



MUSLIM ARTS COLLEGE

(Autonomous)

(Accredited by NAAC with B+ grade & Affiliated to Manonmaniam Sundaranar University,
Tirunelveli; Recognized US 2(f) 12 (B) of UGC Act.)

Thiruvithancode, Kanyakumari District, Tamil Nadu - 629174.

DEPARTMENT OF ZOOLOGY

CBCS SYLLABUS

Learning Outcome-based Curriculum Framework for

ZOOLOGY (M.Sc.)

*Applicable for students admitted from June 2026 as per the Resolutions of the Academic Council Meeting held
on 01.06.2026*

Vision

- To integrate science education, respect for nature, and ethical values in the study and practice of zoological sciences.

Mission

- To help students understand and interpret the environment and biodiversity
- To develop the ability to address issues in conservation biology
- To combine theoretical knowledge and practical skills for research
- To prepare students for active participation in scientific research and environmental protection

Academic and Professional Attributes of the Graduates

1. **Advanced Knowledge and Scientific Competence**
Demonstrate comprehensive knowledge of zoological sciences, including animal diversity, physiology, genetics, ecology, evolution, biotechnology, and conservation biology, with strong scientific reasoning and analytical skills.
2. **Research and Innovation Skills**
Apply scientific methods, experimental techniques, statistical tools, and modern technologies to conduct independent research, analyze biological data, and develop innovative solutions to biological problems.
3. **Critical Thinking and Problem-Solving**
Critically evaluate scientific evidence, interpret experimental results, and solve complex biological and environmental problems using logical and evidence-based approaches.
4. **Technical and Laboratory Proficiency**
Acquire expertise in laboratory techniques, microscopy, molecular biology, bioinformatics, field studies, specimen handling, and scientific instrumentation while adhering to laboratory safety and ethical practices.
5. **Communication and Scientific Writing**
Communicate scientific concepts effectively through oral presentations, technical reports, research papers, digital media, and professional interactions with diverse audiences.
6. **Environmental and Ethical Responsibility**
Demonstrate commitment to biodiversity conservation, sustainable resource management, animal welfare, environmental ethics, and responsible conduct in research and professional practice.
7. **Leadership and Teamwork**
Exhibit leadership, interpersonal skills, and collaborative abilities while working in multidisciplinary teams, research projects, academic institutions, industries, and community outreach programmes.
8. **Professional Competence and Employability**
Develop professional skills required for careers in higher education, research institutions, healthcare, biotechnology, environmental management, wildlife conservation, aquaculture, forensic science, and allied biological sciences.
9. **Global Perspective and Lifelong Learning**
Recognize emerging trends in biological sciences, adapt to technological

advancements, and engage in lifelong learning for continuous personal and professional development.

10. **Reflective Learning and Social Engagement**

Practice self-evaluation, continuous improvement, scientific integrity, and social responsibility while contributing to public awareness, policy development, and community welfare through biological knowledge.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Upon completion of the M.Sc. Zoology Programme, graduates are expected to	Mapping with Mission
PEO1	Demonstrate advanced knowledge and technical competence in zoological sciences, including animal biology, physiology, genetics, ecology, evolution, biotechnology, and biodiversity conservation.	M1 & M3
PEO2	Apply scientific inquiry, analytical reasoning, laboratory skills, and modern research methodologies to investigate biological problems and contribute to scientific innovation.	M2 & M3
PEO3	Uphold professional ethics, environmental stewardship, and social responsibility while addressing challenges related to wildlife conservation, sustainable development, public health, and natural resource management.	M2 & M4
PEO4	Pursue lifelong learning, higher education, entrepreneurship, and professional careers in academia, research organizations, biotechnology, environmental management, healthcare, and allied life sciences through leadership and continuous skill development.	M3 & M4

Programme Outcomes (POs)

POs	Upon completion of the M.Sc. Zoology Degree Programme, students will be able to	Mapping with PEOs
PO1: Advanced Disciplinary Knowledge	Demonstrate advanced knowledge and understanding of zoological sciences, including animal diversity, physiology, genetics, ecology, evolution, biotechnology, and conservation biology.	PEO1
PO2: Critical Thinking and Scientific Reasoning	Critically analyze biological concepts, evaluate scientific evidence, and apply logical reasoning to solve complex biological and environmental problems.	PEO1, PEO2
PO3: Research and Innovation	Design and conduct scientific investigations using appropriate research methodologies, laboratory techniques, statistical tools, and modern technologies to generate valid scientific outcomes.	PEO2
PO4: Technical and Laboratory Competence	Demonstrate proficiency in laboratory practices, field techniques, molecular methods, microscopy, bioinformatics, and data analysis while adhering to safety and ethical standards.	PEO1, PEO2

