Anekant Education Society's

Tuljaram Chaturchand College

of Arts, Science & Commerce, Baramati

(Autonomous)

Two Year M.Sc. Degree Program in Zoology

(Faculty of Science & Technology)

CBCS Syllabus

M.Sc. (Zoology) Semester -I

For P.G. 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: M. 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 Course. 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 Course 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 **M. 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 M.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 analysing 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. M.Sc. Zoology candidates 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 M.Sc. 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 Entomology, Physiology, Genetics, Cell Biology, Taxonomy, Biochemistry & Bioenergetics, Molecular Biology, Embryology, Developmental Biology, Immunology, Ecology, Ichthyology, Fresh Water Zoology, and Applied Zoology.

PSO2. Critical thinking and problem solving: Analyse the relationships of animals with abiotic factors and different biotic factors like plants and microbes. They will able to identify the species based on molecular taxonomy.

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
of Arts, Science & Commerce, Baramati
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Board of Studies (BoS) in Zoology

From 2022-23 to 2024-25

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

Credit Distribution Structure for M.Sc. -2023-2024 (Zoology)

Year (2 Year PG)	Level	Sem. (2 Yr.)	Major		Research Methodology (RM)	OJT/FP	RP	Cum. Cr.	Degree
			Mandatory	Electives					
I	6.0	Sem-I	ZOO-501-MJM:Biochemistry & Bioenergetics (Credit 04) ZOO-502-MJM:Cell Biology (Credit 04) ZOO-503-MJM: Zoology Practical-I (Credit 02) ZOO-504-MJM:Zoology Practical-II (Credit 02)	ZOO-511-MJE: A. Freshwater Zoology & Ichthyology ZOO-511-MJE: B. Biostatistics & Genetics ZOO-511-MJE: C. Biological Techniques (Credit 04)	ZOO-521-RM Research Methodology (Credit 04)	--	--	20	PG Diploma (after 3 Year Degree)
		Sem- II	ZOO-551-MJM: Molecular Biology (Credit 04) ZOO-552-MJM: Developmental Biology (Credit 04) ZOO-553-MJM: Zoology Practical-III (Credit 02) ZOO-554-MJM: Zoology Practical-IV (Credit 02)	ZOO-561-MJE: A. Entomology-I ZOO-561-MJE: B. Animal Physiology-I ZOO-561-MJE: C. Genetics-I (Credit 04)	--	ZOO-581-OJT/FP Credit 04	--	20	
Cum. Cr. For PG Diploma			**24**	**8**	**4**	**4**	**--**	**40**	

Course Structure for M.Sc. Zoology (2023 Pattern)

Sem	Course Type	Course Code	Course Name	Theory / Practical	Credits
I	Major Mandatory	ZOO-501-MJM	Biochemistry & Bioenergetics	Theory	04
	Major Mandatory	ZOO-502-MJM	Cell Biology	Theory	04
	Major Mandatory	ZOO-503-MJM	Zoology Practical-I	Practical	02
	Major Mandatory	ZOO-504-MJM	Zoology Practical-II	Practical	02
	Major Elective	ZOO-511-MJE (A)	Freshwater Zoology & Ichthyology	Theory	04
		ZOO-511-MJE (B)	Biostatistics & Genetics		
		ZOO-511-MJE (C)	Biological Techniques		
	Research Methodology (RM)	ZOO-521-RM	Research Methodology	Theory	04
	Total Credits Semester-I				**20**
II	Major Mandatory	ZOO-551-MJM	Molecular Biology	Theory	04
	Major Mandatory	ZOO-552-MJM	Developmental Biology	Theory	04
	Major Mandatory	ZOO-553-MJM	Zoology Practical-III	Practical	02
	Major Mandatory	ZOO-554-MJM	Zoology Practical-IV	Theory	02
	Major Elective	ZOO-561-MJE (A)	Entomology-I	Theory	04
		ZOO-561-MJE (B)	Animal Physiology-I		
		ZOO-561-MJE (C)	Genetics-I		
	On Job Training (OJT)/Field Project (FP)	ZOO-581-OJT/FP	On Job Training/Field Project relevant to the major course.	Training / Project	04
	Total Credits Semester-II				**20**
	Cumulative Credits Semester I + Semester II				**40**

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: I
Course Type: Major (Mandatory) Theory
Course Code: ZOO-501-MJM
Course Name: Biochemistry and Bioenergetics
Number of Credits: 04
Number of Teaching hours: 60

Course Objectives:-

- Structures of biomolecules.
- Functions of biomolecules.
- Concept of enzymes kinetics.
- Role of enzymes.
- Metabolic pathways of carbohydrates, proteins, lipids and nucleic acids.
- Energetics of biomolecules.
- Mechanism of electron transport chain.

Course Outcomes:-

CO1: Recall the facts about structures of biomolecules.
CO2: Explain the functions of biomolecules.
CO3: Explain the concept of enzymes kinetics.
CO4: Compare the role of enzymes.
CO5: Explain the mechanism of metabolic pathways of carbohydrates, proteins, lipids and nucleic acids.
CO6: Compare the energetics of biomolecules.
CO7: Explain the mechanism of electron transport chain.

Course Articulation Matrix of ZOO-501-MJM: Biochemistry and Bioenergetics
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Disciplinary Knowledge:

CO1, CO2, CO3, CO4, CO5, CO6, CO7:

These COs directly assess students' understanding of key concepts and mechanisms in biochemistry, a core area of zoology. They require students to recall facts, explain functions, compare roles, and analyze mechanisms, demonstrating comprehensive knowledge of the discipline.

PO2: Critical Thinking and Problem Solving:

CO3, CO4, CO5, CO6, CO7: These COs require students to analyze enzyme kinetics, compare roles and energetics, and explain mechanisms. This involves critical thinking to identify relevant information, apply concepts to solve problems, and draw conclusions.

PO3: Social Competence:

CO5, CO6: These COs involve explaining complex biochemical concepts (CO5) and comparing energetics (CO6). This requires clear and concise communication, demonstrating effective social competence in presenting information.

PO4: Research-related skills and Scientific temper:

CO5, CO6, CO7: Explaining metabolic pathways (CO5), comparing energetics (CO6), and explaining electron transport chain (CO7) require students to analyze scientific literature, formulate research questions, and interpret data, demonstrating research skills and scientific temper.

PO5: Trans-disciplinary knowledge:

CO5, CO6: Comparing roles of enzymes (CO4) and energetics of biomolecules (CO6) requires students to integrate knowledge from different areas of biochemistry and apply it to broader contexts, demonstrating trans-disciplinary understanding.

PO6: Personal and professional competence:

CO1, CO2, CO3, CO4, CO5, CO6, CO7: All COs require independent learning, analysis, and explanation, demonstrating personal competence. Additionally, CO5 and CO6 involve comparing information, demonstrating the ability to work collaboratively.

PO7: Effective Citizenship and Ethics: Not directly assessed by these COs. However, understanding the impact of metabolic pathways on living organisms (CO5) could indirectly contribute to an awareness of ethical issues related to genetic engineering. Understanding the role of biomolecules in energy production and metabolism has ethical implications for human health and environmental sustainability.

PO8: Environment and Sustainability: Not directly assessed by these COs However, understanding the role of biomolecules in energy production (CO7) could indirectly contribute to an awareness of the need for sustainable energy sources. The electron transport chain plays a crucial role in cellular energy production, and understanding its mechanism can inform strategies for sustainable energy development.

