

(An Autonomous Institution Affiliated to Madurai Kamaraj University) Re-Accredited with 'A' Grade by NAAC

Academic Council Meeting (ACM) June-2023

Department of Zoology M.Sc., Zoology Syllabus 2023-2024

M.Sc., Zoology

(Programme Code: PZO)

Dr.RM.Murugappan Dean, Curriculum Development

PO1 : Knowledge

Acquire an overview of concepts, fundamentals and advancements of science across a range of fields, with in-depth knowledge in at least one area of study. Develop focused field knowledge and amalgamate knowledge across different disciplines.

PO2 : Complementary skills

Students will be able to engage in critical investigation through principle approaches or methods and through effective information search and evaluation strategies. Employ highly developed conceptual, analytical, quantitative and technical skills and are adept with a range of technologies;

PO3 : Applied learning

Students will be able to apply disciplinary or interdisciplinary learning across multiple contexts, integrating knowledge and practice. Recognize the need for information; effectively search for, evaluate, manage and apply that information in support of scientific investigation or scholarly debate;

PO4 : Communication

Communicate effectively on scientific achievements, basic concepts and recent developments with experts and with society at large. Able to comprehend and write reports, documents, make effective presentation by oral and/or written form.

PO5 :Problem solving

Investigate, design and apply appropriate methods to solve problems in science, mathematics, technology and/or engineering.

PO6 : Environment and sustainability

Understand the impact of the solutions in ethical, societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

PO7 : Teamwork, collaborative and management skills.

Recognise the opportunities and contribute positively in collaborative scientific research. Engage in intellectual exchange of ideas with researchers of other disciplines to address important research issues

Thiagarajar College, Madurai – 9 An Autonomous Institution Affiliated to Madurai Kamaraj University Re-Accredited with 'A' Grade by NAAC M.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Department of –Zoology Programme code:PZO

Vision

• Render exemplary quality education in Life Sciences and laboratory skills to produce generations of responsible, competent and employable graduates

Mission

- To provide a comprehensive set of courses in biological sciences that enhances the understanding, depth of knowledge and technical competency of the students.
- To prepare the students for entry-level research and teaching positions in biological sciences.
- To provide an educational environment that fosters the development of appropriate scientific vocabulary, reasoning skills, effective oral and written communication abilities for students.
- To create a holistic understanding of the allied subjects through interdisciplinary learning.

Programme Educational Objectives (PEO)

The objectives of this programme is to equip/prepare the students

PEO1	Endow with a spirit of resource conservation and love for nature.						
PEO2	Explicate the different forms of organisms their structure, physiology and adaptations. Interpret how ecological aspects of biotic and abiotic components are interrelated, their interactions as well as their influence in the functioning of ecosystem.						
PEO3	Basics and current updates in the areas of Microbiology, Immunology, Biotechnology, Genetic Engineerinng are included to train the students and also sensitize them to scope for research.						
PEO4	The laboratory training in addition to theory will equip the student for careers in the industry, agriculture, and applied research.						
PEO5	Perform functions that demand higher competence in national/international organizations.						

Programme specific outcomes- M.Sc., Zoology

On the successful completion of M.Sc., Zoology the students will

PSO1	Proficient in core concepts, recent trends in different disciplines of life sciences like microbiology, biochemistry, cell and molecular biiology, genetics and genetic engineering, evolution, entomology, IPR, bioethics, bioethics bioinformatics etc.,
PSO2	Explain how organisms function at gene, genome, cell, tissue, organ and organ-system level of organization.
PSO3	Possess theoretical basis and practical skills in the use of basic and advanced instruments. Further able to create, select and apply appropriate techniques, resources and modern technology in multi-disciplinary environment.
PSO4	Apply theoretical knowledge gained for prominent carrear and for further academic study.
PSO5	Appear for competitive exams like CSIR NET, SET etc and also to write research proposals for grants.

Thiagarajar College, Madurai – 9 An Autonomous Institution Affiliated to Madurai Kamaraj University Re-Accredited with 'A++' Grade by NAAC M.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Programme code:PZO

Course	Code	Subject/Paper		Cred	Tot Hr	CA	SE	Total
PART -A		•				•		
Core-I	PZO23CT11	Structure and Function of Invertebrates	5	4	75	25	75	100
Core-2	PZO23CT12	Comparative Anatomy of vertebrates	5	4	75	25	75	100
Core-L1	PZO23CL11	Lab in Invertebrates & Vertebrates	3	2	45	25	75	100
Core-L2	PZO23CL12	Lab in Molecules and their interaction	3	2	45	25	75	100
Core Elec-I	PZO23ET11	Molecules and their interaction relevant to Biology	5	3	75	25	75	100
Core Elect-2	PZO23ET12	Biostatistics	5	3	75	25	75	100
PART -B						•		
SEC-I	PZO23ST11	Intellectual Property Rights (IPR)		2	30	25	75	100
AECC I	PZO23AT11	Sericulture/Forensic Science	2	2	30	25	75	100
		Total	30	22				

Semester- I

	Semester- II								
Course	Code	Subject/Paper	Hrs/ W	Cred	Tot Hrs	CA	SE	Total	
PART- A									
Core-3	PZO23CT21	Cell and Molecular Biology	5	4	75	25	75	100	
Core-4	PZO23CT22	Developmental biology	5	4	75	25	75	100	
Core-L3	PZO23CL21	Lab in Cell and Molecular Biology	3	2	45	25	75	100	
Core-L4	PZO23CL22	Lab in Developmental Biology	3	2	45	25	75	100	
Core Elective-3	PZO23ET21	Economic Entomology	5	3	75	25	75	100	
Core Elective-4	PZO23ET22	Research Methodology	5	3	75	25	75	100	
PART -B									
SEC-2	PZO23ST21	Poultry farming	2	2	30	25	75	100	
AECC-2	PZO23AT21	Apiculture/ Nanotechnology	2	2	30	25	75	100	
		Total	30	22					

Semester- III

Course	Code	Subject/Paper	Hrs/ w	Credi t	Tot Hrs	Max Mark CA	Max Mark SE	Total
Core-7	PZO23CT31	Genetics and Evolution	5	4	75	25	75	100
Core-8	PZO23CT32	Animal Physiology	5	4	75	25	75	100
Core- L5	PZO23CL31	Lab in Genetics and Evolution	3	2	45	25	75	100
Core- L6	PZO23CL32	Lab in Microbiology	3	2	45	25	75	100
Core Elect-5	PZO23ET31	Microbiology	5	3	75	25	75	100
Core 9 Indus modul	PZO23EI31	Medical Lab Technology	5	3	75	25	75	100
PART –B								
SEC-3	PZO23ST32	Dairy farming	2	2				
AECC-3	PZO23AT31	Vermiculture/ Stem cell biology	2	2	45	40	60	100
Internship	PZO23IN31	Internship/Industrial Visit		2				
		Total	30	24				

Semester- IV

Course	Code	Subject/Paper	Hrs/ w	Credi t	Tot Hrs	Max Mark CA	Max Mark SE	Total
Core-10	PZO23CT41	Immunology	5	4	75	25	75	100
Core-11	PZO23CT42	Ecology	5	4	75	25	75	100
Core- L7	PZO23CL41	Lab in Immunology & Biotechnology	3	2	45	25	75	100
Core-L8	PZO23CL42	Lab in Ecology	3	2	45	25	75	100
Core Elect-6	PZO23ET41	Aquaculture/Biotechnolog y	5	3	90	25	75	100
Core Elect 7	PZO23ET42	Project	4	3	60	25	75	100
PART -B		·						
SEC-4	PZO23ST42	Competitive Examination	3	2	45	25	75	100
AECC-4	PZO23AT41	Animal behaviour/ Biosafety and Bioethics	2	2	45	25	75	100
Extension Activity/ MOOC	PZO23ME41	Extension activity/MOOC	-	1				
		Total	30	23				

Component wise Credit Distribution

Credits	Sem I	Sem II	Sem III	Sem IV	Total
Part A	18	18	18	18	72
Part B					
(i) Discipline Centric / Generic Skill	02	02	02	02	08
(ii) Soft Skill	02	02	02	02	
(iii) Summer Internship / Industrial			02		10
training					
Part C				01	01
Extension Act/ MOOC course					
Total	22	22	24	24	91

Part A component and Part B (i) will be taken into account for CGPA calculation for the postgraduate programme and the other components Part B and Part C have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the PG degree

	No of papers	Credit/	Total Credit	Cumulative
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TANI-A		[
Core Theory	8	4	32	72
Core Lab	8	2	16	
Elective	6	3	18	
	1 (Ind Mod)	3	03	
Project	1 (Project	3	03	
PART-B				
SEC	4	2	08	18
AECC	4	2	08	
Internship	1	2	02	
		1	01	
PART -C				·
Extension Act/	1	1	01	01
MOOC course				
	Total		91	91

For Choice Based Credit System (CBCS)

- Choices are offered for Elective Courses
- Total Credits for Core Courses -48
- Total Credits for Elective Courses- 24 (6 Electives + 1 Ind Mod. +1 Project)
- Total credits for SEC, AECC, Internship and Extension Activity 19

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Department of Zoology

(For those joined M. Sc., Zoology on or after June 2023) Programme Code :PZO

Code	Course Title		Category	L	Т	P	Credit
PZO23CT11	Structure and Function Invertebrates	of	Core -1	4	1	-	4

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

Animals are a fascinating group of organisms that inhabit every niches across the globe. The course deals with the comparative physiology, morphology and anatomy of animals from protozoa to mammalian. On completion of the course, the students will have clarity on the fundamentals of zoology that facilitate them to understand the subject further to a greater extent.

Prerequsites

The students should have comparative knowledge on Invertebrates

Course Outcomes

On the completion of the course the student will be able to

On th	e comprehen of the course the student will be usie to		
	Course outcomes	Expected Proficiency%	Expected Attainment%
CO1	Define the general concepts in animal classification, origin, structure, functions and distribution of life in all its forms.	70	60
CO2	Explain the taxonomical classification of invertebrates and evolutionary process.	70	70
CO3	Apply the knowledge gained on structural and functional organization in animals in taxonomical classification	60	60
CO4	Analyse and compare the organ and organ system s in life forms	70	70
CO5	Evaluate the strategies and importance of larval forms	70	70

K: Knowledge K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	L	S	L	L	Μ	-
CO2	S	L	S	L	L	Μ	-
CO3	S	S	S	L	L	L	L
CO4	S	Μ	S	L	L	L	L
CO5	L	-	S	L	-	-	-

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes								
	PSO1	PSO2	PSO3	PSO4	PSO5			
CO1	S	L	-	L	S			
CO2	S	L	-	S	S			
CO3	S	L	-	S	S			
CO4	S	L	-	S	S			
CO5	Μ		-	L	Μ			

Strong –S (+++), Medium –M (++), Low-L (+)

Blooms Taxonomy								
	C	A	End of Semester					
	I Internal	II Internal	Marks					
	Marks	Marks						
Knowledge -K1	15% (9)	15% (9)	15% (20)					
Understand -K2	15% (9)	15% (9)	15% (20)					
Apply-K3	30% (18)	30% (18)	30% (40)					
Analyze-K4	20% (12)	20% (12)	20% (25)					
Evaluate-K5	20% (12)	20% (12)	20% (25)					
Create-K6	60	60	130					

Title of the course: Structure and Function of Invertebrates

Unit I

Structure and function in invertebrates: Principles of Animal taxonomy; Species concept; International code of zoological nomenclature; Taxonomic procedures; New trends in taxonomy

Unit II

Organization of coelom: Acoelomates; Pseudocoelomates; Coelomates: Protostomia and Deuterostomia; Locomotion: Flagella and ciliary movement in Protozoa; Hydrostatic movement in Coelenterata, Annelida and Echinodermata

Unit 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.

Unit 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

Unit 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

Text Books

- 1. Barnes, R.D. 1982. Invertebrate Zoology, IV Ed., Holt Saunders International Edition, USA
- 2. Barrington, E.J.W. 1979. Invertebrate structure and functions, II Ed., ELBS and Nelson.
- 3. Jordan, E.K. and P.S. Verma, 1995. Chordate Zoology and Elements of Animal Physiology, 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi.
- 4. Nigam, H.C., 1983. Zoology of Chordates, Vishal Publications, Jalandhar, India.

Referecne Books

- 1. Ayyar, E.K. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras.
- 2. Ekambaranatha Iyer, M. and Ananthakrishnan, T.N. 2003. A Manual of Zoology. Viswanathan Publications, Chennai.
- 3. Hickman, C.P. Jr., F.M.Hickman and L.S. Roberts, 1984. Integrated Principles of Zoology, 7th Edition, Times Merror/Mosby College Publication. St. Louis.
- 4. Hyman, G.H. The Invertebrates, Vol. I to VII, McGraw Hill Book Co., Inc., New York.
- 5. Kotpal, R.L. 2005. Invertebrate Zoology, Rastogi Publications, Meerat. India
- 6. Newman, H.H., 1981. The Phylum Chordata, Satish Book Enterprise, Agra, India .

Online Resources

www.epathsala.com

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Department of Zoology

(For those joined M. Sc., Zoology on or after June 2023)

Programme Code:PZO

Code	Course Title	Category	L	Т	Р	Credit
PZO23CT12	Comparative Anatomy of Vertebrates	Elective-1	4	1	-	4

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

Exemplifying the vertebrate origin. Acquires the knowledge on evolution of vertebrates and adaptive radiation of animals. The origin and efficiency of mammals and evolutionary changes that occurred in the life of vertebrates.

Prerequsites

Students with knowledge and comprehension on Vertebrates.

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected	Expected
		Proficiency %	Attainment %
CO1	Elaborate the morphology & affinities of prochordates. Remember the general concepts and major groups in animal classification,	70	70
CO2	Appreciate the diversity of chordates living in varied habit and habitats.	70	70
CO3	Elaborate on the evolution, structural organization and function of organ and organ systems	70	70
CO4	Explain the structural organization and function of organ and organ system	70	70
CO5	Critically analyse the organization, complexity and characteristic features of chordates making them familiarize with the morphology and anatomy of representatives of various animal phyla.	70	80

(K-Knowledge)K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	-	S	L	L
CO2	S	S	S	-	Μ	-	L
CO3	S	S	S	-	L	-	L
CO4	S	S	S	-	L	-	L
CO5	S	S	S	-	Μ	М	Μ

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Μ	L	Μ	Μ	Μ
CO2	S	L	Μ	S	S
CO3	S	L	Μ	S	S
CO4	S	S	S	S	S
CO5	S	S	Μ	S	S

Strong –S (+++), Medium –M (++), Low-L (+)

Blooms Taxonomy							
	(CA	End of Semester				
	I Internal	II Internal	Marks				
	Marks	Marks					
Knowledge -K1	15% (9)	15% (9)	15% (20)				
Understand -K2	15% (9)	15% (9)	15% (20)				
Apply-K3	30% (18)	30% (18)	30% (40)				
Analyze-K4	20% (12)	20% (12)	20% (25)				
Evaluate-K5	20% (12)	20% (12)	20% (25)				
Total	60	60	130				

Title of the Paper: Comparative Anatomy of Vertebrates

Unit-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.

Unit-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..

Unit-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

Unit-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.

Unit-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.

Text Books

1. Jordan EL and Verma PS (2013) Chordate Zoology, S.Chand & Co Ltd., New Delhi 2. Ekambaranatha Ayyar and T. N. Ananthakrishnan. 2009. Manual of Zoology, Vol – II, S. Viswanathan Pvt. Ltd. Chennai.

Reference Books

- 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. Kotpal, 2019. R.L. Modern Text Book of Zoology Vertebrates, 4th Edition, Rastogi Publications, Meerut, India.
- 4. Romer AS (1992) The vertebrate body, 3rd Edition, Vakils, Fefer and Simons Pvt. Ltd, Mumbai.
- 5. Saxena RK and Saxena S (2008) Comparative anatomy of vertebrates. Viva books Pvt. Ltd., New Delhi.

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(For those joined M. Sc., Zoology on or after June 2023)

Programme code:PZO

Code	Course Title	Category	L	Т	Р	Credit
PZO23ET11	Molecules and their interaction relevant to Biology	Core-1	3	2	-	3

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

Elaborate the structure and function of biomolecules. Illustrate the metabolic pathways and regulation of biochemical process. Brief about vitamins, enzymes and their regulation.

Prerequisites

Basic knowledge on the structure and function of biomolecules, metabolic pathways, biochemical processes etc.,

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency %	Expected Attainment %
CO1	Summarize the basics of biochemistry principles through the molecular bonding interactions and thermodynamics	70	70
CO2	Explain and analyse the biosynthesis pathways, structural conformations of carbohydrates, and lipids	70	70
CO3	Perceive a holistic knowledge on reactions involved in cellular energy synthesis and enzyme kinetics.	60	70
CO4	Understand the structural conformation of Proteins and Metabolism of Proteins and Aminoacids	70	70
CO5	Discuss the structure and function of nucleic acids, proteins and vitamins	60	70

K: Knowledge K1: Knowledge K2: Understand K3: Apply K4: Analyze K5: Evaluate

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	L	S	-	L	-	-
CO2	S	L	S	-	Μ	-	-
CO3	S	L	S	-	L	-	-
CO4	S	Μ	S	-	Μ	-	L
CO5	S	S	S	М	Μ	-	L

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	-	S	S	S
CO2	S	-	L	L	Μ
CO3	S	-	Μ	L	L
CO4	S	Μ	S	S	S
CO5	S	-	L	L	Μ

S-Strong M-Medium L-Low

Blooms taxonomy: Assessment Pattern

Blooms Taxonomy							
		CA	End of Semester				
	I Internal Marks	II Internal Marks	Marks				
Knowledge -K1	15% (9)	15% (9)	15% (20)				
Understand -K2	15% (9)	15% (9)	15% (20)				
Apply-K3	30% (18)	30% (18)	30% (40)				
Analyze-K4	20% (12)	20% (12)	20% (25)				
Evaluate-K5	20% (12)	20% (12)	20% (25)				
Create-K6	60	60	130				

Course Title: Molecules and their interaction relevant to Biology

Unit I

Basics of biophysical chemistry and biochemistry: Structure of atoms, molecules and chemical bonds - Principles of biophysical chemistry (pH, buffer, thermodynamics, colligative properties). Stabilizing interactions (Vander Waals, electrostatic, hydrogen bonding, hydrophobic interaction, covalent bonding . Water- Molecular structure, properties-Solvent, thermal, Ionization. Henderson Hasselbach equation.

