Sandip P. Chordiya</b>	Chairman
2.	<b>Dr. Vitthal B. Nale</b>	Member
3.	<b>Dr. Deepali M. Sangale</b>	Member
4.	<b>Dr. Sunil N. Pokale</b>	Vice-Chancellor Nominee
5.	<b>Dr. Gulab D. Khedkar</b>	Expert from other University
6.	<b>Dr. Sanjay K. Gaikwad</b>	Expert from other University
7.	<b>Dr. Yogesh A. Karpe</b>	Industry Expert
8.	<b>Mr. Kishor U. More</b>	Invitee member
9.	<b>Mr. Mayur S. Shitole</b>	Invitee member
10.	<b>Mr. Bipin B. Jagtap</b>	Meritorious Alumni
11.	<b>Ms. Rutuja R. Chavan</b>	Student Representative
12.	<b>Mr. Subodh M. Nikam</b>	Student Representative
13.	<b>Mr. Shubham R. Ghadage</b>	Student Representative
14.	<b>Ms. Tamanna S. Tamboli</b>	Student Representative

### Credit Distribution Structure for F.Y.B.Sc. -2023-2024 (Zoology)

Level	Semester	Major		Minor	GE/OE	VSC, SEC (VSEC)	AEC, VEC, IKS	OJT, FP, CEP, CC, RP	Cum. Cr./ Sem.	Degree/ Cum. Cr.
		Mandatory	Electives							
4.5	<b>I</b>	<b>ZOO-101-MJM:</b> Animal Systematics & Diversity-I  <b>ZOO-102-MJM:</b> Fundamentals of Cell Biology  <b>ZOO-103-MJM:</b> Zoology Practical – I  <b>Credits-2+2+2</b>		--	<b>ZOO-116-OE:</b> <b>Fresh Water Fishery</b> (गोड्या पाण्यातील मत्स्यशेती)  <b>ZOO-117-OE:</b> <b>Fresh Water Fishery(Practical)</b> गोड्या पाण्यातील मत्स्यशेती (प्रात्यक्षिक) Credit- 2+2	<b>ZOO-121-VSC:- Biological Techniques-I</b>  <b>ZOO-126-SEC: Medical Laboratory Technology-I</b>  Credit- 2+2	<b>ENG-131-AEC:</b> Functional English-I  <b>ZOO-135-VEC :</b> Environmental Science  <b>ZOO-137-IKS:</b> <b>Animal Diversity &amp; Conservation in Indian Culture</b>  Credit- 2+2+2	<b>US--CC1:</b> NSS/NCC/Yoga/ Cultural Activity/Sports  Credit- 2	22	<b>UG Certificate 44</b>
	<b>II</b>	<b>ZOO-151-MJM:</b> Animal Systematics & Diversity-II  <b>ZOO-152-MJM:</b> Genetics  <b>ZOO-153-MJM:</b> Zoology Practical – II <b>Credits-2+2+2</b>		Credits-2	<b>ZOO-166-OE:</b> <b>Crop pests: Types &amp; management</b> (पिकावरील कीड: प्रकार व व्यवस्थापन)  <b>ZOO-167-OE:</b> <b>Crop pests: Types &amp; management</b> ( पिकावरील कीड: प्रकार व व्यवस्थापन ) (प्रात्यक्षिक) Credit- 2+2	<b>ZOO-171-VSC: Biological Techniques-II</b>  <b>ZOO-176-SEC: Medical Laboratory Technology -II</b>  Credit- 2+2	<b>ENG-181-AEC:</b> English – II  <b>ZOO-185-VEC:</b> Digital and Technological Solutions  Credit- 2+2	<b>US--CC2:</b> NSS/NCC/Yoga/ Cultural Activity/Sports  Credit- 2	22	
	<b>Cum Cr.</b>	12	-	2	8	8	10	4	44	

### Course Structure for F.Y.B.Sc. Zoology (2023 Pattern)

Sem	Course Type	Course Code	Course Name	Theory / Practical	Credits
I	Major Mandatory	ZOO-101-MJM	Animal Systematics & Diversity – I	Theory	02
	Major Mandatory	ZOO-102-MJM	Fundamentals of Cell Biology	Theory	02
	Major Mandatory	ZOO-103-MJM	Zoology Practical – I	Practical	02
	Open Elective (OE)	ZOO-116-OE	Fresh Water Fishery (गोड्या पाण्यातील मत्स्य शेती)	Theory	02
	Open Elective (OE)	ZOO-117-OE	Fresh Water Fishery (Practical) गोड्या पाण्यातील मत्स्य शेती (प्रात्यक्षिक)	Practical	02
	Vocational Skill Course (VSC)	ZOO-121-VSC	Biological Techniques-I	Theory	02
	Skill Enhancement Course (SEC)	ZOO-126-SEC	Medical Laboratory Technology-I	Practical	02
	Ability Enhancement Course (AEC)	ENG-131-AEC	Functional English-I	Theory	02
	Value Education Course (VEC)	ZOO-135-VEC	Environmental Science	Theory	02
	Indian Knowledge System (IKS)	ZOO-137-IKS	Animal Diversity & Conservation in Indian Culture	Theory	02
	Co-curricular Course (CC)	--	To be selected from the Basket	Theory	02
<b>Total Credits Semester-I</b>					<b>22</b>
II	Major Mandatory	ZOO-151-MJM	Animal Systematics & Diversity – II	Theory	02
	Major Mandatory	ZOO-152-MJM	Genetics	Theory	02
	Major Mandatory	ZOO-153-MJM	Zoology Practical – II	Practical	02
	Minor	ZOO-161-MN	Apiculture	Theory	02
	Open Elective (OE)	ZOO-166-OE	Crop pests: Types & management (पिकावरील कीड: प्रकार व व्यवस्थापन)	Theory	02
	Open Elective (OE)	ZOO-167-OE	Crop pests: Types & management (Practical) पिकावरील कीड: प्रकार व व्यवस्थापन (प्रात्यक्षिक)	Practical	02
	Vocational Skill Course (VSC)	ZOO-171-VSC	Biological Techniques-I	Practical	02
	Skill Enhancement Course (SEC)	ZOO-176-SEC	Medical Laboratory Technology -II	Practical	02
	Ability Enhancement Course (AEC)	ENG-181-AEC	Functional English-II	Theory	02
	Value Education Course (VEC)	ZOO-185-VEC	Digital and Technological Solutions	Theory	02
	Co-curricular Course (CC)	--	To be selected from the Basket	Theory	02
<b>Total Credits Semester-II</b>					<b>22</b>
<b>Cumulative Credits Semester I + Semester II</b>					<b>44</b>



## SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2023)

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

**Program Code: ZOO**

**Class: F.Y. B.Sc.**

**Semester: I**

**Course Type: Major (Mandatory) Theory**

**Course Code: ZOO-101-MJM**

**Course Name: Animal Systematics & Diversity-I**

**Number of Credits: 02**

**Number of Teaching hours: 30**

### Course Objectives:-

- Principles of systematics.
- Systems of animal classification.
- Basic characteristics of the non-chordates.
- Evolution and development of systems and animals.
- Habitat diversity of animals.
- Morphology and anatomy of non-chordate.
- Economic importance of animals.

### Course Outcomes:-

Student will be able to-

CO1: Define principles of systematics

CO2: Classify animals according to different systems of classification.

CO3: Identify non-chordate animals with the help of distinguishing characters.

CO4: Explain evolution and development of animals.

CO5: Identify the habitat diversity and role of animals in ecosystem.

CO6: Explain the body plan / organization of non-chordate animals.

CO7: Explore ethical use of animal abilities for environmental sustainability own economic benefits.

### Course Articulation Matrix of ZOO 101 MJM Animal Systematics & Diversity – I

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

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

### PO1: Disciplinary Knowledge:

CO1: Define principles of systematics: This learning outcome directly contributes to program outcome PO1 by laying the foundation for understanding the organization and classification of animals within the discipline of zoology.

CO2: Classify animals according to different systems of classification: This outcome further strengthens PO1 by equipping students with practical skills to apply knowledge of classification systems to diverse animal groups.

CO3: Identify non-chordate animals with the help of distinguishing characters: This directly aligns with PO1 by developing the skill of recognizing and discerning key features of non-chordate animals within the broader realm of animal diversity.

**PO2: Critical Thinking and Problem solving:**

CO4: Explain evolution and development of animals: This outcome encourages critical thinking about complex concepts like animal evolution and development, contributing to PO2.

CO5: Identify the habitat diversity and role of animals in ecosystem: This requires analyzing the relationships between animals and their environments, honing critical thinking skills aligned with PO2.

**PO3: Social competence:**

CO7: Explore ethical use of animal abilities for environmental sustainability own economic benefits. This outcome encourages teamwork and discussion on ethical considerations in animal utilization, aligning with PO3's social adaptation and communication skills.

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

CO6: Explain the body plan / organization of non-chordate animals: Understanding the intricate organization of animal bodies fosters curiosity and the scientific temper needed for PO4.

CO4: Explain evolution and development of animals: This outcome involves understanding scientific theories and data analysis, contributing to research skills in line with PO4.

**PO5: Trans-disciplinary knowledge:**

CO5: Identify the habitat diversity and role of animals in ecosystem: This broadens the scope beyond zoology by considering the ecological context of animals, aligning with PO5's focus on interdisciplinary perspectives.

**PO6: Personal and professional competence:**

CO7: Explore ethical use of animal abilities for environmental sustainability own economic benefits: This outcome promotes self-directed learning and critical reflection on professional ethics in animal interactions, contributing to PO6.

**PO7: Effective Citizenship and Ethics:**

CO7: Explore ethical use of animal abilities for environmental sustainability own economic benefits. This outcome directly engages with ethical considerations in animal utilization, promoting an informed awareness of moral and ethical issues as per PO7.

CO4: Explain evolution and development of animals. Understanding the complex process of animal evolution can foster empathy for the interconnectedness of living beings, contributing to the broader perspective of social concern in PO7.

CO5: Identify the habitat diversity and role of animals in ecosystem. Recognizing the interconnectedness of animals and their environment promotes an awareness of environmental issues and the need for sustainability, aligning with the social concern and commitment to national development aspects of PO7.

CO6: Explain the body plan / organization of non-chordate animals. This in-depth understanding of animal complexity can foster a sense of wonder and respect for living beings, indirectly contributing to the empathetic social concern element of PO7.

