



nghpahh; gy;fi yf;fofk;

PERIYAR UNIVERSITY

DEPARTMENT OF ZOOLOGY

Salem-636 011, Tamil Nadu

NAAC "A++" Grade - State University – NIRF Rank 59, NIRF Innovation Band of 11-50

M.Sc. ZOOLOGY PROGRAMME

[Choice Based Credit System (CBCS)]

(For those admitted in the academic year 2023-2024 onwards)

OBE REGULATIONS AND SYLLABUS

(With effect from the academic year 2023-2024 onwards)

1. Preamble

Department of Zoology was started in the year 2012 with M.Sc., M.Phil., and Ph.D. courses. This Department strives to create a suitable environment that enables teaching and research to attain high levels of excellence (through Publications and Patents) and in which its members can achieve their full potential right from Molecular Cell Physiology to understanding and targeting diseases like cancer and vector borne diseases, impact of climate change on insect diversity and bat behavior, Cultivation to commercialization of earthworms etc. Zoology is central to our understanding of the world. Zoologists seek to discover the fundamental principles that pinpoint animal life focusing on the diversity, function and evolution of animals and thus providing the scientific basis for our knowledge regarding the life style, physiology, diseases and their curative measure in the natural environment by conducting research in insects to mammalian cells.

2. General Graduate Attributes

By studying this programme students get state of the art knowledge about the Zoology and also the opportunities available by studying this course. Student get the aptitude for most of the job oriented course opportunities as well as ability to get success in various competitive exams such as TNPSC, UPSC and Indian forest service etc.

3. Programme Specific Qualification Attributes

By studying this programme the students get the eligibility and capability to clear SET and CSIR NET in Zoology and get eligibility to become Assistant Professors in Zoology as well as NET qualified research scholars. The students also become entrepreneurs and develop their own business and give employment to others.

- **Knowledge and understanding level (K1 and K2)**

This course imparts knowledge which will be helpful to clear the competitive examinations in the field of Zoology. Students can understand the nature, physiology, biochemical and evolutionary aspects of all animals.

- **Application level (K3)**

On completion of this course students can start the clinical and

diagnostic labs in the field of biomedicine. They will also be capable of opening sericulture, apiculture and aquaculture industries.

- **Analytical level (K4)**

Students can analyze each and every aspects of pathophysiology and biochemical reaction in animals including human being.

- **Evaluation capability level (K5)**

Students can evaluate environmental conditions, animal metabolism, and human pathological conditions.

- **Scientific or synthesis level (K6)**

By studying this course they can develop new drugs and patenting skills. They can also develop new hybrids using genetic engineering.

4. Vision

This Department strives to create a suitable an environment that enables teaching and research to attain high levels of excellence (through Publications and Patents) and in which its members can achieve their full potential right from Molecular Cell Physiology to understanding and targeting diseases like cancer and vector borne diseases, impact of climate change on insect diversity and bat behavior, Cultivation to commercialization of earthworms etc. In addition to the routine work, the Faculties actively engaging in research and also have collaboration with other Universities/ Research Institutions at national as well as International level. So far the Department of Zoology received more than a Crore of Rupees as research grant from various funding agencies like DST, UGC etc.

5. Programme Objectives and Outcomes

Spelt the PEOs (Programme Educational Objectives), Programme Specific Objectives (PSOs) and Programme Outcomes (POs)

Programme Educational Objectives

- To train our stakeholders to transform their theoretical knowledge into practical for the benefit of our society.

Programme Specific Objectives

- To motivate our stake holders to adopt fundamental mathematical tools (statistics) and physical Principles (physics, chemistry) to the analysis of relevant biological situations.
- The outgoing students must be talented to identify the major groups of organisms (invertebrates and chordates) with an emphasis on animals and be able to classify them within a phylogenetic framework (Evolution).
- Students will be able to compare and contrast the characteristics of animals that differentiate them from other forms of life (Comparative Biology).
- Our Stake holders would be clever to explain how organisms function at the level of the gene, genome, cell, tissue (Genetics, Cell Biology, Molecular Biology), 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 forms of animals.
- To develop our students to apply their scientific knowledge to formulate testable hypotheses, gathering data that spell out these hypotheses, and analyzing those data to assess the degree to which their scientific work supports their society.