Unit II

Biological significance of carbohydrates, Metabolism of carbohydrates- Glycolysis, Kreb's cycle , Pentose phosphate pathway, Glycogenesis, Glycogenolysis, Gluconeogenesis, Structure and functions of Glycosaminoglycans (Hyaluronic acid, CS, HS, KS,)

Biological significance of lipids , Metabolism of lipids – Fattyacid synthesis, Cholesterol synthesis, Beta oxidation, Degradation of cholesterol, lipid peroxidation,

Unit III

ATP synthesis, Proton Motive Force, Chemiosmotic theory, oxidative phosphorylation, Coupled reaction,

Enzymes – Mechanism of enzyme action, Enzyme Kinetics- MM equation, Line Weaver Burk plot, Regulation – competitive, Non competitive and Allosteric.

Unit IV

Classification of Amino acids based on Polarity, Biological Significance of Proteins, Structural conformation of proteins: secondary, tertiary and quaternary structure, Ramachandran plot.

Overview of amino acid synthesis, amino acid degradation – Transamination, Deamination, Urea Cycle, degradation pathways of-glucogenic aminoacids and ketogenic aminoacids

Unit V

Chemical Structure of nucleic acids, Nucleic acid synthesis- denovo and salvage pathway, Catabolism of Purines and Pyrimidines. Vitamins: Structure, occurrence and biochemical functions. Metabolism of Bilurubin

Text Books

- 1. Jain, J.L., Sunjay Jain and Nitin Jain. 2010. Fundamentals of Biochemistry, Fifth Edition, S. Chand and Company Ltd, NewDelhi
- 2. Satyanarayana, U. and Chakrapani, U. 2009. Biochemistry, Books and Allied Pvt. Ltd., Kolkata.

Reference Books

- 1. Rastogi, S.C.2010. Biochemistry, 3rd Edition, Tata McGraw Hill Edition, New Delhi.
- 2. Nelson, D.L., and M.M.Cox, 2010, Lehninger Principles of Biochemistry, 5th edition, Worth Publishers, New York.
- 3. Stryer, L., 2000. Fourth edition Biochemistry, W.H. Freeman and Company, New York.
- 4. Voet, D., and J.G.Voet, 1995, Biochemistry, second edition John Wiley & Sons Inc, New
- 5. York.
- 6. Zubay, G. 1993, Biochemistry, third edition Won.C.Brown Communications Inc., Oxford, England.
- 7. Campbell and Farrell 2008. Biochemistry Cengage Learning India (P) ltd. New Delhi.
- 8. Ramarao, A.V.S.S. and Suryalakshmi, A 2009. Textbook of Biochemistry for Medical Students, 11th UVS Publishers Distributors Pvt. Ltd., New Delhi
- 9. Deb, A.C. 2011. Fundamentals of Biochemistry, 10th Edition, New Central Book Agency Pvt. Ltd., Kolkata.
- 10. Conn, E.E., P.K.Stumpf, G.Bruening and R.H.Doi, 1999. Outline of Biochemistry, John Wiley & Sons Inc., New York.
- 11. Bose, S. 1982. Elementary Biophysics. Vijaya Printers, Madurai
- 12. Casey, E.J. 1969. Biophysics Concepts and mechanism. East West Press. New Delhi.
- 13. Morris, J.G. 1974. A Biologist's physical chemistry. II edition. Edward Arnold A division of Holder and Stoughton, London.

Course designer : Dr.T S Ramyaa Lakshmi

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Department of Zoology

(For those joined M. Sc., Zoology on or after June 2023)

Programme Code:PZO

Course Code	Course Title	Category	L	Т	Р	Credit
PZO20CL11	Lab in Invertebrates and Vertebrates	Core Lab-1	-	-	3	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

This course is designed to study anatomical details of animals in general or common examples of specific phyla more thoroughly than it is presented in lecture. This method of 'hands on' learning will enhance and strengthen the knowledge the students gain in lectures.

Prerequsites

Basic knowledge on the animals living in different habitats

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected Proficiency %	Expected Attainment %
CO1	Elaborate the structure & functions of various systems in animals	80	80
CO2	Interpret the adaptive features of different groups of animals	80	80
CO3	Identify and sketch the animals.	70	70
CO4	Familiarize with mounting techniques.	60	70
CO5	Develops basic skills necessary to dissect and display the various organs and organ system in animals.	70	70

K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	L	-	-
CO2	S	S	S	L	L	-	-
CO3	S	S	S	L	L	-	-
CO4	S	S	S	L	L	-	-
CO5	S	S	S	L	L	-	-

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S		S	S	
CO2	S		S	S	L
CO3	S		S	S	
CO4	Μ	-	S	S	
CO5	Μ		S	S	Μ

Strong –S (+++), Medium –M (++), Low-L (+)

Title of the Paper: Lab in Invertebrates and Vertebrates

Invertebrates

Dissection

: Nervous system,
: Digestive and Nervous system
: Digestive system and mouth parts
: Appendages, nervous and digestive systems

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

- 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 9^{th} and 10^{th}

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. *Mugil cephalus* (Mullet)
- 8. *Tilapia mossambicus* (Tilapia)

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

Reference Books

Text Books:

- 1. Lal, S.S. 2013. Practical Zoology, Invertebrate, Rastogi Publications, Meerut, India
- 2. Iuliis G. D. and D. Pulerà, 2007. The Dissection of Vertebrates: A Laboratory Manual. Academic Press, Imprint of Elsevier Publication,
- 3. Verma, P.S. 2004. A Manual of Practical Zoology: Chordates, S. Chand Publishing Company, New Delhi India
- 4. Jordon, E.L. and Verma, P.S. 2005. Invertebrate Zoology, S.Chand& Co. New Delhi
- 5. J.Sinha, A.K.Chatterji and P.Chattopathiya 2019. Advanced Practical Zoology,Booksand Allied (PvtP ltd, Kolkata.
- 6. Jeyasuria et al., 2013. Practical Zoology Vol I Invertebrate-Saras Publications
- 7. Preeti, G., and C. Mridula, 2000. Modern Experimental Zoology, Indus International Publication.India

Thiagarajar College : Madurai – 625 009 An Autonomous Institution affiliated by Madurai Kamaraj University (Re-Accredited with 'A⁺⁺' Grade by NAAC) Department of Zoology (For those joined M. Sc., Zoology on or after June 2023) Programme Code:PZO

CodeCourse TitleCategoryLTPCreditPZO23CL12Lab in Molecules and their
interactionCore Lab-2--32

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

The course encompasses qualitative and quantitative analyses of biomolecules in the biological samples. Explain the factors influencing enzyme activity.

Prerequsites

Basic laboratory techniques in both chemistry and biology.

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected	Expected
		Proficiency	Attainment
		%	%
C01	Define the nature of biomolecules present in the samples	80	80
CO2	Estimate the amount of biomolecules present in the samples	80	80
CO3	Test the various factors that influence enzyme activity	70	80
CO4	Demonstrate permeability of cell membrane	80	80
CO5	Acquire hands on training needed to work in or start a clinical lab	70	80

(K- Knowldege)K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	Μ	S	-	Μ	-	Μ
CO2	S	S	S	-	S	-	L
CO3	S	S	S	-	S	-	L
CO4	S	S	S	-	S	L	L
CO5	S	S	S	S	S	L	S

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	S	Μ	S	L	Μ
CO2	S		S	S	Μ
CO3	S	Μ	S	Μ	
CO4	Μ	Μ	Μ	Μ	
CO5	Μ	L	S	S	

Strong –S (+++), Medium –M (++), Low-L (+)

Title of the Paper: Lab in Biological Chemistry and Biophysics

- 1. Qualitative analysis of Carbohydrates.
- 2. Qualitative analysis of Proteins
- 3. Qualitative analysis of Lipids
- 4. pH, pKa and pH meter:
 - a. Working mechanism & determination of pH.
 - b. Titration of weak acid and strong base (titration curve)
- 5. Colorimeter: a. Principle and working mechanism
 - b. Verification of Beer's law
 - c. Quantitative estimation of
 - i) Carbohydrates
 - ii) Proteins
 - iii) Lipids
- 6. Chromatography: i) Paper chromatography
 - ii) TLC Thin layer chromatography
 - iii) Column chromatography
- 7. Centrifuge Density gradient centrifugation
- 9. Quantitative estimation of ascorbic acid
- 10. Enzymes: Analysis of amylase activity
 - i) Effect of substrate concentration
 - ii) Effect of pH
 - iii) Effect of temperature
 - iv) Effect of Enzyme concentration

Reference Books

- 1. D.T.Plummer.2008 An Introduction to Practical Biochemistry, Tata McGraw-Hill Publication, New Delhi
- 2. Dua, S and N.Garg 2010. Biochemical methods of analysis, Narosa Publishing, New Delhi.

Course Designer: Dr.T S Ramyaa Lakshmi

Thiagarajar College (Autonomous):: Madurai – 625 009 An Autonomous Institution affiliated by Madurai Kamaraj University (Re-Accredited with 'A⁺⁺' Grade by NAAC)

Department of Zoology

(For those joined M. Sc., Zoology on or after June 2023)

Prgramme Code:PZO

Code	Course Title	Category	L	Т	Р	Credit
PZO23ET12	Biostatistics	Core Elective-2	3	2	-	3

L: Lecture. T: Tutorial. P: Practical

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

The goal of the skill based elective course in Biostatistics is to prepare students to comprehend, develop and apply, quantitative and qualitative techniques in mathematics, statistics, and computing to handle biological data collection and analysis. The course strives to emphasize the understanding of inherent variation, bias, and uncertainty in sampling. Distribution patterns in experimental data generation, probability of results obtained and the required statistical action to arrive at a best possible conclusion.

Prerequsites

A basic knowledge of high school mathematics

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected Proficiency %	Expected Attainment %
CO1	Define variability and uncertainty in sampling and data collection	70	70
CO2	Categorize the type of variables, summarize the data and construct graphical, diagrammatic representation of data.	70	70
CO3	Apply probability principles for setting significance levels and testing hypothesis using statistical tests	60	70
CO4	Analyse results of statistical test and interpret experimental conclusion	60	60
CO5	Perform basic statistical test using MS-Office Excel at ease and independently	70	70

K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
C01	S	S	S	L	Μ	-	L
CO2	S	S	S	L	S	-	L
CO3	S	S	S	-	S	-	L
CO4	S	S	S	-	S	-	L
CO5	М	S	S	L	S	L	L

Mapping of Course Outcomes with Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	Μ		L	S	Μ
CO2	Μ		Μ	Μ	Μ
CO3	L		L	Μ	Μ
CO4			S	S	Μ
CO5	S		Μ	S	S

Strong –S (+++) Medium-M (++) Low-L (+)

Blooms taxonomy: Assessment Pattern

Blooms Taxonomy			
	C	4	End of Semester
	I Internal II Internal		Marks
	Marks	Marks	
Knowledge -K1	15% (9)	15% (9)	15% (20)
Understand -K2	15% (9)	15% (9)	15% (20)
Apply-K3	30% (18)	30% (18)	30% (40)
Analyze-K4	20% (12)	20% (12)	20% (25)
Evaluate-K5	20% (12)	20% (12)	20% (25)
	60	60	130

Title of the Paper: Biostatistics

Unit I- Descriptive statistics

Statistical population and sample in biological studies, variables – qualitative and quantitative; Types of biological data-ratio, interval, ordinal, nominal, discrete and continuous; Sampling methods – Random and non random sampling methods; Frequency distribution, Representation of data – Tables-Tabulation of data, components of table; histogram, frequency curve and ogives. Diagrammatic representation of data.

Unit II-Summary statistics

Measures of central tendency – mean, median and mode; Measures of dispersion –range, standard deviation, variance, standard error; Quartile Deviation, Range. Probability distribution – binomial, Poisson (definition) and normal distribution(detailed). Symmetry- skewness and kurtosis(definition), proportions of a normal curve- Z scores, assessing normality, confidence limits. Practical training using MS-Office excel.

Unit III-Hypothesis testing-I

Testing of hypothesis – Null and alternate hypothesis, Student 't' distribution, Two tailed and one tailed hypotheses concerning mean, confidence limits for the population mean, variability about the mean; null hypothesis, one sample t-test, paired and unpaired t-tests. Practical training using MS-Office excel.

Unit IV-Hypothesis testing-II

Single factor ANOVA; basic assumptions under ANOVA, loss of replications, ANOVA with two treatments. Tests for Aposteriori comparisons/Multiple comparisons- Tukey test. Practical training using MS-Office excel.

Unit V- Bivariate analysis

Correlation – types, methods of correlation – graphical method, mathematical method; Karl Pearson's Rank; Regression analysis – equation, estimation of unknown value from known value; Mann-Whitney U test, Chi-square test, test of independence; Data transformations. Arcsine, logarithmic and square root transformations.

Text Books

- 1. Zar, J.H. 1996. Biostatistical Analysis, Prentice Hall International, USA.
- 2. Khan., IA, Khanum, A. 2004 Fundamentals of Biostatistics second edition, Ukaaz publications, Hyderabad, Andhra Pradesh.India
- 3. Gurumani, N. 2004. An Introduction to Biostatistics. MJP publishers, Chennai. India

Reference Books

- 1. Schefler W.C. 1980. Statistics for the biological sciences. Addison-Wesley publishing company, New York.USA
- 2. Daniel, W.W 2006 Biostatistics-A foundation for analysis in health sciences, John Wiley (Asia) & sons, Singapore.
- 3. Gupta S.P. 1987. Statistical Methods. Sultan Chand & Sons Publishers, New Delhi
- 4. Attwood, T.K. and Parry, D.J Smith, D.J. 2002. Introduction to Bioinformatics. Pearson Education (Singapore) Pvt. Ltd.Singapore
- 5. Palanichamy, S. Manoharan, M. 1994. Statistical methods for Biologists, Palani Paramount Publications, Tamil Nadu.India
- 6. Arora, P.N and P.K.Malhan 2008. Biostatistics. Himalaya Publications, Mumbai.India
- 7. Sokal, R.R. and Rohif, F.J. 1987. Introduction to Biostatistics. W.H. Freeman and company, New York.USA
- 8. Misra, B.N. and Misra, B. K. 1998. Introductory Practical Biostatistics. Naya Prakash, Calcutta.USA
- 9. Pillai, RSN and Bagavathi, V. 1989. Statistics Theory and Practice. S Chand & CompanyLtd. New Delhi.India
- 10. Banergi, P.K. 2004 Introduction to Biostatistics, S.Chand& company Ltd. New Delhi.India
- 11. Sundar Rao, P.S.S. and Righard, J. 2002. An Introduction to Biostatistics. III edn. Prentice Hall of India, New Delhi.India

Course Designer: Dr.C.Binu Ramesh, Assistant professor

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(For those joined M. Sc., Zoology on or after June 2023)

Programme Code-UZO

		8					
Code	Course T	Course Title			Т	P	Credit
PZO23ST1	1 Intellectual Property	Intellectual Property Rights (IPR)			-	-	2
Year	Semester	Int. Ma	t. Marks Ext.Marks		ks	Total	
First	First	25			75		100

Preamble

The course is designed to provide comprehensive knowledge to the students regarding the general principles of IPR, Concept and Theories, Criticisms of Intellectual Property Rights, International Regime Relating to IPR

Prerequisites

Basic Knowledge and necessity of IPR

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected	Expected
		Proficiency %	Attainment %
CO1	Define the basic concepts, types of IPR and its protection	70	70
	through various laws.		
CO2	Outline IPR related issues. Deliver the purpose and function	70	70
	of IPR		
CO3	Elaborate on IPR in India and abroad	60	70
CO4	Apply the knowledge of IPR for professional development	60	60
CO5	Appraise the process of patent filing and licensing	60	70

K1: Knowledge K2: Understand K3: Apply

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	L	S	S	L
CO2	S	S	S	Μ	L
CO3	S	S	S	Μ	L
CO4	М	L	М	L	S
CO5	S	S	S	L	М

Strong –S (+++) **Medium-M** (++) **Low-L** (+)

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	-	S	L	Μ
CO2	S	Μ	-	Μ	-	L
CO3	S	Μ	L	S	-	L
CO4	S	М	L	S	L	L
CO5	Μ	S	L	Μ	L	L

Blooms taxonomy: Assessment Pattern

Blooms Taxonomy							
	C	4	End of Semester				
	I Internal II Internal		Marks				
	Marks	Marks					
Knowledge -K1	15% (9)	15% (9)	15% (20)				
Understand -K2	15% (9)	15% (9)	15% (20)				
Apply-K3	30% (18)	30% (18)	30% (40)				
Analyze-K4	20% (12)	20% (12)	20% (25)				
Evaluate-K5	20% (12)	20% (12)	20% (25)				
	60	60	130				

Course Title: Intellectual Property Rights

Unit I

Concepts, theories and need for Intellectual Property rights. Note on - Patents, Copyrights, Trade Marks, Geographical Indications.

Unit II

IPR in India and Abroad - Genesis and Development - the way from WTO to WIPO – TRIPS, GATT and other treaties, Technological research, inventions and innovations, Examples of IPR. **Unit III**

Types of Patents, Patent filing process in India, Rights of an IPR owner, licensing agreements, Infringement of IPRs, Enforcement measures.

Unit IV

Biopiracy and documenting traditional knowledge, Digital innovations and developments as knowledge assets-IP laws, Cyber law and digital content protection, cybersquatting.

Unit V

Emerging issues in IPR, Case Studies: The basmati rice issue, revocations of turmeric patent, revocation of neem patent.

Text Books

- 1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
- 2. S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Ess Publications, New
- Delhi, 2002

Reference Books

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.