**PO8: Environment and Sustainability:**

CO5: Identify the habitat diversity and role of animals in ecosystem: Understanding the role of animals in ecosystems directly ties to environmental awareness and sustainable development, as per PO8.

CO7: Explore ethical use of animal abilities for environmental sustainability own economic benefits: This outcome encourages responsible interaction with animals for environmental wellbeing, aligning with PO8's focus on sustainability.

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

All Course Outcomes (COs): By mastering various aspects of non-chordate animals, students develop the foundation for independent learning and a lifelong interest in zoology, contributing to PO9.

**SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020  
(w. e. f. June, 2023)**

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

**Program Code: ZOO**

**Class: F.Y. B.Sc.**

**Semester: I**

**Course Type: Major (Mandatory) Theory**

**Course Code: ZOO-102-MJM**

**Course Name: Fundamentals of Cell Biology**

**Number of Credits: 02**

**Number of Teaching hours: 30**

**Course Objectives:-**

- Identification of cell types based on structural peculiarities.
- Comparison of structural properties of the cells.
- Functions of cell organelles.
- Facts & definitions of cytology, mitosis, meiosis, etc.
- Concept of cell division.
- Interpretation of the cell division stages with the help of pictures.
- Construction the models of types of cells, cell organelles, and stages of cell division.

**Course Outcomes:-**

Student will be able to-

CO1: Identify cell types based on structural peculiarities.

CO2: Compare structural properties of the cells.

CO3: Explain the functions of cell organelles.

CO4: Recall the facts & definitions of cytology, mitosis, meiosis, etc.

CO5: Explain the concept of cell division.

CO6: Interpret the stage of cell division with the help of pictures.

CO7: Create the models of types of cells, cell organelles, and stages of cell division.

**Course Articulation Matrix of ZOO 102 MJM Fundamentals of Cell Biology**

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

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

**PO1: Disciplinary Knowledge**

CO1: Identify cell types based on structural peculiarities: This directly assesses understanding of key cell types and their distinguishing features, contributing to PO1's focus on disciplinary knowledge in cell biology.

CO2: Compare structural properties of the cells: This further strengthens PO1 by requiring students to analyze and compare various aspects of cell structure, deepening their understanding.

CO3: Explain the functions of cell organelles: This outcome directly aligns with PO1 by assessing comprehension of organelle function within the context of cellular activities.

CO4: Recall the facts & definitions of cytology, mitosis, meiosis, etc.: While primarily knowledge-based, recalling key terms contributes to foundational understanding needed for further comprehension in PO1.

**PO2: Critical Thinking and Problem solving:**

CO5: Explain the concept of cell division: This requires analyzing and understanding the complex processes of cell division, contributing to PO2's critical thinking skills.

CO6: Interpret the stage of cell division with the help of pictures: This outcome involves analyzing visual data and applying knowledge to identify stages of cell division, developing critical thinking skills aligned with PO2.

**PO3: Social competence:**

CO7: Create the models of types of cells, cell organelles, and stages of cell division: This promotes collaborative learning and communication skills through teamwork and model creation, contributing to PO3's social competence.

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

CO3: Explain the functions of cell organelles: This encourages curiosity about cellular mechanisms and the scientific temper needed for PO4, laying foundation for research skills.

CO5: Explain the concept of cell division: Understanding the complexities of cell division fosters critical thinking and research skills aligning with PO4.

CO6: Interpret the stage of cell division with the help of pictures: Analyzing data and drawing conclusions from visuals aligns with research skills required by PO4.

**PO5: Trans-disciplinary knowledge:**

CO3: Explain the functions of cell organelles: Understanding organelle function connects cell biology to other disciplines like biochemistry and physiology, contributing to PO5's focus on trans-disciplinary knowledge.

CO5: Explain the concept of cell division: Cell division has implications for various biological processes, promoting trans-disciplinary connections aligned with PO5.

**PO6: Personal and professional competence:**

CO7: Create the models of types of cells, cell organelles, and stages of cell division: This activity fosters independent learning, self-motivation, and teamwork skills associated with PO6.

**PO7: Effective Citizenship and Ethics:**

CO3: Explain the functions of cell organelles: Understanding how organelle malfunctions can contribute to diseases can cultivate empathy and awareness of ethical implications in medical research, indirectly aligning with PO7.

**PO8: Environment and Sustainability:**

CO3: Explain the functions of cell organelles: Understanding how organelles like chloroplasts contribute to carbon fixation and energy production indirectly connects to environmental sustainability aligning with PO8.

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

All Course Outcomes (COs) Mastering various aspects of cell biology fosters curiosity, independent learning, and a lifelong interest in the field, contributing to PO9.

## SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2023)

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

**Program Code: ZOO**

**Class: F.Y. B.Sc.**

**Semester: I**

**Course Type: Major (Mandatory) Practical**

**Course Code: ZOO-103-MJM**

**Course Name: Zoology Practical-I**

**Number of Credits: 02**

**Number of Teaching hours: 60**

### Course Objectives:-

- Taxonomic classification of invertebrate animals.
- Culturing of animals.
- Preparation of vermiculture unit.
- Use of dissecting instruments.
- Working of microscope.
- Mountings of prokaryotic and eukaryotic cells.
- Demonstration of mitochondria and bar body with suitable experiment.

### Course Outcomes:-

Students will be able to-

CO1: Classify the invertebrate animals.

CO2: Culture the animals.

CO3: Apply known procedures to solve the problem of biodegradable waste.

CO4: Acquire the skills in handling and dissecting the earthworm.

CO5: Explain handling, principle and working of microscope.

CO6: Compare the mounting types of cells.

CO7: Plan the experiment for demonstration of mitochondria and bar body.

### Course Articulation Matrix of ZOO 103 MJM Zoology Practical-I

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

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

### PO1: Disciplinary Knowledge:

CO1: Classify the invertebrate animals: This builds knowledge of invertebrate diversity and taxonomic systems, contributing to PO1 in zoology.

CO2: Culture the animals: This involves understanding their habitat and environmental needs, strengthening knowledge of invertebrate biology for PO1.

CO3: Apply known procedures to solve the problem of biodegradable waste: This links invertebrate ecology and biodegradation processes, expanding PO1 to include environmental applications.

CO5: Explain handling, principle and working of microscope: This directly contributes to PO1 by developing knowledge of a fundamental research tool used in studying invertebrates.

CO6: Compare the mounting types of cells: This enhances understanding of microscopy and cell preparation techniques, strengthening PO1 in cell biology.

**PO2: Critical Thinking and Problem solving:**

CO3: Apply known procedures to solve the problem of biodegradable waste: This requires analyzing waste composition, selecting appropriate invertebrates, and adapting procedures, demonstrating problem-solving skills for PO2.

CO7: Plan the experiment for demonstration of mitochondria and bar body: This involves critical thinking to design an experiment, select appropriate tissues, and control variables, aligning with PO2.

**PO3: Social competence:**

CO2: Culture the animals: This can involve teamwork and group discussions on animal handling and maintenance, contributing to social competence for PO3.

CO4: Acquire the skills in handling and dissecting the earthworm: This fosters collaboration and communication through observing and practicing dissection techniques together, aligning with PO3.

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

CO2: Culture the animals: This requires careful observation, data recording, and analysis of animal behavior and growth, developing research skills in line with PO4.

CO5: Explain handling, principle and working of microscope: Understanding and operating a microscope is essential for research skills and scientific temper in zoology, as per PO4.

CO6: Compare the mounting types of cells: This involves analyzing data and critically evaluating different procedures, aligning with research skills and scientific temper in PO4.

CO7: Plan the experiment for demonstration of mitochondria and bar body: This requires designing experiments, using resources efficiently, and analyzing results, contributing to research skills and scientific temper aligned with PO4.

**PO5: Trans-disciplinary knowledge:**

CO3: Apply known procedures to solve the problem of biodegradable waste: This connects invertebrate biology to environmental science and waste management, contributing to trans-disciplinary knowledge as per PO5.

**PO6: Personal and professional competence:**

CO2: Culture the animals: This fosters independent learning, responsibility, and time management skills through maintaining animal cultures, aligning with PO6.

CO4: Acquire the skills in handling and dissecting the earthworm: This develops manual dexterity, precision, and attention to detail, contributing to personal and professional competence in PO6.

**PO7: Effective Citizenship and Ethics:**

CO3: Apply known procedures to solve the problem of biodegradable waste: This promotes awareness of environmental sustainability and responsible utilization of resources, indirectly aligning with the social concern aspect of PO7.

**PO8: Environment and Sustainability:**

CO3: Apply known procedures to solve the problem of biodegradable waste: This directly addresses environmental sustainability by using invertebrates for biodegradation, aligning with PO8.

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

All Course Outcomes (COs): By developing various skills like animal handling, research planning, and problem-solving, the course encourages independent learning and a lifelong interest in invertebrate biology and environmental solutions, contributing to PO9.



**SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020  
(w. e. f. June, 2023)**

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

**Program Code: ZOO**

**Class: F.Y. B.Sc.**

**Semester: I**

**Course Type: Open Elective (Theory)**

**Course Code: ZOO-116-OE Course Name: Fresh Water Fishery (गोड्या पाण्यातील मत्स्यशेती)**

**Number of Credits: 02**

**Number of Teaching hours: 30**

**Course Objectives:-**

- मत्स्यव्यवसायाची संकल्पना आणि व्याप्ती अभ्यासणे
- मत्स्यतलावाचे प्रकार अभ्यासणे
- गोड्या पाण्यातील माशांच्या विविध जाती अभ्यासणे.
- माशांसाठी अन्न तयार करण्याच्या प्रक्रिया अभ्यासणे.
- मत्स्यसंवर्धन करताना घ्यावयाच्या दक्षतांचा अभ्यास करणे.
- मासे टिकविण्याच्या विविध पद्धती अभ्यासणे.
- मत्स्य व्यवसायासाठी उपलब्ध सरकारी योजनांचा आढावा घेणे.

**Course Outcomes:-**

**सदर वर्षाचा अभ्यास केल्यानंतर वद्यार्थी-**

CO1: मत्स्य व्यवसायातील संधींचा फायदा घेऊ शकतील.

CO2: गरजेनुसार मत्स्य तलाव बांधण्यासाठी लागणारी तयारी करू शकेल.

CO3: गोड्या पाण्यातील योग्य जातीचे मासे मत्स्य पालनासाठी निवडू शकेल.

CO4: विविध माशांना लागणारे अन्न तयार करण्याची माहिती आत्मसात करतील.