PO5: Problem Solving and Decision Making	Apply biological knowledge and interdisciplinary approaches to address challenges in biodiversity conservation, public health, agriculture, biotechnology, environmental management, and sustainable development.	PEO2, PEO3
PO6: Professional Ethics and Environmental Responsibility	Uphold ethical values, scientific integrity, environmental stewardship, and social responsibility in research, professional practice, and community engagement.	PEO3
PO7: Communication and Leadership	Communicate scientific information effectively through oral presentations, technical writing, research publications, and digital platforms while demonstrating leadership and teamwork.	PEO3, PEO4
PO8: Lifelong Learning and Professional Development	Engage in self-directed learning, adapt to emerging technologies, and pursue higher education, research, entrepreneurship, and career advancement in life sciences.	PEO4
PO9: Global Perspective and Interdisciplinary Collaboration	Integrate zoological knowledge with allied disciplines and collaborate effectively to address global challenges related to biodiversity, climate change, ecosystem health, and sustainable development.	PEO2, PEO3, PEO4
PO10: Employability and Societal Contribution	Demonstrate professional competence, innovation, and entrepreneurial skills for successful careers in academia, research, healthcare, biotechnology, environmental consultancy, wildlife conservation, and allied biological sciences while contributing to societal well-being.	PEO3, PEO4

Programme Specific Outcomes (PSOs)

PSOs	Programme Specific Outcomes	Mapping with POs
PSO1	Demonstrate advanced knowledge of animal diversity, comparative anatomy, physiology, genetics, evolution, ecology, taxonomy, and biodiversity conservation to understand the complexity of animal life.	PO1, PO2, PO4
PSO2	Apply modern laboratory techniques, molecular biology, biotechnology, bioinformatics, field-based methods, and quantitative analytical tools to investigate biological systems and solve research problems.	PO2, PO3, PO4, PO5
PSO3	Design, execute, and communicate independent research by employing scientific methodologies, data analysis, critical thinking, and scientific writing in zoological and interdisciplinary studies.	PO2, PO3, PO7, PO8
PSO4	Develop professional competencies, ethical values, leadership, entrepreneurship, and collaborative skills required for careers in teaching, research, biotechnology, wildlife conservation, environmental management, healthcare, and allied life science industries.	PO5, PO6, PO7, PO10
PSO5	Apply zoological knowledge to address societal and environmental	PO5, PO6,

	challenges related to biodiversity conservation, ecosystem management, climate change, public health, sustainable resource utilization, and animal welfare through responsible scientific practices.	PO9, PO10
PSO6	Engage in lifelong learning, innovation, and continuous professional development by adapting to emerging trends, advanced technologies, and global developments in zoological sciences.	PO7, PO8, PO9, PO10

Mapping of Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

POs / PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1: Advanced Disciplinary Knowledge	3	2	2	2	2	1
PO2: Critical Thinking and Scientific Reasoning	3	3	3	2	3	2
PO3: Research and Innovation	2	3	3	2	2	3
PO4: Technical and Laboratory Competence	3	3	3	2	2	2
PO5: Problem Solving and Decision Making	2	3	2	3	3	2
PO6: Professional Ethics and Environmental Responsibility	2	2	2	3	3	2
PO7: Communication and Leadership	1	2	3	3	2	3
PO8: Lifelong Learning and Professional Development	1	2	3	3	2	3
PO9: Global Perspective and Interdisciplinary Collaboration	2	2	2	2	3	3
PO10: Employability and Societal Contribution	2	2	2	3	3	3

●3 – High Correlation

●2 – Moderate Correlation

●1 – Low Correlation

COURSES OFFERED

SEMESTER I

Part	Course Code	Title of the Course	Credits	Hours / Week
Core Course - I	NMZO11	Structure and Function of Invertebrates	4	6
Core Course - II	NMZO12	Comparative Anatomy of Vertebrates	4	6
Core Course - PI	NMZOP1	Lab Course in Invertebrates & Lab Course in Vertebrates	4	4
Core Course - PII	NMZOP2	Biochemistry Practical	2	4
Elective Course - I	NEZO11	Biochemistry	3	5
Elective Course - II	NEZO12	Poultry Farming	3	5
Total			20	30

SEMESTER I

CORE COURSE I: STRUCTURE AND FUNCTION OF INVERTEBRATES

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
NMZO11	Core	Y	Y	-	-	4	6	25	75	100

Learning Objectives

The course aims to:

1. To understand the concept of classification and their characteristic features of major group of invertebrates.
2. To realize the range of diversification of invertebrate animals.
3. To enable the students to find out the ancestors or derivatives of any taxon.
4. To know the functional morphology of system biology of invertebrates.