2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.

Course designers:

Dr.Rm. Murugappan, Associate Professor N. Arun Nagendran, Associate Professor Dr.C.Usha Assistant Professor

THIAGARAJAR COLLEGE, MADURAI:: 9 An Autonomous Institution affiliated by Madurai Kamaraj University (Re-Accredited with 'A⁺⁺' Grade by NAAC) DEPARTMENT OF ZOOLOGY & MICROBIOLOGY

(For those joined M.Sc., Zoology on or after June 2023)

Programme Code: PZO

Code	Course Title	Category	L	Т	P	Credit
PZO23AT11	Sericulture	AECC	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100
Preambl	e			

This course gives an overview of silkworm biology & introduces students to the methods of silkworm rearing.

Prerequisites

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected	Expected
		Proficiency	Attainment
		%	%
CO1	Classify silkworms & trace the history of sericulutre	60	60
CO2	Summarize the lifecycle of Bombyx mori	70	70
CO3	Outline the methods of silkworm rearing	70	60
CO4	Describe the processing of harvested cocoons	60	50
CO5	Compare the symptoms & control measures of diseases	60	60
	affecting silkworm		

K1: Knowledge K2: Understand K3: Apply

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	L	S	S	S	
CO2	S	Μ	S	Μ	S	
CO3	Μ	L	L	Μ	S	
CO4	L	L	L	L	Μ	
CO5	S	S	S	S	Μ	

Mapping of Course Outcomes with Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	S	S	-	S	L
CO2	S	Μ	-	Μ	-
CO3	S	Μ	L	S	-
CO4	S	Μ	L	S	L
CO5	М	S	L	Μ	L

Blooms taxonomy: Assessment Pattern

Blooms Taxonomy								
	C	A	End of Semester					
	I Internal	II Internal	Marks					
	Marks	Marks						
Knowledge -K1	15% (9)	15% (9)	15% (20)					
Understand -K2	15% (9)	15% (9)	15% (20)					
Apply-K3	30% (18)	30% (18)	30% (40)					
Analyze-K4	20% (12)	20% (12)	20% (25)					
Evaluate-K5	20% (12)	20% (12)	20% (25)					
Create-K6	60	60	130					

Title of the course

Unit I

History of sericulture & silk route; Types of silkworms- mulberry & non-mulberry silkworms, univoltine, bivoltine & multivoltine. Bombyx mori- morphology and life cycle.

Unit II

Construction of rearing house, rearing equipments & disinfection; Methods of rearing mulberry silkworm.

Moriculture- Propogation-Seedling, cutting, grafting, layering and propogation.

UNIT III:

Diseases of silkworm- causes, symptoms. Pathogenesis & control measures of Flacherie, Green Muscardine, Pebrine & Nuclear Polyhedrosis virus; Pests of silkworm- nature of damage & control pf Uzi fly and red ants;

Unit IV

Physical and Commercial characteristic of cocoons. Harvesting, processing of cocoons – sorting, stifling, deflossing, riddling, cooking, brushing and reeling. Properties of raw and processed silk

Unit V

Marketing of cocoons, By products of sericulture industry. Role of central silk board. Visit to silk rearing unit.

Text Books

- 1. Ganga .G & Sulochana Chetty .J, 2020 An Introduction to Sericulture, 2nd ed., Oxford & IBH publishing house, New Delhi. India
- 2. Madan Mohan Rao.,2019 An Introduction to sericulture 2nd ed., BS Publications, New Delhi, Inida
- 3. Shukla, G.S. and V.B. Upadhyay, 2016. Economic Zoology, First edition, Rastogi publication, Meerut, India.

Thiagarajar College, Madurai – 9 An Autonomous Institution Affiliated to Madurai Kamaraj University Re-Accredited with 'A++' Grade by NAAC Department of Zoology (For those joined B. Sc.,Zoology on or after June 2023)

Tor those joined B. Sc., 20010gy on or after Julie 20

Programme Code- Certificate Course

	C C									
Course Code	Course Title	Category	L	Τ	Р	Credit				
	Forensic Science		2	-	-	2				

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

The course explains the various concepts and importance of forensic science. Elaborates on the links between forensic science and the legal system.

Prerequisites

Basic Knowledge and importance of Forensic Science

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Proficiency Expected%	Expected Attainment%
CO1	Spell the history and development of forensic science	70	70
CO2	Explain the organization of forensic laboratories, its functions and special areas of forensic science	70	70
CO3	Explain the basics of crime scene examination, documentation and process of crime investigation	60	70
CO4	Explain the fundamental concepts in physical, chemical and biological methods of crime investigation	60	70
CO5	Make use of biological evidence for crime investigation	60	70

K1: Knowledge K2: Understand K3: Apply

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	-	S	S	Μ
CO2	S	-	S	S	Μ
CO3	S	-	S	S	L
CO4	S	-	S	M	-
CO5	S	-	S	Μ	-

Strong –S (+++) Medium-M (++) Low-L (+)

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	L	L	S
CO2	S	S	S	Μ	-	-	L
CO3	S	S	S	S	S	Μ	S
CO4	S	S	S	S	S	Μ	S
CO5	S	S	S	S	Μ	-	S

Strong –S (+++) Medium-M (++) Low-L (+)

Course Title: Forensic Science

Unit I

History and Development of Forensic science in India. Forensic science Laboratories - CFSL, NCRB (National Crime Records Bureau), CFPB. Crime Scene examinations - documentation of crime scene.

Unit II

Physical evidence -Nature, types, search methods, collection, preservation, packing and forwarding of physical and trace evidence for analyses. Tool marks - identification - restoration of field off/erased marks.

Unit III

Foot and tyre impressions - examination of foot and tyre prints. Finger prints - Finger print patterns and classification.

Unit IV

Toxicology - classification and toxicological investigation of poison death; Examination of biological fluids - blood, seminal and saliva stains, forensic characterization of the above stains, stain patterns of the blood.

Unit V

Examination of fibres, hair, bones, teeth and skull; Fundamentals of DNA typing.

Text Book

- 1. Eckert, W.G. (Ed), 1997, Introduction to Forensic Sciences, II Edn. CRC Press, Boca Raton.
- 2. B.B. Nanda and R.K. Tiwari, 2001.Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi

Reference Books

- 1. James, S.H., and Nordby, J.J. 2005. Forensic Science: An Introduction to Scientific and
- 2. Investigative Techniques, 2nd Edition, CRC Press, Boca Raton.
- 3. Bevel, T., and Gardner, R.M. 2008. Gardner, Bloodstain Pattern Analysis, 3rd Edition, CRC
- 4. Press, Boca Raton.
- 5.Duncan, G.T., and M.I. Tracey, M.I. 1997. Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton .
- 6. Poklis. 1997. Forensic toxicology in, Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton.
- 7. Tilstone, W.J., M.L. Hastrup, M.L., and C. Hald, Fisher's, C. 2013. Techniques of Crime Scene Investigation, CRC Press, Boca Raton

Course designers: Dr.Rm. Murugappan, Associate Professor Dr.N. Arun Nagendran, Associate Professor Dr.C.Usha Assistant Professor

Thiagarajar College: Madurai – 625 009 An Autonomous Institution affiliated by Madurai Kamaraj University (Re-Accredited with 'A⁺⁺' Grade by NAAC) Department of Zoology

(For those joined M. Sc., Zoology on or after June 2023)

Programme Code :PZO

Code	Course Title	Category	L	Т	Р	Credit
PZO23CT21	Cell and Molecular Biology	Core-5	4	1	-	4

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100
Preambl	e			

The course is intended to elaborate the different types, structure and functions of cells and biomolecules. Explains the types and stages of cell cycle. Explain cell signaling pathways in normal and cancerous cell. Spell gene expression and protein synthetic machinery.

Prerequsites

Knowledge on prokaryotic and eukaryotic cells, cell organelles, nucleic acids and central dogma of protein synthesis.

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Proficiency Expected%	Attainment Expected %
CO1	Illustrate the cell organelles and their functions	70	70
CO2	Understand the cell junctions and organization of cells for communication of cells	70	70
CO3	Explain the cell signalling pathways and regulation of cell cycle	70	70
CO4	Emphasis the structure, forms, types and function of nucleic acids;	70	70
CO5	Demonstrate central dogma of protein synthesis and gene regulation	60	70

K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	Μ	S	S	-	Μ	-	L
CO2	Μ	L	Μ	-	L	-	L
CO3	S	S	S	-	Μ	-	L
CO4	S	S	S	-	-	-	-
CO5	S	S	S	L	Μ	-	Μ

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	Μ		S	S	
CO2	S	S	S	S	Μ
CO3	S	S		S	S
CO4	S	S	S	S	S
CO5	S	L		S	S

Strong –S (+++), Medium –M (++), Low-L (+)

Blooms taxonomy: Assessment Pattern

Blooms Taxonomy							
	C	End of Semester					
	I Internal Marks	II Internal Marks	Marks				
Knowledge -K1	15% (9)	15% (9)	15% (20)				
Understand -K2	15% (9)	15% (9)	15% (20)				
Apply-K3	30% (18)	30% (18)	30% (40)				
Analyze-K4	20% (12)	20% (12)	20% (25)				
Evaluate-K5	20% (12)	20% (12)	20% (25)				
Create-K6	60	60	130				

Title of the Course: Cell and Molecular Biology

Unit I

Cell theory ; Ultrastructure of animal cells. Specialization of cells into tissues Structure and function of organelles - Nucleus, endoplasmic reticulum, golgi complex, mitochondria, ribosomes, lysosomes, Peroxisomes, cytoskeletal structures The cell membrane & its properties ; Fluid mosaic model of Plasma membrane; Integral & peripheral membrane proteins.

Unit II

Cell junctions- gap junctions, tight junctions & anchoring junctions

Transport of molecules across the membrane- diffusion & facilitated diffusion & active transport(Sodium Potassium ATPase pumps).

Intracellular Vesicular Trafficking

Structural organization of Eukaryotic Chromosome ; giant chromosomes.

Unit III

Cell signalling- G-protein coupled receptor system JAK/STAT, and MAP kinase pathway

Cell cycle & its regulation- mitosis and meiosis

Molecular and biochemical characteristics of cancer cells

Cell ageing, Cell death and its regulation

Unit IV

Experimental evidence for DNA as genetic material

DNA- structure, types, replication (both prokaryotes and eukaryotes) and Holliday model of recombination

RNA –structure, types and function

Mutation- types & repair mechanisms

Unit V

Transcription of mRNA prokaryotes and eukaryotes & post transcriptional modification Translation in prokaryotes and eukaryotes & Post translational modifications Bacterial Genetics- Regulation of gene expression in prokaryotes: lac & trp operon Mobile Genetic Elements

Text Books

- 1. Frifelder, D. 2000. Molecular Biology 2nd edition. Narosa Publishing House, New Delhi.
- Krebs, J.E., Goldstein, E.S., Kilpatrick, S.T. 2011 Lewin's Genes X, Jones and Bartlett publishers Inc, London UK

Reference Books

- 1. Alberts, B. et al. 1994. Molecular Biology of the Cell (3rd edition). Garland Publishing, Inc., New York.
- De Roberties E.D.P and E.M.F.De Roberties 2011. Cell and Molecular Biology. 8th edition. B.I. Publicatons Pvt. Ltd., India
- 3. Paul, A. 2009. Cell and Molecular Biology, Books and Allied (P) ltd, India.
- 4. Power, C.B. 2009 Cell Biology Himalayan Publishing House, New Delhi.
- 5. Prakash S.L. 2007.Cell and Molecular Biology. M.J.P. publishers, Chennai
- 6. Allison LA. 2007. Fundamental Molecular Biology. Blackwell Publishing Ltd., USA.
- 7. Cooper, GM and Hawman RE. 2013. Cell a Molecular Approach (6th Edition). Sinauer Associates, Inc.
- 8. Haddin J. et al. 2011 Becker's World of the Cell (8th Editon). Benjamin Cummings Publishing Company , New York
- 9. Karp G. 2013. Cell and Molecular Biology Concepts and Experiments. John Wiley & Sons, Inc.
- 10. Lodish, Berk, Zipursky, Matsudara, Baltimore and Darnell.1999. Molecular Cell Biology, Fourth Edition, W.H.Freeman and Company, Newyork.
- 11. Watson, J.D., N.H.Hopkins, J.W.Roberts, J.A.Steitz and A.M.Weiner, 1998. Molecular Biology of the Gene, Fourth edition, The Benjamin / Cummings Publishing Company Inc., Tokyo.
- 12. Wolfe, L.S., 1993. Molecular and Cellular Biology, Wadsworth publishing company.

Course designers: Mrs. U.Soundarya Assistant Professor

Thiagarajar College: Madurai – 625 009 An Autonomous Institution affiliated by Madurai Kamaraj University (Re-Accredited with 'A⁺⁺' Grade by NAAC) Department of Zoology (For those joined M. Sc., Zoology on or after June 2023)

Programme Code :PZO

Code	Course Title	Category	L	Т	Р	Credit
PZO23 CT22	Developmental Biology	Core-5	4	1	I	4

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100
Preambl	e			

The course is intended to elaborate the different types, structure and functions of cells and biomolecules. Explains the types and stages of cell cycle. Explain cell signaling pathways in normal and cancerous cell. Spell gene expression and protein synthetic machinery.

prerequisites

Basic knowledge on organs associated with reproductive system and cell biology

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected Proficiency	Expected Proficiency
COI	Elaborates the various stages of embryogenesis & organogenesis	70	70 60
COI	Elaborates the various stages of enioryogenesis & organogenesis	70	00
CO2	Explain the basis of organ differentiation. Trace the sequence of events in fertilization	70	60
CO3	Illustrate the methods of assisted reproductive technology	60	60
CO4	Appraise on metamorphosis, regeneration and ageing as a part of postembryonic development	60	60
CO5	Emphasize the modern implications of developmental biology in terms ofteratogenesis, <i>in-vitro</i> fertilization, stem cell research and amniocentesis	60	60

K: Knowledge, K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	М	S	S	-	Μ	-	L
CO2	Μ	L	Μ	-	L	-	L
CO3	S	S	S	-	Μ	-	L
CO4	S	S	S	-	-	-	-
CO5	S	S	S	L	Μ	-	Μ

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	Μ		S	S	
CO2	S	S	S	S	Μ
CO3	S	S		S	S
CO4	S	S	S	S	S
CO5	S	L		S	S

Strong –S (+++), Medium –M (++), Low-L (+)

Blooms taxonomy: Assessment Pattern

Blooms Taxonomy						
	C	End of Semester				
	I Internal Marks	II Internal Marks	Marks			
Knowledge -K1	15% (9)	15% (9)	15% (20)			
Understand -K2	15% (9)	15% (9)	15% (20)			
Apply-K3	30% (18)	30% (18)	30% (40)			
Analyze-K4	20% (12)	20% (12)	20% (25)			
Evaluate-K5	20% (12)	20% (12)	20% (25)			
Create-K6	60	60	130			

Title of the Course: Developmental biology

Unit I

Historical thoughts and concepts, scope of embryology. Gametogenesis: primordial germ cells, origin of primordial germ cells. Spermatozoan: sperm - structure, types and spermatogenesis; egg - morphology (size, shape and egg membranes) and organization (yolk, pigments and egg cortex), types and oogenesis.

Unit II

Fertilization: Approximation of gametes - Chemotaxis, fertilizing-antifertilizing reaction, acrosome reaction, cortical reaction and physiological changes in fertilization. *Parthenogenesis:* types (natural and artificial) and significance. *Cleavage:* salient features, planes of cleavage, patterns of cleavage and factors affecting cleavage. *Gastrulation:* salient features, metabolic and molecular changes during gastrulation, gastrulation in amphioxus.

Unit III

Fate-map: construction of fate-map in amphibians – artificial and natural markings. *Organogenesis:* development of brain, heart and kidney in frog. *Placentation:* classification (based on the types of foetal membrane involved, distribution of villi and types of tissues involved) and physiology of placenta.

Unit-IV

Differentiation: types, processes and factors causing (induction, competence, determination). *Metamorphosis:* amphibian metamorphosis – ecological, morphological and physiological and chemical changes. *Regeneration:* types, events in regeneration and factors influencing
regeneration. *Teratogenesis:* Malformation and disruption, gene-phene relationship, autophene, allophene and teratogenic agents (retinoic acid, pathogens, alcohol, drugs and heavy metals).

Unit V

Male Reproductive System in human: testes, seminiferous tubules, epididymis, spermatic cord, ejaculatory ducts, auxiliary male genital glands (prostate gland and bulbourethral or cowper's glands). Female Reproductive System in human: ovary, oviduct, genital duct and uterus.Sexual cycle: estrous and menstrual cycle, hormonal regulation of ovulation. Assisted Reproductive Technology: Artificial insemination (AI), *In-vitro* fertilization (IVF)-Test tube baby, Embryo transfer (ET), Contraceptive devices and vaccines.

Text books

- 1. Balinsky, B.I 1981. An Introduction to embryology. W.B.Saunders and Co.London
- 2. Verma., P.S and V.K.Agarwal 1975 Chordate Embryology S.Chand Publishing House, New Delhi
- 3. Rastogi, V.B. 2018. Developmental Biology, Rastogi Publications, New Delhi
- 4. Arora M.P.2009. Embryology, Himalaya Publishing House, NewDelhi

Reference books

- 1. Berril, N.J.1976. Developmental biology, Tata Mc.Graw Hill Pub.Co.Ltd.New Delhi
- 2. Gillbert. S.F.1994. Developmental Biology. Sinauer Associates Inc.Massachusetts,USA
- 3. Adams W.1986. Genetic Analysis of Animal Development. A WileyInterSciencePublication.USA.
- 4. Balinsky, B.I. and B.C. Fabian. 2012. An Introduction to Embryology. Fifth Edition, CengageLearning India Private Limited, New Delhi.
- 5. Carlson, B.M. 2007. Foundations of Embryology. Sixth Edition, Tata McGraw-Hill PublishingCompany Limited, New Delhi.