CO5: मत्स्य संवर्धनासाठी आवश्यक दक्षता घेतील.

CO6: मासे टिकविण्याच्या विविध पद्धतींचा वापर करू शकेल.

CO7: मत्स्य व्यवसायासाठी उपलब्ध सरकारी योजनांची सर्वंकष माहिती घेतील.

**Course Articulation Matrix of ZOO 116 OE Fresh Water Fishery (गोड्या पाण्यातील**

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

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

PO1: व्यावसायिक क्षमता:

CO1: मत्स्य व्यवसायातील संधींचा फायदा घेऊ शकतील.: या उद्दिष्टाद्वारे, विद्यार्थी मत्स्य व्यवसायाच्या विविध पैलूंबद्दल ज्ञान आणि कौशल्ये विकसित करतात, ज्यामुळे त्यांना व्यवसायात यशस्वी होण्यास मदत होते.

CO2: गरजेनुसार मत्स्य तलाव बांधण्यासाठी लागणारी तयारी करू शकेल.: या उद्दिष्टाद्वारे, विद्यार्थी मच्छीपालनासाठी आवश्यक पायाभूत सुविधांच्या बांधकामासाठी आवश्यक ज्ञान आणि कौशल्ये विकसित करतात.

**CO3:** गोड्या पाण्यातील योग्य जातीचे मासे मत्स्य पालनासाठी निवडू शकेल.: या उद्दिष्टाद्वारे, विद्यार्थी मत्स्यपालनासाठी योग्य मासे प्रजातींची निवड करण्यासाठी आवश्यक ज्ञान आणि कौशल्ये विकसित करतात.

**CO4:** विविध माशांना लागणारे अन्न तयार करण्याची माहिती आत्मसात करतील.: या उद्दिष्टाद्वारे, विद्यार्थी विविध माशांच्या पोषणाच्या गरजा पूर्ण करण्यासाठी अन्न तयार करण्यासाठी आवश्यक ज्ञान आणि कौशल्ये विकसित करतात.

**CO5:** मत्स्य संवर्धनासाठी आवश्यक दक्षता घेतील.: या उद्दिष्टाद्वारे, विद्यार्थी मत्स्य संवर्धनाच्या महत्वाबद्दल आणि त्यासाठी लागणाऱ्या उपाययोजनांबद्दल जागरूक होतात.

**CO6:** मासे टिकवण्याच्या विविध पद्धतींचा वापर करू शकेल.: या उद्दिष्टाद्वारे, विद्यार्थी मासेमारी आणि मासे टिकवण्याच्या विविध पद्धतींबद्दल ज्ञान आणि कौशल्ये विकसित करतात.

**CO7:** मत्स्य व्यवसायासाठी उपलब्ध सरकारी योजनांची सर्वकष माहिती घेतील.: या उद्दिष्टाद्वारे, विद्यार्थी मत्स्य व्यवसायासाठी उपलब्ध सरकारी अनुदाने आणि वित्तीय सहाय्याबद्दल माहिती घेतात, ज्यामुळे त्यांना व्यवसाय सुरू करण्यासाठी आणि चालवण्यासाठी मदत होते.

**PO2: सामाजिक जागरूकता**

**CO5:** मत्स्य संवर्धनाच्या महत्वाबद्दल जागरूकता सामाजिक जबाबदारीची भावना दर्शवते.

**PO3: संशोधन कौशल्ये**

**CO4, CO6:** माशांच्या पोषणाच्या गरजा आणि मासे टिकवण्याच्या पद्धतींचा अभ्यास करणे आवश्यक संशोधन कौशल्ये विकसित करते.

**PO4: संख्यात्मक आणि विश्लेषणात्मक कौशल्ये:**

**CO2, CO5:** तलाव बांधणीसाठी गणिते आणि मोजमात आवश्यक असतात, तर मत्स्यपालनाची कार्यक्षमता विश्लेषणासाठी डेटा विश्लेषण करणे गरजेचे आहे, यामुळे या कौशल्यांना योगदान मिळते.

**PO5: आंतर-विषय ज्ञान:**

**CO7:** सरकारी योजना आणि धोरण समजून घेण्यासाठी अर्थशास्त्र आणि सामाजिक विकास यांचे ज्ञान आवश्यक आहे, ज्यामुळे मत्स्यपालन इतर विषयांशी जोडते.

**PO6: वैयक्तिक आणि व्यावसायिक कौशल्ये:**

**CO1, CO2, CO3, CO6, CO7:** तलाव बांधणी, मासे निवड, टिकवण आणि सरकारी योजनांचा लाभ घेण्यासाठी व्यावसायिक उपक्रम, नियोजन, निर्णय घेणे आणि गट कार्य आवश्यक असतात, या वैयक्तिक आणि व्यावसायिक कौशल्ये विकसित करतात.

**PO7: प्रभावी नागरिकत्व आणि नीतिशास्त्र:**

**CO5:** टिकाऊ मत्स्यपालन पद्धती प्रोत्साहित करणे जबाबदार पर्यावरण व्यवस्थापनाशी सुसंगत आहे, यामुळे नीतिमान नागरिकत्वाला योगदान मिळते.

**PO8: पर्यावरण आणि टिकाऊपणा:**

**CO5:** टिकाऊ मत्स्यपालन तंत्र आणि पर्यावरणीय परिणामाविषयी जागरूकता पर्यावरण टिकाऊपणाला योगदान देतात.

**PO9: स्व-निर्देशित आणि आजीवन शिकणे**

सर्व कार्यक्रम परिणाम: **All COs:** मत्स्यपालनाच्या विविध पैलूंमध्ये प्रभुत्व मिळविणे स्वतंत्र शिकण्याचा धागा आणि या क्षेत्रात आजीवन रस निर्माण करते, हे महत्वाचे कौशल्य विकसित करते.



**SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020  
(w. e. f. June, 2023)**

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

**Program Code: ZOO**

**Class: F.Y. B.Sc.**

**Semester: I**

**Course Type: Open Elective (Practical)**

**Course Code: ZOO-117-OE**

**Course Name: Fresh Water Fishery (गोड्या पाण्यातील मत्स्यशेती प्रात्यक्षिक)**

**Number of Credits: 02**

**Number of Teaching hours: 60**

**Course Objectives:-**

- मत्स्यतलावाचे प्रकार अभ्यासणे
- मत्स्य पालनासाठी आवश्यक पाण्याची गुणवत्ता तपासणे.
- गोड्या पाण्यातील माशांच्या विविध जाती अभ्यासणे.
- माशांसाठी अन्न तयार करण्याच्या प्रक्रिया अभ्यासणे.
- मत्स्यसंवर्धन करताना घ्यावयाच्या दक्षतांचा अभ्यास करणे.
- मत्स्यपालनासाठी लागणाऱ्या साधनांचा आणि सरकारी योजनांचा अभ्यास करणे.
- मत्स्य बीज निर्मिती, पॅकिंग आणि वाहतूक यांचा अभ्यास करणे.

**Course Outcomes:-**

**सदर विषयाचा अभ्यास केल्यानंतर विद्यार्थी-**

CO1: गरजेनुसार मत्स्य तलाव बांधण्यासाठी लागणारी तयारी करू शकेल.

CO2: मत्स्य पालनासाठी आवश्यक पाण्याची गुणवत्ता तपासेल.

CO3: गोड्या पाण्यातील योग्य जातीचे मासे ओळखू आणि निवडू शकेल.

CO4: विविध माशांना लागणारे अन्न तयार करतील.

CO5: मत्स्य संवर्धनासाठी आवश्यक दक्षता घेतील आणि रोगप्रतिबंधक उपाय योजतील.

CO6: मत्स्यपालनासाठी लागणाऱ्या साधनांचा आणि सरकारी योजनांचा उपयोग करू शकेल.

CO7: मत्स्य बीज निर्मिती, पॅकिंग आणि वाहतूक यांचा अभ्यास करून स्वतःचा व्यवसाय करू शकेल.

**Course Articulation Matrix of ZOO 117 OE Fresh Water Fishery (गोड्या पाण्यातील मत्स्यशेती प्रात्यक्षिक) Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related**

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

**PO1: व्यावसायिक क्षमता:**

CO1, CO2, CO3, CO4, CO6, CO7: व्यवसायाच्या संधी ओळखणे, तलाव बांधणे, योग्य माशांची निवड करणे, अन्न तयार करणे, मासे टिकवणे आणि सरकारी योजनांचा लाभ घेणे या सर्व व्यावसायिक कौशल्ये आहेत.

**PO2: सामाजिक जागरूकता:**

CO5: मत्स्य संवर्धनाच्या महत्वाबद्दल जागरूकता सामाजिक जबाबदारीची भावना दर्शवते.

**PO3: संशोधन कौशल्ये:**

CO4, CO6: माशांच्या पोषणाच्या गरजा आणि मासे टिकवण्याच्या पद्धतींचा अभ्यास करणे आवश्यक संशोधन कौशल्ये विकसित करते.

**PO4: संख्यात्मक आणि विश्लेषणात्मक कौशल्ये:**

CO2, CO5: तलाव बांधणीसाठी गणिते आणि मोजमात आवश्यक असतात, तर मत्स्यपालनाची कार्यक्षमता विश्लेषणासाठी डेटा विश्लेषण करणे गरजेचे आहे, यामुळे या कौशल्यांना योगदान मिळते.

**PO5: आंतर-विषय ज्ञान:**

CO7: मत्स्य बीज निर्मिती, पॅकिंग आणि वाहतूक हे विषय अर्थशास्त्र, व्यवस्थापन आणि पर्यावरणशास्त्र यासारख्या इतर विषयांशी संबंधित आहेत.

**PO6: वैयक्तिक आणि व्यावसायिक कौशल्ये:**

CO1, CO2, CO3, CO6, CO7: तलाव बांधणी, मासे निवड, टिकवण आणि सरकारी योजनांचा लाभ घेण्यासाठी व्यावसायिक उपक्रम, नियोजन, निर्णय घेणे आणि गट कार्य आवश्यक असतात, या वैयक्तिक आणि व्यावसायिक कौशल्ये विकसित करतात.

**PO7: प्रभावी नागरिकत्व आणि नीतिशास्त्र:**

CO5: टिकाऊ मत्स्यपालन पद्धती प्रोत्साहित करणे जबाबदार पर्यावरण व्यवस्थापनाशी सुसंगत आहे, यामुळे नीतिमान नागरिकत्वाला योगदान मिळते.