Outcome of the Programme

- Zoology program offered by Periyar University will mould our students to transform their theoretical knowledge into practical for the benefit of our Society by promoting agriculture and health care products. They will be the best academicians cum Academic advisors for other institutions. Our stake holders will get an opportunity to serve for our Government as Zoologist at ZSI, Entomologist in ICAR institutes, Aqua-culturist, Sericulture Specialist as an entrepreneur. There is an opportunity for our young minds to serve as conservators, Educators as teachers, professors etc.

6. Candidate's eligibility for admission

Candidates who have qualified B.Sc., Zoology / Animal Science / Any other Degree related to Zoology / Life Sciences approved by the Syndicate of Periyar University, Salem.

7. Duration of the programme

The duration of the M.Sc. Zoology Course shall be over a period of **Two Years** from the commencement of the course. A student shall obtain the M.Sc. Degree in Zoology if he/she has registered, undergone and secured the required minimum credits for all the

Core and Elective courses and completed the Project Work / Dissertation within the stipulated time.

8. M.Sc. Zoology Programme Structure-Course work, contact hours, credits and maximum internal and external marks for the students admitted from 2023-2024 onwards

Sem	Course Code	Title of Course Work	Contact Hr/Week	Credit	Int. Mark	Ext. Mark	Total Mark
I	23PUZOC01	Structure and Function of Invertebrates	7	5	25	75	100
	23PUZOC02	Comparative Anatomy of Vertebrates	7	5	25	75	100
	23PUZOCP01	Lab Course I	6	4	40	60	100
	23PUZOE01A 23PUZOE01B	Biological Chemistry/ Microbiology	5	3	25	75	100
	23PUZOE02A 23PUZOE02B	Biostatistics/ Bioinstrumentation	5	3	25	75	100
				30	20		

9. Examinations

Examinations are conducted in semester pattern. The examination for the Semester I & III will be held in November/December and that for the Semester II and IV will be in the month of April/May in every academic year.

Candidates failing in any subject (both theory and practical) will be permitted to appear for such failed subjects in the same syllabus structure at subsequent examinations within next 5 years. Failing which, the candidate has to complete the course in the present existing syllabus structure.

10. Scheme for Evaluation and Attainment Rubrics

Evaluation will be done on a continuous basis and will be evaluated four times during the course work. The first evaluation will be in the 7th week, the second in the 11th week, third in the 16th week and the end – semester examination in the 19th week. Evaluation may be by objective type questions, short answers, essays or a combination of these, but the end semester examination is a University theory examination with prescribed question paper pattern.

Attainment Rubrics for Theory Courses

Internal (Max. Marks - 25)

S.No.	Approaches	Marks
1	Internal tests (Best two tests out of 3)	10
2	Attendance	5
3	Seminar	5

4	Assignment	5
Total		25

External (Max. Marks - 75)

Section	Approaches	Mark Pattern	K Level	CO Coverage
A	Objective Type (Answer all questions)	20X1 = 20 (Multiple Choice Questions)	✓	✓
B	Descriptive Type (100 to 200 words) (Answer any three out of five questions)	3X5 = 15 (Analytical type questions)	✓	✓
C	Essay Type (500 to 1000 words) (Answer all questions)	5X8 = 40 (Essay type questions)	✓	✓

Attainment Rubrics for Lab Courses

Internal (Max. Marks-40)

S.No.	Approaches	Marks
1	Practical tests (Best two tests out of 3)	30
2	Attendance	5
3	Record	5
Total		40

External (Max. Marks - 60)

Section	Approaches	Mark Pattern	K Level	CO Coverage
A	Major practical	1X20 = 20	✓	✓
B	Minor practical	1X10 = 10	✓	✓
C	Spotters	4X5 = 20	✓	✓
D	Viva-voce	10	✓	✓
Total		60		

Attainment Rubrics for Research

Internal (Max. Marks - 40)

S.No.	Approaches	Marks
1	Manual involvements in experiments	30
2	Attendance	10
Total		40

External (Max. Marks - 60)

S.No.	Approaches	Marks
-------	------------	-------

1	Project Report	40
2	Viva voce	20
Total		60

11. Grading System

Evaluation of performance of students is based on ten-point scale grading system as given below.