PO9: Self-directed and Life-long learning:

All COs: All COs require independent learning, analysis, and critical thinking, which are essential skills for lifelong learning.

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: I
Course Type: Major (Mandatory) Theory
Course Code: ZOO-502-MJM
Course Name: Cell Biology
Number of Credits: 04
Number of Teaching Hours: 60

Course Objectives:-

- Structures of basic components of prokaryotic and eukaryotic cells.
- Cellular components and their functions.
- Mechanism of cell signaling.
- Cell division and regulation.
- Role of cell cytoskeleton.
- Mechanism of cell death.
- Role of stem cells in tissue repairing.

Course Outcomes:-

Student will be able to-

CO1: Compare the components of prokaryotic and eukaryotic cells.
CO2: Explain the role of cellular components.
CO3: Compare the mechanisms of cell signaling.
CO4: Explain the concept of cell division.
CO5: Recall the role of cytoskeleton.
CO6: Explain the mechanism of cell death.
CO7: Explain the importance of stem cells in tissue repairing.

Course Articulation Matrix of ZOO-502-MJM: Cell Biology
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Disciplinary Knowledge:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
These COs directly assess students' understanding of key concepts in cell biology, including cellular components, their roles, signaling mechanisms, division, cytoskeleton function, cell death, and stem cell significance in tissue repair.

PO2: Critical Thinking and Problem Solving:
CO1, CO2, CO3, CO4, CO6:
Comparing cellular components, analyzing signaling mechanisms, understanding cell division mechanisms, and evaluating the role of cell death all require critical thinking and problem-solving skills.
PO3: Social Competence:
CO3, CO5:
Explaining the mechanisms of cell signaling and the role of the cytoskeleton requires effective communication skills, both written and oral.
PO4: Research-related skills and Scientific temper:
CO3, CO4, CO6, CO7:
Analyzing signaling mechanisms, understanding cell division regulation, and exploring cell death mechanisms involve critical thinking, research skills, and an appreciation for scientific evidence and ethics.
PO5: Trans-disciplinary knowledge:
CO1, CO5, CO6:
Comparing prokaryotic and eukaryotic cells connects cell biology to other disciplines like microbiology and medicine, demonstrating trans-disciplinary understanding. The cytoskeleton's role in cell movement also connects to biomechanics.
PO6: Personal and professional competence:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
Mastering these COs requires independent learning, self-motivation, and the ability to work effectively with others to understand complex cellular processes.
PO7: Effective Citizenship and Ethics:
CO6, CO7:
Understanding the mechanisms of cell death and the potential of stem cells in tissue repair has ethical implications for human health and medical treatments.
PO8: Environment and Sustainability:
CO2, CO6:
Understanding the role of cellular components and mechanisms in maintaining cellular health and function is crucial for developing sustainable practices in areas like environmental toxicology and bioremediation.
PO9: Self-directed and Life-long learning:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
Mastering these COs provides a strong foundation for ongoing learning and exploration in the field of cell biology and related disciplines.

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: I
Course Type: Major (Mandatory) Practical
Course Code: ZOO-503-MJM
Course Name: Zoology Practical-I
Number of Credits: 02
Number of Teaching Hours: 60

Course Objectives:-

- Principle and working of instruments.
- Preparation of chemicals of different concentrations.
- Preparation of buffers of known pH.
- Estimation of inorganic phosphates and carbohydrates.
- Estimation of amino acids.
- Methodology for vitamin estimation.
- Effect of temperature, pH, activator and inhibitor on enzyme activity.

Course Outcomes:-

Student will be able to-

CO1: Explain principle and working of instruments.
CO2: Prepare chemicals of different concentrations.
CO3: Prepare buffers of known pH.
CO3: Estimate inorganic phosphates and carbohydrates with suitable method.
CO4: Estimate amino acid.
CO5: Explain the methodology for vitamin estimation.
CO6: Compare the effect of temperature, pH, activator and inhibitor on enzyme activity.

Course Articulation Matrix of ZOO-503-MJM: Zoology Practical-I
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Disciplinary Knowledge:
CO1, CO2, CO3, CO4, CO5, CO6:
These COs directly assess students' understanding of key laboratory techniques and principles in biochemistry, including instrument operation, chemical preparation, buffer calibration, and enzyme assays.

PO2: Critical Thinking and Problem Solving:
CO2, CO3, CO6:
Preparing solutions of different concentrations and buffers of known pH requires solving basic mathematical problems and applying critical thinking to select appropriate methods and troubleshoot issues. Analyzing the effects of different factors on enzyme activity involves critical thinking and drawing conclusions from experimental data.
PO3: Social Competence:
CO1, CO5:
Explaining the principle and working of instruments and the methodology for vitamin estimation requires clear communication skills, both written and oral.
PO4: Research-related skills and Scientific temper:
CO2, CO3, CO4, CO5, CO6:
Performing biochemical assays, including preparing solutions, calibrating buffers, and conducting enzyme assays, involves following protocols, recording data accurately, and analyzing results with a scientific approach.

PO5: Trans-disciplinary knowledge:
CO1, CO2:
Understanding the principles and operation of various instruments connects biochemistry to other disciplines like physics and engineering, demonstrating trans-disciplinary understanding.
PO6: Personal and professional competence:
CO1, CO2, CO3, CO4, CO5, CO6:
Mastering these COs requires independent work in the lab, self-motivation to learn new techniques, and the ability to work effectively with others to conduct experiments and interpret data.
PO7: Effective Citizenship and Ethics:
CO2, CO3:
Preparing chemicals and buffers safely and responsibly demonstrates awareness of ethical considerations in scientific research and laboratory practices.
PO8: Environment and Sustainability:
CO1, CO3:
Understanding the impact of pH and other factors on enzyme activity and using environmentally friendly buffers can contribute to sustainable practices in laboratory research.
PO9: Self-directed and Life-long learning:
CO1, CO2, CO3, CO4, CO5, CO6:
Mastering these COs provides a strong foundation for independent learning and exploration in the field of biochemistry and related disciplines, including the ability to adapt to new techniques and technologies in the lab.

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: I
Course Type: Major (Mandatory) Practical
Course Code: ZOO-504-MJM
Course Name: Zoology Practical-II
Number of Credits: 02
Number of Teaching Hours: 60

Course Objectives:-

- Use of stage and ocular micro-meter.
- Centrifugation for harvesting subcellular molecules.
- Detection of collagen in animal tissues.
- Methodology for DNA and RNA detection.
- Effect of chemicals on mitosis.
- Cell viability test.
- Study of metaphase chromosomes.

Course Outcomes:-

Student will be able to-

CO1: Use stage & ocular micro-meter and measure the cell size.
CO2: Perform the cell fractionation by centrifugal technique.
CO3: Detect the presence of collagen in animal tissues by appropriate staining method.
CO4: Detect the nucleic acids by appropriate staining method.
CO5: Interpret the effect of chemical on mitosis.
CO6: Performs appropriate test to check the cell viability.
CO7: Prepare the temporary slides to study metaphasic chromosomes.

Course Articulation Matrix of ZOO-504-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	3	2	2	3	3	1	1	3
CO2	3	3	3	3	1	3	3	3	3
CO3	3	3	3	3	3	3	3	1	3
CO4	3	3	3	3	3	3	3	1	3
CO5	3	3	1	3	1	3	1	1	3
CO6	3	3	1	3	1	3	2	3	3
CO7	2	3	3	3	2	3	3	1	3

PO1: Disciplinary Knowledge:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
These COs directly assess students' understanding of key techniques and concepts in cell biology, including measuring cell size, cell fractionation, identifying specific biomolecules like collagen and nucleic acids, analyzing effects on cell processes like mitosis, and assessing cell viability.