**PO8: पर्यावरण आणि टिकाऊपणा:**

CO5: टिकाऊ मत्स्यपालन तंत्र आणि पर्यावरणीय परिणामाविषयी जागरूकता पर्यावरण टिकाऊपणाला योगदान देतात.

**PO9: स्व-निर्देशित आणि आजीवन शिकणे:**

सर्व कार्यक्रम परिणाम (COs): मत्स्यपालनाच्या विविध पैलूंमध्ये प्रभुत्व मिळविणे स्वतंत्र शिकण्याचा धागा आणि या क्षेत्रात आजीवन रस निर्माण करते, हे महत्वाचे कौशल्य विकसित करते.

## SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2023)

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

**Program Code: ZOO**

**Class: F.Y. B.Sc.**

**Semester: I**

**Course Type: Vocational Skill Courses (Theory)**

**Course Code: ZOO-121-VSC**

**Course Name: Biological Techniques-I**

**Number of Credits: 02**

**Number of Teaching hours: 30**

### Course Objectives: -

- Acquaintance with good laboratory practices.
- Working mechanism of laboratory instruments
- Instrument handling and maintenance.
- Cleaning and sterilization of glass-wares.
- Preparation of solutions.
- Principle and working of pH meter.
- Separation of biomolecules.

### Course Outcomes: -

Student will be able to-

CO1: Implement good laboratory practices.

CO2: Demonstrate working mechanism of laboratory instruments.

CO3: Handle the instruments and keep its maintenance.

CO4: Clean and sterilize glass-wares for different experiments.

CO5: Prepare the solutions of different concentrations.

CO6: Measure the pH of different samples with the help of pH meter.

CO7: Separate different biomolecules.

### Course Articulation Matrix of ZOO-121-VSC: Biological Techniques-I

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

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

**PO1: Disciplinary Knowledge:**

CO1, CO2, CO3, CO4, CO5, CO6, CO7: All COs involve understanding and using fundamental laboratory techniques, equipment, and principles, contributing to disciplinary knowledge in specific fields.

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

CO2, CO3, CO4, CO6, CO7: Troubleshooting equipment, designing solutions for cleaning/sterilization, adapting procedures to different samples, and interpreting pH measurements require critical thinking and problem-solving skills.

**PO3: Social Competence:**

CO3, CO4, CO7: Safely handling equipment, collaborating in experiments, sharing and discussing results, & maintaining lab ethics promote social competence & teamwork.

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

All COs: Mastering laboratory skills is essential for research. CO1-7 involve planning experiments, using equipment precisely, recording data accurately, and analyzing results, strengthening research skills and scientific temper.

**PO5: Trans-disciplinary knowledge:**

CO4, CO5, CO6, CO7: Cleaning protocols, solution preparation, pH measurement, and biomolecule separation techniques are applicable across various scientific disciplines, promoting trans-disciplinary knowledge.

**PO6: Personal and professional competence:**

All COs: Developing dexterity, attention to detail, time management, & organizational skills for effective lab work strengthens personal & professional competence.

**PO7: Effective Citizenship and Ethics:**

CO1, CO3: Implementing good laboratory practices ensures safety, reduces environmental impact, & promotes waste disposal, aligning with ethical citizenship.

**PO8: Environment and Sustainability:**

CO1, CO4: GLP emphasizes resource conservation, minimal waste generation, and proper waste disposal, contributing to environmental sustainability.

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

All COs: Mastering laboratory skills fosters independent learning, adaptability to new equipment/techniques, and a curiosity to explore scientific concepts, contributing to lifelong learning.

## SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2023)

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

**Program Code: ZOO**

**Class: F.Y. B.Sc.**

**Semester: I**

**Course Type: Skill Enhancement Course (Practical)**

**Course Code: ZOO-126-SEC**

**Course Name: Medical Laboratory Technology-I**

**Number of Credits: 02**

**Number of Teaching hours: 60**

### Course Objectives:-

- Identification of glass-wares and instruments.
- Working of instruments.
- Identification of blood cells and blood groups.
- Estimation of hemoglobin.
- Counting of blood cells and its interpretation.
- Preparation of blood smear and measurement of blood pressure.
- Deproteinization of samples.

### Course Outcomes:-

Student will be able to-

CO1: Distinguish glass-wares and identify instruments.

CO2: Demonstrate the working of instruments.

CO3: Distinguish blood cells based on morphology and identify blood groups.

CO4: Determine haemoglobin content.

CO5: Count blood cells and interpret obtained data.

CO6: Prepare blood smear and measure blood pressure.

CO7: Deproteinize blood samples.

### Course Articulation Matrix of ZOO-126-SEC: Medical Laboratory Technology-I

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

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

### PO1: Disciplinary Knowledge:

CO1, CO2, CO3, CO4, CO5, CO6, CO7: All COs involve understanding and applying fundamental knowledge of hematology techniques, equipment, and blood cell properties, contributing to disciplinary knowledge in biology and healthcare.

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

CO2, CO3, CO5, CO6, CO7: Analyzing instrument functions, differentiating blood cells, interpreting data from cell counts and haemoglobin levels, and troubleshooting technical issues require critical thinking and problem-solving skills.

**PO3: Social Competence:**

CO3, CO5, CO6 Collaborating in lab work, discussing results, and maintaining professionalism in patient care settings promote social competence and teamwork.

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

All COs: Mastering hematology skills is essential for medical research. CO1-7 involve planning experiments, using equipment accurately, recording data systematically, and analyzing results, strengthening research skills and scientific temper.

**PO5: Trans-disciplinary knowledge:**

CO3, CO4, CO5, CO6, CO7: Blood analysis data is utilized in various medical specialties, making these skills relevant to areas like pathology, immunology, and clinical research, promoting trans-disciplinary knowledge.

**PO6: Personal and professional competence:**

All COs: Developing dexterity, precision, time management, & organizational skills for efficient lab work & patient interaction strengthens personal & professional competence.

**PO7: Effective Citizenship and Ethics:**

CO3, CO6: Accurate diagnosis & blood group identification are crucial for patient care. Adhering to safety protocols and patient confidentiality promotes ethical citizenship in healthcare.

**PO8: Environment and Sustainability:**

CO1: Identifying reusable glass-ware and minimizing waste generation during experiments contribute to environmental sustainability.

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

All COs: Mastering hematology skills fosters independent learning, adaptability to new technologies and procedures, and a curiosity to explore new advancements in blood analysis, contributing to lifelong learning.

**SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020  
(w. e. f. June, 2023)**

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

**Program Code: ZOO**

**Class: F.Y. B.Sc.**

**Semester: I**

**Course Type: Indian Knowledge System (Theory)**

**Course Code: ZOO-137-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

**Course Articulation Matrix of ZOO-137-IKS: Animal Diversity & Conservation in  
Indian Culture**

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

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

**PO1: Cultural Awareness and Sensitivity:**

All COs: Understanding the various ways animals are integrated into Indian culture, traditions, and beliefs fosters cultural awareness and sensitivity.

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

CO3, CO4, CO5: Analyzing habitat and behavioral diversity, evaluating the role of culture in conservation, and understanding the animal-ecosystem relationship require critical thinking and problem-solving skills.

**PO3: Communication and Collaboration:**

CO2, CO7: Discussing classification systems, sharing insights on animal taming practices, and collaborating on projects about domestication promote communication and collaboration skills.

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

CO3, CO5, CO6: Researching specific animal-habitat connections, exploring the scientific basis of animal roles in ecosystems, and predicting correlations between culture and domestication strengthen research skills and scientific temper.

**PO5: Environmental Sustainability:**

CO4, CO5: Analyzing cultural conservation practices, understanding the importance of animal roles in ecosystems, and exploring responsible taming practices contribute to environmental sustainability awareness.

**PO6: Personal and Professional Competence:**

CO1, CO2, CO7: Acquiring knowledge about animals in Indian culture enhances personal cultural literacy, while classifying animals and explaining taming practices can develop research and presentation skills, contributing to personal and professional competence.

**PO7: Lifelong Learning and Adaptability:**

All COs: Exploring the diverse connections between animals and Indian culture encourages a lifelong interest in learning and adaptability to new perspectives and knowledge domains.

**PO8: Environment and Sustainability:**

CO1, CO4, CO5: Recalling cultural stories and practices that promote animal respect and conservation connects environmental values embedded in Indian culture. Analyzing the role of animals in ecosystems highlights their importance for environmental balance. Understanding traditional conservation practices can inspire solutions for sustainable wildlife management.

CO6, CO7: Predicting correlations between Indian culture and animal domestication can reveal how historical practices influenced sustainable agricultural and pastoral systems. Explaining taming practices can raise awareness about responsible human-animal interactions, promoting sustainable animal care.

**PO9: Self-Directed and Lifelong Learning:**

All COs: Exploring the rich tapestry of relationships between animals and Indian culture fosters a lifelong curiosity about diverse cultural expressions and their historical contexts. Engaging with these insights encourages continuous learning, research, and exploration of new connections between animals, culture, and sustainability.

Recalling and classifying animals through Indian traditions stimulates independent learning and knowledge sharing. Explaining taming practices encourages research into historical methods and their relevance in modern contexts, promoting lifelong engagement with the subject.