Ten Point Scale			
Grade of Marks	Grade points	Letter Grade	Description
90-100	9.0-10.0	O	Outstanding
80-89	8.0-8.9	D+	Excellent
75-79	7.5-7.9	D	Distinction
70-74	7.0-7.4	A+	Very Good
60-69	6.0-6.9	A	Good
50-59	5.0-5.9	B	Average
00-49	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT



நெற்பாஹி; க்யஃபி யஃஃஃஃஃ;
PERIYAR UNIVERSITY
DEPARTMENT OF ZOOLOGY
Salem-636011, Tamil Nadu

M.Sc. Zoology Course - SEMESTER-I

(This syllabus is applicable to the students who are admitted on or after 2023-2024 academic year onwards)

STRUCTURE AND FUNCTION OF INVERTEBRATES

Core Paper-01

Paper Code: 23PUZOC01

Total Contact Hours: 126

Credits: 5

Weekly Contact Hours: 7

Course Objectives:		
The main objectives of this course are:		
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 to find out the ancestors or derivatives of any taxon.	
4.	To know the functional morphology of system biology of invertebrates.	
Course I	:	Core I
Course title	:	Structure and Function of Invertebrates
Credits	:	5
Pre-requisite:		
Students should know the taxonomical classification of invertebrate animals in relation to their functional morphology.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Remember the general concepts and major groups in animal classification, origin, structure, functions and distribution of life in all its forms.	K1 & K2
2.	Understand the evolutionary process. All are linked in a sequence of life patterns.	K2 & K4
3.	Apply this for pre-professional work in agriculture and conservation of life forms.	K3 & K5
4.	Analyze what lies beyond our present knowledge of life process.	K4 & K6
5.	Evaluate and to create the perfect phylogenetic relationship in classification.	K5 & K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Units	
I	Structure and function in invertebrates: Principles of Animal taxonomy; Species concept; International code of zoological nomenclature; Taxonomic procedures; New trends in taxonomy; Molecular Taxonomy
II	Organization of coelom: Acoelomates; Pseudocoelomates; Coelomates: Protostomia and Deuterostomia; Locomotion: Flagella and ciliary movement in Protozoa; Hydrostatic movement in Coelenterata, Annelida and Echinodermata
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
IV	Excretion: Organs of excretion: coelom, coelomoducts, Nephridia and Malpighian 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
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
Reading list	
1. Barrington, E. J.W. 1979. Invertebrate Structure and Function. The English Language Book Society and Nelson, pp-765.	
Recommended texts	
1. Barnes, R. D. 1974. Invertebrate Zoology, (Second Edition), Holt-Saunders International Edition, pp-1024.	
2. 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.	
3. Dechenik, J. A. 2015. Biology of Invertebrates (Seventh Edition). Published by McGraw Hill Education (India) Private Limited, pp-624.	

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	S	S	S
CO2	S	S	M	M	S	S	M	M	S	S
CO3	S	M	S	M	S	S	M	M	S	S
CO4	S	M	S	M	S	S	M	M	S	M
CO5	S	M	S	M	S	S	M	M	S	M

*S - Strong; M - Medium; L - Low

Units	
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.
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.
III	General plan of circulation in various groups; Blood; Evolution of heart; Evolution of aortic arches and portal systems. Respiratory system: 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; Flight adaptation in birds.
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; Nerves-Cranial, Peripheral and Autonomous nervous systems. Physiology and behavior of mammalian pheromones – Bruce effect, Lee-Boot effect, Vandenbergh effect, Flehmen and Lordosis behaviour.
Reading list	
1. Swayam Prabha https://www.swayamprabha.gov.in/index.php/program/archive/9	
2. Yong, J. Z. 1981. The life of Vertebrates, English language Book society, London, pp-645.	
3. Romer, A.S. 1971. The Vertebrate body, W.B.S. Saunders, Philadelphia, pp-600.	
Recommended texts	
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. Ananthkrishnan. 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.	