PO2: Critical Thinking and Problem Solving:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
Selecting appropriate staining methods, interpreting microscope observations, analyzing chemical effects on cell division, and troubleshooting technical issues in laboratory procedures require critical thinking and problem-solving skills.
PO3: Social Competence:
CO2, CO3, CO4, CO7:
Collaborating with lab partners, sharing equipment and materials, and communicating observations and results effectively require good social and communication skills.
PO4: Research-related skills and Scientific temper:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
Designing experiments, collecting data, maintaining accurate records, and analyzing results with skepticism and objectivity involve research skills and scientific temper.
PO5: Trans-disciplinary knowledge:
CO1, CO3, CO4:
Measuring cell size connects cell biology to mathematics and physics, while identifying biomolecules like collagen and nucleic acids links it to molecular biology and chemistry.
PO6: Personal and professional competence:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
Mastering these COs requires independent learning, self-management, attention to detail, and the ability to work effectively with laboratory equipment and protocols, demonstrating good professional skills.
PO7: Effective Citizenship and Ethics:
CO2, CO3, CO4, CO7:
Handling chemicals and biological materials responsibly, following safety protocols, and minimizing waste generation demonstrate ethical awareness and environmental responsibility.
PO8: Environment and Sustainability:
CO2, CO6:
Utilizing centrifuge techniques efficiently and choosing cell viability tests with minimal environmental impact can contribute to sustainable practices in laboratory research.
PO9: Self-directed and Life-long learning:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
Mastering these COs equips students with the skills and knowledge to independently design and conduct cell biology experiments, fostering lifelong learning in the field.

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: I
Course Type: Major (Elective) Theory
Course Code: ZOO-511-MJE (A)
Course Name: Freshwater Zoology and Ichthyology
Number of Credits: 04
Number of Teaching Hours: 60

Course Objectives:-

- Types of aquatic habitats.
- Physical & chemical properties of water.
- Aquatic adaptations of various animal groups.
- Economic importance of aquatic animals.
- Classification of fishes
- Anatomy of fishes.
- Fish disease.

Course Outcomes:-

Student will be able to-

CO1: Explain the types of aquatic habitats.
CO2: Interpret importance of physical & chemical properties of water for aquatic life.
CO3: Compare various adaptations in aquatic animals.
CO4: Explore the importance of aquatic animals for economic development.
CO5: Classify the fishes based upon their characters.
CO6: Explain the anatomy of fishes.
CO7: Identify the fish diseases based on symptoms.

Course Articulation Matrix of ZOO-511-MJE (A): Freshwater Zoology and Ichthyology
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Disciplinary Knowledge:
CO1, CO2, CO3, CO5, CO6:
These COs directly assess students' understanding of key themes in aquatic zoology, including diverse aquatic habitats, water qualities affecting life, animal adaptations, fish classification, and their anatomy.
PO2: Critical Thinking and Problem Solving:
CO2, CO3, CO6, CO7:
Interpreting the connection between water properties and life, analyzing adaptations in different contexts, evaluating fish classification systems, and diagnosing fish diseases based on symptoms all require critical thinking and problem-solving skills.
PO3: Social Competence:
CO3, CO5, CO6:
Explaining animal adaptations, classifying fish based on specific characters, and describing fish anatomy effectively require good communication and presentation skills.
PO4: Research-related skills and Scientific temper:
CO2, CO3, CO7:
Researching specific water properties and their impact, exploring diverse adaptations, and identifying fish diseases based on scientific evidence involve research skills and an appreciation for scientific methodology.
PO5: Trans-disciplinary knowledge:
CO2, CO3, CO6:
Understanding water chemistry connects aquatic zoology to chemistry, while studying animal adaptations can draw on concepts from ecology and evolution. Fish anatomy relates to comparative anatomy and zoophysiology.
PO6: Personal and professional competence:
CO1, CO2, CO3, CO5, CO6, CO7:
Mastering these COs requires independent learning, self-motivation, attention to detail, and the ability to work effectively with scientific texts and materials.
PO7: Effective Citizenship and Ethics:
CO2, CO3:
Understanding the importance of maintaining healthy aquatic environments and the impact of human activities on aquatic life promotes environmental awareness and responsible citizenship.
PO8: Environment and Sustainability:
CO2, CO3:
Recognizing the role of water quality in supporting aquatic life and understanding the negative impacts of pollution on animal adaptations can inform sustainable practices for managing aquatic ecosystems.
PO9: Self-directed and Life-long learning:
CO1, CO2, CO3, CO5, CO6, CO7:
Mastering these COs equips students with the skills and knowledge to independently explore various aspects of aquatic zoology, fostering lifelong learning in the field.

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: I
Course Type: Major (Elective) Theory
Course Code: ZOO-511-MJE (B)
Course Name: Biostatistics and Genetics
Number of Credits: 04
Number of Teaching Hours: 60

Course Objectives:-

- Chemical basis of heredity.
- Principles of genetics and patterns of inheritance.
- Relative contribution of genes and environment to common disorders.
- Numerical data analysis.
- Representation of data.
- Correlation between variables for making conclusions.
- Importance of statistical tests for scientific communications.

Course Outcomes:-

Student will be able to-

CO1: Explain the chemical basis of heredity.
CO2: Recall the facts about patterns of inheritance.
CO3: Correlates the contribution of genes and environment in disorders.
CO4: Analyse numerical data.
CO5: Represent data by appropriate method.
CO6: Make conclusions by analysing correlation between the variables.
CO7: Explain the importance of statistics in scientific communications.

Course Articulation Matrix of ZOO-511-MJE (B): Biostatistics and Genetics
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Disciplinary Knowledge:
CO1, CO2:
These COs directly assess students' understanding of key concepts in genetics, including the chemical basis of heredity (DNA) and fundamental patterns of inheritance (Mendelian and non-Mendelian).
PO2: Critical Thinking and Problem Solving:
CO2, CO3, CO4, CO5, CO6:
Recalling and applying knowledge of inheritance patterns, analyzing the interplay of genes and environment, interpreting numerical data, and drawing conclusions from correlations all require critical thinking and problem-solving skills.
PO3: Social Competence:
CO2, CO5, CO6:
Explaining complex genetic concepts like inheritance patterns and genetic contributions to disorders, presenting data effectively, and communicating conclusions clearly require strong communication and presentation skills.
PO4: Research-related skills and Scientific temper:
CO3, CO4, CO5, CO6, CO7:
Analyzing the contribution of genes and environment in disorders, interpreting numerical data, representing data appropriately, drawing conclusions from correlations, and emphasizing the importance of statistics in scientific communication all involve research skills and an appreciation for scientific methods and evidence.
PO5: Trans-disciplinary knowledge:
CO1, CO3:
Understanding the chemical basis of heredity connects genetics to biochemistry and molecular biology, while exploring the role of genes and environment in disorders bridges genetics with medicine and public health.
PO6: Personal and professional competence:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
Mastering these COs requires independent learning, self-motivation, attention to detail, and the ability to work effectively with data, scientific texts, and presentation tools.
PO7: Effective Citizenship and Ethics:
CO3:
Understanding the complex interplay of genes and environment in human disorders can inform ethical considerations in areas like genetic testing and counseling.
PO8: Environment and Sustainability:
CO3:
Recognizing the potential impact of environmental factors on genetic expression and disease risk can contribute to sustainable practices for environmental protection and public health.
PO9: Self-directed and Life-long learning:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
Mastering these COs equips students with the skills and knowledge to independently explore various aspects of genetics, analyze data, and communicate complex information, fostering lifelong learning in the field.