**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**

**F.Y. B.Sc. (Zoology) Semester -II**

**For Department of Zoology**

**Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati**

**Choice Based Credit System Syllabus (2023 Pattern)**

**(As Per NEP 2020)**

**To be implemented from Academic Year 2023-2024**

## 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 be 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.

### Credit Distribution Structure for F.Y.B.Sc. -2023-2024 (Zoology)

Level	Semester	Major		Minor	GE/OE	VSC, SEC (VSEC)	AEC, VEC, IKS	OJT, FP, CEP, CC, RP	Cum. Cr./Sem.	Degree/ Cum.Cr.
		Mandatory	Electives							
4.5	<b>I</b>	<b>ZOO-101-MJM:</b> Animal Systematics & Diversity-I  <b>ZOO-102-MJM:</b> Fundamentals of Cell Biology  <b>ZOO-103-MJM:</b> Zoology Practical-I  <b>Credits-2+2+2</b>		--	<b>ZOO-116-OE:</b> <b>Fresh Water Fishery</b> (गोड्या पाण्यातील मत्स्य शेती.)  <b>ZOO-117-OE:</b> <b>Fresh Water Fishery(Practical)</b> (गोड्या पाण्यातील मत्स्यशेती (प्रात्य क्षक) Credit-2+2	<b>ZOO-121-VSC:- Biological Techniques-I</b>  <b>ZOO-126-SEC: Medical Laboratory Technology-I</b>  Credit-2+2	<b>ENG-131-AEC:</b> Functional English-I  <b>ZOO-135-VEC:</b> Environmental Science  <b>ZOO-137-IKS:</b> <b>Animal Diversity &amp; Conservation in Indian Culture</b> Credit-2+2+2	<b>US--CC1:</b> NSS/NCC/Yoga/Cultural Activity/Sports  Credit-2	22	<b>UG Certificate 44</b>
	<b>II</b>	<b>ZOO-151-MJM:</b> Animal Systematics & Diversity-II  <b>ZOO-152-MJM:</b> Genetics  <b>ZOO-153-MJM:</b> Zoology Practical – II <b>Credits-2+2+2</b>		<b>ZOO-161-MN:</b> Apiculture  Credits-2	<b>ZOO-166-OE:</b> <b>Crop pests: Types &amp; management</b> (पकावरील कड: प्रकार व व्यवस्थापन)  <b>ZOO-167-OE:</b> <b>Crop pests: Types &amp; management</b> (पकावरील कड: प्रकार व व्यवस्थापन) (प्रात्य क्षक) Credit-2+2	<b>ZOO-176-SEC: Medical Laboratory Technology-II</b>  <b>ZOO-171-VSC: Biological Techniques-II</b>  Credit-2+2	<b>ENG-181-AEC:</b> English– II  <b>ZOO-185-VEC:</b> Digital and Technological Solutions  Credit-2+2	<b>US--CC2:</b> NSS/NCC/Yoga/Cultural Activity/Sports  Credit-2	22	
	<b>Cum Cr.</b>	<b>12</b>	<b>-</b>	<b>2</b>	<b>8</b>	<b>8</b>	<b>10</b>	<b>4</b>	<b>44</b>	

### Course Structure for F.Y.B.Sc. Zoology (2023 Pattern)

Sem	Course Type	Course Code	Course Name	Theory / Practical	Credits
I	Major Mandatory	ZOO-101-MJM	Animal Systematics & Diversity – I	Theory	02
	Major Mandatory	ZOO-102-MJM	Fundamentals of Cell Biology	Theory	02
	Major Mandatory	ZOO-103-MJM	Zoology Practical – I	Practical	02
	Open Elective (OE)	ZOO-116-OE	Fresh Water Fishery (गोड्या पाण्यातील मत्स्य शेती.)	Theory	02
	Open Elective (OE)	ZOO-117-OE	Fresh Water Fishery (Practical) (गोड्या पाण्यातील मत्स्यशेती (प्रात्य क्षक)	Practical	02
	Vocational Skill Course (VSC)	ZOO-121-VSC	Biological Techniques-I	Theory	02
	Skill Enhancement Course (SEC)	ZOO-126-SEC	Medical Laboratory Technology-I	Practical	02
	Ability Enhancement Course (AEC)	ENG-131-AEC	Functional English-I	Theory	02
	Value Education Course (VEC)	ZOO-135-VEC	Environmental Science	Theory	02
	Indian Knowledge System (IKS)	ZOO-137-IKS	Animal Diversity & Conservation in Indian Culture	Theory	02
	Co-curricular Course (CC)	--	To be selected from the Basket	Theory	02
<b>Total Credits Semester-I</b>					<b>22</b>
II	Major Mandatory	ZOO-151-MJM	Animal Systematics & Diversity – II	Theory	02
	Major Mandatory	ZOO-152-MJM	Genetics	Theory	02
	Major Mandatory	ZOO-153-MJM	Zoology Practical – II	Practical	02
	Minor	ZOO-161-MN	Apiculture	Theory	02
	Open Elective (OE)	ZOO-166-OE	Crop pests: Types & management ( पकावरील कड: प्रकार व व्यवस्थापन)	Theory	02
	Open Elective (OE)	ZOO-167-OE	Crop pests: Types & management (Practical) ( पकावरील कड: प्रकार व व्यवस्थापन) (प्रात्य क्षक)	Practical	02
	Vocational Skill Course (VSC)	ZOO-171-VSC	Biological Techniques-II	Practical	02
	Skill Enhancement Course (SEC)	ZOO-176-SEC	Medical Laboratory Technology -II	Practical	02
	Ability Enhancement Course (AEC)	ENG-181-AEC	Functional English-II	Theory	02
	Value Education Course (VEC)	ZOO-185-VEC	Digital and Technological Solutions	Theory	02
	Co-curricular Course (CC)	--	To be selected from the Basket	Theory	02
<b>Total Credits Semester-II</b>					<b>22</b>
<b>Cumulative Credits Semester I + Semester II</b>					<b>44</b>

## SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2023)

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

**Program Code: ZOO**

**Class: F.Y. B.Sc.**

**Semester: II**

**Course Type: Major (Mandatory) Theory**

**Course Code: ZOO-151-MJM**

**Course Name: Animal Systematics & Diversity-II**

**Number of Credits: 02**

**Number of Teaching hours: 30**

### Course Objectives:

- Understand the diversity of animal life and their evolutionary relationships.
- To explore the evolutionary affinities and relationships of Hemichordata with other phyla.
- Describe the characteristics and classification of different subphyla and classes of animals.
- Explain the processes of metamorphosis in Urochordata and Neoteny in Amphibia.
- Analyze the various forms of fish migration and its ecological importance.
- Comprehend the anatomy and physiological systems of frogs, with a focus on *Hoplobatrachus tigerinus*.
- Develop practical skills in the identification and observation of external and internal structures of animals.

### Course Outcomes:

Student will be able to-

- CO 1: classify animals into different subphyla and classes, citing specific examples for each category.
- CO 2: recognize the key characteristics of Hemichordata, Urochordata, and Cephalochordata.
- CO 3: explain the concept of retrogressive metamorphosis in Urochordata and Neoteny in Amphibia.
- CO 4: discuss the significance of migration in fish and its impact on aquatic ecosystems.
- CO 5: analyze the anatomy and physiology of the digestive, circulatory, nervous, and reproductive systems in frogs.
- CO 6: demonstrate the ability to identify external features and structures of various animals through practical exercises and observations.
- CO 7: explore ethical use of animal abilities for environmental sustainability and own economic benefits.

**Course Articulation Matrix of ZOO-151-MJM: Animal Systematics & Diversity-II**

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

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

**PO1: Disciplinary Knowledge**

CO1 aligns with PO1 as it requires comprehensive knowledge of animal classification and the ability to apply this knowledge in a practical context.

**PO1: Disciplinary Knowledge**

CO2 aligns with PO1 as it involves understanding the characteristics of specific animal subphyla, which is a form of disciplinary knowledge.

**PO3: Social Competence**

CO3 aligns with PO2 as it requires students to explain complex concepts, demonstrating critical thinking and problem-solving skills.

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

CO4 relates to PO5 as it requires an understanding of the ecological impact of fish migration, which involves integration of different disciplines.

**PO5: Trans-disciplinary knowledge**

CO5 aligns with PO4 as it involves scientific skills and knowledge application through the analysis of the anatomy and physiology of various systems in frogs.

**PO6: Personal and professional competence**

CO6 aligns with PO6 as it involves practical work and the development of professional skills in animal observation and identification, contributing to personal and professional competence.

**PO7: Effective Citizenship and Ethics:**

CO7 addresses ethical considerations, social concern, and sustainability, aligning with both PO7 and PO8.

**PO8: Environment and Sustainability:**

CO7 This course outcome requires students to consider the environmental impact of using animal abilities for human benefit.

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

CO7 This course outcome requires students to explore new and innovative ways to use animal abilities for environmental sustainability and economic benefit.

**SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020  
(w. e. f. June, 2023)**

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

**Program Code: ZOO**

**Class: F.Y. B.Sc.**

**Semester: II**

**Course Type: Major (Mandatory) Theory**

**Course Code: ZOO-152-MJM**

**Course Name: Genetics**

**Number of Credits: 02**

**Number of Teaching hours: 30**

**Course Objectives:**

- To introduce students to the basic concepts of classical genetics.
- To provide students with a comprehensive understanding of Mendelian Laws of Inheritance and their practical applications.
- To enable students to learn about different types of gene interaction and their implications.
- To acquaint students with the concept of multiple alleles and polygenic inheritance, and their importance in human genetics.
- To provide students with an overview of chromosome structure, function, and aberrations.
- To familiarize students with the different mechanisms of sex determination and sex-linked inheritance in humans.

**Course Outcomes:**

Student will able to

CO1: define and explain the key concepts in classical genetics and applies Mendelian laws of inheritance to solve problems in genetics.

CO2: understand the different types of gene interaction and their effects on inheritance

CO3: explain the concept of multiple alleles and polygenic inheritance and their implications for human health and disease.

CO4: describe the morphology, composition, and classification of chromosomes.

CO5: identify and explain the different types of chromosomal aberrations and their effects on human development.

CO6: understand the chromosomal theory of sex determination and the different mechanisms of environmental sex determination.

CO7: describe the inheritance of sex-linked traits in humans.

**Course Articulation Matrix of ZOO-152-MJM: Genetics**

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

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

Each course outcome is mapped to one or more program outcomes based on the following criteria:

Directly related: The course outcome directly addresses a program outcome.

Indirectly related: The course outcome indirectly addresses a program outcome by providing students with the knowledge or skills necessary to achieve a program outcome.

Supportive: The course outcome supports students in achieving a program outcome by providing them with opportunities to practice or develop the skills and knowledge necessary to achieve that outcome.

**PO1: Disciplinary Knowledge**

This program outcome requires students to demonstrate a comprehensive knowledge of genetics. All the course outcomes in this course are directly related to the study of genetics.

**PO2: Critical Thinking and Problem Solving**

This program outcome requires students to be able to use critical thinking and problem-solving skills to analyze and interpret complex information. All the course outcomes in this course require students to use these skills to solve genetics problems.

**PO3: Social Competence:**

This program outcome requires students to be able to communicate effectively and work collaboratively with others. All the course outcomes in this course can be achieved through individual and group work, such as completing problem sets, conducting laboratory experiments, and writing research papers.

**PO4: Research-related Skills and Scientific Temper**

This program outcome requires students to be able to design and conduct experiments, interpret results, and establish hypotheses. All the course outcomes in this course provide students with the opportunity to develop these skills.