Course Designers: Dr. T Rajagopal

Thiagarajar College: Madurai – 625 009 An Autonomous Institution affiliated by Madurai Kamaraj University (Re-Accredited with 'A⁺⁺' Grade by NAAC) Department of Zoology (For those joined M. Sc., Zoology on or after June 2023) Programme Code :PZO

Code	Course Title	Category	L	Т	Р	Credit
PZO20CL21	Lab in Cell and Molecular Biology	CoreLab-5	-	-	3	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

Provides a basic understanding on the organization of different tissues and cells. Helps to visualize the different stages of cell division. Provide hands on training on gene transfer mechanism.

Prerequsites

Knowledge on tissues, cells, biomolecules etc.,

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Proficiency Expected %	Expected Attainment %
CO1	Differentiate the types of tissues and cells	70	80
CO2	Appraise the different gene transfer methods	70	70
CO3	Summarise safe laboratory practices and perform basic molecular biology techniques	70	70
CO4	Distinguish mutant and wild bacterial colonies	70	70
CO5	Isolate nucleic acids from cells and quantify.	70	70

K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	-	L	-	L
CO2	S	S	S	-	L	-	L
CO3	S	S	S	-	Μ	-	L
CO4	S	S	S	L	L	-	L
CO5	S	S	S	L	L	-	L

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	L	S	S	L
CO3	Μ		S	S	L
CO4	Μ		S	S	L
CO5	Μ	S	S	S	

Strong –S (+++), Medium –M (++), Low-L (+)

Title of the Course : Lab in Cell and Molecular Biology

- 1. Observation of different types of tissues
- 2. Observation of Barr body
- 3. Observation of giant chromosomes
- 4. Observation of the stages of mitosis
- 5. Observation of the stages of meiosis
- 6. Quantitative estimation of nucleic acids
- 7. Isolation of mutant colonies by Gradient plate method.
- 8. Isolation of mutant colonies by Replica plate method.
- 9. UV-irradiation and photoreactivation experiment
- 10. Complementation test
- 11. Phage isolation and titration

Reference Books

- 1. Brown, T.A. 1998. Molecular Biology Lab; Gene Analysis, Academic Press, London.
- 2. Malov, S.R. 1990. Experimental Techniques in Bacterial Genetics, Jones and Bartlett Publishers, Boston.
- 3. Miller, J.H. 1992. A Short Course in Bacterial Genetics: A Lab Manual & Hand Book for *E. coli* and related Bacteria. Cold spring Harbor Lab press, Cole Spring Harbar
- 4. Rajamanickam, C.2001 Experimental protocols in basic molecular biology, Osho Scientific Publications, Madurai.
- 5. S.Janarthanan and S.Vincent 2007.Practical Biotechnology, Methods and Protocols. University Press, Hyderabad., India
- 6. Gunasekaran, P. 2008. Laboratory Manual in Microbiology, New Age International (P) Ltd. Publishers, New Delhi

Thiagarajar College: Madurai – 625 009 Department of Zoology (For those joined M. Sc., Zoology on or after June 2023) Programme Code :PZO

Code	Course Title	Category	L	Т	Р	Credit
PZO23CL22	Lab in Developmental Biology	Core-9	-	-	3	2

Year	Semester	Int. Marks	Ext.Marks	Total
Second	Third	25	75	100

Preamble

Explain the development of organ and organ system using slides , spotters and models

Prerequisites

Basic knowledge on embryogenesis and organogenesis

Course Outcomes

	Course outcomes	Expected Proficiency %	Expected Attainment %
CO1	Make use of microscope and mount a specimen	70	70
CO2	Identify the different stages of development -model organism	70	70
CO3	Summarize and distinguish the structural organization of different organ and organ system	60	60
CO4	Spell the influence of hormones in development	60	60
CO5	Work in a clinical lab and perform experiments related to histology and developmental biology	60	60

On the completion of the course the student will be able to

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	-	-	-	М
CO2	М	М	М	-	-	-	L
CO3	М	L	L	М	-	-	L
CO4	М	М	-	-	L	L	L
CO5	S	S	S	М	М	-	S

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1			М	L	
CO2	М	М	М	М	
CO3	S			М	L
CO4	М			М	
CO5	М		S	S	М

Blooms taxonomy: Assessment Pattern

Blooms Taxonomy			
	C	Α	End of Semester
	I Internal Marks	II Internal Marks	Marks
Knowledge-K1	15%(9)	15% (9)	20%(30)
Understand-K2	15%(9)	15% (9)	20%(30)
Apply -K3	30%(18)	30% (18)	20%(30)
Analyze -K4	20% (12)	20% (12)	20% (30)
Evaluate -K5	20% (12)	20% (12)	20%(30)
	60	60	150

Title of the course: Lab in Developmental Biology

- 1. Observation of different stages of chick blastoderm (24, 48,72 and 96 hrs)
- 2. Temporary mounting of chick blastoderm(24, 48, 72 and 96 hrs)
- 3. Regeneration intadpoles.
- 4. Observation of bull spermatozoa.
- 5. Observation of frog-egg, sperm, cleavage, blastula, gastrula and neurula-Slide
- 6. T.S. of testis and ovary of mice-slide
- 7. Human eye and ear-model
- 8. In vitro culture of chickembryo
- 9. Microtome technique –demonstration
- 10. Effect of thyroxine and iodine in Amphibianmetamorphosis
- 11. Observation of endocrine glands inchick.

Reference books

- 1. Tyler .M.S2008. Developmental biology- A guide for experimental study. Sinauer Associates ,Sunderland, Massachusetts USA.
- 2. Arora M.P.2009. Embryology, Himalaya Publishing House, New Delhi

Course Designers: Dr. T S Ramyaa Lakshmi Dr. T Rajagopal

Thiagarajar College : Madurai – 625 009 Department of Zoology (For those joined M. Sc., Zoology on or after June 2020) Programme Code:PZO

Course Code	Course Title	Category	L	Т	Р	Credit
PZO23ET21	Economic Entomology	Core-4	3	2	-	3

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

The course delivers a comprehensive insight on the basic and applied aspects of Entomology. One half of the syllabus offers morphological as well as molecular based taxonomy and systematic of insects; and also their anatomical and functional details. The other half corroborates insects harmful nature and their management, besides having entrepreneurial aspects of entomology.

Prerequsites

Basic knowledge on the morphology and classification of insects.

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Proficiency Expected %	Expected Attainment %
CO1	Discuss the morphology based variation and diversity among all insect groups	70	70
CO2	Emphasize and compare the structural and functional aspects of insects	70	70
CO3	Explain the trophic interaction of insects with their host plants their management and tools of control	60	60
CO4	Apply/Utilize natural enemies for the control of insect pests	60	60
CO5	Appear for competitive examinations and/ or become an entrepreneur,	60	60

K:Knowledge, K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	Μ	Μ	S	-	L	-	-
CO2	S	S	S	-	L	L	Μ
CO3	S	S	S	-	L	L	L
CO4	Μ	Μ	Μ	-	Μ	-	Μ
CO5	S	S	S	-	S	-	S

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	S	L	S	S	S
CO2	S	L	Μ	S	S
CO3	S		S	S	
CO4	S		S	S	
CO5	Μ		Μ	S	S

Strong –S (+++), Medium –M (++), Low-L (+)

Blooms taxonomy: Assessment Pattern

Blooms Taxonomy			
	C	Α	End of Semester
	I Internal Marks	II Internal Marks	Marks
Knowledge -K1	15% (9)	15% (9)	15% (20)
Understand -K2	15% (9)	15% (9)	15% (20)
Apply-K3	30% (18)	30% (18)	30% (40)
Analyze-K4	20% (12)	20% (12)	20% (25)
Evaluate-K5	20% (12)	20% (12)	20% (25)
Create-K6	60	60	130

Title of the Course: Economic Entomology

Unit I

Classification of Insects-General characteristics of class Insecta and classification up to Order level – characteristics of each order with examples. Modern scheme of insect classification: Apterygota- Pterygota: Exopterygota (Hemimetabolous): Paleopteroid, Orthopteriod, Hemipteroid orders -Endopterygota (Holometabolous): Coleopteroid, Neuropteroid, Panorpoid and Hymnopteroid orders-Studies on molecular evolutionary relationship between different groups of insects

Unit II

Anatomy and Physiology of Insects: Respiratory system: Spiracle, tracheal gills, air sacs, trachea and tracheoles -Excretory system: in aquatic and terrestrial insects-Reproductive system: Male – accessory glands – vas efferense, vas difference, aediagus; Female –panoistic, meroistic, telotrophic, polytrophic ovaries, spermatheca, -Endocrine system: Structure of Corpora cardiac(CC), Carpora allata (CA) and neurosecretary cells(NSC); ecdysone, neuropeptides, prothoracicotropic hormone (PTTH), ATH, JH and JH analogues

Unit III

Pests and Pest Management –Economic threshold level, Pests: Pests of Cotton (*Pectinophora gossypiella, Aphis gossypii, and Helicoverpa armigera*) Paddy (*Scirpophaga incertulus, Aphis dorsalis, Nephotettix virescense*), Sugarcane Chilo infuscatellus and Alerolopus parodonsis). Ground nut (Amsacta albistiga, Cnephalocrocis medinalis and Aphis craccivora, Tomato (Amrasca bigutalla biguttala, Aphis sp.) Brinjal- (Leucinodes orbanals, Phemberules affinis)- IPM concept, methods

and tools (Case study on cotton)-Chemical control: Insecticide – Classification, nomenclature, toxicity, mode of entry, mode of action, synergistic – formulations, repellents, attractants- law and regulations.

Unit IV

Biological Control: Parasitoids and predators – Genetic Control - Breeding insect resistance host; Ecological control – Cultural and mechanical; microbial control – Bacteria – *Bacillus thuringiensis*-Fungi – *Metarhizium anisopliae, Beauveria bassiana*- Virus – nuclearpolyhedral virus (NPV) and Granulosis virus (GV)-Protozoans: *Nozema locustae* Nematode: *Stenernema sp.*, and *Heterorhbdidis sp.*

Unit V

Bombyx mori –Biology and silk secretion-Grainage technology- Silkworm rearing-Pests and Disease management-Biology and silk production of non-mulberry silkworm: Eri, Muga and Tasar-Silk reeling and marketing

Text books

- 1. David, B.V.2002 Elements of Economic Entomology. Popular Book Depot, Madras.
- 2. Tembhare, D.B. 2009 Modern Entomology, Himalaya publishing house, Mumbai.

Reference Books

- 1. Chapman, R.F. 2008. The insects: Structure and Function. ELBS.
- 2. Chapman, R.F. and Joern, A. 1990. (eds.). Biology of Grasshoppers. John Wiley & Sons, New York. USA
- 3. Romoser, W.S., Stoffolano Jr, J.G .1998, Entomology, fourth edition, WCB Mc Graw Hill Publishing Co.
- 4. David, B.V and. Ananthakrishnan, T.N. 2004. General and Applied Entomology. Tata Mc Graw Hill Publishing Co.
- 5. Pedigo, L.P. 2009. Entomology and Pest Management. Prentice Hall of India, New Delhi
- 6. Regupathy, A., Palanisamy, S., Chandramohan, N. and Gunathilagaraj,K. 1997. A guide on Crop Pests. Sooriya Desktop Publishers, Coimbatore, India.
- 7. Wigglesworth, V.B. 1972. The principles of Insect Physiology. Chapman & Hall, New York. USA
 - 8. Dandin, S.B., J.Jayaswal and K.Giridhar 2003. Handbook of Sericulture Technologies. Central Silkboard, Bangalore, India
 - 9. Ganga, G. and Sulochana chetty, J. 1997. Introduction to Sericulture. II Edn, Oxford and IBH publishing Co Pvt. Ltd.

Course designers : Dr.P.Suresh, Associate Professor

THIAGARAJAR COLLEGE, MADURAI:: 9 An Autonomous Institution affiliated by Madurai Kamaraj University (Re-Accredited with 'A⁺⁺' Grade by NAAC) DEPARTMENT OF ZOOLOGY & MICROBIOLOGY

(For those joined M.Sc., Zoology on or after June 2023)

Programme Code: PZO

Code	Course Title	Categor	y L	Т	P	Credit
PZO23ET22	Research Methodology		3	2	-	3
L - Lecture	T - Tutorial	P – Practicals				

Year	Semester	Int. Marks	Ext. Marks	Total
First	Second	25	75	100

Preamble

Acquire knowledge on the procedure and the techniques adopted while conducting the research. To know the dos and donots while performing experiments and research.

Prerequisite

Interest towards pursing research

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency (%)	Expected Attainment (%)
CO1	Elaborates the basic and advanced microscopy based analytical techniques in researchprocess	70	60
CO2	Illustrates the use of differentinstrumentations needed to identify, visualizecharacterize and separation in research	60	70
CO3	Familiarizes various separation techniques employed in research	70	60
CO4	Elaborates the basic need and process of research and Understanding of conducting applied research	60	70
CO5	Appreciate the ethical dimensions and different components of scholarly writing with ways to evaluate its quality.	60	70

K:Knowledge, K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate Mapping of COS with POs

#	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	М	М	L	М
CO2	S	М	S	-	S	-	L
CO3	S	S	М	S	S	-	М
CO4	S	М	М	S	М	L	М
CO5	S	S	М	S	S	S	-

S: Strong M: Medium

L: Low

Mapping of COS with PSOs

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	М	S	S	S
CO2	S	М	S	S	-
CO3	S	S	-	М	S
CO4	S	S	S	S	S
CO5	S	М	М	М	S

S: Strong M: Medium L: Low

Blooms Taxonomy

Blooms Taxonomy							
	С	End of Semester					
	I Internal Marks	II Internal Marks	Marks				
Knowledge -K1	15% (9)	15% (9)	15% (20)				
Understand -K2	15% (9)	15% (9)	15% (20)				
Apply-K3	30% (18)	30% (18)	30% (40)				
Analyze-K4	20% (12)	20% (12)	20% (25)				
Evaluate-K5	20% (12)	20% (12)	20% (25)				
Create-K6	60	60	130				

Title of the Paper: Research Methodology

Unit I

Principles of light rays – Reflection, Refraction, Diffraction, Dispersion and Polarisation, Compound (Dark and Light field), Phase Contrast, Fluorescent, Polarised, Electron (Transmission and Scanning), AFM and Confocal Microscopy; Micrometry.

Unit II

Histology- Sectioning, fixation and Staining of tissues, Centrifuge (Clinical, Density gradient and Ultra) – preparative and analytical - sedimentation coefficient, RCF, RPM. GM counter, Liquid Scintillation counter, Lyophilizer, Sphygmomanometer, Spectrophotometer (visible, ultraviolet), ELISA reader, FTIR, Atomic Absorption and Mass Spectrophotometer, NMR, XRD.

Unit III

Paper (Ascending and circular), Thin layer, Column, gel filtration, ion exchange, Gas and High Performance Liquid Chromatography, Kjeldahl apparatus, PAGE, Agarose Gel Electrophoresis, 2D Gel Electrophoresis, Western blotting, PCR and FACS. Fermentor, Micro array

Unit IV

Identification of research problem: sources and considerations, Steps in formulating a research problem. Thesis writing - Introduction, Review of literature, Methodology, Results - illustrations and tables, Discussion, Bibliography, Foot notes and proof correction.

Unit V

Publication of research and review articles – Plagiarism – choosing the right journal; refereed journals, open access journals, Journal metrics, citation, impact factor, SCI, H index, i10 index, referencing software (Zotero/Mendeley), software for paper formatting like LaTex/MS Office, Software for detection of Plagiarism.

Text Books:

- **1.** Gastel, B. and Day, R.A. 2016. How to Write and Publish a Scientific Paper, Eighthedition, Greenwood publishing house, Westport, Connecticut, USA
- **2.** Coley, S.M. and Scheinberg, C. A. 2016. Proposal Writing: Effective Grantsmanship for Funding, Fifth edition, Sage Publications, Thousand Oaks, California.
- 3. Jeyaraman, J., 1985. Lab. Manual in Biochemistry, Wiley Eastern Ltd, New Delhi.
- **4.** Plummer D.T. 2017. An Introduction to Practical Biochemistry 3rd Edition. McGraw Hill Publication. New Delhi
- 5. Veerakumari, L. 2009. Bioinstrumentation. MJP Publishers, Chennai
- **6.** Palanivel, P. 2000. Laboratory Manual for Analytical Biochemistry & Separation Techniques. School of Biotechnology, Madurai Kamaraj University, Madurai.

Reference Books:

- 1. Roy, R.N. 1996. A Textbook of Biophysics. New Central Book Agency (P) Ltd.Calcutta.
- 2. Boyer, R.F. 1993. Modern Experimental Biochemistry. The Benjamin Cummings Publishing Company, Inc., New York.
- 3. Chatwal, G.R and Anand, S.K. 2009. Insturmental Methods of Chemical Analysis. Himalaya Publishing House, New Delhi.
- 4. Fink, A. 2019. Conducting Research Literature Reviews: From the Internet to Paper. Fifth edition, Sage Publications, Thousand Oaks, California
- 5. Graziano, A.M. and Raulin, M.L. 2019. Research Methods: A Process of Inquiry, Ninth edition, Pearson publications, Hoboken, New Jersey.
- 6. Kothari, C.R. 2019. Research methodology: Methods and Techniques, Fourth edition New Age International publishers, New Delhi.
- 7. Fink, A. 2019. Conducting Research Literature Reviews: From the Internet to Paper. Fifth edition, Sage Publications, Thousand Oaks, California
- 8. Wilson, K. and Walker, J. 2003. Principles and Techniques of Practical Biochemistry, 5 th Edition Cambridge University Press, New York.