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: I
Course Type: Major (Elective) Theory
Course Code ZOO-511-MJE (C)
Course Name: Biological techniques
Number of Credits: 04
Number of Teaching Hours: 60

Course Objectives:-

- Advanced techniques in Life sciences.
- Principles and working of instruments.
- Techniques used in research.
- Databases and their applications.
- Cell culture technology.
- Importance of bioinformatics.
- Characterization of biomolecules.

Course Outcomes:-

Student will be able to-

CO1: Recall facts about techniques used in Life sciences.
CO2: Demonstrate the working of laboratory instruments.
CO3: Choose appropriate technique for research.
CO4: Analyse obtained data by using databases.
CO5: Compares different cell culture techniques.
CO6: Explains importance of bioinformatics
CO7: Characterizes biomolecules using appropriate techniques.

Course Articulation Matrix of ZOO-511-MJE (C): Biological Techniques
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	3	1	1	3
CO2	3	3	3	3	3	3	3	1	3
CO3	3	3	3	3	1	3	3	1	3
CO4	1	3	1	3	1	3	1	1	3
CO5	3	3	3	1	1	3	1	3	3
CO6	3	3	3	3	3	3	3	3	3
CO7	3	3	1	3	2	3	1	1	3

PO1: Disciplinary Knowledge:
CO1, CO2, CO3, CO5, CO6, CO7:
These COs directly assess students' understanding of key techniques in life sciences, including various methodologies, instrument operation, research application, data analysis, cell culture approaches, bioinformatics importance, and characterization methods for biomolecules.

PO2: Critical Thinking and Problem Solving:
CO2, CO3, CO4, CO5, CO6, CO7:
Demonstrating instrument function, troubleshooting errors, selecting appropriate techniques based on research needs, analyzing data with databases, comparing and evaluating different cell culture methods, applying bioinformatics to solve problems, and choosing characterization techniques based on biomolecule properties all require critical thinking and problem-solving skills.

PO3: Social Competence:
CO2, CO4, CO5, CO6:
Explaining laboratory instrument operation, communicating data analysis results using databases, sharing knowledge about cell culture techniques, and discussing the importance of bioinformatics can contribute to effective communication and collaboration.

PO4: Research-related skills and Scientific temper:
CO2, CO3, CO4, CO6, CO7:
Operating instruments, designing experiments, selecting and applying techniques, analyzing data critically, using bioinformatics tools, and characterizing biomolecules accurately represent crucial research skills and an appreciation for scientific methodology and data integrity.

PO5: Trans-disciplinary knowledge:
CO2, CO6:
Understanding the principles of various instruments connects life sciences techniques to physics and engineering, while bioinformatics bridges life sciences with computer science and mathematics.

PO6: Personal and professional competence:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
Mastering these COs requires independent learning, attention to detail, self-management, the ability to work effectively with equipment and protocols, and collaboration with research teams.

PO7: Effective Citizenship and Ethics:
CO2, CO4, CO6:
Responsible use of laboratory instruments, proper data handling and sharing practices, and understanding the ethical implications of bioinformatics applications demonstrate ethical awareness and responsible research conduct.

PO8: Environment and Sustainability:
CO5, CO6:
Utilizing sustainable cell culture techniques, minimizing waste generation during experiments, and applying bioinformatics for environmental research and resource management all contribute to sustainable practices in life sciences research.

PO9: Self-directed and Life-long learning:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
Mastering these COs equips students with the skills and knowledge to independently explore new techniques, design and conduct research, and adapt to the evolving landscape of life sciences, fostering lifelong learning.

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: I
Course Type: Research Methodology (RM Theory)
Course Code: ZOO-521-RM
Course Name: Research Methodology
Number of Credits: 04
Number of Teaching Hours: 60

Course Objectives:-

- Overview of the research methodology.
- Technique of defining a research problem.
- Importance of literature review in research.
- Research designs and their characteristics.
- Sampling designs and methods of data collections.
- Parametric tests of hypotheses and Chi-square test.
- Art of writing research reports and research papers.

Course Outcomes:-

Student will be able to-

CO1: Explain concept of research methodology.
CO2: Define research problem.
CO3: Explain need of literature review in research.
CO4: Prepare research designs and explain their characteristics
CO5: Collect and present the data.
CO6: Analyse data by using appropriate tests.
CO7: Write research report and research paper.

Course Articulation Matrix of ZOO-521-RM: Research Methodology
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Disciplinary Knowledge:
CO1, CO4:
These COs directly assess students' understanding of key concepts in research methodology, including the overall framework, research design types and their characteristics.

PO2: Critical Thinking and Problem Solving:
CO2, CO4, CO5, CO6:
Defining a research problem, choosing the appropriate research design, analyzing data effectively, and applying statistical tests all require critical thinking and problem-solving skills.

PO3: Social Competence:
CO5, CO7:
Effectively presenting data and writing clear and concise research reports and papers require strong communication and presentation skills.

PO4: Research-related skills and Scientific temper:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
Understanding the research process, formulating research questions, conducting literature reviews, choosing appropriate data collection and analysis methods, interpreting results, and writing reports all involve research skills and an appreciation for scientific methods and evidence.

PO5: Trans-disciplinary knowledge:
CO1, CO6;
Understanding research methodology can be applied across various disciplines, while data analysis using statistical tests draws on concepts from mathematics and statistics.

PO6: Personal and professional competence:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
Mastering these COs requires independent learning, self-motivation, attention to detail, the ability to work effectively with information, and manage research projects.

PO7: Effective Citizenship and Ethics:
CO3, CO7:
Conducting ethical research, acknowledging sources properly, and avoiding plagiarism demonstrate ethical awareness and responsible research conduct.

PO8: Environment and Sustainability:
CO3, CO4:
Reviewing research on environmental issues and designing research to address sustainability challenges contribute to responsible environmental practices.

PO9: Self-directed and Life-long learning:
CO1, CO2, CO3, CO4, CO5, CO6, CO7:
Mastering these COs equips students with the skills and knowledge to independently conduct research, analyze data, communicate findings, and adapt to different research contexts, fostering lifelong learning.

Anekant Education Society's

Tuljaram Chaturchand College

of Arts, Science & Commerce, Baramati

(Autonomous)

Two Year M.Sc. Degree Program in Zoology

(Faculty of Science & Technology)

CBCS Syllabus M.Sc.

(Zoology) Semester -II

For P.G. 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 Entomology, Physiology, Genetics, Cell Biology, Taxonomy, Biochemistry & Bioenergetics, Molecular Biology, Embryology, Developmental Biology, Immunology, Ecology, Ichthyology, Fresh Water Zoology, and Applied Zoology.

PSO2. Critical thinking and problem solving: Analyse the relationships of animals with abiotic factors and different biotic factors like plants and microbes. They will able to identify the species based on molecular taxonomy.