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.	K1
CO2	Understand the evolutionary process. All are linked in a sequence of life patterns.	K2
CO3	Apply this for pre-professional work in agriculture and conservation of life forms.	K3
CO4	Analyze what lies beyond our present knowledge of life process.	K4
CO5	Evaluate and to create the perfect phylogenetic relationship in classification.	K5

Bloom's Taxonomy Levels

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, K6 – Create

Course Content

Units	Contents	No. of Hours
I	Structure and function in invertebrates: Principles of Animal taxonomy; Species concept; International code of zoological nomenclature; Taxonomic procedures; New trends in taxonomy	15
II	Organization of coelom: Acoelomates; Pseudocoelomates; Coelomates: Protostomia and Deuterostomia; Locomotion: Flagella and ciliary movement in Protozoa; Hydrostatic movement in Coelenterata, Annelida and Echinodermata	15
III	Nutrition and Digestion: Patterns of feeding and digestion in lower metazoan; Filter feeding in Polychaeta, Mollusca, and Echinodermata. Respiration: Organs of respiration: Gills, lungs, and trachea; Respiratory pigments; Mechanism of respiration	15
IV	Excretion: Organs of excretion: coelom, coelomoducts, Nephridia and Malphigian tubules; Mechanisms of excretion; Excretion and osmoregulation. Nervous system: Primitive nervous system: Coelenterata and Echinodermata; Advanced nervous system: Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda); Trends in neural evolution	15
V	Invertebrate larvae: Larval forms of free-living invertebrates - Larval forms of parasites; Strategies and Evolutionary significance of larval forms. Minor Phyla: Concept and significance; Organization and general characters	15
	Total	75

S. No.	Text Book
1	Barrington, E. J.W. 1979. Invertebrate Structure and Function. The English Language Book Society and Nelson, pp-765.
2	Barnes, R. D. 1974. Invertebrate Zoology, (Second Edition), Holt-Saunders International Edition, pp-1024.
3	Barnes, R. S. K., P. Calow, P. J. W. Olive, D. W. Golding, J. J. Spicer. 2013. The Invertebrates: A Synthesis. Third Edition. John Wiles & Sons Inc., Hoboken. New Jersey, New Delhi.
4	Dechenik, J. A. 2015. Biology of Invertebrates (Seventh Edition). Published by McGraw Hill Education (India) Private Limited, pp-624.

S. No.	Reference Books
1	Brusca, R. C., Moore, W., & Shuster, S. M. (2023). Invertebrates (4th ed.). Oxford University Press.
2	Ruppert, E. E., Fox, R. S., & Barnes, R. D. (2004). Invertebrate Zoology: A Functional Evolutionary Approach (7th ed.). Brooks/Cole, Cengage Learning.
3	Jordan, E. L., & Verma, P. S. (2020). Invertebrate Zoology. S. Chand Publishing.

S. No.	Web Resources
1	https://animaldiversity.org/
2	https://www.marinespecies.org/
3	https://www.itis.gov/
4	https://eol.org/
5	https://library.si.edu/research/invertebrate-zoology

Mapping with Programme Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	1	2	1	1	1	1	1	1
CO2	3	3	2	2	2	1	1	2	2	1
CO3	2	3	2	2	3	2	2	2	2	2
CO4	2	3	3	2	3	2	2	2	2	2
CO5	3	3	3	3	2	2	2	2	2	2

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	1	1	2	1
CO2	3	2	2	1	2	2
CO3	2	3	2	2	3	2
CO4	2	3	3	2	2	2
CO5	3	3	3	2	2	2
Weightage	13	13	11	8	11	9
Weighted Percentage of Course Contribution to PSOs	2.6	2.6	2.2	1.6	2.2	1.8

Mapping Scale: 3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

FIRST YEAR - SEMESTER I

CORE II - COMPARATIVE ANATOMY OF VERTEBRATES

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
NMZO12	Core	Y	Y	-	-	4	6	25	75	100

Learning Objectives

The course aims to:

1. Exemplifying the vertebrate origin and the intermediary position of Prochordates between invertebrates and vertebrates.
2. Acquires the knowledge on evolution and adaptive radiation of Agnatha and Pisces.
3. Understanding knowledge about the first terrestrial vertebrates and the adaptive radiation of land animals.
4. Imparting conceptual knowledge about the animal life in the air and their behaviours.
5. Understanding the origin and efficiency of mammals and evolutionary changes that occurred in the life of vertebrates.