ICT Tutorials

- How to write thesis- <u>https://youtu.be/XDgXzdl9bCw</u>
- LaTex Tutorial- <u>https://youtu.be/VhmkLrOjLsw</u>

Course Designers:

- 1. Dr.C.Binu Ramesh- Assistant Professor
- 2. Dr.S.Ramayaa Lakshmi- Assistant Professor
- 3. RM.Murugappan Associate Professor

THIAGARAJAR COLLEGE, MADURAI:: 9 An Autonomous Institution affiliated by Madurai Kamaraj University (Re-Accredited with 'A⁺⁺' Grade by NAAC) DEPARTMENT OF ZOOLOGY & MICROBIOLOGY

(For those joined M.Sc., Zoology on or after June 2023) Programme Code: PZO

Cod	e	Course Title		Catego	ry L	Т	P	Credit
PZO23ST	21	Poultry farming	g		2	-	-	2
L - Lecture T - Tutorial		rial P – Pra	cticals					
Year		Semester	Int. Marks	s Ext. Marks			Total	
First		Second	25		75	5		100

Preamble

Inclusion of skill enhancement courses in the Zoology curriculum enriches the skill based know how for the students. Poultry farming is one such enterprising area in Zoology which can cater to the industrial and food needs of the society as well as provide a source of income to the students after graduation.

Prerequisite

Basic knowledge on poultry farming and disease management

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Expected Proficiency (%)	Expected Attainment (%)
CO1	Explain the needs for Poultry farming and the status in India and in global market.	70	60
CO2	Apply the techniques and practices needed or Poultry farming.	60	70
CO3	Develop rearing systems for layers and broilers.	70	60
CO4	Apply basic concepts of nutrition, health and management into practical and profitable poultry production	60	70
CO5	Explain the difficulties in Poultry farming and be able to propose plans against it.	60	70

K:Knowledge, K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COS with POs

#	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	М	М	L	М
CO2	S	М	S	-	S	-	L
CO3	S	S	М	S	S	-	М
CO4	S	М	М	S	М	L	М
CO5	S	S	М	S	S	S	-

S: Strong M: Medium L: Low

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	М	S	S	S
CO2	S	М	S	S	-
CO3	S	S	-	М	S
CO4	S	S	S	S	S
CO5	S	М	М	М	S
			•		

ping of COS with PSOs

Blooms Taxonomy

Blooms Taxonomy				
	C	End of Semester		
	I Internal	I Internal II Internal		
	Marks	Marks		
Knowledge -K1	15% (9)	15% (9)	15% (20)	
Understand -K2	15% (9)	15% (9)	15% (20)	
Apply-K3	30% (18)	30% (18)	30% (40)	
Analyze-K4	20% (12)	20% (12)	20% (25)	
Evaluate-K5	20% (12)	20% (12)	20% (25)	
	60	60	130	

Title of the Paper: Poultry Farming

Unit I

Poultry Science –an overview-scope and status of poultry farming with special reference to Tamilnadu, India. Poultry housing

Unit II

Meat type – Broilers, Layers -White Leghorn, Dual purpose Varieties, Game and Ornamental purpose breeds.

Unit III

Poultry Rearing system- Deep litter system and cage system- construction and criteria, Nutrient requirements for different stages of layers and broilers - Feed formulation and Methods of feeding.

Unit-IV

Summer and winter management, Health care- Poultry diseases-viral, bacterial, fungal and parasitic (two each); symptoms, control and management; Vaccination programme.

Unit V

Preparation of project proposal – finance and insurance. Recycling of poultry waste.

Text Books:

- 1. Gnanamani, M.R (1998) Modern aspects of Commercial Poultry Keeping, Giri Publications, Madurai.
- 2. Gopalakrishnan C.A and G.Murley Mohan Lal (1997), Livestock and Poultry enterprises for rural development, Vikash, New Delhi.

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Reference Books:

- 1. Chauhan H.V.S. and S.Roy, (1996) Poultry diseases, diagnosis and treatment New Age International, New Delhi, India
- 2. Sreenivasaiah., P. V., (2015) Textbook of Poultry Science. 1st Edition. Write & Print Publications, New Delhi
- 3. Jull A. Morley, 2007. Successful Poultry Management. 2nd Edition. Biotech Books, New Delhi"
- 4. Hurd M. Louis, 2003. Modern Poultry Farming. 1st Edition. International Book Distributing Company, Lucknow."

ICT Tutorials

- 1. http://www.asci-india.com/BooksPDF/Small%20Poultry%20Farmer.pdf
- 2. https://nsdcindia.org/sites/default/files/MC_AGR-Q4306_Small-poultry-farmer-.pdf
- 3. <u>http://ecoursesonline.iasri.res.in/course/view.php?id=335</u>
- 4. https://swayam.gov.in/nd2_nou19_ag09/preview

Course Designers:

1. Dr.P.Suresh, Associate Professor. Dr.C.Binnu Ramesh, Assistant Professor

Thiagarajar College, Madurai – 625 9 Re-Accredited with 'A++' Grade by NAAC Department of Zoology

(For those joined M. Sc., Zoology on or after June 2023)

Course Code	Course Title	Category I	Ĺ	Τ	Р	Credit
PZO23AT21	Apiculture	2	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

Acquire skills on bee keeping, managing bee colonies from pest and disease infestation. Able to harvest , preserve and process honey and other bee products.

Prerequisites

Students should be aware of the importance of honey bees and their impact on the ecosystem

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected	Expected
		Proficiency%	Attained%
CO1	Explain the morphology, life cycle, characteristics, colony	70	70
	organization and importance of honey bees		
CO2	Enlist the tools and equipments needed for bee keeping	70	70
CO3	Elucidate the importance of h o n e y a n d	70	70
	byproducts of bees.		
CO4	Imparts conceptual knowledge on the harvesting, preserving	70	70
	and processing of bee products		
CO5	Perform apiculture as an Entrepreneurial venture	70	70
		-	

K1: Knowledge

K2: Understand K3: Apply

Mappir	ng of Cours	e Outcomes	with Prog	ramme Speci	fic Outcomes
	PSO	PSO2	2 PSC	O3 PSO4	4 PSO5
CO	1 S	L	S	S	L
CO	2 S	S	S	Μ	L
CO	3 S	S	S	Μ	L
CO	4 M	L	Μ	L	S
CO	5 S	S	S	L	Μ

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	-	S	L	Μ
CO2	S	Μ	-	Μ	-	L
CO3	S	Μ	L	S	-	L
CO4	S	Μ	L	S	L	L
CO5	Μ	S	L	Μ	L	L

Strong –S (+++) Medium-M (++) Low-L (+)

Blooms taxonomy: Assessment Pattern

Blooms Taxonomy					
	C	End of Semester			
	I Internal Marks	II Internal Marks	Marks		
Knowledge -K1	15% (9)	15% (9)	15% (20)		
Understand -K2	15% (9)	15% (9)	15% (20)		
Apply-K3	30% (18)	30% (18)	30% (40)		
Analyze-K4	20% (12)	20% (12)	20% (25)		
Evaluate-K5	20% (12)	20% (12)	20% (25)		
	60	60	130		

Course Title: Apiculture

Unit I :

History of apiculture. Systematic position of honey bees. *Apis indica*. Colony organization of honeybees- Queen , Drone & Worker bees.

Unit II :

Life cycle of honey bees- Nuptial flight , Swarming, Supersedure, absconding. Socialbehavior of honey bees- Honey bee communication – Round dance & waggle dance.

Unit III:

Bee Keeping Equipments- Newton's Bee Hive and its components ; Equipments for beekeeping- smoker, uncapping knife, bee suit, honey extractor.

Bee Keeping: Selection of site for apiary, management of apiary at different seasons, extraction of honey.

Unit IV:

Pests of honey bee: Ants, wasps, Wax moths, birds, bears, & rodents. Diseases of Honeybee: American foulbrood disease (AFB),European foulbrood disease(EFB),Chalk brood disease & Nosema.

Unit V:

Products of apiculture: Honey, beeswax, royal jelly, propolis, bee venom. Economic & ecological importance of honey bees. Apiculture as an Entrepreneurial venture.

Text Books

- 1. Jayashree, K.V, C.S. Tharadevi, C.S. N.Aruugam 2014. Apiculture, Saras Publication. Tamil Nadu
- 2. Ravindranathan, K.R., 2005, A text book of Economic Zoology, Dominant publisher and distributors (P) Ltd., New Delhi.

Reference Books

- 1. Singh, D., Singh, D. Pratap. 2006. A Handbook of Beekeeping. AGROBIOS (INDIA)
- 2. Sharma, D. 2018. Guide on Good Beekeeping Practices for Sustainable quality honey production, Hi-Tech Natural Products publication, India
- 3. Abrol D.P. 2023. Beekeeping: A Concise Guide.Scientific Publishers, India

Web Resources

http://nbb.gov.in/ National Bee Board http://ecoursesonline.iasri.res.in/mod/page/view.php?id=16175

Course Designer Mrs. U.Soundarya Assistant Professor

M.Phil., Zoology (Programme Code: MEC)

Programme outcome-PO (Aligned with Graduate Attributes)-Master of Philosophy (M.Phil.,)

PO1: Knowledge and critical thinking

Acquire, analyse, evaluate and interpret data using appropriate techniques. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO2: Problem solving

Critically evaluate information and ideas from multiple perspectives. Employ conceptual, analytical, quantitative and technical skills in solving the problems and are adept with a range of technologies

PO3: Complementary Skills

Recognize the need for information, effectively search for, retrieve, evaluate and apply that information gathered in support of scientific investigation or scholarly debate.

PO4 :Communication efficiency

Communicate and disseminate clearly and convincingly the research findings effectively in the academic community and to stakeholders of their discipline in written and or oral form. Elaborate on the ideas, findings and contributions in their field of interest to expert and non-expert audiences.

PO5: Environment, Ethical and Social relevance

Apply ethical principles for societal development on environment context. Demonstrate the knowledge of and need for sustainable development.

PO6 :Life-Long Learning

Recognize the need, and have the ability, to engage in continuous reflective learning in the context of technological advancement.

PO7: Team work

Work effectively in teams, both collaboratively and independently to meet a shared goal with people whose disciplinary and cultural backgrounds differ from their own. Engage in intellectual exchange of ideas with researchers of other disciplines to address important research issues

THIAGARAJAR COLLEGE, MADURAI – 9. (Re-Accredited with 'A' Grade by NAAC) Department of –Zoology

Vision

• Render exemplary quality education in Life Sciences and laboratory skills to produce generations of responsible, competent and employable graduates

Mission

- To provide a comprehensive set of courses in biological sciences that enhances the understanding, depth of knowledge and technical competency of the students.
- To prepare the students for entry-level research and teaching positions in biological sciences.
- To provide an educational environment that fosters the development of appropriate scientific vocabulary, reasoning skills, effective oral and written communication abilities for students.
- To create a holistic understanding of the allied subjects through interdisciplinary learning.

Programme Educational Objectives (PEO)

The objectives of this programme is to equip/prepare the students

PEO1	Engage in critical intellectual enquiry
PEO2	Demonstrate a thorough understanding of research methodologies and techniques at an advanced level
PEO3	Conduct innovative, high-impact and leading edge research
PEO4	Provide novel solutions to complex problems
PEO5	Work with others and make constructive contributions. Demonstrate leadership and advocacy skills

Programme specific outcomes- M.Phil Zoology

On the successful completion of M.Phil., Zoology the students will

PSO1	Design , write and execute research proposal Demonstrate practical fieldwork skills (e.g. ecological survey techniques, species identification and ecological impact assessments)			
PSO2	Develop research orientation and familiar/acquaint with the principle, working mechanism and application of biological instruments			
PSO3	Identify and define emerging problems in the field concerned. Offer innovative and original solutions to problems and issues Further able to apply appropriate techniques in multi-disciplinary research environment.			
PSO4	Engage in intellectual exchange with researchers from other disciplines to address important research issues Collaborate effectively with researchers			
PSO5	Appear for competitive exams like CSIR NET, SET etc and also to write research proposals for grants.			

THIAGARAJAR COLLEGE, MADURAI – 9. (Re-Accredited with 'A' Grade by NAAC) Department of –Zoology Master of Philosophy (M.Phil.,) Zoology (w.e.f. 2023 batch onwards) Programme Code-MZO

Course Structure

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max Mark CA	Max Marks SE	Total
First Seme	ester							
Core 1	MZO23 C11	Research Methodology I	6	6	90	25	75	100
Core 2	MZO23 C12	Applied Entomology	6	6	90	25	75	100
Core 3	MZO23 C13	Research Methodology I I	6	6	90	25	75	100
Second Ser	mester							
Core 4	MZO23 PJ21	Project		6		100	100	200
				24				

Thiagarajar College, Madurai – 9 An Autonomous Institution Affiliated to Madurai Kamaraj University Re-Accredited with 'A++' Grade by NAAC Department of Zoology

(For those joined M. Phil.,,,Zoology on or after June 2023)

Course Code	Course Title	Category	L	Т	Р	Credit
MZO23C11	Research Methodology I	Core-1	6	-	-	6

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

Research Methodology is a hands-on training course designed to impart knowledge in the foundational methods and techniques of academic research in various disciplines of Life sciences. The course imparts a research orientation among the scholars and to acquaint them with fundamentals of research methods.

Prerequsites

Basic idea about principle, working mechanism and application of biological instruments

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected Proficiency %	Expected Attainment %
CO1	Comprehend the working principle and applications of various analytical instruments.	70	80
CO2	Spell the importance of animal cell culture techniques	70	80
CO3	Apply various nucleic acid analyses techniques	70	80
CO4	Make use of the techniques learnt for execution of the project work	70	60
CO5	Work in an educational institution or to pursue doctoral studies.	50	50

K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate K6: Create

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	-	-	S	L
CO2	S	S	S	-	-	S	L
CO3	S	S	S	-	L	S	L
CO4	S	S	S	-	-	-	L
CO5	-	-	Μ	S	S	S	S

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1		S	S	S	S
CO2		S	S	S	Μ
CO3		S	Μ	S	Μ
CO4		S	S	S	S
CO5		Μ	L	S	L

Strong –S (+++), Medium –M (++), Low-L (+)

Blooms taxonomy: Assessment Pattern

Blooms Taxonomy									
	0	End of Semester							
	I Internal Marks	II Internal Marks	Marks						
Knowledge -K1	20	20	40						
Understand -K2	20	20	40						
Apply-K3	20	20	40						
Analyze-K4	20	20	40						
Evaluate-K5	20	20	20						
Create-K6	20	20	20						

Title of the Course: Research Methodology I

Unit I

Working principle and applications of: Compound, Phase Contrast, Fluorescent, Polarised, Electron (Transmission and Scanning) and Confocal Microscopy; Micrometry, cytophotometry and flow cytometry; live cell imaging Principles and techniques involved in histological and histochemical staining of animal tissues Microbial staining techniques – simple, differential, spore and capsule staining.

Unit II

Working principle and applications of: pH meter, Centrifuge (Density gradient and Ultra) - preparative and analytical - sedimentation coefficient, RCF, RPM; GM counter, Liquid Scintillation counter, Sonicator, Lyophilizer and Micropipettes. Colorimeter, Spectrophotometer (visible, ultraviolet), FTIR, Flame Photometer, Atomic Absorption and Mass Spectrophotometer.

Unit III

Chromatographic techniques: Paper, Thin layer, Column, Gel filtration, Ion exchange, Gas and High Performance Liquid Chromatography. Electrophoretic techniques: SDS-PAGE, Native PAGE, Agarose Gel Electrophoresis, 2D Gel Electrophoresis, Gel Documentation Blotting techniques: Southern, Northern and Western blotting

Unit IV

Animal cell culture techniques: Media types, primary and secondary culture, cell lines, types of culture, culture of mammalian cells, tissues and organs, somatic cell cloning and hybridization, transfection and transformation of cells, commercial scale production of animal cells, application of animal cell culture - *in vitro* testing of drugs and toxicity of pollutants - production of vaccines and pharmaceutical products; Stem cells – types – isolation - culture and applications

Unit V

PCR – working principle, types and applications; DNA sequencing methods – Maxam and Gilbert, Sanger and automation methods, next generation sequencing; protein sequencing; DNA and protein microarray

Immunotechniques: Agglutination and precipitation assays – immunoelectrophoresis – immunoflouresence – immunohistochemistry – ELISA – RIA - Hybridoma technology – Antibody engineering – Phage display techniques **Report submission: Protocols pertained to the above techniques**

Reference Books

1. Boyer, R.F. 1993. Modern Experimental Biochemistry. The Benjamin Cummings Publishing Company, Inc., New York.

2. Chatwal, G.R and Anand, S.K. 2009. Insturmental Methods of Chemical Analysis. Himalaya Publishing House, New Delhi.

3. Jeyaraman, J., 1985. Lab. Manual in Biochemistry, Wiley Eastern Ltd, New Delhi.

4. Kuby, J. 2003, Immunology 5th edition, W.H. Freeman and Company, Newyork.

5. Lincoln PJ & Thomson J. 1998. Forensic DNA Profiling Protocols. Humana Press.

6. Mendham, J., Denney, R.C., Barnes, J.D. and Thomas, M.J.K. 2004. Vogel's Textbook of Quantitative Chemical Analysis. Pearson Publishers Pvt. Ltd., New Delhi, India.

7. Palanivel, P. 2000. Laboratory Manual for Analytical Biochemistry & Separation

Techniques. School of Biotechnology, Madurai Kamaraj University, Madurai.

8. Plummer, D.T. 2008. An Introduction to Practical Biochemistry. Tata McGraw Hill Publications, New Delhi.

9. Portner R. 2007. Animal Cell Biotechnology. Humana Press.

10. Primrose. S.B., Twyman R.M., Old. R.W. 2001. Pricinciples of Gene Manipulation. Blackwell Science Limited.

11. Spinger TA. 1985. Hybridoma Technology in Biosciences and Medicine. Plenum Press.

12. Warton, D.C. and McCarthy, R.E. 1972. Experiments and Methods in Biochemistry. MacMillan, New York.

13. Williams, B.L. and Wilson, K. 1983. A Biologist's Guide to Principles and Techniques of Practical Biochemistry. Edward Arnold Publishers Ltd., London.

14. Wilson, K. and Walker, J. 2003. Principles and Techniques of Practical Biochemistry, 5th Edition Cambridge University Press, New York.