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 M.Sc. -2023-2024 (Zoology)

Year (2 Year PG)	Level	Sem. (2 Yr.)	Major		Research Methodology (RM)	OJT/FP	RP	Cum. Cr.	Degree
			Mandatory	Electives					
I	6.0	Sem-I	ZOO-501-MJM:Biochemistry & Bioenergetics (Credit 04) ZOO-502-MJM:Cell Biology (Credit 04) ZOO-503-MJM: Zoology Practical-I (Credit 02) ZOO-504-MJM:Zoology Practical-II (Credit 02)	ZOO-511-MJE: A. Freshwater Zoology & Ichthyology ZOO-511-MJE: B. Biostatistics & Genetics ZOO-511-MJE: C. Biological Techniques (Credit 04)	ZOO-521-RM Research Methodology (Credit 04)	--	--	20	PG Diploma (after 3 Year Degree)
		Sem- II	ZOO-551-MJM: Molecular Biology (Credit 04) ZOO-552-MJM: Developmental Biology (Credit 04) ZOO-553-MJM: Zoology Practical-III (Credit 02) ZOO-554-MJM: Zoology Practical-IV (Credit 02)	ZOO-561-MJE: A. Entomology-I ZOO-561-MJE: B. Animal Physiology-I ZOO-561-MJE: C. Genetics -I (Credit 4)	--	ZOO-581-OJT/FP Credit 04	--	20	
Cum. Cr. For PG Diploma			**24**	**8**	**4**	**4**	**--**	**40**	

Course Structure for M.Sc. Zoology (2023 Pattern)

Sem	Course Type	Course Code	Course Name	Theory / Practical	Credits
I	Major Mandatory	ZOO-501-MJM	Biochemistry & Bioenergetics	Theory	04
	Major Mandatory	ZOO-502-MJM	Cell Biology	Theory	04
	Major Mandatory	ZOO-503-MJM	Zoology Practical-I	Practical	02
	Major Mandatory	ZOO-504-MJM	Zoology Practical-II	Practical	02
	Major Elective	ZOO-511-MJE (A)	Freshwater Zoology & Ichthyology	Theory	04
		ZOO-511-MJE (B)	Biostatistics & Genetics		
		ZOO-511-MJE (C)	Biological Techniques		
	Research Methodology (RM)	ZOO-521-RM	Research Methodology	Theory	04
	Total Credits Semester-I				**20**
II	Major Mandatory	ZOO-551-MJM	Molecular Biology	Theory	04
	Major Mandatory	ZOO-552-MJM	Developmental Biology	Theory	04
	Major Mandatory	ZOO-553-MJM	Zoology Practical-III	Practical	02
	Major Mandatory	ZOO-554-MJM	Zoology Practical-IV	Practical	02
	Major Elective	ZOO-561-MJE (A)	Entomology-I	Theory	04
		ZOO-561-MJE (B)	Animal Physiology-I		
		ZOO-561-MJE (C)	Genetics-I		
	On Job Training (OJT)/Field Project (FP)	ZOO-581-OJT/FP	On Job Training/Field Project relevant to the major course.	Training / Project	04
	Total Credits Semester-II				**20**
	Cumulative Credits Semester I + Semester II				**40**

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: II
Couse Type: Major (Mandatory) Theory
Course Code: ZOO-551-MJM
Course Name: Molecular Biology
Number of Credits: 04
Number of Teaching hours: 60

Course Objectives:-

- To define DNA's basic elements and models
- To educate students about DNA replication modes and key experiments.
- To differentiate between euchromatin and heterochromatin, and understand histone's role in chromatin.
- To teach the prokaryotic genome organization, genes, and genome size concepts.
- To familiarize students with DNA damage types and repair systems.
- To describe transcription units, RNA polymerase, and mechanisms (initiation, elongation, termination).
- To introduce students with concepts of prokaryotic operon models and process of lambda phage regulation.

Course Outcomes:-

After completion of this course, student will be able to

CO1: define the basic elements and models of DNA
CO2: explain the two main modes of DNA replication
CO3: explain the role of histones in chromatin packaging and gene expression.
CO4: describe the organization of the prokaryotic genome.
CO5: identify and describe the different types of DNA damage
CO6: elucidate the step-by-step mechanisms of transcription
CO7**:** develops comprehensive understanding regarding DNA damage and repair mechanism

Course Articulation Matrix of ZOO-551-MJM: Molecular Biology
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	1	1

PO1: Disciplinary Knowledge
All of the course outcomes map to PO1, which means that the course will help students to develop a comprehensive knowledge of the field of molecular biology. Students will learn about the basic elements and models of DNA, the modes of DNA replication, the role of histones in chromatin packaging and gene expression, the organization of the prokaryotic genome, DNA damage and repair mechanisms, and the mechanisms of transcription. This knowledge is essential for students who plan to pursue a career in molecular biology or a related field.

PO2: Critical Thinking and Problem Solving
The course outcomes also map to PO2, which means that the course will help students to develop their critical thinking and problem-solving skills. Students will be asked to analyze and interpret data, design and conduct experiments, and draw conclusions. They will also be asked to think critically about the ethical implications of their work. These skills are essential for success in any field, but they are especially important in molecular biology, where students need to be able to think outside the box and come up with new and innovative solutions to complex problems.

PO3: Social Competence
The course outcomes also map to PO3, which means that the course will help students to develop their social competence skills. Students will be required to work collaboratively on assignments and projects. They will also be required to communicate their findings effectively to a variety of audiences. These skills are essential for success in any field, but they are especially important in molecular biology, where students need to be able to collaborate with other scientists and communicate their findings to the public.

PO4: Research-related skills and Scientific temper
The course outcomes also map to PO4, which means that the course will help students to develop their research-related skills and scientific temper. Students will learn how to design and conduct experiments, analyze and interpret data, and draw conclusions. They will also learn to think critically about scientific research and identify the strengths and weaknesses of different studies. These skills are essential for success in any field, but they are especially important in molecular biology, where students need to be able to conduct independent research and contribute to the scientific knowledge base.

PO5: Trans-disciplinary knowledge
The course outcomes also map to PO5, which means that the course will help students to develop their trans-disciplinary knowledge. Students will learn about the connections between molecular biology and other fields, such as genetics, biochemistry, and medicine. This knowledge will help students to think more holistically about scientific problems and to develop innovative solutions.

PO6: Personal and professional competence
The course outcomes also map to PO6, which means that the course will help students to develop their personal and professional competence skills. Students will learn how to manage their time effectively, organize their work, and work independently and as part of a team. They will also learn how to communicate their ideas effectively and to take responsibility for their work. These skills are essential for success in any field, but they are especially important in molecular biology, where students need to be able to work independently and collaboratively on complex projects.

PO7: Effective Citizenship and Ethics
The course outcomes also map to PO7, which means that the course will help students to develop their understanding of ethical issues in molecular biology. Students will learn about the potential benefits and risks of their work and the importance of responsible research conduct. They will also learn to think critically about the ethical implications of new scientific technologies. This knowledge is essential for students who plan to pursue a career in molecular biology or a related field.

PO8: Environment and Sustainability
The course outcomes also map to PO8, which means that the course will help students to develop their understanding of the environmental and sustainability implications of their work. Students will learn about the potential impact of molecular biology research on the environment and society. They will also learn about the importance of sustainable development in the field of molecular biology. This knowledge is essential for students who plan to pursue a career in molecular biology or a related field.

PO9: Self-directed and Life-long learning
The course outcomes also map to PO9, which means that the course will help students to develop their self-directed and life-long learning skills. Students will learn how to identify and pursue opportunities for life-long learning in the field of molecular biology. They will also learn to adapt to new technologies and changes in their field. This knowledge is essential for students who plan to pursue a career in molecular biology or a related field.