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.	K1
CO2	Understand the evolutionary process. All are linked in a sequence of life patterns.	K2
CO3	Apply this for pre-professional work in agriculture and conservation of life forms.	K3
CO4	Analyze what lies beyond our present knowledge of life process.	K4
CO5	Evaluate and to create the perfect phylogenetic relationship in classification.	K5

Bloom's Taxonomy Levels

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, K6 – Create

Course Content

Units	Contents	No. of Hours
I	Origin of vertebrates: Concept of Protochordata; The nature of vertebrate morphology; Definition, scope and relation to other disciplines; Importance of the study of vertebrate morphology.	15
II	Origin and classification of vertebrates; Vertebrate integument and its derivatives. Development, general structure and functions of skin and its derivatives; Glands, scales, horns, claws, nails, hoofs, feathers and hairs.	15
III	General plan of circulation in various groups; Blood; Evolution of heart; Evolution of aortic arches and portal systems. Respiratory system:	15

	Characters of respiratory tissue; Internal and external respiration; Comparative account of respiratory organs.	
IV	Skeletal system: Form, function, body size and skeletal elements of the body; Comparative account of jaw suspensorium, Vertebral column; Limbs and girdles; Evolution of Urinogenital system in vertebrate series.	15
V	Sense organs: Simple receptors; Organs of Olfaction and taste; Lateral line system; Electroreception. Nervous system: Comparative anatomy of the brain in relation to its functions; Comparative anatomy of spinal cord; Nerves-Cranial, Peripheral and Autonomous nervous systems.	15
	Total	75

S. No.	Text Book
1	Waterman, A.J. 1972. Chordate Structure and Function, MacMillan Co., New York, pp.587.
2	Parker T. J. and W. A. Haswell. 1962. A text book of Zoology, Vol. 2, Vertebrates, 7th Edition, Mac Millan Press, London, pp-750.
3	Ekambaranatha Ayyar and T. N. Ananthakrishnan. 2009. Manual of Zoology, Vol – II, S. Viswanathan Pvt. Ltd. Chennai.
4	Kotpal, 2019. R.L. Modern Text Book of Zoology Vertebrates, 4th Edition, Rastogi Publications, Meerut, pp-968.
5	Swayam Prabha https://www.swayamprabha.gov.in/index.php/program/archive/9
6	Yong, J. Z. 1981. The life of Vertebrates, English language Book society, London, pp-645.
7	Romer, A.S. 1971. The Vertebrate body, W.B.S. Saunders, Philadelphia, pp-600.

S. No.	Reference Books
1	Kardong, K. V. (2019). Vertebrates: Comparative Anatomy, Function, Evolution (8th ed.). McGraw-Hill Education.
2	Romer, A. S., & Parsons, T. S. (2018 Reprint). The Vertebrate Body (6th ed.). CBS Publishers & Distributors.
3	Kent, G. C., & Carr, R. K. (2001). Comparative Anatomy of the Vertebrates (9th ed.). McGraw-Hill.
4	Ekambaranatha Ayyar, M., & Ananthakrishnan, T. N. (2019 Reprint). Manual of Zoology, Volume II: Chordata. S. Viswanathan (Printers & Publishers) Pvt. Ltd.

S. No.	Web Sources
1	https://animaldiversity.org/
2	https://ucmp.berkeley.edu/
3	https://www.britannica.com/science/vertebrate
4	https://www.marinespecies.org/
5	https://www.biodiversitylibrary.org/

Mapping with Programme Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	1	2	1	1	1	1	1	1
CO2	3	3	2	2	2	1	1	2	2	1
CO3	2	3	2	2	3	2	2	2	2	2
CO4	2	3	3	3	3	2	2	2	2	2
CO5	3	3	3	3	2	2	2	2	2	2

3 – Strong, 2 – Medium, 1 – Low

Mapping with Programme Specific Outcomes

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	1	1	2	1
CO2	3	2	2	1	2	2
CO3	2	3	2	2	3	2
CO4	3	3	3	2	2	2
CO5	3	3	3	2	2	2
Weightage	14	13	11	8	11	9
Weighted Percentage of Course Contribution to PSOs	2.8	2.6	2.2	1.6	2.2	1.8

Mapping Scale: 3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

FIRST YEAR - SEMESTER I

CORE COURSE PI- LAB COURSE IN INVERTEBRATES & VERTEBRATES

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
NMZOP1	Core	-	-	Y	Y	4	4	25	75	100

Learning Objectives

The course aims to:

1. Understanding the different systems in invertebrates & vertebrates.
2. Learning about various animal species, their phylogenetic affinities and their adaptive features.
3. Imparting conceptual knowledge about the salient features and functional anatomy.
4. Developing the skill in mounting techniques of the biological samples.
5. Gaining fundamental knowledge on the skeletal system.