Course Designer Dr. C. Ravi

Thiagarajar College, Madurai – 9 An Autonomous Institution Affiliated to Madurai Kamaraj University Re-Accredited with 'A++' Grade by NAAC Department of Zoology

(For those joined M. Phil., Zoology on or after June 2023)

Code	Course Title	Category	L	Т	Р	Credit
MZO23C12	Applied Entomology	Core-2	6	-	-	6

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

It provides the detailed information on economically important insect orders, including their characteristic feature. Applied entomology elaborate the impact of insects (both positive and negative) on human health, agriculture, and the environment. Disuss the techniques and methods that are useful for the management of harmful insects that cause significant damage to the crops. It also explain the detailed account on the management of harmful insects by adopting various methods, including IPM.

Prerequsites

The student should identify common insect in the crop fields and should posses knowledge on common pest control measures.

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected Proficiency %	Expected Attainment %
CO1	Classify and identify the insects on agricultural crops	70	70
CO2	Plan and implement plant protection and pest control measures according to the IPM principles in different crop ecosystem	70	70
CO3	Elaborate on Insect host relationship	70	70
CO4	Demonstrate practical fieldwork skills (e.g. ecological survey techniques, species identification and ecological impact assessments)	70	70
CO5	Implement the theoretical knowledge learnt in the farm. Lab- to-land approach	70	70

K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate K6: Create

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	L	S	L	S	S	Μ
CO2	S	S	S	Μ	S	S	Μ
CO3	Μ	Μ	S	-	Μ	S	Μ
CO4	S	S	S	Μ	S	S	Μ
CO5	S	S	S	Μ	S	S	S

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1	S	S	Μ	S	Μ
CO2	S	Μ	S	S	L
CO3	S	Μ	S	Μ	L
CO4	S	М	S	М	L
CO5	S	S	S	S	

Strong –S (+++), Medium –M (++), Low-L (+)

Blooms taxonomy: Assessment Pattern

Blooms Taxonomy							
		СА					
	I Internal Marks	II Internal Marks	Marks				
Knowledge -K1	20	20	40				
Understand -K2	20	20	40				
Apply-K3	20	20	40				
Analyze-K4	20	20	40				
Evaluate-K5	20	20	20				
Create-K6	20	20	20				

Title of the Course: Applied Entomology

Unit: I An outline classification and taxonomy of Class Insecta down to order level

Unit: II

Helpful insects Productive insects – Honey bee and lac insect-Insect pollinators-Predators and parasites-Weed killers-Soil builders-Scavengers- Aesthetic and scientific values of insects **Harmful insects** - Insects pests of crops and control measures Pests of rice-Pests of cotton-Pests of sugarcane- Pests of stored products - Insect pest in relation to public heath and household with reference to Mosquito and Housefly.

Unit: III

The idea of insect population Ecosystem and agro ecosystems-The ecological role of insect outbreak-Regulation of insect population Economic decision levels for Insect Pestpopulations, Economic damage, Economic injury level, Economic threshold, Calculation of economic decision level. Insect pest management - theory and practice The concept and development of insect pest management-Ecological management of the crop environment.

Unit: IV

Plant resistance and insects: Insect and host relationships.-Mechanism of resistance; Non – preference, antibiosis, tolerance -Factors mediating the expression of resistance - physical and biological pest control: Methods and principle of pest control.-Natural control Application of artificial or direct method-Biological control Integrated control-Role in juvenile mimics and pheromones in the management of insect pests-Recent advances in using plant products in the management of insect pests-Microbial bio insecticides- IPM in cotton.

Unit: V

Insecticides classification of Insecticides

Classification based on mode of entry-Classification based on mode of action Classification based on chemical nature Plant production appliances: Dusting and dusters-Aerosols-Spraying and sprayers- Vaporisers

Reference books:

1. Ananthakrishnan, T.N. 1982. Recent advances in Entomology in India. S. Viswanathan Publishers.

2. Busvine, J.R. 1980. Insect and Hygiene. III edition, Chapman& Hall, New York.

3. Chapman, R.F. and Joern, A.1990. (eds.). Biology of Grasshoppers. John Willy & Sons, NewYork.

4. Chapman, R.F. 1982. The insect: Structure and Function. ELBS.

5. David, B.V. and Kumarasamy, T.2002. Elements of Economic Entomology. Popular Book Depot, Madras.

6. Mani, M.S. 1982. General Entomology. Oxford and IBH Publishing, New Delhi.

7. Nayar,K.K., Ananthakrishnan,T.N. and David, B.V.1976.General and Applied Entomology. Tata McGraw Hill Publishing Co.

8. Pedigo, L.P.1996.Entomology and Pest Managment.Prentice Hall of India, New Delhi.

9. Regupathy, A., Palanisamy, S., Chandramohan, N. and Gunathilagaraj, K. 1997. A guide on Crop Pests. Sooriya Desktop Publishers, Coimbatore, India.

10. Richards, O.W. and Davies, R.G.1977. Imm's General Text Book of Entomology. X edition. Chapman & Hall, London.

11. Wigglesworth, V.B.1972. The Principles of Insect Physiology. Chapman & Hall, NewYork.

Course Designers Dr.C.Balasubramanian

Thiagarajar College, Madurai – 9 An Autonomous Institution Affiliated to Madurai Kamaraj University Re-Accredited with 'A++' Grade by NAAC Department of Zoology

(For those joined M. Phil.,,Zoology on or after June 2023)

Course Code	Course Title	Category	L	Т	Р	Credit
MZO23C13	Research Methodology II	Core 3	6	-	-	6

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

Research scholars will be exposed to the main components of a research framework i.e., problem definition, research design, data collection, ethical issues in research, report writing, and presentation. Specifically, the course introduce them to the basic concepts used in research. It includes discussions on sampling techniques, research designs and techniques of analysis.

Prerequsites

Basic idea on research design, thesis writing and data analyses

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected Proficiency %	Expected Attainment%
CO1	Identify, design and execute research problems suggested.	70	70
CO2	Spell and collect relevant literature from various sources	70	70
CO3	Elaborate their findings in conferences.	70	70
CO4	Analyse and Prepare research report and thesis	70	70
CO5	Placed in a research institute to conduct disciplined research under supervision in an area of their choosing.	70	70

K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate K6: Create

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	-	М	S	Μ
CO2	S	Μ	S	Μ	-	S	M
CO3	S	S	S	S	L	S	S
CO4	L	Μ	S	S	-	S	S
CO5	-	M	S	S	Μ	S	S

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5
CO1		S	Μ	S	
CO2	Μ	S	S	S	Μ
CO3		L	Μ	Μ	Μ
CO4		L	М	S	Μ
CO5	Μ	Μ	S	S	Μ

Strong –S (+++), Medium –M (++), Low-L (+)

Blooms taxonomy: Assessment Pattern

Blooms Taxonomy							
	(End of Semester					
	I Internal Marks	II Internal Marks	Marks				
Knowledge -K1	20	20	40				
Understand -K2	20	20	40				
Apply-K3	20	20	40				
Analyze-K4	20	20	40				
Evaluate-K5	20	20	20				
Create-K6	20	20	20				

Title of the Course: Research Methodology II

Unit I

Objectives and significance of research, types of research - descriptive vs. analytical, applied vs. fundamental, quantitative vs. qualitative, conceptual vs. empirical; literature review - various sources of information; identification, defining and devising of research problem.

Unit II

Hypothesis - null and alternate hypothesis - hypothesis testing; Exploratory and descriptive research design - concept, types and uses; Concept of independent and dependent variables;

Sampling methods - sample, sampling frame, sampling error, sample size, non-response, simple random sample, systematic sample, stratified random sample and multi-stage sampling, determining size of the sample - practical considerations in sampling and sample size; Sample collection, transport, handling and preservation of microorganisms, planktons, insects, animals from natural and lab bred population; Biological models

Unit III

Observation and collection of data - methods of data collection; data Processing and analysis strategies - univariate analysis (frequency tables, bar charts, pie charts, percentages), measures of central tendency and dispersion; bivariate analysis - cross tabulations and chi-square test including testing hypothesis of association; Correlation, Regression, ANOVA – one and two way, DMRT, Tukey test; R software.

Unit IV

Thesis writing - Introduction, Review of literature, Methodology, Results - illustrations and tables, Discussion, Bibliography, Foot notes and proof correction. Oral presentation - planning and preparation - use of visual aids - importance of effective communication; Publication of research articles – plagiarism – copyright violation – choosing the right journal; refereed journals, open access journals, citation, impact factor, SCI, H index, i10 index, referencing software

Unit V

Impact of research on environment - GMO; Biosafety measures – risk assessment and management - Institutional biosafety - ethical and animal welfare committee; Ethical, legal and social issues related to research; Ethical implications of biotechnological products and techniques; IPR - copy right - patent - patent law – patenting of biological process and products in India – trademark - WIPO; Reproduction of published material - Plagiarism - Acknowledgement

Reference Books

- 1. Day, R.A., 1992. How to Write and Publish a Scientific Paper, Cambridge University Press.
- 2. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications.
- 3. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An Introduction to Research Methodology, RBSA Publishers.
- 4. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
- 5. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall.
- 6. Martin. M.W. and Schinzinger.R. 2003. Ethics in engineering, III Edition, Tata McGraw-Hill, New Delhi.
- 7. Satarkar, S.V., 2000. Intellectual Property Rights and Copy right. Ess Ess Publications.
- 8. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
- 9. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, AtomicDog Publishing. 270p.
- 10. Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.

Course Designer Dr. C. Ravi

Thiagarajar College, Madurai – 9 An Autonomous Institution Affiliated to Madurai Kamaraj University Re-Accredited with 'A++' Grade by NAAC Department of Zoology

(For those joined M. Phil.,Zoology on or after June 2023) Programme Code :PZO

Course Code	Course Title	Category	L	Т	Р	Credit
MZO23PJ21	Project		-	-	6	6

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	100	100	200

Preamble

Learn to collect and read literature pertaining to their project work. Train the students to do lab exercise individually under the guidance of their project guide. Design an experient to meet the objective of the project.

Prerequsites

Basic knowledge on the Laboratory techniques related to Life Sciences .Interpretation of data using statistical tools, basic computer literacy.

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected Proficiency %	Expected Attainment %
CO1	Collect and analyse the scientific literature from web resources. Critically evaluate information and ideas from multiple perspectives Integrate knowledge at the forefront of a particular field	70	80
CO2	Design an original research that takes a new technological, methodological, or theoretical approach	70	80
CO3	Demonstrate theoretical basis and practical skills in the use of tools, technologies and methods common to life sciences	70	80
CO4	Apply the scientific method and evaluate and interpret the results obtained using statistical tools.	70	80
CO5	Articulate analyses and propose a summative project or paper that propose solutions in response to social issues . Communicate and disseminate research findings effectively in the academic community and to stakeholders in society	70	80

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

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	-	S	S
CO2	S	S	S	S	S	S	S
CO3	S	S	S	S	Μ	S	Μ
CO4	S	S	S	Μ	-	S	S
CO5	S	S	S	S	L	S	S

Strong –S (+++), Medium –M (++), Low-L (+)

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S		S	L	-
CO2	S	S	S	L	-
CO3	Μ	S	L	L	М
CO4	М	S	S	L	М
CO5	S	S	S	Μ	-

Strong –S (+++), Medium –M (++), Low-L (+)

Thiagarajar College

(An Autonomous Institution Affiliated to Madurai Kamaraj University) Re-Accreditedwith_A++ 'Grade by NAAC

Academic Council Meeting (ACM) June-2023

Department of Zoology B.Sc., Zoology Syllabus 2023-2024

B.Sc., Zoology Programme Code-UZO

Dr.RM.Murugappan Dean, Curriculum Development

Programmeoutcome-PO(Aligned with Graduate Attributes)-<u>**Bachelor of Science (B.Sc.,)</u>**</u>

PO1- ScientificKnowledgeandCriticalThinking

Apply the knowledge of Life Science, Physical and Chemical Science, Mathematics, statistics, Computer science and humanities for the attainment of solutions to the problems that comeacrossin ourday-to-daylife/activities.

PO2- ProblemSolving

Identify and analyze the problem andformulate solutions for problems using the principles of mathematics, natural sciences with appropriate consideration for the public health, safety and environmental considerations.,

PO3- CommunicationandComputerLiteracy

Communicate the fundamental and advanced concepts of their discipline in written and oralform. Able to make appropriate and effective use of information and information technologyrelevantto their discipline

PO4- Life-LongLearning

Recognize the need for and have the preparation and ability to engage in independent and lifelonglearningin the broadest context of technologicalchange.

PO5-Ethical,SocialandProfessionalUnderstanding

Commitment to principles, codes of conduct and social responsibility in order to behaveconsistently with personal respect. Acquire the responsibility to contribute for the personaldevelopment and for the development of the community. Respect the ethical values, socialresponsibilities and diversity.

PO 6-Innovative,LeadershipandEntrepreneurSkillDevelopment

Function as an individual, and as member or leader in diverse teams and in multidisciplinarysettings. Become an entrepreneur by acquiring technical, communicative, problem solving, intellectual skills.

THIAGARAJARCOLLEGE,MADURAI–9. (Re-Accreditedwith'A++'GradebyNAAC) Departmentof Zoology

Vision

• Torenderexemplaryqualityeducation inLifeSciencesand laboratoryskillsin order toproduce generationsofresponsible, competentandemployablegraduates

Mission

- Toprovideacomprehensivesetofcoursesinbiologicalsciencesthatenhancestheunderstanding, depthofknowledgeandtechnicalcompetencyofthe students.
- Topreparethestudentsforentry-levelresearchandteachingPositionsinbiologicalsciences.
- To provide an environment that fosters the development of appropriatescientific vocabulary, reasoning skills, effective oral and written communication abilities for students.
- Tocreateaholisticunderstandingofthealliedsubjectsthroughinterdisciplinarylearning.

ProgrammeEducationalObjectives(PEO)-B.Sc Zoology

Theobjectivesofthisprogramme(B.Sc., Zoology)istoequip/prepare thestudentsto

PEO1	Appraisethetaxonomy, diversity, relationship and evolution of animals.
PEO2	Elaborate the importance and interrelationship of basic, applied and advanced fields of
	lifesciences.
PEO3	Createanawarenessamongthepublicontheimportanceandinfluenceofanimalson
	theenvironment, society, and development.
PEO4	Think methodically, independently and draw a logical conclusion for a
	biological/environmentalproblem.
PEO5	Anewgeneration of zoologists, capable of excelling incareers of their choosing and
	nationbuilding

Programmespecificoutcomes- B.Sc., Zoology

OnthesuccessfulcompletionofB.Sc.,Zoologythestudentswill

PSO1	Comprehendthecoreconcepts, methods and recenttrends/updates/practices in different disciplines of lifesciences.
PSO2	$\label{eq:explain} Explain how organisms function at the level of the gene, genome, cell, tissue, organisms for the level of the gene, genome, cell, the second s$
	andorgan-system.
PSO3	Interpret the complex evolutionary processes, behavioural pattern, physiological and
	biochemicalprocessesofvariousanimal
PSO4	Acquire theoretical basis and practical skills in the use of basic tools, technologies
	andmethods common to different disciplines of life sciences like.Taxonomy,
	Physiology, Ecology, Cellbiology, Genetics, Applied Zoology, Clinical science, Biochemist
	ry,
	biotechnology, Microbiology, Immunologyetc.
PSO5	Developsempathyandlovetowardstheanimals. Applytheknowledgeand
	understandingofvariousdisciplinesoflifescience toone'sownlife and work
THIAGARAJARCOLLEGE, MADURAI-9.

(Re-Accredited with 'A'Gradeby NAAC)

Department of Zoology

Bachelor of Science (B.Sc.,) Zoology (w.e.f. 2020 batchonwards)

Programme Code - UZO

Semester-I

Course		Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Part - I	Tamil	U23P1TA11 B	பொதுத்தமிழ் - I	6	3	90	25	75	100
Part - II	English	U23P2EN11	General English - I	4	3	60	25	75	100
	Core The 1	UZO23CT11	Invertebrata I	4	4	60	25	75	100
	Core The 2	UZO23CT12	Invertebrata II	3	3	45	25	75	100
Part -	Core Lab 1	UZO23CL11	Lab in Invertebrata	2	1	30	25	75	100
III	Generic Elec Theo Chem1	UCH23GT11Z	Ancillary Chemistry	3	2	30	25	75	100
	Generic Elec Lab Chem	UCH23GL21Z	Ancillary Chemistry Lab	2	-	30	-	-	-
	NME 1	UZO23NT11	Apiculture	2	2	30	25	75	100
Part - IV	Foundation Course	UZO23FT11	GoodLaboratory Practices	2	2	30	25	75	100
	AECC1	UEN23AT11	Introduction to Personality Development	2	2	30	25	75	100
TOTAL				30	22				

Semester-II.

Course		Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Part - I	Tamil	U23P1T21	பொதுத்தமிழ் - II	6	3	90	25	75	100
Part - II	English	U23P2E21	General English - II	4	3	60	25	75	100
	Core The 3	UZO23CT21	Chordata	4	4	60	25	75	100
	Core The 4	UZO23CT22	CT22 Biochemistry		3	45	25	75	100
Part -	Core Lab 2	UZO23CL21	.21 Chordata Lab		1	30	25	75	100
III	Generic Elec Theo Chem2	UCH23GT21Z	Ancillary Chemistry	3	2	30	25	75	100
	Generic Elec Lab Chem1	UCH23GL21Z	Ancillary Chemistry Lab	2	2	30	25	75	100
Part-IV	NME 2	UZO23NT21	Sericulture	2	2	30	25	75	100
	SEC1	UZO23ST21	Ornamental Fish Farming and Management/ Aquarium Keeping	2	2	30	25	75	100
	AECC 2	UEN23AT21	Employability Skills	2	2	30	25	75	100
TOTAL				30	24	450			
Extra creditNaan MudhalvanScheme Language Proficiency for Employability			2						

Thiagarajar College, Madurai. Department of Zoology, 42nd ACM, Syllabus 2023-2024

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total
							Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	10	12	10	12	22	18	84
Part IV	6	6	6	6	3	4	31
Part V	-	-	-	-	-	1	1
Total	22	24	22	24	25	23	140
NAAN MU Cou —Extra	DHALVAN urses Credit —	02		02		02	06

Consolidated Semester wise and Component wise Credit distribution

*Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree

Thiagarajar College, Madurai – 9 Re-Accredited with 'A' Grade by NAAC B.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Department of –Zoology Programme code:UZO

Course Code		courseTitle	Category	L	Т	Р	Credit
UZO23CT	11	nvertebrata-I	Core-1	4	-	I	4
Year	Semester	Int.Ma	nrks	Ex	t.Mar	ks	Total
First	First	25			75		100

Preamble

Invertebrates comprises of fascinating group of animals inhabiting diverse niches across the globe. The diversity and their ecosystem services are of paramount importance and theyreceive special attention in the medical field too. This course will take the students through thewonderful invertebrate world and make them realize the significance of these tiny spinelesscreatures.