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: II
Couse Type: Major (Mandatory) Theory
Course Code: ZOO-552-MJM
Course Name: Developmental Biology
Number of Credits: 04
Number of Teaching hours: 60

Course Objectives:-

- Understand the basic concepts of developmental biology.
- Comprehend gametogenesis and its regulation.
- Explore fertilization and its significance.
- Analyze post-fertilization events and embryonic development.
- Examine the role of organizers in embryonic development.
- Development of *Drosophila* and axis formation.
- Investigate neural competence, induction, and other developmental processes.

Course Outcomes:-

After completion of this course students will be able to
CO1: explain the fundamental principles of developmental biology.
CO2: gain knowledge about the processes of gametogenesis.
CO3: learn about the fertilization processes.
CO4: explain the post-fertilization events and embryonic development
CO5: grasp the concept of organizers and their role in development.
CO6: gain insight into the development of *Drosophila*.
CO7: explain the processes of animal development.

Course Articulation Matrix of ZOO-552-MJM: Developmental Biology
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Disciplinary Knowledge
The COs are strongly related to PO1 because they cover the fundamental principles of developmental biology, the processes of gametogenesis and fertilization, post-fertilization events and embryonic development, the concept of organizers and their role in development, and the development of Drosophila and other animals.

PO2: Critical Thinking and Problem Solving
The COs are also strongly related to PO2 because they require students to think critically about the processes of developmental biology and to solve problems related to these processes. For example, students may be asked to design experiments to test hypotheses about the role of a particular gene in development or to explain how a particular developmental anomaly arises.

PO3: Social Competence
The COs are moderately related to PO3 because they require students to work collaboratively on assignments and projects, and to communicate their ideas effectively in writing and orally. For example, students may be asked to work in groups to write a research paper on a developmental biology topic or to give a presentation on their research findings.

PO4: Research-related skills and Scientific temper
The COs are partially related to PO4 because they require students to learn about the processes of developmental biology and to understand the scientific evidence that supports these processes. However, the COs do not explicitly require students to design and conduct their own experiments in developmental biology.

PO5: Trans-disciplinary knowledge
The COs are moderately related to PO5 because they require students to integrate their knowledge of developmental biology with their knowledge of other disciplines, such as genetics, molecular biology, and cell biology. For example, students may be asked to explain how the expression of a particular gene affects embryonic development or to discuss the implications of developmental biology research for human health and disease.

PO6: Personal and professional competence
The COs are moderately related to PO6 because they require students to work independently and as part of a team, to manage their time effectively, and to meet deadlines.

PO7: Effective Citizenship and Ethics
The COs are moderately related to PO7 because they require students to think critically about the ethical implications of developmental biology research. For example, students may be asked to discuss the ethical implications of using gene editing technologies to modify human embryos.

PO8: Environment and Sustainability
The COs are partially related to PO8 because they require students to learn about the impact of developmental biology research on the environment. For example, students may be asked to discuss the environmental implications of using genetically modified crops.

PO9: Self-directed and Life-long learning
The COs are moderately related to PO9 because they require students to develop the skills and knowledge necessary to learn about new advances in developmental biology research.

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: II
Couse Type: Major (Mandatory) Practical
Course Code: ZOO-553-MJM
Course Name: Zoology Practical - III
Number of Credits: 02
Number of Teaching hours: 60

Course Objectives:-

- Learn and apply precise techniques to estimate the concentration of DNA using diphenyl amine reagent and RNA using orcinol reagent, ensuring accurate quantification.
- Gain proficiency in isolating DNA from bacterial and animal sources, followed by quantification and quality assessment to ensure the integrity of the genetic material.
- Understand and utilize spectrophotometric assays and melting temperature (Tm) analysis to characterize DNA, enabling the identification of unique features of DNA samples.
- Acquire skills in the isolation of RNA from biological samples, ensuring its purity and integrity for downstream applications.
- Learn the techniques involved in the isolation of plasmids from bacterial cells, including their extraction, quantification, and quality evaluation.
- Explore mutagenic processes by conducting experiments to study the effects of chemical and physical mutagens on DNA, gaining insights into the mechanisms and outcomes of induced mutations.
- Develop the ability to perform DNA digestion using restriction enzymes, a crucial skill for genetic engineering and molecular biology applications.

Course Outcomes:-

After completion of this course students will

CO1: be proficient in employing precise techniques to accurately estimate the concentration of DNA.

CO2: gain competence in isolating DNA from diverse sources, including bacteria and animal tissues.

CO3: skilled to utilize spectrophotometric assays and melting temperature (Tm) analysis to comprehensively characterize DNA.

CO4: acquire the necessary skills to effectively isolate RNA from various biological samples while ensuring its purity and integrity for subsequent experimental applications.

CO5: proficient in the extraction, quantification, and quality assessment of plasmid DNA.

CO6: gain insights of mutagenic processes by conducting experiments to study the effects of chemical and physical mutagens on DNA.

CO7: develop the ability to proficiently perform DNA digestion using restriction enzymes.

Course Articulation Matrix of ZOO-553-MJM: Zoology Practical - III
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Disciplinary Knowledge
All of the COs are also directly mapped to PO1 because it requires students to learn how to isolate, purify, quantify, and characterize DNA, as well as how to use restriction enzymes to manipulate DNA. For example, CO1 requires students to be proficient in employing precise techniques to accurately estimate the concentration of DNA. This requires students to have a strong understanding of the principles and practices of DNA quantification.

PO2: Critical Thinking and Problem Solving
All of the COs are also directly mapped to PO2 because it require students to think critically and solve problems in order to successfully complete the laboratory experiments. For example, CO3 requires students to be able to think critically about the results of the assays and to draw accurate conclusions about the properties of the DNA samples.

PO3: Social Competence
All of the COs are also directly mapped to PO3 because it require students to develop their social competence by working in groups to complete laboratory experiments and to discuss and present their results. For example, CO4 requires students being able to work effectively as part of a team to complete the experiment and to communicate their results to others.

PO4: Research-related skills and Scientific temper
All of the COs are also directly mapped to PO4 because it require students to develop research-related skills and scientific temper. For example, CO5 requires students to be able to design and conduct an experiment to extract plasmid DNA from a bacterial culture, and to use a variety of laboratory techniques to quantify and assess the quality of the DNA.

PO5: Trans-disciplinary knowledge
All of the COs are also directly mapped to PO5 because it require students to develop trans-disciplinary knowledge by learning how DNA manipulation techniques can be used to solve problems in a variety of fields, including biology, chemistry, medicine, and agriculture. For example, CO6 requires students to have knowledge of both biology and chemistry, as well as an understanding of the mutagenic effects of different types of agents.

PO6: Personal and professional competence
All of the COs are also directly mapped to PO6 because it require students to develop their personal and professional competence by learning how to work independently and as part of a team to achieve common goals. Students also learn how to manage their time and resources effectively. For example, CO7 requires students to be able to follow instructions carefully and to perform the experiment with precision.

PO7: Effective Citizenship and Ethics
All of the COs are also directly mapped to PO7 because it require students to discuss the ethical implications of DNA manipulation. For example, students discuss the potential risks and benefits of using DNA manipulation techniques to genetically modify organisms. For example, All seven COs in the DNA course contribute to PO7 by requiring students to adhere to ethical standards in the laboratory.

PO8: Environment and Sustainability
All of the COs are also directly mapped to PO8 because it require students to learn about the environmental and sustainability implications of DNA manipulation. For example, students must properly dispose of hazardous waste and they must use resources efficiently.