**PO5: Trans-disciplinary Knowledge**

This program outcome requires students to be able to integrate knowledge from different disciplines. Course Outcome 3 (CO3) requires students to explain the implications of multiple alleles and polygenic inheritance for human health and disease. This requires students to integrate their knowledge of genetics with their knowledge of human physiology and disease. Course Outcome 7 (CO7) requires students to describe the inheritance of sex-linked traits in humans. This requires students to integrate their knowledge of genetics with their knowledge of human reproduction and development.

**PO6: Personal and Professional Competence**

This program outcome requires students to be able to work independently and as part of a team to achieve common goals. All the course outcomes in this course can be achieved through individual and group work, such as completing problem sets, conducting laboratory experiments, and writing research papers.

**PO7: Effective Citizenship and Ethics**

This program outcome requires students to be able to make ethical decisions in a variety of contexts. Course Outcome 7 (CO7) requires students to consider the ethical implications of sex-linked inheritance.

**PO8: Environment and Sustainability**

This program outcome requires students to be able to understand the environmental impact of human activity. Course Outcome 7 (CO7) requires students to consider the implications of sex-linked inheritance for environmental sustainability.

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

This program outcome requires students to be able to learn independently and adapt to new situations. All of the course outcomes in this course require students to be able to learn new information and apply it to solve problems.



## SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2023)

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

**Program Code: ZOO**

**Class: F.Y. B.Sc.**

**Semester: II**

**Course Type: Major (Mandatory) Practical**

**Course Code: ZOO-153-MJM**

**Course Name: Zoology Practical-II**

**Number of Credits: 02**

**Number of Teaching hours: 60**

### Course Objectives:-

- Vertebrate classification system.
- Morphometric analysis & different types of tail fins of the fishes.
- Culturing of *Drosophila*
- Human genetic traits & human karyotype ABO blood group system
- Basic physiology in vertebrate animal
- To provide students with hands-on experience in the study of chordate animals, including their classification, morphology, anatomy, physiology, and genetics.
- To develop students' critical thinking and problem-solving skills by applying their knowledge of chordate biology to real-world examples.
- To prepare students for further study in chordate biology and related fields.

### Course Outcomes:

Student will able to

CO1: classify chordate animals into the appropriate subphyla and classes, and explain the reasons for their classification.

CO2: identify and describe the key morphological and anatomical features of different chordate animals, including fishes, amphibians, and humans.

CO3: understand the basic physiological processes of chordate animals, such as digestion, circulation, and reproduction.

CO4: apply their knowledge of chordate biology to solve problems related to animal diversity, conservation, and human health.

CO5: conduct basic laboratory experiments in chordate biology, including morphometric analysis, dissection, and karyotyping.

CO6: interpret and analyze scientific data, such as images, graphs, and tables.

CO7: communicate their findings effectively in writing and orally.

### Course Articulation Matrix of ZOO-153-MJM: Zoology Practical-II

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

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

Each course outcome is mapped to one or more program outcomes based on the following criteria:

Directly related: The course outcome directly addresses a program outcome.

Indirectly related: The course outcome indirectly addresses a program outcome by providing students with the knowledge or skills necessary to achieve a program outcome.

Supportive: The course outcome supports students in achieving a program outcome by providing them with opportunities to practice or develop the skills and knowledge necessary to achieve that outcome.

### **PO1: Disciplinary Knowledge**

CO1: Classify chordate animals into the appropriate subphyla and classes, and explain the reasons for their classification. This course outcome requires students to demonstrate their understanding of the different subphyla and classes of chordate animals, as well as the key features that distinguish them from each other. This aligns with the program outcome of disciplinary knowledge, which requires students to have a comprehensive understanding of the field of biology.

CO2: Identify and describe the key morphological and anatomical features of different chordate animals, including fishes, amphibians, and humans. This course outcome requires students to demonstrate their understanding of the key morphological and anatomical features of different chordate animals. This aligns with the program outcome of disciplinary knowledge, which requires students to have a comprehensive understanding of the field of biology.

CO3: Understand the basic physiological processes of chordate animals, such as digestion, circulation, and reproduction. This course outcome requires students to demonstrate their understanding of the basic physiological processes of chordate animals. This aligns with the program outcome of disciplinary knowledge, which requires students to have a comprehensive understanding of the field of biology.

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

CO4: Apply their knowledge of chordate biology to solve problems related to animal diversity, conservation, and human health. This course outcome requires students to apply their knowledge of chordate biology to solve real-world problems. This aligns with the program outcome of critical thinking and problem solving, which requires students to be able to use their knowledge to solve complex problems.

### **PO3: Social Competence**

CO7: Communicate their findings effectively in writing and orally. This course outcome requires students to develop their social competence by communicating their findings effectively in writing and orally. This aligns with the program outcome of social competence, which requires students to be able to communicate and work effectively with others.

### **PO4: Research-related Skills and Scientific Temper**

CO5: Conduct basic laboratory experiments in chordate biology, including morphometric analysis, dissection, and karyotyping. This course outcome requires students to develop their research-related skills and scientific temper. This aligns with the program outcome of research-related skills and scientific temper, which requires students to be able to design and conduct experiments, interpret and analyze data, and establish hypotheses.

CO6: Interpret and analyze scientific data, such as images, graphs, and tables. This course

outcome requires students to develop their research-related skills and scientific temper. This aligns with the program outcome of research-related skills and scientific temper, which requires students to be able to interpret and analyze scientific data.

**PO5: Trans-disciplinary Knowledge**

CO7: Explore ethical use of animal abilities for environmental sustainability and own economic benefits. This course outcome requires students to integrate their knowledge of chordate biology with other disciplines, such as ethics and economics. This aligns with the program outcome of trans-disciplinary knowledge, which requires students to be able to integrate knowledge from different disciplines to solve complex problems.

**PO6: Personal and Professional Competence**

CO6: Demonstrate the ability to identify external features and structures of various animals through practical exercises and observations. This course outcome requires students to develop their personal and professional competence by demonstrating their ability to identify external features and structures of various animals through practical exercises and observations. This aligns with the program outcome of personal and professional competence, which requires students to be able to work independently and as part of a team to achieve common goals.

**PO7: Effective Citizenship and Ethics**

CO7: Explore ethical use of animal abilities for environmental sustainability and own economic benefits. This course outcome requires students to consider the ethical implications of using animal abilities for human benefit. This aligns with the program outcome of effective citizenship and ethics, which requires students to make ethical decisions in a variety of contexts.

**PO8: Environment and Sustainability**

CO7: Explore ethical use of animal abilities for environmental sustainability and own economic benefits. This course outcome requires students to consider the environmental impact of using animal abilities for human benefit. This aligns with the program outcome of environment and sustainability, which requires students to understand the environmental impact of human activity and to develop solutions to environmental problems.

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

CO7: Explore ethical use of animal abilities for environmental sustainability and own economic benefits. This course outcome requires students to think critically about the ethical implications of using animal abilities for human benefit. This aligns with the program outcome of self-directed and life-long learning, which requires students to be able to learn independently and adapt to new situations.

## SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2023)

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

**Program Code: ZOO**

**Class: F.Y. B.Sc.**

**Semester: II**

**Course Type: Minor**

**Theory Course Code: ZOO-161-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:

**Students will be able to-**

CO 1: Identify different honey bee species.

CO 2: Explain the tools & techniques used in apiculture.

CO 3: Illustrate the diseases of honey bee.

CO 4: 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.

CO 5: Get acquainted about communication system among the casts in the colony.

CO 6: Understand the seasonal management of bees for bee keeping.

CO 7: Acquire knowledge about structure of bee colony, functions of each casts in colony

### Course Articulation Matrix of ZOO-161-MN: Apiculture

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

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

Each course outcome is mapped to one or more program outcomes based on the following criteria:

Directly related: The course outcome directly addresses a program outcome.

Indirectly related: The course outcome indirectly addresses a program outcome by providing students with the knowledge or skills necessary to achieve a program outcome.

Supportive: The course outcome supports students in achieving a program outcome by providing them with opportunities to practice or develop the skills and knowledge necessary to achieve that outcome.

### **PO1: Disciplinary Knowledge**

CO 1: Identify different honey bee species. Identifying different honey bee species requires comprehensive knowledge of bee taxonomy and characteristics specific to each species. This aligns with the program outcome of disciplinary knowledge.

CO 2: Explain the tools & techniques used in apiculture. Understanding apiculture tools and techniques is a part of the specific knowledge related to beekeeping, aligning with PO1.

CO 7: Acquire knowledge about the structure of the bee colony, functions of each caste in the colony. Understanding the structure and functions of a bee colony involves disciplinary knowledge specific to apiculture.

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

CO 5: Get acquainted with the communication system among the castes in the colony. Understanding the communication system in a bee colony involves critical thinking to comprehend complex social behavior in bee castes.

### **PO3: Social Competence**

CO5: CO 5: Get acquainted with the communication system among the castes in the colony. This knowledge contributes to social competence by understanding the intricate social structure of a bee colony and implementing that principle in human social life.

### **PO4: Research-related Skills and Scientific Temper**

CO 3: Illustrate the diseases of honey bee. Understanding and illustrating bee diseases involves research-related skills and scientific knowledge, as it requires a systematic understanding of diseases affecting honey bees.

### **PO5: Trans-disciplinary Knowledge**

CO 4: 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. Understanding the economic importance of apiculture involves integrating knowledge about different bee products and their utilization, which is a trans-disciplinary approach.

### **PO6: Personal and Professional Competence**

CO 2: Explain the tools & techniques used in apiculture. Explaining these tools and techniques also demonstrates the development of professional skills and competence, which is in line with PO6.

CO 5: Get acquainted with the communication system among the castes in the colony. This knowledge also contributes to personal and professional competence by understanding the intricate social structure of a bee colony.

CO 6: Understand the seasonal management of bees for beekeeping. Understanding the

seasonal management of bees is a practical aspect of beekeeping and contributes to personal and professional competence.

**PO7: Effective Citizenship and Ethics**

CO 3: Illustrate the diseases of honey bee. Being knowledgeable about bee diseases aligns with demonstrating empathy for bee populations and ethical concerns regarding beekeeping.

**PO8: Environment and Sustainability**

CO 4: 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. Recognizing the economic value of bee products relates to the sustainability of apiculture and its impact on society and the environment.

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

CO 6: Understand the seasonal management of bees for beekeeping. Seasonal management skills can be applied in various contexts, promoting the ability for self-directed and lifelong learning as beekeeping practices evolve.

**SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020  
(w. e. f. June, 2023)**

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

**Program Code: ZOO**

**Class: F.Y. B.Sc.**

**Semester: II**

**Course Type: Open Elective (Theory)**

**Course Code: ZOO-166-OE**

**Course Name: Crop pest- types and management (पिकांवरील कीड: प्रकार व व्यवस्थापन)**

**Number of Credits: 02**

**Number of Teaching hours: 30**

**Course Objectives:-**

- शेतातील वेगवेगळ्या कीड नियंत्रणाच्या पद्धती अभ्यासणे.
- तृणधान्य आणि कडधान्याच्या कीड नियंत्रणाच्या पद्धती अभ्यासणे.
- नगदी पिकांच्या कीड नियंत्रणाच्या पद्धती अभ्यासणे.
- साठविलेल्या धान्याला होणारी किडी समजून घेणे.
- आहारामध्ये वापरल्या जाणाऱ्या शाकभाजावरील किडीचा प्रादुर्भाव अभ्यासणे.
- टोळ आणि गवती टोळचा अभ्यास करणे.
- पिकांचे ईतर शत्रूचा अभ्यास करणे.

**Course Outcomes:-**

सदर विषयाचा अभ्यास केल्यावर विद्यार्थी-

**CO1:** वेगवेगळ्या कीड नियंत्रणाच्या पद्धती आत्मसात करेल.

**CO2:** कीड नियंत्रणाच्या माध्यमातून तृणधान्य आणि कडधान्याचे उत्पन्नात वाढ करू शकतो.

**CO3:** नगदी पिकांसाठी कीड नियंत्रणाच्या योग्य पद्धती शेतात अवलंबू शकतो.

**CO4:** टोळ आणि गवती टोळ मुळे होणारे नुकसान टाळू शकतो.

**CO5:** शाकभाजांवरील किडीचा प्रादुर्भाव रोखू शकतो.

**CO6:** साठविलेल्या धान्याला होणारी किडीचा प्रादुर्भाव रोखू शकतो.

**CO7:** पिकांचे कीडनियंत्रण करून जास्तीत जास्त उत्पन्न मिळवू शकतो

**Course Articulation Matrix of ZOO-166-OE: Crop pest- types and management (पिकांवरील कीड: प्रकार व व्यवस्थापन) Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related**

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



Each course outcome is mapped to one or more program outcomes based on the following criteria:

Directly related: The course outcome directly addresses a program outcome.

Indirectly related: The course outcome indirectly addresses a program outcome by providing students with the knowledge or skills necessary to achieve a program outcome.

Supportive: The course outcome supports students in achieving a program outcome by providing them with opportunities to practice or develop the skills and knowledge necessary to achieve that outcome.

**PO1: Disciplinary Knowledge**

CO1: वेगवेगळ्या कीड नियंत्रणाच्या पद्धती आत्मसात करेल. This course outcome requires students to demonstrate their knowledge of the different methods of pest control. This aligns with the program outcome of disciplinary knowledge, which requires students to have a comprehensive understanding of the field of agriculture.

**PO2: Critical Thinking and Problem Solving**

CO2: कीड नियंत्रणाच्या माध्यमातून तृणधान्य आणि कडधान्याचे उत्पन्नात वाढ करू शकतो. This course outcome requires students to apply their knowledge of pest control to improve crop yield. This aligns with the program outcome of critical thinking and problem solving, which requires students to be able to apply their knowledge to solve real-world problems.

**PO3: Social Competence**

CO3: नगदी पिकांसाठी कीड नियंत्रणाच्या योग्य पद्धती शेतात अवलंबू शकतो. This course outcome requires students to be able to apply their knowledge of pest control to specific crops in the field. This aligns with the program outcome of social competence, which requires students to be able to work effectively in a variety of contexts.

**PO4: Research-related Skills and Scientific Temper**

CO4: टोळ आणि गवती टोळ मुळे होणारे नुकसान टाळू शकतो. This course outcome requires students to be able to identify and mitigate the damage caused by specific pests. This aligns with the program outcome of research-related skills and scientific temper, which requires students to be able to conduct research and apply scientific principles to solve real-world problems.

**PO5: Trans-disciplinary Knowledge.**

CO5: शाकभाजांवरील किडीचा प्रादुर्भाव रोखू शकतो. This course outcome requires students to integrate their knowledge of pest control with their knowledge of vegetable production. This aligns with the program outcome of trans-disciplinary knowledge, which requires students to be able to apply their knowledge from different disciplines to solve complex problems.

**PO6: Personal and Professional Competence**

CO6: साठविलेल्या धान्याला होणारी किडीचा प्रादुर्भाव रोखू शकतो. This course outcome requires students to be able to independently apply their knowledge of pest control to protect stored grain. This aligns with the program outcome of personal and professional competence, which requires students to be able to work independently and as part of a team to achieve common goals.



**PO7: Effective Citizenship and Ethics**

CO7: पिकांचे कीडनियंत्रण करून जास्तीत जास्त उत्पन्न मिळवू शकतो. This course outcome requires students to consider the ethical implications of using pest control methods to increase crop yield. This aligns with the program outcome of effective citizenship and ethics, which requires students to make ethical decisions in a variety of contexts.

**PO8: Environment and Sustainability**

CO7: पिकांचे कीडनियंत्रण करून जास्तीत जास्त उत्पन्न मिळवू शकतो. This CO requires students to consider the environmental impact of pest control. This aligns with the PO of environment and sustainability, which requires students to understand the impact of their actions on the environment.

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

CO7: पिकांचे कीडनियंत्रण करून जास्तीत जास्त उत्पन्न मिळवू शकतो. This CO requires students to be able to learn new methods of pest control as they become available. This aligns with the PO of self-directed and life-long learning, which requires students to be able to learn independently throughout their lives.

## SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020 (w. e. f. June, 2023)

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

**Program Code: ZOO**

**Class: F.Y. B.Sc.**

**Semester: II**

**Course Type: Open Elective (Practical)**

**Course Code: ZOO-167-OE**

**Course Name: Crop pest- types and management (पिकांवरील कीड: प्रकार व व्यवस्थापन)**

**(प्रात्यक्षिक)**

**Number of Credits: 02**

**Number of Teaching hours: 60**

**Course Objectives:-**

- शेतातील कीड नियंत्रणाच्या पद्धती समजून घेणे.
- फळझाडांवरील कीड नियंत्रणाच्या पद्धती अभ्यासणे.
- तृणधान्य आणि कडधान्याना होणारी कीड अभ्यासणे.
- ऊस या प्रमुख नगदी पिकांच्या कीड नियंत्रणाच्या पद्धती अभ्यासणे.
- घरामध्ये साठविलेल्या धान्याला होणारी किडी समजून घेणे.
- आहारामध्ये वापरल्या भाजांवरील किडीचा प्रादुर्भाव रोखणे.
- शेतातील वेगवेगळ्या कीड प्रकारांची माहिती करून घेणे.

**Course Outcomes:-**

सदर विषयाचा अभ्यास केल्यावर विद्यार्थी-

CO1: वेगवेगळ्या कीड नियंत्रणाच्या पद्धतीचे अवलोकन करेल.

CO2: कीड नियंत्रणाच्या माध्यमातून फळझाडांचे संगोपन आणि उत्पन्न घेऊ शकतो.

CO3: तृणधान्य आणि कडधान्याचे संगोपन आणि उत्पन्न घेऊ शकतो.

CO4: ऊस या प्रमुख नगदी पिकांच्या कीड नियंत्रणाच्या पद्धती शेतात अवलंबू शकतो.

CO5: घरामध्ये साठविलेल्या धान्याला होणारी किडी रोखू शकतो.

CO6: आहारामध्ये वापरल्या भाजांवरील किडीचा प्रादुर्भाव रोखून जास्त उत्पन्न घेऊ शकतो.

CO7: पिकांचे कीडनियंत्रण करून जास्तीत जास्त उत्पन्न मिळऊ शकतो.

**Course Articulation Matrix of ZOO-167-OE: Crop pest- types and management (पिकांवरील कीड :**

**प्रकार व व्यवस्थापन) Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related**

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

Each course outcome is mapped to one or more program outcomes based on the following criteria:

Directly related: The course outcome directly addresses a program outcome.

Indirectly related: The course outcome indirectly addresses a program outcome by providing students with the knowledge or skills necessary to achieve a program outcome.

Supportive: The course outcome supports students in achieving a program outcome by providing them with opportunities to practice or develop the skills and knowledge necessary to achieve that outcome.

**PO1: Disciplinary Knowledge**

CO1: वेगवेगळ्या कीड नियंत्रणाच्या पद्धती आत्मसात करेल. This course outcome requires students to demonstrate their knowledge of the different methods of pest control. This aligns with the program outcome of disciplinary knowledge, which requires students to have a comprehensive understanding of the field of agriculture.

**PO2: Critical Thinking and Problem Solving**

CO2: कीड नियंत्रणाच्या माध्यमातून फळझाडांचे संगोपन आणि उत्पन्न घेऊ शकतो. This course outcome requires students to apply their knowledge of pest control to improve crop yield. This aligns with the program outcome of critical thinking and problem solving, which requires students to be able to apply their knowledge to solve real-world problems.

**PO3: Social Competence**

CO3: तृणधान्य आणि कडधान्याचे संगोपन आणि उत्पन्न घेऊ शकतो. This course outcome requires students to be able to apply their knowledge of pest control to specific crops in the field. This aligns with the program outcome of social competence, which requires students to be able to work effectively in a variety of contexts.

**PO4: Research-related Skills and Scientific Temper**

CO4: ऊस या प्रमुख नगदी पिकांच्या कीड नियंत्रणाच्या पद्धती शेतात अवलंबू शकतो. This course outcome requires students to be able to identify and mitigate the damage caused by specific pests. This aligns with the program outcome of research-related skills and scientific temper, which requires students to be able to conduct research and apply scientific principles to solve real-world problems.

**PO5: Trans-disciplinary Knowledge.**

CO5: घरामध्ये साठविलेल्या धान्याला होणारी किड रोखू शकतो. This course outcome requires students to integrate their knowledge of pest control with their knowledge of vegetable production. This aligns with the program outcome of trans-disciplinary knowledge, which requires students to be able to apply their knowledge from different disciplines to solve complex problems.