Onthecompletionofthecoursethestudentwillbeableto

CourseOutcomes

	Courseoutcomes	Expected Proficienc	Proficiency Attainment%
		y %	
CO1	Define the fundamental concepts, history and	60	70
	development of invertebrates.		
CO2	Outline the taxonomical classification of invertebrates.	60	70
CO3	Analyse the structural, functional organization and	60	60
	importance of invertebrates.		
CO4	Imparts conceptual knowledge of invertebrate	60	60
	adaptations to their environment		
CO5	Recognize the affinities and interaction between different	60	60
	invertebrate groups		

K1:Knowledge K2:Understand K3: Apply

MappingofCourseOutcomeswithProgrammeSpecificOutcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	-	S	M	M
CO2	S	-	S	M	L
CO3	S	-	S	Μ	M
CO4	S	-	S	Μ	S
CO5	S	Μ	S	M	S

Strong–S(+++)Medium-M(++)Low-L(+)

MappingofCourseOutcomes withProgrammeOutcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	-	S	L	M
CO2	S	M	-	Μ	-	L
CO3	S	M	L	S	-	L
CO4	S	M	L	S	L	L
CO5	Μ	S	L	Μ	L	L

Bloomstaxonomy:AssessmentPattern

	(CA	End
	Firs t	Secon d	ofSemes ter
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

CourseTitle:Invertebrata-I

UnitI:

Protozoa: Introduction to Classification, taxonomy and nomenclature. General characters and classification of Phylum Protozoa up to classes. Type study - *Paramecium* and *Plasmodium* - Parasitic protozoans (*Entamoeba*, *Trypanasoma&Leishmania*) - Economic importance Nutrition in protozoa - Host-parasitic interactions in *Entamoeba* and *Plasmodium*-Locomotion in protozoa

UnitII:

Porifera: General characters and classification up to Classes. Type study - Ascon& Sycon - Canal system in sponges - Skeleton in sponges, Economic importance, Canal system in sponges - Reproduction in sponges.

UnitIII:

Coelenterata : General characters and classification up to classes – Type study - *Obelia* and *Aurelia* - Corals and coral reefs - Polymorphism - Economic importance - Mesenteries in Anthozoa - Economic importance of corals and coral reefs - Polymorphism in Hydrozoa.

UnitIV:

Platyhelminthes: General characters and classification of up to classes. Type study – *Fasciola hepatica*. Nemathelminthes: *Taenia solium*– Parasitic adaptations. Host- parasitic interactions of Helminth parasites. Nematode Parasites and diseases - *Wuchereriabancrofti, Enterobius vermicularis, Ancylostome duodenale*. Aschelminthes : General characters and classification of up to classes - Type study - *Ascaris lumbricoide*

UnitV:

Annelida: General characters and classification up to Classes. Type study *–Nereis* and *Hirudinariagranulosa*.Metamerism Nephridium and coelomoducts - Modes of life in Annelids.REproduction in polychaetes.

Text Books

- 1. EkambaranathaIyer,M.andAnanthakrishnan,T.N.2003.AManualofZoology,Viswanathan Publications, Chennai.
- $2. \ Jordon, E.L. and Verma, P.S. 2005. Invertebrate Zoology, S. Chand \& Co. New Delhi$

Reference Books

- 1. Barnes, R.D. 1974. Invertebrate Zoology, W.B. Saunders & Co., Philadelphia.
- 2. Dhami, P.S. and Dhami, J.K. 2003. Invertebrate Zoology, R.Chand & Co. New Delhi.
- 3. Hyman, L.H.2017. The Invertebrates. McGrawHillpublishers, Delhi.
- 4. Kotpal, R.L. 2005. Invertebrate Zoology, RastogiPublications, Meerut.

Thiagarajar College, Madurai – 9 Re-Accredited with 'A' Grade by NAAC B.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Department of –Zoology Programme code:UZO

Code	CourseTitle	Category	L	Т	Р	Credit
UZO23CT12	Invertebrata II	Core-2	3	-	-	3

Year	Semester	Int.Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

Learn the basic concepts of invertebrate animals and recall its structure and functions. Elaborate on the fascinating group of animals inhabiting diverse niches acrossthe globe.

CourseOutcomes

Onthecompletionofthecoursethestudentwillbeableto

Proficiency % Attain	ment %
CO1Able to classify animals upto class level in each phylum70	70
based on their general characteristics.	
CO2Elaborate the organ systems of type study organisms70	70
under each phylum.	
CO3Identify the unique characteristics & specialized60	70
structures of each phylum	
CO4 Interpret the interaction of invertebrates with the 60	70
environment as pollinators, disease vectors & pests.	
CO5Exemplify the different crop pests, their damaging60	70
potential and control measures.	

K1:Knowledge K2:Understand K3: Apply

MappingofCourseOutcomeswithProgrammeSpecificOutcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Μ		Μ	Μ	S
CO2	Μ			Μ	M
CO3	Μ	Μ		Μ	S
CO4	L			Μ	Μ
CO5	Μ			Μ	

Strong–S (+++)Medium-M(++) Low-L(+)

MappingofCourseOutcomes withProgrammeOutcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	Μ	-	Μ	L	-
CO2	Μ	Μ	-	Μ	L	L
CO3	Μ	Μ	-	Μ	L	-
CO4	S	S	-	Μ	L	-
CO5	S	M	L	Μ	L	L

Strong–S(+++)Medium-M(++)Low-L(+)

Bloomstaxonomy:AssessmentPattern

	(CA	End
	First	Second	ofSemester
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

CourseTitle:Invertebrata II

UnitI-

Arthropoda: General characters and classification of Phylum Arthropoda up to Classes. Detailed study: *Penaeus indicus*. Affinities of *Peripatus* – Larval forms in Crustacea – Organization of Centipede and Millipedes.

Unit II

Mollusca: General characters and classification of Phylum Mollusca up to Classes. Detailed study: *Pila globosa*. Foot and torsion in Mollusca, Economic importance of Molluscs – Cephalopoda as the most advanced invertebrate.

UnitIII–

Echinodermata: General characters and classification of Phylum Echinodermata up to Classes. Detailed study: *Asterias*. Water vascular system in Echinodermata – Larval forms of Echinoderms. **UnitIV-**

Detailed study: *Periplaneta americana*. Insect pollinators- predators – parasites. Insects associated with human diseases: Mosquitoes, housefly, bed bug, human head louse. Insects associated with household materials: Ants, Termites, Silver fish.

UnitV-

Insect pests: Insect pests, life cycle and types of damage to plants. Pest of rice: Rice stem borer (*Scirpophagaincertulas*) – Pest of Sugarcane: The shoot borer (*Chiloinfuscatellus*) – Pest of coconut: The rhinoceros beetle (*Oryctes rhinoceros*) Pest of cotton: The spotted bollworm (*Eariasinsulana*) – Pests of vegetables: Brinjal-The shoot and fruit borer (*Leucinodesorbonalis*) – Cauliflower: The diamond black moth(*Plutellaxylostella*)Pests of fruits: Citrus butterfly(*Papiliodemoleus*) – Pest of stored products: The rice weevil(*Sitophilus oryzae*). Principles of Integrated Pest Management.

Text Books

- 1. EkambaranathaIyer,M.andAnanthakrishnan,T.N.2003.AManualofZoology,Viswanathan Publications, Chennai.
- 2. Jordon, E.L. and Verma, P.S. 2005. Invertebrate Zoology, S. Chand & Co. New Delh

Reference Books

- 1. Barnes, R.D. 1974. Invertebrate Zoology, W.B. Saunders & Co., Philadelphia.
- 2. Dhami, P.S. and Dhami, J.K. 2003. Invertebrate Zoology, R.Chand & Co. New Delhi.
- 3. Hyman, L.H.2017. The Invertebrates. McGrawHillpublishers, Delhi.
- 4. Kotpal, R.L. 2005. Invertebrate Zoology, RastogiPublications, Meerut

Thiagarajar College, Madurai – 625 009 Re-Accredited with 'A' Grade by NAAC B.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Department of –Zoology Programme code:UZO

Course Code	CourseTitle	Category	L	Т	Р	Credit
UZO23CL11	Lab in Invertebrata	Core Lab-1	-	-	2	1

Year	Semester	Int.Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

Invertebrates comprises of fascinating group of animals inhabiting diverse niches across

CourseOutcomes

Onthecompletionofthecoursethestudentwillbeableto

	Courseoutcomes	Expected	Expected
		Proficiency %	Attainment
			%
CO1	Able to identify the animals of invertebrate phyla and to recognize their distinguishing features.	70	70
CO2	Differentiate and compare the structure, function and mode of life of various groups of animals	70	70
CO3	Elucidate the life history of important invertebrates.	60	70
CO4	To compare and distinguish the dissected internal organs of lower animals.	70	70
CO5	Familiarize with the mounting procedure.	70	70

K1:Knowledge K2:Understand K3: Apply

MappingofCourseOutcomeswithProgrammeSpecificOutcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	L	Μ	S	L
CO2	S	Μ	Μ	S	M
CO3	S	L	S	L	L
CO4	S	L	S	M	L
CO5	S	Μ	S	L	L

Strong-S(+++)Medium-M(++)Low-L(+)

MappingofCourseOutcomes withProgrammeOutcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	L	-	S	M	L
CO2	S	S	-	Μ	L	-
CO3	S		-	Μ	-	L
CO4	S	L	-	Μ	-	-
CO5	S	Μ	-	S	L	-

Strong–S(+++)Medium-M(++)Low-L(+)

CourseTitle:InvertebrataLab

Major Dissection

Cockroach: Circulatory system, Nervous system, Reproductive system. Earthworm: Nervous System, Reproductive system. *Pila globosa*: Nervous system. Prawn: Nervous system (including Appendages).

Minor Dissection:

Cockroach: Digestive system. Earthworm: Viscera, Lateral hearts. *Pila globosa*: Digestive system (Including radula). Freshwater Mussel: Digestive system.

Mounting:

Earthworm: Body setae; Pineal setae. *Pila globosa*: Radula. Freshwater muscle: Pedal ganglia. Thestingof honeybee.

> Cockroach: Salivary apparatus, Mouth parts - Honey Bee, House fly and Mosquito mouth parts.

Spotters

(i). **Protozoa:** Amoeba, Paramoecium, Paramoecium Binary fission and Conjugation, Vorticella, Entamoeba histolytica, Plasmodium vivax

(ii). Porifera: Sycon, Spongilla, Euspongia, Sycon - T.S & L.S, Spicules, Gemmule

(iii). Coelenterata: Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula

(iv). Platyhelminthes: Planaria, Fasciola hepatica, Fasciola larval forms – Miracidium, Redia, Cercaria, Echinococcus granulosus, Taenia solium, Schistosoma haematobium

(v). Nemathelminthes: Ascaris(Male & Female), Drancunculus, Ancylostoma, Wuchereria (vi) Annelida: Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva

(vii). Arthropoda: Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus,

Larvae - Nauplius, Mysis, Zoea, Mouth parts of male & female Anopheles and Culex,

Mouthparts of Housefly and Butterfly.

(viii). Mollusca: Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva

(ix). Echinodermata: Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon, Bipinnaria Larva

Reference Books

- 1. P.S.Verma, 2004. AManual of Practical Zoology, S.Chand & Company ltd, New DDelhi.
- $2. \hspace{0.1in} S.S.Lal 2013 Practical Zoology, Invertebrate Rastogi Publications, Meerut.$
- 3. Jordon, E.L. and Verma, P.S. 2005. Invertebrate Zoology, S. Chand & Co. New Delhi
- 4. J.Sinha,A.K.ChatterjiandP.Chattopathiya2019.AdvancedPracticalZoology,BooksandAll ied (PvtPltd,Kolkata.
- 5. Jeyasuriaetal., 2013. Practical Zoology Vol IInvertebrate-Saras Publications

Thiagarajar College (Autonomous):: Madurai – 625 009 Re-Accredited with 'A' Grade by NAAC B.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Department of –Zoology Programme Code:UZO

Course Code	Course Title	Category	L	Т	Р	Credit
UZO23NT11	Apiculture	NME1	2	-	-	2

L-Lecture. T-Tutorial. P-Practicals

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

The course provides opportunity to learners to develop one step entrepreneurial skills how to rear honey bees, Harvest and market the honey, and maintain bees in a scientific way and to know the importance for becoming successful entrepreneur.

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected Proficiency %	Expected Attainment %
CO1	Familiarize with the Life cycle of bee colony and types	70	60
CO2	Handle beekeeping systems and beekeeping equipment	70	60
CO3	Manage and maintain beehives for production and pollination	70	60
CO4	Extract honey using appropriate procedure, Asses the quality	70	60
CO5	Develop entrepreneur skills by theoretical learning	60	60

K1: Knowledge K2: Understand K3: Apply

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Μ	-	Μ	Μ	S
CO2	Μ	-	Μ	Μ	S
CO3	Μ	-	Μ	Μ	S
CO4	S	-	Μ	Μ	S
CO5	L	-	-	L	S

Mapping of Course Outcomes with Programme Outcomes

	102	rus	r04	PO5	PO6
S	Μ	-	S	Μ	S
S	Μ	-	S	Μ	S
S	Μ	-	S	Μ	S
S	Μ	-	S	Μ	S
S	Μ	-	S	Μ	S
	S S S S S S S	S M S M S M S M S M S M	S M - S M - S M - S M - S M - S M -	S M - S S M - S S M - S S M - S S M - S S M - S S M - S	S M - S M S M - S M S M - S M S M - S M S M - S M S M - S M S M - S M

Strong –S (+++) Medium-M (++) Low-L (+)

Blooms taxonomy: Assessment Pattern

	(CA	End of
	First	Second	Semester
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Course Title:Apiculture

Unit I

History and Biology of Honey bee

History, Importance and Scope of Apiculture- Different species of Honey bees, Colony organization and life cycle, Social behavior of honey bees

Unit II

Diseases and Enemies of Honey bees

Pests of Honey – Wax moth, Ants, Wasps, Mites Bacterial disease- American Foulbrood, Viral disease – deformed wing virus, Fungal disease – Chalkbrood, Protozoan disease- *Nosema cerana*

UNIT – III

Methods of Bee Keeping

Selection of site for apiary, Management of apiary at different seasons. Bee keeping equipment, Methods of bee keeping- Traditional and Modern methods.

Unit IV

Honey processing and Bee Hive products

Honey processing- Collection and Extraction, Processing, Preservation and storage of honey. Quality control standards - Honey testing

Unit V

Honey- properties, adulteration and therapeutic application. Bee products – Royal jelly, Pollen, Propolis, Bee wax, Bee venom.

Text Books

1. Jayashree, K.V, C.S. Tharadevi, C.S. N. Aruugam 2014. Apiculture, Saras Publication. TN.

2. Ravindranathan, K.R., 2005, A text book of Economic Zoology, Dominant publisher and distributors (P) Ltd., New Delhi.

http://nbb.gov.in/ National Bee Board http://ecoursesonline.iasri.res.in/mod/page/view.phpid=16175

Thiagarajar College, Madurai – 625 009 Re-Accredited with 'A++' Grade by NAAC B.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Department of –Zoology

Programme code:UZO

CourseCode	CourseTitle	Category	L	Т	Р	Credit
UZO23FT1	Good Laboratory Practices	Foundation Course	2	-	-	2

Year	Semester	Int.Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

Good Laboratory Practice (GLP) is a quality system covering the organizational process and conditions under which non-clinical laboratory studies are planned, performed, monitored, recorded, reported, and archived. GLP ensures the quality and integrity of safety test data submitted to the government for the issuance of research permits.

CourseOutcomes

Onthecompletionofthecoursethestudentwillbeableto

	Course outcomes	Droficionay	Exported
	Course outcomes	Proficiency	Expected
		Expected%	Attainment %
CO1	Comprehend the idea of living organisms and outline the process of	70	70
	scientific discovery.		
CO2	Appreciate the major contributors and specializations in the field of	70	70
	Zoology		
CO3	Aware of various job avenues in the field of Zoology and exposure	70	70
	to entrepreneurial ventures		
CO4	Have basic knowledge in biosystematics and taxonomy	70	70
CO5	Calculate chemical compositions for reagent preparation and	70	70
	thorough knowledge of safety procedures of the laboratory		

K1:Knowledge K2:Understand K3: Apply

MappingofCourseOutcomes withProgrammeOutcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	L	-	S	M	Μ
CO2	S	S	-	S	M	L
CO3	S	S	-	S	M	L
CO4	S	S	Μ	S	S	L
CO5	S	S	Μ	S	S	Μ

Strong–S(+++)Medium-M(++)Low-L(+)

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L		M		Μ
CO2	Μ	L	S	L	L
CO3	Μ	L	L	Μ	Μ
CO4	Μ		M	Μ	Μ
CO5		Μ	S	S	Μ

MappingofCourseOutcomeswithProgrammeSpecificOutcomes

Course Title : Good Laboratory Practices

Unit-I-Nature of Life

The Science of Zoology-General Properties of Living Systems- Chemical uniqueness-Complexity and hierarchical organization (acellular, unicellular and multicellular) -Reproduction (asexual & sexual) - Possession of a genetic program- Metabolism (Homeostatsis) - Development- Environmental interaction - Evolutionary adaptation. Introduction to Scientific Studies: Types of knowledge: practical, theoretical, and scientific knowledge. The scientific method- Observation-Hypothesis- prediction- method of experiment-results- conclusion-Knowledge dissemination- Journals and patents.