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	S	M	S	M	S	M	S
CO2	S	L	L	S	M	S	M	M	M	M
CO3	S	M	L	S	M	S	M	L	M	M
CO4	S	L	L	S	L	S	M	L	M	L
CO5	S	M	L	S	S	S	M	S	M	M

*S - Strong; M - Medium; L - Low



நிழ்பாஹி; டிபி யஃஃஃஃ;
PERIYAR UNIVERSITY
DEPARTMENT OF ZOOLOGY
Salem-636011, Tamil Nadu

M.Sc. Zoology Course - SEMESTER-I

(This syllabus is applicable to the students who are admitted on or after 2023-2024 academic year onwards)

LAB COURSE I
(INVERTEBRATES & VERTEBRATES)

Core Paper-03

Paper Code: 23PUZOC03

Total Contact Hours: 108

Credits: 4

Weekly Contact Hours: 6

Course Objectives:		
The main objectives of this course are:		
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 I	:	Core III
Course title	:	Lab Course-I: Invertebrates & Vertebrates
Credits	:	4
Pre-requisite:		
Basic knowledge on the animals living in different habitats		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
1.	Understand the structure and functions of various systems in animals	K2 & K4
2.	Learn the adaptive features of different groups of animals	K1 & K2
3.	Learn the mounting techniques	K2 & K3
4.	Acquire strong knowledge on the animal skeletal system	K2 & K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

INVERTEBRATES

Dissection

- 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. *Panaeus 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

1. Nervous system of *Scoliodon laticaudatus* – 5th or Trigeminal nerve
2. Nervous system of *Scoliodon laticaudatus* – 7th or Facial nerve
3. Nervous system of *Scoliodon laticaudatus* – 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. *Belone cancila* (Flute fish)
8. *Exocoetus poecilopterus* (Flying fish)
9. *Mugil cephalus* (Mullet)

10. *Tilapia mossambicus* (Tilapia)
11. *Rachycentron canadum* (Cobia)
12. *Tetrodon punctatus* (Puffer fish)
13. *Dendrophis* 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

Text Books:

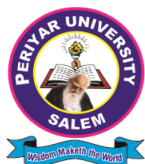
1. Lal, S.S. 2009. Practical Zoology, Rastogi Publications, pp-484.
2. Iuliis G. D. and D. Pulerà, 2007. The Dissection of Vertebrates: A Laboratory Manual. Academic Press, Imprint of Elsevier Publication, pp-416.
3. Verma, P.S. 2000. Manual of Practical Zoology: Chordates, S. Chand Publishing Company, pp-528

Reference Books:

1. Preeti, G., and C. Mridula, 2000. Modern Experimental Zoology, Indus International Publication.
2. Sinha, J., A. K. Chatterjee, P. Chattopadhyaya. 2011. Advanced Practical Zoology, Arunabha Sen Publishers, pp-1070.

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	M	S	M	S
CO2	S	M	L	S	M	S	M	M	M	M
CO3	M	M	L	S	L	S	M	L	M	M
CO4	S	S	L	S	L	S	M	L	M	L
CO5	S	S	M	L	M	S	M	S	M	M

*S - Strong; M - Medium; L – Low



நிழல்; கிழி யிழல்;

PERIYAR UNIVERSITY

DEPARTMENT OF ZOOLOGY

Salem-636011, Tamil Nadu

M.Sc. Zoology Course - SEMESTER-I

(This syllabus is applicable to the students who are admitted on or after 2023-2024 academic year onwards)

BIOLOGICAL CHEMISTRY

Elective Paper-01A

Paper Code: 23PUZOE01A

Total Contact Hours: 90

Credits: 3

Weekly Contact Hours: 5

Course Objectives:		
The main objectives of this course are:		
1.	Students should know the fundamentals of biochemistry	
Course I	:	Elective IA
Course title	:	Biological Chemistry
Credits	:	3
Pre-requisite:		
Understanding fundamental properties of elements, atoms, molecules, chemical bonds, linkages and structure, composition, metabolism and functions of biomolecules.		
Expected Course Outcome:		
On the successful completion of the course, student will be able to:		
I	Learn the structure, properties, metabolism and bioenergetics of biomolecules	K1 & K3
II	Acquire knowledge on various classes and major types of enzymes, classification, their mechanism of action and regulation	K1 & K2
III	Understand the fundamentals of biophysical chemistry and biochemistry, importance and applications of methods in conforming the structure of biopolymers	K2 & K3
IV	Comprehend the structural organization of and proteins, carbohydrates, nucleic acids and lipids	K2 & K4
V	Familiarize the use of methods for the identification, characterization and conformation of biopolymer structures	K5 & K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Units	
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).
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).
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
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).
V	Stabilizing interactions in biomolecules: Stability of protein and nucleic acid structures - hydrogen bonding, covalent bonding, hydrophobic interactions and disulfide linkage.