**PO6: Personal and Professional Competence**

CO6: आहारामध्ये वापरल्या भाजांवरील किडीचा प्रादुर्भाव रोखून जास्त उत्पन्न घेऊ शकतो. This course outcome requires students to be able to independently apply their knowledge of pest control to protect stored grain. This aligns with the program outcome of personal and professional competence, which requires students to be able to work independently and as part of a team to achieve common goals.

**PO7: Effective Citizenship and Ethics**

CO7: पिकांचे कीडनियंत्रण करून जास्तीत जास्त उत्पन्न मिळवू शकतो. This course outcome requires students to consider the ethical implications of using pest control methods to increase crop yield. This aligns with the program outcome of effective citizenship and ethics, which requires students to make ethical decisions in a variety of contexts.

**PO8: Environment and Sustainability**

CO7: पिकांचे कीडनियंत्रण करून जास्तीत जास्त उत्पन्न मिळवू शकतो. This CO requires students to consider the environmental impact of pest control. This aligns with the PO of environment and sustainability, which requires students to understand the impact of their actions on the environment.

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

CO7: पिकांचे कीडनियंत्रण करून जास्तीत जास्त उत्पन्न मिळवू शकतो. This CO requires students to be able to learn new methods of pest control as they become available. This aligns with the PO of self-directed and life-long learning, which requires students to be able to learn independently throughout their lives.

**SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020  
(w. e. f. June, 2023)****Name of the Program: B.Sc. Zoology****Program Code: ZOO****Class: F.Y. B.Sc.****Semester: II****Course Type: Vocational Skill Courses (Practical)****Course Code: ZOO-171-VSC****Course Name: Biological Techniques-II****Number of Credits: 02****Number of Teaching hours: 60****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 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.

**Course Articulation Matrix of ZOO-171-VSC: Biological Techniques-II**  
**Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related**

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

Each course outcome is mapped to one or more program outcomes based on the following criteria:

Directly related: The course outcome directly addresses a program outcome.

Indirectly related: The course outcome indirectly addresses a program outcome by providing students with the knowledge or skills necessary to achieve a program outcome.

Supportive: The course outcome supports students in achieving a program outcome by providing them with opportunities to practice or develop the skills and knowledge necessary to achieve that outcome.

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

All of the COs in this example require students to demonstrate their knowledge of laboratory practices and techniques. For example, CO1 requires students to apply Good Laboratory Practices (GLP), CO2 requires students to demonstrate proficiency in laboratory sterilization techniques, and CO3 requires students to identify, select, and effectively utilize basic laboratory tools and glassware.

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

All of the COs in this example require students to think critically and solve problems. For example, CO1 requires students to apply GLP to ensure the safety, precision, and reliability of their work, CO2 requires students to select the appropriate sterilization technique for a given situation, and CO7 requires students to troubleshoot problems that may arise during serial dilutions or acid-base titrations.

#### **PO3: Social Competence**

CO1 requires students to apply GLP, which includes best practices for teamwork and communication. CO3 requires students to identify, select, and effectively utilize basic laboratory tools and glassware, which requires them to be able to communicate effectively with other laboratory workers.

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

All of the COs in this example require students to develop research-related skills and scientific temper. For example, CO1 requires students to apply GLP, which is essential for conducting rigorous scientific research. CO2 requires students to demonstrate proficiency in laboratory sterilization techniques, which is essential for preventing contamination and producing reliable results. CO4 requires students to successfully sterilize laboratory glassware and equipment, which is essential for creating a contamination-free environment for experiments. CO5 requires students to prepare and work with normal (N) and molar (M) solutions accurately, which is essential for conducting a variety of chemical calculations and experiments. CO6 requires students to create and utilize percent solutions accurately, which is essential for conducting a variety of chemical and biological experiments. CO7 requires

students to perform serial dilution methods and conduct acid-base titrations with precision, which is essential for analyzing solutions and generating accurate data.

**PO5: Trans-disciplinary knowledge**

CO5 requires students to prepare and work with normal (N) and molar (M) solutions accurately, which is essential for conducting a variety of chemical calculations and experiments.

**PO6: Personal and professional competence**

CO6 requires students to create and utilize percent solutions accurately, which is essential for conducting a variety of chemical and biological experiments.

**PO7: Effective Citizenship and Ethics**

CO7 requires students to perform serial dilution methods and conduct acid-base titrations with precision, which is essential for analyzing solutions and generating accurate data. Serial dilution methods and acid-base titrations are two important techniques that are used in a variety of chemical and biological experiments. By mastering these techniques, students are able to develop their skills in independent learning and to prepare themselves for a career in science.

**PO8: Environment and Sustainability**

CO1: Apply Good Laboratory Practices (GLP) consistently to ensure safety, precision, and reliability in laboratory work. GLP is a set of principles and practices that ensure the quality and integrity of nonclinical laboratory studies. By following GLP, scientists can conduct their work in a safe and ethical manner, and to produce reliable data that can be used to improve public health and safety.

CO2: Demonstrate proficiency in laboratory sterilization techniques to maintain sterile conditions and minimize contamination risks. Sterilization is a critical process for preventing contamination in the laboratory. By sterilizing their equipment and glassware, scientists are able to protect the environment from harmful microorganisms and to ensure that their experiments are conducted in a controlled environment.

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

CO7 requires students to perform serial dilution methods and conduct acid-base titrations with precision, which is essential for analyzing solutions and generating accurate data. Serial dilution methods and acid-base titrations are two important techniques that are used in a variety of chemical and biological experiments. By mastering these techniques, students can develop their skills in independent learning and to prepare themselves for a career in science.

**SYLLABUS (CBCS) FOR F. Y. B. Sc. ZOOLOGY as per NEP 2020  
(w. e. f. June, 2023)****Name of the Program: B.Sc. Zoology****Program Code: ZOO****Class: F.Y. B.Sc.****Semester: II****Course Type: Skill Enhancement Course Practical****Course Code: ZOO-176-SEC****Course Name: Medical Laboratory Techniques-II****Number of Credits: 02****Number of Teaching hours: 60****Course Outcomes**

- To introduce students to the essential equipment and techniques used in hematology laboratories and to provide hands-on experience in the preparation of different staining solutions and the observation of blood smears.
- To develop practical skills in estimating blood normal and abnormal concentrations of sugar, cholesterol, uric acid, and creatinine.
- To familiarize students with the morphology of red blood cells, their osmotic fragility and characteristics of common hematological disorders.
- To educate students about the anticoagulants commonly used in hematology.
- To instruct students in the technique of determining packed cell volume (PCV) using Wintrobe's method.
- To teach the principles and methods for determining erythrocyte sedimentation rate (ESR).
- To enable students to perform a comprehensive analysis of urine samples and identifies normal and abnormal constituents.

**Course Outcomes****After completion of this course, student will be able to**

- CO 1: operate hematology laboratory equipment and prepare staining solutions for blood smears effectively.
- CO 2: accurately estimate blood concentrations of sugar, cholesterol, uric acid, and creatinine, distinguishing between normal and abnormal levels.
- CO 3: recognize red blood cell morphology, assess osmotic fragility, and identify common hematological disorders.
- CO 4: explain the use and impact of common anticoagulants in hematology.
- CO 5: proficiently determine packed cell volume (PCV) using Wintrobe's method.
- CO 6: understand and execute the principles and methods for erythrocyte sedimentation rate (ESR) determination.
- CO 7: perform a comprehensive analysis of urine samples, precisely identifying normal and abnormal constituents.



**Course Articulation Matrix of ZOO-176-SEC: Medical Laboratory Technology-II**  
**Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related**

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

**PO1: Disciplinary Knowledge**

CO1 directly mapped to PO1 because they require students to demonstrate knowledge of the disciplinary concepts and skills relevant to medical laboratory technology. For example, CO1 requires students to operate hematology laboratory equipment and prepare staining solutions for blood smears effectively, which demonstrates their knowledge of the principles and practices of hematology.

**PO2: Critical Thinking and Problem Solving**

All of the COs are also directly mapped to PO2 because they require students to apply critical thinking and problem-solving skills to real-world scenarios in the field of medical laboratory technology. For example, CO2 requires students to accurately estimate blood concentrations of sugar, cholesterol, uric acid, and creatinine, distinguishing between normal and abnormal levels. This requires students to be able to analyze the data and make sound judgments about the patient's health status.

**PO3: Social Competence**

All of the COs are also directly mapped to PO3 because they require students to interact with others in a professional and effective manner. For example, CO7 requires students to perform a comprehensive analysis of urine samples, precisely identifying normal and abnormal constituents. This may involve communicating the results of the analysis to other healthcare professionals, such as doctors and nurses.

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

All of the COs are also directly mapped to PO4 because they require students to apply the principles of scientific research to their work. For example, CO3 requires students to recognize red blood cell morphology, assess osmotic fragility, and identify common hematological disorders. This requires students to be able to understand and interpret scientific data.

**PO5: Trans-disciplinary knowledge**

All of the COs are also directly mapped to PO5 because they require students to apply knowledge from different disciplines to solve problems in the field of medical laboratory technology. For example, CO4 requires students to explain the use and impact of common anticoagulants in hematology. This requires students to have knowledge of both hematology and chemistry.

**PO6: Personal and professional competence**

All of the COs are also directly mapped to PO6 because they require students to demonstrate the personal and professional skills that are essential for success in the field of medical laboratory technology. For example, CO5 requires students to proficiently determine packed cell volume (PCV) using Wintrobe's method. This requires students to be able to follow instructions accurately and precisely.

**PO7: Effective Citizenship and Ethics**

All of the COs are also directly mapped to PO7 because they require students to uphold the ethical standards of the medical laboratory profession. For example, CO6 requires students to understand and execute the principles and methods for erythrocyte sedimentation rate (ESR) determination. This requires students to be aware of the potential risks and benefits of the procedure and to obtain the patient's consent before performing it.

**PO8: Environment and Sustainability**

All of the COs are also directly mapped to PO8 because they require students to be aware of the environmental and sustainability implications of their work. For example, CO7 requires students to perform a comprehensive analysis of urine samples, precisely identifying normal and abnormal constituents. This may involve using hazardous chemicals, so students need to be aware of the proper safety procedures and how to dispose of waste safely.

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

All of the COs are also directly mapped to PO9 because they require students to develop the skills necessary for self-directed and lifelong learning. For example, CO1 requires students to operate hematology laboratory equipment and prepare staining solutions for blood smears effectively. This requires students to be able to read and understand technical instructions and to learn new procedures as needed.