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Understand the structure and functions of various systems in animals	K2
CO2	Learn the adaptive features of different groups of animals	K2
CO3	Learn the mounting techniques	K2
CO4	Acquire strong knowledge on the animal skeletal system	K4

Bloom's Taxonomy Levels

K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyse, **K5** – Evaluate, **K6** – Create

Course Content

S.No	Contents	No. of Hours
	INVERTEBRATES	
	Dissection / Virtual Earthworm : Nervous system Pila : Digestive and nervous systems Sepia : Nervous system Cockroach : Nervous system Grasshopper : Digestive system and mouth parts Prawn : Appendages, nervous and digestive systems Crab : Nervous system	
	Study of the following slides with special reference to their salient features and their modes of life 1. Amoeba 2. Entamoeba histolytica 3. Paramecium 4. Hydra with bud 5. Sporocyst – Liver fluke 6. Cercaria larva 7. Tape worm (Scolex) 8. Ascaris T. S. 9. Mysis of prawn	
	Spotters 1. Scorpion 2. Penaeus indicus 3. Emerita (Hippa) 4. Perna viridis Mounting Earthworm : Body setae Pila : Radula Cockroach : Mouth parts Grasshopper : Mouth parts	
	CHORDATES	
	Study the nervous system of Indian dog shark – Dissection / Virtual 1. Nervous system of <i>Scoliodon laticaudatus</i> – 5th or Trigeminal nerve 2. Nervous system of <i>Scoliodon laticaudatus</i> – 7th or Facial nerve 3. Nervous system of <i>Scoliodon laticaudatus</i> – 9th and 10th or Glossopharyngeal & Vagus nerve	
	Study of the following specimens with special reference to their salient features and their modes of life: 1. Amphioxus sp. (Lancelet) 2. Ascidia sp. (sea squirt) 3. Scoliodon laticaudatus (Indian dog shark) 4. Trygon sp. (Sting ray) 5. Torpedo sp. (Electric ray) 6. Arius maculatus (Cat fish)	

	7. <i>Belone cancila</i> (Flute fish) 8. <i>Exocoetus poecilopterus</i> (Flying fish) 9. <i>Mugil cephalus</i> (Mullet) 10. <i>Tilapia mossambicus</i> (Tilapia) 11. <i>Rachycentron canadum</i> (Cobia) 12. <i>Tetrodon punctatus</i> (Puffer fish) 13. <i>Dendrophis</i> sp. (Tree snake)	
	Study of the different types of scales in fishes 1. Cycloid scale 2. Ctenoid scale 3. Placoid scale	
	Study of the frog skeleton system (Representative samples) 1. Entire skeleton 2. Skull 3. Hyoid apparatus 4. Pectoral girdle and sternum 5. Pelvic girdle 6. Fore limb 7. Hind limb	
	Mounting 1. Weberian ossicles of fish	
	Total	60

S. No.	Text Books
1	Lal, S.S. 2009. Practical Zoology, Rastogi Publications, pp-484.
2	Iuliis G. D. and D. Pulerà, 2007. The Dissection of Vertebrates: A Laboratory Manual. Academic Press, Imprint of Elsevier Publication, pp-416.
3	Verma, P.S. 2000. Manual of Practical Zoology: Chordates, S. Chand Publishing Company, pp-528
S. No.	Reference Works
1	Preeti, G., and C. Mridula, 2000. Modern Experimental Zoology, Indus International Publication.
2	Sinha, J., A. K. Chatterjee, P. Chattopadhyay. 2011. Advanced Practical Zoology, Arunabha Sen Publishers, pp-1070.
S. No.	Web Sources (URL)
1	https://www.marinespecies.org/
2	https://www.biodiversitylibrary.org/
3	https://www.amnh.org/research/invertebrate-zoology
4	https://www.digitalfishlibrary.org/
5	https://www.fishbase.se/