Reading list

1. Berg, J. M., J. L. Tymoczko and L. Stryer 2012. 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. 2018. Lehninger's Principles of Biochemistry. (6th Edition). W. H. Freeman Publishers, New York, pp-1158.
5. Satyanarayana U. and U. Chakrapani, 2020. Biochemistry. (3rd Edition). Books and Allied (P) Ltd. Calcutta, pp-695.

Recommended texts

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. 2019. Biochemistry. (6th Edition). John Wiley & Sons (Asia) Pvt. Ltd., pp-1428.

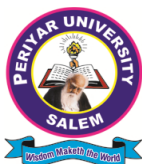
Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	S	L	S	M	S	M	M
CO2	S	S	L	S	S	S	M	M	M	S
CO3	M	M	M	S	M	S	S	S	S	L
CO4	S	M	S	M	S	M	S	S	S	M
CO5	M	S	S	M	M	S	M	L	S	M

*S - Strong; M - Medium; L-Low

II	Culture and Characterization: Isolation and identification of bacteria. Techniques of pure culture methods. Phases of growth. Microbial control – Physical and chemical agents Methods of sterilization and disinfection. Staining: Simple and differential staining; Gram staining; acid fast staining; endospore staining; capsule staining and flagella staining.
III	Microbial genetics: Methods of genetic transfers – transformation, conjugation, transduction. Mutations and mutagenesis: Definition and types of Mutations; Physical and chemical mutagens; Uses of mutations, DNA repair mechanisms. Microbial Genomics: Genome project of <i>Escherichia coli</i> and <i>Yeast</i> . Metagenomics concepts and Significance
IV	Host pathogen interaction: Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections. Transmission of infection. Bacterial diseases - Tuberculosis, Plague, Anthrax. Viral disease - Rabies, Dengue, AIDS, Influenza, Corona swine flu, Chikungunya. Protozoan diseases - Amoebiasis and Malaria.
V	History and developments in industrial microbiology: Microbial fermentation Microbial production of Antibiotics: penicillin, streptomycin, Vitamin B12 Vaccines - genetic recombinant vaccines. Bioremediation-Principles and applications.
Reading list	
1. Pelczar M J, Chan ECS and Kreig NR (2020) Microbiology. Tata-McGraw Hill.	
Recommended texts	
1. Atlas RM (2015) Principles of Microbiology. 2 nd edition, McGraw-Hill. 2. Dubey RC and Maheswari DK (2018) Textbook of Microbiology. S. Chand and Co. 3. Prescott LM (2016) Microbiology. 6 th Edition. McGraw-Hill. 4. Stanier R, Ingraham J, Wheelis M and Painter P (2014) General Microbiology. 5 th Edition, Macmillan Press. 5. Kathleen Park Talaro and Barry Chess Foundations in Microbiology 10 th Edition. 2018 Mc Graw Hill Education Publishers, USA. 6. Gerard J. Tortora, Berdell R. Funke, Christine L. Case, Microbiology: An Introduction, 12 th Edition (2017) Pearson publishers, USA	

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	S	S	S	M	M	M
CO2	M	M	M	S	S	S	S	M	S	M
CO3	S	S	S	M	M	S	M	M	L	S
CO4	M	M	S	L	S	S	L	M	S	S
CO5	S	M	M	S	S	S	S	M	S	S

*S - Strong; M - Medium; L - Low



நெற்பாஹ்; ஐயி யஃஃஃஃ

PERIYAR UNIVERSITY

DEPARTMENT OF ZOOLOGY

Salem-636011, Tamil Nadu

M.Sc. Zoology Course - SEMESTER-I

(This syllabus is applicable to the students who are admitted on or after 2023-2024 academic year onwards)