PO9: Self-directed and Life-long learning
All of the COs are also directly mapped to PO9 because it require students to learn the skills and knowledge they need to engage in self-directed and life-long learning. For example, students learn how to access and evaluate scientific literature, and they learn how to design and conduct independent experiments.

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: II
Couse Type: Major (Mandatory) Practical
Course Code: ZOO-554-MJM
Course Name: Zoology Practical - IV
Number of Credits: 02
Number of Teaching hours: 60

Course Objectives:-

- Develop skills in embryo dissection and observation.
- Knowledge of chick embryo development
- Learn techniques for specimen preservation and mounting
- Familiarize with techniques for measuring lung capacity, including vital capacity, tidal volume, and residual volume
- Develop proficiency in genetic experimental techniques
- Genetic analysis and manipulation
- Application of microbial genetics techniques

Course Outcomes:-

After completion of this course students will be able to
CO1: analyze and understand the structural development of various species.
CO2: develop a comprehensive understanding of chick embryo development.
CO3: proficiently dissect and analyze the anatomical structures of insects.
CO4: proficient in executing pulmonary function tests (PFTS) for lung capacity measurement
CO5: execute experimental protocols with precision, ensuring accurate observation, recording, and interpretation of genetic data.
CO6: analyze and interpret genetic data obtained from experimental setups
CO7: exhibit proficiency in fundamental microbial genetics methods

Course Articulation Matrix of ZOO-554-MJM: Zoology Practical - IV
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Disciplinary Knowledge
All of the COs are also directly mapped to PO1 because requires knowledge and understanding of specific biological concepts and principles related to structural development, chick embryo development, insect anatomy, pulmonary function, genetics, and microbial genetics.

PO2: Critical Thinking and Problem Solving
All of the COs are also directly mapped to PO2 because involves analyzing complex information, identifying patterns, drawing conclusions, and solving problems related to biological processes, data analysis, and experimental design.

PO3: Social Competence
All of the COs are also directly mapped to PO3 because it require students hand-eye coordination, technical expertise, and potentially collaboration with others, demonstrating aspects of social competence.

PO4: Research-related skills and Scientific temper
All of the COs are also directly mapped to PO4 because they involve research skills like data collection, recording, and interpretation, reflecting scientific approach and methodology.

PO5: Trans-disciplinary knowledge
All of the COs are also directly mapped to PO5 because they require students to apply knowledge from genetics, experimental protocols, and data analysis, demonstrating integration of knowledge across disciplines.

PO6: Personal and professional competence
All of the COs are also directly mapped to PO7 because it require students technical skills, attention to detail, accuracy, and potentially effective communication of findings, contributing to personal and professional competence.

PO7: Effective Citizenship and Ethics
All of the COs are also directly mapped to PO7 because they promotes awareness of health issues and fosters responsible citizenship behavior.

PO8: Environment and Sustainability
All of the COs are also directly mapped to PO8 because it require students to be aware of the environmental and sustainability implications of their work. For example, CO3 provides insights into insect anatomy, highlighting their importance in environmental balance and conservation efforts.

PO9: Self-directed and Life-long learning
All of the COs are also directly mapped to PO9 because it require students to develop the skills and knowledge necessary for self-directed and lifelong learning. For example, CO1 requires students to analyze and understand the scientific literature on the structural development of various species. This requires students to be able to identify and evaluate relevant literature sources.

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: II
Couse Type: Major (Elective) Theory
Course Code: ZOO-561-MJE (A)
Course Name: Entomology-I
Number of Credits: 04
Number of Teaching hours: 60

Course Objectives:-

- To acquire proficiency in classifying insects based on their taxonomy, origin, and evolutionary history.
- To identify and differentiate between various insect orders, including Apterygote, Exopterygote, and Endopterygote insects, and understand their evolutionary relationships.
- To comprehending the insect integument and its diverse derivatives, their structural and functional significance.
- To familiarize students with the insect tagmata, focusing on the head, thorax, and abdomen, and comprehend their adaptations and modifications.
- To Delve into the internal systems of insects, including the digestive, respiratory, circulatory, excretory, reproductive, and nervous systems, gaining insights into their functions.
- To gain insight into the mechanisms of light and sound production in insects, and their role in communication, mating, and species survival.
- To develop proficiency in insect collection and preservation methods, ensuring the proper handling and conservation of valuable entomological specimens.

Course Outcomes:-

After completion of this course students will

CO1: have the proficiency to accurately classify insects based on their taxonomy, origin, and evolutionary history, demonstrating a deep understanding of insect diversity.

CO2: be able to identify and differentiate between various insect orders and explain their evolutionary relationships, showcasing a sound knowledge of insect evolution.

CO3: comprehensively understand the insect integument and its derivatives, recognizing their structural and functional importance in insect adaptation and survival.

CO4: be well-versed in insect tagmata, specifically the head, thorax, and abdomen, and comprehend their adaptations and modifications, gaining insights into the diversity of insect body plans.

CO5: have a strong understanding of insect internal systems and able to explain their functions within the context of insect biology.

CO6: gain insights into the mechanisms of light and sound production in insects.

CO7: develop the skills necessary for insect collection and preservation, ensuring proper handling and conservation of entomological specimens.

Course Articulation Matrix of ZOO-561-MJE (A) : Entomology-I
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Disciplinary Knowledge
CO1 requires students to have a deep understanding of insect diversity, which is a key component of disciplinary knowledge in entomology.
CO2 requires students to have a sound knowledge of insect evolution, which is another key component of disciplinary knowledge in entomology.
CO3 requires students to have a comprehensive understanding of the insect integument and its derivatives, which is essential for understanding insect adaptation and survival.
CO4 requires students to be well-versed in insect tagmata and their adaptations and modifications, which is essential for understanding the diversity of insect body plans.
CO6 requires students to gain insights into the mechanisms of light and sound production in insects, which are important aspects of insect communication and behavior.

PO2: Critical Thinking and Problem Solving
CO1 requires students to have a deep understanding of insect diversity, which is a key component of critical thinking in entomology.
CO2 requires students to have a sound knowledge of insect evolution, which is another key component of critical thinking in entomology.

PO4: Research-related skills and Scientific temper
CO7 requires students to develop the skills necessary for insect collection and preservation, which are essential for conducting entomological research.

PO5: Trans-disciplinary knowledge
CO1, CO2, CO3, CO4, and CO5 all require students to apply their knowledge of insect biology to other disciplines, such as agriculture, ecology, and medicine.

PO6: Personal and professional competence
All of the COs require students to develop personal and professional skills, such as time management, self-motivation, and responsibility.

PO7: Effective Citizenship and Ethics
All of the COs require students to demonstrate ethical behavior in their research and to be aware of the social and environmental implications of their work.

PO8: Environment and Sustainability
CO1, CO2, CO3, CO4, and CO5 all require students to understand the role of insects in the environment and to be able to develop sustainable solutions to insect-related problems.

PO9: Self-directed and Life-long learning
All of the COs require students to develop their independent learning skills and to be able to stay up-to-date on the latest advances in entomology.