Mapping with Programme Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	3	2	1	1	2	1	1
CO2	3	3	2	3	3	2	2	2	2	2
CO3	2	2	3	3	2	2	2	2	1	2
CO4	3	3	2	3	2	2	2	2	2	2
CO5	2	2	3	3	3	2	3	2	2	3

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	1
CO2	3	3	2	2	3	2
CO3	2	3	3	2	2	2
CO4	3	3	3	2	2	2
CO5	2	3	3	3	3	2
Weightage	13	15	13	11	12	9
Weighted Percentage of Course Contribution to PSOs	2.6	3.0	2.6	2.2	2.4	1.8

Mapping Scale: 3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

FIRST YEAR - SEMESTER I

CORE COURSE PII– BIOCHEMISTRY PRACTICAL

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
NMZOP2	Core	-	-	Y	Y	2	4	25	75	100

Learning Objectives

The course aims to:

1. To provide hands-on training in fundamental biochemical laboratory techniques and safe laboratory practices.
2. To develop practical skills in the qualitative and quantitative estimation of biomolecules such as carbohydrates, proteins, nucleic acids, and enzymes.
3. To familiarize students with the operation and applications of laboratory instruments including pH meter, colorimeter, centrifuge, and chromatography techniques.
4. To enable students to perform enzyme assays, analyze experimental data, and interpret biochemical results using scientific methods.
5. To develop competency in cell biology techniques, including microscopic examination of cells, chromosome studies, and membrane properties, while promoting accuracy, critical thinking, and ethical laboratory practices.

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Outline the principles of biochemical techniques.	K2
CO2	Estimate biomolecules and enzyme activity.	K5
CO3	Perform experiment using colorimeter, centrifuge and chromatograph.	K2
CO4	Identify various types of cells utilizing microscopic techniques	K4
CO5	Demonstrate membrane properties, cell division and types of chromosomes.	K2

Bloom's Taxonomy Levels

K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyse, **K5** – Evaluate, **K6** – Create

Course Content

S.No.	Contents	No. of Hours
I	1. pH metry 2. Preparation of biological buffer. 3. Colorimetry 4. Estimation of Glucose- Anthrone method. 5. Estimation of Protein- Lowry's method. 6. Estimation of DNA by Diphenylamine reaction. 7. Estimation of RNA by Orcinol reagent. 8. Centrifugation technique. 9. Chromatography: Paper and Thin Layer 10. Enzyme assay- alkaline phosphatase activity 11. Enzyme kinetics using alkaline phosphatase	60
	Total	60

S. No.	Text Books
1	Plummer, D. T. (2017). An Introduction to Practical Biochemistry (6th ed.). McGraw-Hill Education.
2	Wilson, K., & Walker, J. (2018). Principles and Techniques of Biochemistry and Molecular Biology (8th ed.). Cambridge University Press.
3	Sawhney, S. K., & Singh, R. (2015). Introductory Practical Biochemistry. Narosa Publishing House.
S. No.	Reference Works
1	Jayaraman, J. (2011). Laboratory Manual in Biochemistry. New Age International Publishers.
2	Sadasivam, S., & Manickam, A. (2020). Biochemical Methods (4th ed.). New Age International Publishers.
S. No.	Web Sources (URL)
1	https://www.ncbi.nlm.nih.gov/
2	https://www.protocols.io/
3	https://www.thermofisher.com/in/en/home/references/protocols.html
4	https://www.sigmaaldrich.com/technical-documents/protocols.html
5	https://openstax.org/details/books/biology-2e

Mapping with Programme Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	2	2	3	1	1	1	2	1	1
CO2	2	3	3	3	3	2	1	2	2	2
CO3	2	2	3	3	2	2	2	2	2	2
CO4	2	3	2	3	2	2	2	2	2	2
CO5	2	2	2	3	2	2	2	2	2	2

3 – Strong, 2 – Medium, 1 - Low

Mapping with Programme Specific Outcomes

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	1	2	1
CO2	2	3	3	2	3	2
CO3	2	3	3	2	2	2
CO4	2	3	3	2	2	2
CO5	2	2	3	2	2	2
Weightage	10	14	14	9	11	9
Weighted Percentage of Course Contribution to PSOs	2.0	2.8	2.8	1.8	2.2	1.8

Mapping Scale: 3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

SEMESTER I
ELECTIVE COURSE-I (EC-I)
BIOCHEMISTRY

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	Marks		
								CIA	External	Total
NEZO11	Elective -I	Y	Y	-	-	3	5	25	75	100

Learning Objectives

The course aims to:

1. To provide a comprehensive understanding of the structure, properties, and functions of biologically important molecules such as carbohydrates, proteins, lipids, nucleic acids, and vitamins.
2. To impart knowledge of the principles of biophysical chemistry, bioenergetics, thermodynamics, enzyme kinetics, and metabolic pathways in living systems.
3. To explain the molecular basis of enzyme action, regulation, and their significance in cellular metabolism and physiological processes.
4. To develop an understanding of the structural organization, conformation, stability, and interactions of proteins and nucleic acids using modern biochemical concepts.
5. To familiarize students with biochemical techniques and analytical methods used for the identification, characterization, and study of biomolecules, fostering critical thinking and research aptitude.