BIostatISTICS

Elective Paper-02A

Paper Code: 23PUZOE02A

Total Contact Hours: 90

Credits: 3

Weekly Contact Hours: 5

Course Objectives:		
The main objectives of this course are:		
1.	Students should know basic concepts in Biostatistics.	
Course I	:	Elective 02A
Course title	:	Biostatistics
Credits	:	3
Pre-requisite:		
Students should be aware of importance of analysis of quantitative and qualitative information from biological studies.		
Expected Course Outcome:		
Upon completion of this course, Students would have		
I	Clear understanding of design and application of biostatistics relevant to experimental and population studies.	K2 & K3
II	Acquired skills to perform various statistical analyses using modern statistical techniques and software.	K3 & K4
III	Knowledge on the merits and limitation of practical problems in biological/ health management study as well as to propose and implement appropriate statistical design/ methods of analysis.	K5 & K6

K1- Remember; **K2-** Understand; **K3-** Apply; **K4-**Analyze; **K5-**Evaluate; **K6-** Create

Units	
I	Definition, scope and application of statistics; Primary and secondary data: Source and implications; Classification and tabulation of biological data: Types and applications. Variables: Definition and types. Frequency distribution: Construction of frequency, distribution table for grouped data; Graphic methods: Frequency polygon and ogive curve; Diagrammatic representation: Histogram, bar diagram, pictogram and pie chart.
II	Measures of central tendency: Mean, median and mode for continuous and discontinuous variables. Measures of dispersion: Range, variation, standard

	deviation, standard error and coefficient of variation.
III	Probability: Theories and rules; Probability - Addition and multiplication theorem; Probability distribution: Properties and application of Normal, Binomial and Poisson distributions.
IV	Hypothesis testing: Student 't' test – one sample, paired sample and independent sample tests. Correlation: Types - Karl Pearsons Co-efficient, Rank correlation, Significance test for correlation coefficients. Regression analysis: Computation of biological data, calculation of regression co-efficient, graphical representation and prediction.
V	Analysis of variance: one way and two way classification. Data analysis with comprehensive statistical software using Statistical Package for the Social Sciences (SPSS).

Reading list

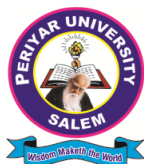
1. Arora, P. N. and P. K. Malhan. 1996. Biostatistics, Himalaya Publishing House, Mumbai, pp-447.
2. Gurumani, N. 2005. Introduction to Biostatistics, M.J.P. Publishers, Delhi, pp-407.
3. Das, D. and A. Das. 2004. Academic Statistics in Biology and Psychology, Academic Publisher, Kolkata, pp-363.
4. Palanichamy, S. and Manoharan, M. 1990. Statistical Methods for Biologists, Palani Paramount Publications, Tamil Nadu, pp-264.

Recommended texts

1. Bailey, N. T. J. 1959. Statistical in Biology, English Universities Press, London, pp-48.
2. Sokal, R. R. and F. J. Rohlf, 1973. Introduction to Biostatistics, W.H. Freeman, London, pp-467.
3. Sokal, R.R. and F.J. Rohlf. 1981. Biometry: The principles and practice of statistics in biological research, San Francisco: W.H. Freeman, London, pp-859.
4. Zar, J.H. 1998. Biostatistical Analysis, Pearson Education (Singapore) Pvt. Ltd., Delhi, India, pp-660.
5. Bailey, N. T. J. 1994. Statistical Methods in Biology (Third Edition), Cambridge University Press, Cambridge, pp-255.
6. Wayne W. Daniel. Biostatistics: A Foundation for Analysis in the Health Sciences, John Wiley & Sons Inc, USA, pp-443.
7. Snedecor, G. W. and W. G. Cochran. 1967. Statistical Methods (Sixth Edition), Oxford & IBH Publishing Co., New Delhi, pp-593.
8. Pagano, M. and K. Gauvreau. 2008. Principles of Biostatistics (Second Edition), Cengage Learning, New Delhi, pp-525.