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: II
Course Type: Major (Elective) Theory
Course Code: ZOO-561-MJE (B)
Course Name: Animal Physiology-I
Number of Credits: 04
Number of Teaching hours: 60

Course Objectives:-

- To understand the factors affecting animal physiology, including both extrinsic and intrinsic factors.
- To explore the concept of homeostasis and its regulatory mechanisms, including tolerance, resistance, acclimatization, and acclimation.
- To examine the role of biological clocks in regulating physiological rhythms, such as circadian rhythms, lunar and tidal rhythms, and photoperiodism.
- To study the structure and dynamics of biological membranes and their role in cellular physiology.
- To understand the physiology of digestion, including nutritional requirements, digestion and absorption, and the neuronal and hormonal control of digestion.
- To investigate muscle physiology, including the structure of skeletal muscle, muscle contraction, and types of muscle fiber.
- To introduce students to clinical physiology, including its scope, techniques, and processes involved in clinical science.

Course Outcomes:-

After completion of this course students will be able to

CO1: Understand and explain the impact of extrinsic and intrinsic factors on animal physiology, including their roles in adaptation and regulation.

CO2: Describe the structure and dynamics of biological membranes and understand their significance in cellular physiology.

CO3: Explain the concept of homeostasis, its regulation, and the mechanisms involved in maintaining internal stability.

CO4: Demonstrate knowledge of biological clocks and their role in regulating physiological rhythms in animals.

CO5: Comprehend the physiology of digestion, including nutritional requirements, digestion and absorption processes, and the control mechanisms.

CO6: Explain the different modes of respiration, gas exchange, and the neural control of respiration, as well as understand abnormalities in gas transport.

CO7: Describe muscle physiology, including muscle structure, contraction mechanisms, and muscle fiber types.

Course Articulation Matrix of ZOO-561-MJE (B): Animal Physiology-I
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Disciplinary Knowledge
CO1 aligns with PO1 as it involves comprehensive knowledge of animal physiology, including the factors influencing it. CO2 aligns with PO1 as it pertains to understanding the structure and importance of biological membranes in cellular physiology, reflecting discipline-specific knowledge. CO3 aligns with PO1 as it requires an in-depth understanding of the concept of homeostasis and its regulation, which is part of animal physiology. CO4 aligns with PO1 as it involves knowledge of biological clocks and their role in animal physiology.

PO2: Critical Thinking and Problem Solving
CO1 encourages critical thinking by examining the complex factors influencing animal physiology.

PO4: Research-related skills and Scientific temper
CO2 involves understanding the structure and dynamics of biological membranes, which is a fundamental aspect of scientific research in physiology. CO4 relates to understanding biological clocks and their role in physiology, which is a part of scientific temper and research-related skills.

PO5: Trans-disciplinary knowledge
CO1 aligns with PO5 as it involves knowledge of factors influencing animal physiology, which can transcend beyond the discipline of physiology.

PO6: Personal and professional competence
CO7 focuses on developing practical skills necessary for personal and professional competence, particularly in the context of specimen handling and conservation.

PO7: Effective Citizenship and Ethics
CO7 aligns with PO7 as it involves ethical considerations related to specimen collection and preservation in the context of entomology.

PO8: Environment and Sustainability
CO9 relates to understanding natural phenomena (bioluminescence and animal electricity) in animals, which can have relevance to environmental and ecological aspects.

PO9: Self-directed and Life-long learning
CO9 encourages self-directed learning by exploring complex topics related to bioluminescence and animal electricity.

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: II
Course Type: Major (Elective) Theory
Course Code: ZOO-561-MJE (C)
Course Name: Genetics-I
Number of Credits: 04
Number of Teaching hours: 60

Course Objectives:-

- To understand the life cycles and advantages of model genetic systems commonly used in genetic studies.
- To recapitulate the basic concepts of population genetics and explore the Hardy-Weinberg law.
- To delve into evolutionary genetics, including concepts of continuous variation, genetic polymorphism, and the genetics of speciation.
- To explore the applications of molecular methodologies in genetic analysis, including gene localization on chromosomes and the use of chromosomal probes.
- To study microbial genetics, covering topics such as conjugation, transformation, and conjugational mapping.
- To gain an understanding of the molecular biology of viruses, including virus structure, classification, and the role of viroids and prions.
- To develop critical thinking and problem-solving skills in the field of genetics.

Course Outcomes:-

After completion of this course students will be able to

CO1: Explain the life cycles and advantages of model genetic systems such as *Neurospora, E. coli*, and *Drosophila*.

CO2: Apply the principles of the Hardy-Weinberg law and estimate gene frequencies in populations through mutation and genetic equations.

CO3: Analyze the concepts of continuous variation, genetic polymorphism, and the genetics of speciation in both classical and modern contexts.

CO4: Utilize molecular information to understand phylogenetic relationships and explore the role of molecular methodologies in genetic analysis.

CO5: Describe the mechanisms of microbial genetics, including conjugation, transformation, and the concept of Hfr conjugation.

CO6: Explain the molecular biology of viruses, including their classification, structure, and the role of viroids and prions.

CO7: Develop critical thinking skills and problem-solving abilities by applying genetic principles to various biological systems.

Course Articulation Matrix of ZOO-561-MJE (C): Genetics-I
Weightage: 1: Partially related, 2: Moderately related, 3: Strongly related

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

PO1: Disciplinary Knowledge

CO1 aligns with PO1 as it involves acquiring comprehensive knowledge of genetic model systems and their life cycles, demonstrating a strong theoretical understanding in genetics.
CO6 aligns with PO1 as it involves acquiring comprehensive knowledge of virology and virus structure, reflecting discipline-specific knowledge in molecular biology.

PO2: Critical Thinking and Problem Solving

CO2 aligns with PO2 as it requires critical thinking and problem-solving skills in genetic calculations and understanding population genetics. CO7 aligns with PO2 as it focuses on developing critical thinking skills and problem-solving abilities in the context of genetics and biology.

PO3 - Social Competence:

CO7 involves skill development in a social context, reflecting the importance of social competence in collaborative problem-solving.

PO4: Research-related skills and Scientific temper

CO4 aligns with PO4 as it involves using molecular information and methodologies in genetics, demonstrating research-related skills and scientific temper. CO5 aligns with PO4 as it involves understanding mechanisms and techniques in microbial genetics, demonstrating research-related skills.

PO5: Trans-disciplinary knowledge

CO3 aligns with PO5 as it involves integrating genetic concepts with classical and modern perspectives, transcending beyond discipline-specific approaches.

PO6: Personal and professional competence

CO7 focuses on skill development, which is essential for personal and professional competence in the context of genetic problem-solving.

PO7: Effective Citizenship and Ethics

CO7 involves critical thinking with ethical considerations, aligning with effective citizenship and ethical awareness.

PO8: Environment and Sustainability

CO7 may involve addressing biological problems related to environmental sustainability, reflecting the relevance to environmental and sustainability concerns.

PO9: Self-directed and Life-long learning

CO7 encourages self-directed learning and problem-solving, aligning with the development of self-directed and life-long learning skills.

SYLLABUS (CBCS) FOR M. Sc. ZOOLOGY as per NEP 2020
(w. e. f. June, 2023)

Name of the Program: M.Sc. Zoology
Program Code: ZOO
Class: M. Sc. I
Semester: II
Couse Type: On Job Training (OJT)/Field Project (FP)
Course Code: ZOO-581- OJT/FP
Course Name: On Job Training/Field Project relevant to the major course.
Number of Credits: 04
Number of Teaching hours: 60

The filed project course would involve:

1. Training to students in:

a) Literature survey,

b) Planning and execution of experimental work,

c) Analysis of data and its presentation.

Studies would utilize few of the practicals from their course more intensively for this course. **Project should start at second** semester and **will be assessed at the end of second semester**. The experimentation work during the project should be equivalent to minimum 15 practicals in the semester.

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