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Learn the structure, properties, metabolism, and bioenergetics of biomolecules	K2
CO2	Acquire knowledge on various classes and major types of enzymes, classification, their mechanism of action and regulation	K2
CO3	Understand the fundamentals of biophysical chemistry and biochemistry, importance, and applications of methods in conforming the structure of biopolymers	K2
CO4	Comprehend the structural organization of and proteins, carbohydrates, nucleic acids and lipids	K4
CO5	Familiarize the use of methods for the identification, characterization, and conformation of biopolymer structures.	K5

Bloom's Taxonomy Levels

K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyse, **K5** – Evaluate, **K6** – Create

Course Content

Unit	Contents	No. of Hours
I	Basics of biophysical chemistry and biochemistry: Structure of atoms, molecules and chemical bonds - Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).	15
II	Biomolecular interactions and their properties: Stabilizing interactions (Vander Waals, electrostatic, hydrogen bonding, hydrophobic interaction etc. - Composition, structure, metabolism and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).	15
III	Bioenergetics and enzymology: Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers - Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isoenzymes	15
IV	Structural conformation of proteins and nucleic acids: Conformation of proteins (Ramachandran plot, secondary, tertiary, and quaternary structure; domains; motifs and folds)- Conformation of nucleic acids (A-, B-, Z-DNA), t-RNA, micro-RNA).	15
V	Stabilizing interactions in biomolecules: Stability of protein and nucleic acid structures - hydrogen bonding, covalent bonding, hydrophobic interactions, and disulfide linkage.	15
	Total	75

S. No.	Text Book
1	Berg, J. M., J. L. Tymoczko and L. Stryer 2002. Biochemistry. 5th Ed., W.H. Freeman & Co., New York, pp-1050.
2	Kuchel P.W. and G. B. Ralston. 2008. Biochemistry. McGraw Hill (India) Private Limited, UP, pp-580.
3	McKee T. and J. R. McKee. 2012. Biochemistry: The Molecular Basis of Life. (7th Edition). Oxford University Press, US, pp-793.
4	Nelson D.L. and M.M. Cox. 2012. Lehninger's Principles of Biochemistry. (6th Edition). W. H. Freeman Publishers, New York, pp-1158.
5	Satyanarayana U. and U. Chakrapani, 2006. Biochemistry. (3rd Edition). Books and Allied (P) Ltd. Calcutta, pp-695.

S. No.	Reference Books
1	Buchanan, B.B., W. Gruissem and R.L. Jones. 2015. Biochemistry and Molecular Biology of Plants. John Wiley and Sons Ltd., UK, pp-1280.
2	Murray, R.K., D.K. Granner, P.A. Mayes and V.W. Rodwell. 2003. Harper's Illustrated Biochemistry (26th Edition), The McGraw-Hill Companies, Inc., USA, pp-704.
3	Palmer, T. 2004. Enzymes. Affiliated East-West Press Pvt. Ltd., New Delhi, pp-416.
4	Voet D. and J.G. Voet. 2011. Biochemistry. (4th Edition). John Wiley & Sons (Asia) Pvt. Ltd., pp-1428.

S. No.	Web Resources
1	https://www.ncbi.nlm.nih.gov/
2	https://www.khanacademy.org/science/biology
3	https://bio.libretexts.org/
4	https://openstax.org/details/books/biology-2e
5	https://www.nature.com/subjects/biochemistry

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES (POs)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	1	2	1	1	1	2	1	1
CO2	3	3	2	2	2	1	1	2	2	2
CO3	2	3	3	3	2	2	2	2	2	2
CO4	3	3	2	3	2	2	2	2	2	2
CO5	2	3	3	3	2	2	2	3	2	2

3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation.