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	M	S	S	M	S	M	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	M	S	S	S	S	S	S	S	S	L
CO4	M	M	S	L	M	M	M	S	L	M
CO5	M	M	S	L	M	S	M	L	S	M

*S - Strong; M - Medium; L- Low



nghpahl; gy;fi yf;fofk;

PERIYAR UNIVERSITY

DEPARTMENT OF ZOOLOGY

Salem-636011, Tamil Nadu

M.Sc. Zoology Course - SEMESTER-I

(This syllabus is applicable to the students who are admitted on or after 2023-2024 academic year onwards)

ADVANCED TECHNIQUES IN ZOOLOGY

Elective Paper-02B

Paper Code: 23PUZOE02B

Total Contact Hours: 90

Credits: 3

Weekly Contact Hours: 5

Course Objectives:		
The main objectives of this course are: 1. To gain knowledge about the mechanism of advanced instruments in Zoology 2. To understand the importance of ethics in research work 3. To impart the knowledge on gene cloning and DNA Microarray technologies		
1.	Students should know advanced techniques in Zoology	
Course I	:	Elective 02B
Course title	:	Advanced Techniques in Zoology
Credits	:	3
Pre-requisite:		
Students should be aware of various techniques in Zoological Science.		
Expected Course Outcome:		
Upon completion of this course, Students would be		
I	Able to explain the composition and responsibilities of IAEC.	K2 & K3
II	Knowing the working principles of GC-MS and MS-MS.	K3 & K4
III	Gain overall knowledge about advances in Zoological research.	K5 & K6

K1- Remember; K2- Understand; K3- Apply; K4-Analyze; K5-Evaluate; K6- Create

Units	
I	Scope of Zoological research: Agriculture, environment and health. Guide lines of Institutional animal ethical committee, composition and responsibilities of IAEC . Research ethics in animal experiments. Procedure for maintenance of small mammals in Animal House .
II	Molecular Spectroscopy: Principle and applications of UV-Visible, Raman, Nano-Drop spectrophotometers, Mass Spectrometry (MS), LC-MS, GC-MS, MS-MS, MALDI-TOF, SELDI. Current Scenario of molecular spectroscopic Techniques.
III	Molecular Spectroscopy: Principle and applications of NMR Spectroscopy and its types - XRD - Powder and crystal forms. Separation methods - Centrifuges-Ultra,

	Cooling refrigerated, gradient centrifuges-Working principle and applications.
IV	Molecular separation and characterization: Principle method and applications of SDS-PAGE, Immunoelectrophoresis, AGE, DNA finger printing, Blotting methods-southern and western blotting. DNA sequencing-Maxam-Gilbert, and Sanger methods. Next generation sequencing. Genome editing: CRISPR – cas9 Technology and its application. RNAi technology and its applications.
V	Gene cloning: Cloning of Dolly, Fishes, Sheep and Goat, Human cloning and its social and ethical impact, Organ on chip, Human on chip. Microarray technology and its applications. Evolution of Animal cell culture techniques – 2 Dimensional and 3D cell culture. Tissue engineering. Impact of nanotechnology in animal sciences.
Reading list	
<ol style="list-style-type: none"> 1. Kannan S, Krishnan M, Thirumurugan R and Achiraman S (2012) Methods in Molecular Biology, UVN Publishers, India. 2. Kannan S, and Kayalvizhi N (2022) Cell and Molecular biology-A Practical Approach, MJ Publishers, India. 3. John M. Davis (2011) Animal Cell Culture: Essential Methods , John Wiley & Sons, Ltd. 	
Recommended texts	
<ol style="list-style-type: none"> 1. R. Ian Freshney (2016) Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. 7th Edition Wiley-Blackwell Publishers New York. 2. Michael Butler Animal Cell Culture and Technology (THE BASICS) 2003 Garland Science Taylor and Francis. 3. K. Wilson & J.M. Walker, (2019) Principles and Techniques of Practical Biochemistry ELBS Publication 25th Edition. 	

Mapping with Programme Outcomes*										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	M	S	S	M	S	M	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	M	S	S	S	S	S	S	S	S	L
CO4	M	M	S	L	M	M	M	S	L	M
CO5	M	M	S	L	M	S	M	L	S	M

*S - Strong; M - Medium; L- Low