MAPPING OF COURSE OUTCOMES WITH PROGRAMME SPECIFIC OUTCOMES (PSOs)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	1	2	1
CO2	3	3	2	2	2	2
CO3	2	3	3	2	2	2
CO4	3	3	3	2	2	2
CO5	2	3	3	2	2	3
Weightage	13	14	13	9	10	10
Weighted Percentage of Course Contribution to PSOs	2.6	2.8	2.6	1.8	2.0	2.0

3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

FIRST YEAR – SEMESTER I

ELECTIVE COURSE-II: POULTRY FARMING

Subject Code	Category	L	T	P	S	Credits	Inst. Hours	CIA	External	Total
NEZO12	Elective -II	Y	Y	-	-	3	5	25	75	100

Learning Objectives

The course aims to:

1. Understand the anatomy, physiology, and genetics of poultry.
2. Learn about different poultry breeds and their characteristics.
3. Understand feed formulation and the importance of balanced diets.
4. Gain knowledge on poultry health management and disease prevention.
5. Gain knowledge on poultry reproduction and breeding techniques.

Course Outcomes

Upon successful completion of the course, students will be able to:

CO No.	Course Outcomes	BT Level
CO1	Understand the various practices in Poultry farming, needs for Poultry farming and the status of India in global market.	K2
CO2	Able to apply the techniques and practices needed for Poultry farming.	K3
CO3	Know the difficulties in Poultry farming and be able to propose plans against it.	K1
CO4	Implement effective health management and disease prevention strategies.	K5
CO5	Apply principles of poultry reproduction and breeding techniques.	K3

Bloom's Taxonomy Levels

K1 – Remember, **K2** – Understand, **K3** – Apply, **K4** – Analyse, **K5** – Evaluate, **K6** – Create

Course Content

Unit	Contents	No. of Hours
I	Introduction to Poultry farming General introduction to poultry farming - Definition of Poultry - Past and present scenario of poultry industry in India - Principles of poultry housing - Poultry houses - Systems of poultry farming.	15
II	Farm Management Management of chicks - growers and layers - Management of Broilers. - Preparation of project report for banking and insurance.	15
III	Feed and Nutrition Poultry feed management-Principles of feeding, Nutrient requirements for different stages of layers and broilers - Feed formulation and Methods of feeding	15
IV	Poultry diseases Poultry diseases-viral, bacterial, fungal and parasitic (two each); symptoms, control and management; Vaccination programme.	15
V	Handling and Hatching Selection, care and handling of hatching eggs - Egg testing. Methods of hatching.- Brooding and rearing -. Sexing of chicks. - Farm and Water Hygiene - Recycling of poultry waste.	15
	Total	75

S. No.	Text Books
1	Panda, B., & Singh, R. P. (2018). Developments in Processing, Packaging and Quality Assurance of Poultry Products. CBS Publishers & Distributors.
2	Banerjee, G. C. (2018). A Textbook of Animal Husbandry (10th ed.). Oxford & IBH Publishing Co. Pvt. Ltd

S. No.	Reference Books
1	Sreenivasaiah., P. V., 2015. Textbook of Poultry Science. 1stEdition. Write & Print Publications, New Delhi 2.
2	Jull A. Morley, 2007. Successful Poultry Management. 2ndEdition. Biotech Books, New Delhi"
3	Hurd M. Louis, 2003. Modern Poultry Farming. 1stEdition. International Book Distributing Company, Lucknow."

S. No.	Web Resources
1	http://www.asciindia.com/BooksPDF/SmallPoultryFarmer.pdf
2	https://nsdcindia.org/sites/default/files/MC_AGR-Q4306_Small-poultry-farmer-.pdf
3	http://ecoursesonline.iasri.res.in/course/view.php?id=335
4	https://swayam.gov.in/nd2_nou19_ag09/preview

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES (POs)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	1	1	2	2	1	2	2	2
CO2	2	3	2	2	3	2	2	2	2	3
CO3	2	3	3	2	3	2	2	2	2	3
CO4	2	2	2	3	3	3	2	2	2	3
CO5	2	3	2	3	3	2	2	2	2	3

Mapping Scale

3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation

MAPPING OF COURSE OUTCOMES WITH PROGRAMME SPECIFIC OUTCOMES (PSOs)

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	1	2	3	2
CO2	2	3	2	3	3	2
CO3	2	3	3	3	3	2
CO4	2	3	2	3	3	2
CO5	2	3	3	3	3	3
Weightage	10	14	11	14	15	11
Weighted Percentage of Course Contribution to PSOs	2.0	2.8	2.2	2.8	3.0	2.2

Mapping Scale

3 – Strong Correlation, 2 – Moderate Correlation, 1 – Low Correlation