Unit-II History and Branches in Zoology

Contributions of William Harvey, Carl Linnaeus, Schleiden, Schwann, Lamarck, Charles Darwin, de Vries, Mendel and Louis Pasteur. Branches of Zoology- Morphology- Histology-Anatomy- Physiology-Embryology-Genetics-Ecology- Ethology- Evolution- Branches based on taxonomic Categories: Ichthyology –Batrachology- Herpetology - Ornithology - Malacology - Mammalogy -Entomology –Anthropology.

Unit-III Scope of Zoology

Opportunities as Zoologist- Government and Private- entrepreneurial – Apiculture, Sericulture, Lac culture-aquaculture- dairy farming-poultry farming. Institutes of Zoological and Scientific importance in India- Location, major activities (academic and scientific) of Zoological Survey of India, Central Marine Fisheries Research Institute, Central Institute of Brackish water aquaculture, Rajiv Gandhi Centre for Aquaculture.

Unit-IV Taxonomical Principles and tools

Systematics, Taxonomy, Phylogeny [Brief account], Approaches to taxonomy, Molecular taxonomy, Bar coding. Zoological nomenclature, International Code of Zoological Nomenclature (ICZN) Identification tools -Taxonomic key.

Unit-V Introduction to Practical Zoology

Preparing Solutions: Percent Solutions — Mass per Volume Percent Solutions — Volume per Volume Percent Solutions. Using Stock Solutions Given in Terms of $-x\parallel$,

Molar Solutions — The Mole — Molarity — Making Molar Solutions- Normality solutions-Problems. Precautions and safety in handling: chemicals, reagents, solutions and solids. Laboratory associated hazards/infections, disposal of biohazard materials, fire prevention and safety.

Recommended Texts

- 1. Jordan, E.L. and Verma, P.S. 2005. Invertebrate Zoology, S.Chand & Co.New Delhi
- 2. Stephenson F. H. 2010. Calculations for Molecular Biology and Biotechnology: A Guide to Mathematics in the Laboratory. 2nd edition Academic Press Inc, London, UK.
- 3. Raven P, Johnson G, Mason K , Losos J, Singer S 2016 Biology, 11th edition, McGraw-Hill Education, New Delhi
- 4. Ekambaranatha Iyer, M. and Ananthakrishnan, T.N. 2003. A Manual of Zoology, Viswanathan Publications, Chennai.
- 5. P.S.Verma, 2004.A Manual of Practical Zoology, S.Chand & Company Ltd, New Delhi
- 6. Lal S.S 2013 Practical Zoology, Invertebrate Rastogi Publications, Meerut.

Thiagarajar College, Madurai – 9 Re-Accredited with 'A' Grade by NAAC B.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Department of –Zoology Programme code:UZO

Course Code	Course Title	Category	L	Т	Р	Credit
UZO23CT21	Chordata	Core-2	4	-	-	4

Year	Semester	Int.Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

The course provides a overview of chord atediversity & special characteristics. It outlines the general characteristics, an atomy and adaptations of each class of vertebrates.

CourseOutcomes

Onthecompletionofthecoursethestudentwillbeableto

	Courseoutcomes	Expected Proficiency %	Expected Attainment%
CO1	Elaboratethe morphology&affinitiesofprochordates	70	70
CO2	DescribeScoliodonandappreciatethe specialcharacteristicsoforderPisces.	70	70
CO3	ComparativestudiesRanahexadactyla&Calotesversicolor	70	70
CO4	Explain <i>Columbalivia</i> withspecialreferencetoflightadaptationsand mechanismofflight	70	70
CO5	Compare different types of Mammals and their adaptation	70	70

K1:Knowledge K2:Understand K3: Apply

MappingofCourseOutcomeswithProgrammeSpecificOutcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Μ		Μ	Μ	S
CO2	Μ			M	M
CO3	Μ	Μ		Μ	S
CO4	L			Μ	Μ
CO5	Μ			M	

Strong–S(+++)Medium-M(++)Low-L(+) MappingofCourseOutcomes withProgrammeOutcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	-	-	Μ	-	-
CO2	M	L	-	Μ	L	-
CO3	M	L	-	Μ	L	L
CO4	M	-	-	Μ	L	-
CO5	S	S	-L	Μ	L	L

Strong–S(+++)Medium-M(++)Low-L(+)

Bloomstaxonomy:AssessmentPattern

	(End	
	First Second		ofSemest
			er
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

CourseTitle:Chordata

UnitI: Prochordates

General characteristics of chordates- classification upto class level– Prochordates – cephalochordate-*Amphioxus*morphology,feedingmechanism&affinities-Hemichordates-*Balanoglossus*externalmorphology&affinities–Urochcordata– Ascidianexternalmorphology, affinities&retrogressivemetamorphosis.

UnitII: Pisces

Generalcharacteristics&classificationuptoorders–OstacodermandPlacodermscharacters&significance–Petromyzonexternalmorphology&comparisonwithhagfishes-Type study *Scoliodon*– externalmorphology, digestion, respiration, bloodvascular system , nervous system, urinogenital system – Parental care andMigration infishes

UnitIII: Amphibia& Reptilia

Amphibia:Generalcharacteristics&classificationuptoorders–Typestudy*Ranahexadactyla*externalmorphology, digestion, respiration, blood vascular system, nervoussystem ,urinogenital system– Parentalcareinamphibians

Reptilia:Generalcharacteristics&classificationuptoorders-Typestudy*Calotesversicolor*externalmorphology, digestion, respiration, blood vascular system, nervous system, urinogenital system – Poison apparatus & biting mechanism of snakes –Jacobson'sorgan

UnitIV :Aves

General characteristics & classification upto orders – Type study *Columba livia* - externalmorphology,digestion,respiration,bloodvascularsystem,nervoussystem,urinogenit alsystem-Flightadaptations-Mechanismofflight–structureofcontourfeather –migrationin birds.Flightlessbirds

UnitV:Mammalia

General characteristics & classification upto orders – Type study *Oryctolagus*externalmorphology,digestion,respiration,bloodvascularsystem,nervoussystem,urinogenit alsystem-Flyingmammals&theiradaptations–Aquaticmammals&adaptations-Egglayingmammals-Pouched mammals

Text Books

- 1. JordanELandVerma PS(2013)Chordate Zoology,S.Chand&CoLtd.,NewDelhi
- 2. AyyarE(1982)ManualofZoologyVol.II-.S.Viswanathan(Printers&Publishers)Pvt.Ltd.,Chennai.

Reference Books

- 1. RomerAS(1992)Thevertebratebody,3rdEdition,Vakils, FeferandSimonsPvt. Ltd,Mumbai.
- 2. KotpalRL(2014)ModerntextbookofZoologyVertebrates.3rdEditionRastogiPubic ations,Meerut.
- 3. Saxena RK and Saxena S (2008) Comparative anatomy of vertebrates. Viva books Pvt.Ltd.,NewDelhi.

Thiagarajar College, Madurai – 9 Re-Accredited with 'A' Grade by NAAC B.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Department of –Zoology Programme code:UZO

Course Code	CourseTitle	Category	L	Т	Р	Credit
UZO23CL21	Chordata Lab	Core Lab-2		-	2	1

Year	Semester	Int.Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

The course provides a overview of chord atediversity & special characteristics. It outlines the general characteristics, anatomy and a daptations of each class of vertebrates.

CourseOutcomes

Onthecompletionofthecoursethestudentwillbeableto

Courseoutcomes	Expected	Expected
	Proficiency %	Attainment%
Elaboratethemorphology&differentiationofanimals	70	70
Proficientindissectionanddisplayoffishesand	70	70
otherchordates		
Efficientinmounting of parts of organs	70	70
Studyofdifferentsystemsusingvirtualdissection	70	70
Identifythe preserved specimensand theirimportance	70	70
	Courseoutcomes Elaboratethemorphology&differentiationofanimals Proficientindissectionanddisplayoffishesand otherchordates Efficientinmountingof partsof organs Studyofdifferentsystemsusingvirtualdissection Identifythe preserved specimensand theirimportance	CourseoutcomesExpected Proficiency%Elaboratethemorphology&differentiationofanimals70Proficientindissectionanddisplayoffishesand otherchordates70Efficientinmountingof partsof organs70Studyofdifferentsystemsusingvirtualdissection70Identifythe preserved specimensand theirimportance70

K1:Knowledge K2:Understand K3: Apply

MappingofCourseOutcomeswithProgrammeSpecificOutcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Μ	-	S	S	Μ
CO2	S	-	S	S	Μ
CO3	S	-	Μ	S	Μ
CO4	S	-	S	S	L
CO5	Μ	-	L	S	-

Strong–S(+++)Medium-M(++)Low-L(+)

MappingofCourseOutcomes withProgrammeOutcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	L	-	Μ	-	L
CO2	S	S	-	Μ	S	-
CO3	S	L	-	L	S	-
CO4	S	S	S	Μ	-	Μ
CO5	Μ	Μ	-	Μ	L	-

Strong–S(+++)Medium-M(++)Low-L(+)

Bloomstaxonomy:AssessmentPattern

	C	A	End
	First	Second	ofSemes
			ter
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

CourseTitle:Chordatalab

- 1. Identifiation of
 - a. maleandfemale fishes
 - b. Poisonousand nonpoisonoussnakes
- 2. Differentiating sheep from goat., rabbit from

hare3.Morphologyof fishes.

- 4. Dissection and display of digestive system and cranial nerves of fishes.
- 5. Study of dentition in man and
- rat.6.Mountingof placoidscales

7. Comparitive study: Skeletal system of frog and rat.

Virtualdissection

- 1. Digestive, nervous and reproductive system of frog.
- 2. Rat–Digestive, respiratory, circulatory and reproductive system.

Spotters

- 1. Amphioxus, Balanoglossus, Ascidian
- 2. Shark, Catla, Goldfish, Electric ray, Echeneis
- 3. Frog, Toad, Tadpole Axolotyllarva, Hyla
- 4. Cobra, Krait, Russel viper, Python, Calotes, Chameleon.
- 5. Pigeon, Eagle, Kingfisher, Woodpecker, Peacock, Archaeopteryx
- 6. .Kangaroo,Pteropos.Echidna

Thiagarajar College, Madurai – 625 9 Re-Accredited with 'A' Grade by NAAC B.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Department of –Zoology Programme code: UZO

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Code	Course Title	Category	L	Τ	Р	Credit
UZO23CT21	Biochemistry	Core-3	3	-	-	3

Year	Semester	Int.Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

The course integrates the concepts of Chemistry in biology field to understand the biomolecules in a better way. It emphasizes on the chemical and physical properties of biomolecules. The structure, classification and functions of carbohydrates, proteins, lipids, and nucleic acids have been unravelled.

CourseOutcomes

Onthecompletionofthecoursethestudentwillbeableto

	Courseoutcomes	Expected	Expected
		Proficiency %	Attainment%
CO1	Illustrate the structure of atom, molecules and comprehend	70	60
	on the properties of water.		
CO2	Explain the structure, classification, properties and	70	60
	importance of carbohydrates.		
CO3	Decipher the structural complexity of proteins and their	60	60
	significance.		
CO4	Interpret the biological functions of lipids and understand the	70	60
	chemistry of nucleic acids		
CO5	Differentiate fat soluble from water soluble vitamins and	70	70
	unravel the mystery of enzymes.		

K1:Knowledge K2:Understand K3: Apply

MappingofCourseOutcomeswithProgrammeSpecificOutcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	Μ	L	S	Μ
CO2	S	Μ	L	S	L
CO3	S	Μ	L	S	L
CO4	Ŝ	Μ	Ĺ	Ŝ	L

Strong–S(+++)Medium-M(++)Low-L(+)

MappingofCourseOutcomes withProgrammeOutcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	L	-	Μ	-	L
CO2	S	L	-	Μ	-	L
CO3	S	L	-	Μ	-	L
CO4	S	L	-	Μ	-	L
CO5	S	L	-	Μ	-	Μ

Bloomstaxonomy:AssessmentPattern							
		CA	End				
	Firs t	Secon d	ofSemes ter				
Knowledge	40%	40%	40%				
Understan d	40%	40%	40%				
Apply	20%	20%	20%				

CourseTitlE: BIOCHEMISTRY

UnitI:

Structure of atoms and molecules; Types of bonds – Ionic, Covalent and Non covalent interactions - Van derWaals, Electrostatic, Hydrogen bonding and hydrophobic interactions; Water – molecular structure andproperties (Thermal, solvent and colligative) - dissociation and ionization of water; pH and buffers(bicarbonate, phosphate and acetate); Henderson-Hasselbalch equation; pKa; Redox reactions.

UnitII

Carbohydrates - classification – physical and chemical properties – isomerism; structure and biologicalimportance of glucose, fructose, galactose, maltose, sucrose, lactose, starch, glycogen and chitin; Glycolysis,Glycogenesis, Glycogenolysis, Kreb^w s cycle and Pentose phosphate pathway.

Unit III:

Amino acids - structure, classification (based on polarity), physical properties and chemical reactions.Proteins – classification, properties and biological importance; structural organization of protein - primary, secondary - Ramachandran plot, tertiary and quaternary structure.

Unit IV:

Lipids: Classification, properties (physical and chemical) and biological importance. Structure of triglyceridesand phospholipids; Biosynthesis of fatty acids and cholesterol; Beta oxidation and lipid peroxidation.

Unit V:

Enzymes: Classification and mechanism of action (lock and key and induced fit theories). Michaelis Mentenequation; Factors influencing enzyme activity; Regulation of enzyme activity; Coenzymes and isoenzymes.

Vitamins – types, source, significance and deficiency.

TEXT BOOKS

1. Jain, J.L., Sunjay Jain and Nitin Jain. 2010. Fundamentals of Biochemistry, Fifth Edition, S. Chand and Company Ltd, New Delhi.

2. Satyanarayana, U. and Chakrapani, U. 2009. Biochemistry, Books & Allied Pvt. Ltd., Kolkata

Reference Books

1.Berg J. M., Tymoczko J. L., Stryer L. 2002. Biochemistry, 5th ed., W. H. Freeman and Company, New York.

2. Murray, R.K., Granner, D.K., Mayes, P.A and Rodwell, V.W 1996. Harper's Biochemistry. 24th Edition. Prentice-Hall International.

3. Emil. L Smith., Philip, H. and Abraham, W 1973. Principles of Biochemistry. McGraw - Hill

International book Company.

4. Voet, D., Voet, G.J and Pratt, C.W. 2016. Fundamentals of Biochemistry. John Wiley and Sons, Inc.

5. Nelson, D.L., and M.M.Cox, 2010, Lehninger Principles of Biochemistry, 5th edition, Worth Publishers, New York.

6. Stryer, L., 2000. Fourth edition Biochemistry, W.H. Freeman and Company, New York.

7. Geoffrey L Zubay, William W Parson and Dennis E Vance1996. Principles of Biochemistry, William C.Brown Pub. U.K.

8. Campbell and Farrell 2008. Biochemistry Cengage Learning India (P) ltd. New Delhi.

9. Deb, A.C. 2011. Fundamentals of Biochemistry, 10th Edition, New Central Book Agency Pvt. Ltd., Kolkata.

Thiagarajar College, Madurai – 9 Re-Accredited with 'A++' Grade by NAAC B.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Department of –Zoology Programme code:UZO

Code	Course Title	Category	L	Т	P	Credit
UZO23NT21	Sericulture	NME	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

This course gives an overview of silkworm biology & introduces students to the methods of silkworm rearing.

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected	Expected
		Proficiency%	Attainment%
CO1	Classify silkworms & trace the history of sericulture	60	60
CO2	Summarize the lifecycle of Bombyx mori	70	70
CO3	Outline the methods of silkworm rearing	70	60
CO4	Describe the processing of harvested cocoons	60	50
CO5	Compare the symptoms & control measures of diseases affecting silkworm	60	60

K1: Knowledge K2: Understand K3: Apply

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	L	S	S	S	S
CO2	S	Μ	S	Μ	S	-
CO3	M	L	L	Μ	S	S
CO4	L	L	L	L	M	S
CO5	S	S	S	S	Μ	S

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Μ		M	Μ	S
CO2	Μ			Μ	Μ
CO3	Μ	Μ		M	S
CO4	L			M	Μ
CO5	М			M	

Blooms taxonomy: Assessment Pattern

	(CA	End of
	First	Second	Semester
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Title of the Course: Sericultrue

UNIT 1:

History of sericulture & silk route; Types of silkworms- mulberry & non-mulberry silkworms, univoltine, bivoltine & multivoltine. Bombyx mori- morphology and life cycle.

Unit II

Construction of rearing house, rearing equipments& disinfection; Methods of rearing mulberry silkworm.

Moriculture- Propogation-Seedling, cutting, grafting, layering and propogation.

UNIT III:

Diseases of silkworm- causes, symptoms. Pathogenesis & control measures of Flacherie, Green Muscardine, Pebrine& Nuclear Polyhedrosis virus; Pests of silkworm- nature of damage & control pf Uzi fly and red ants;

Unit IV

Physical and Commercial characteristic of cocoons. Harvesting, processing of cocoons – sorting, stifling, deflossing, riddling, cooking, brushing and reeling. Properties of raw and processed silk

Unit V

Marketing of cocoons, By products of sericulture industry. Role of central silk board. Visit to silk rearing unit.

Text Books

- 1. Ganga .G &Sulochana Chetty .J, An Introduction to Sericulture, 2nd ed., Oxford & IBH publishing house, (2020).
- 2. Madan Mohan Rao., An Introduction to sericulture 2nd ed., BS Publications (2019)
- 3. Shukla, G.S. and V.B. Upadhyay, Economic Zoology, First edition, Rastogi publication, Meerut(2016).

Thiagarajar College, Madurai – 625 009 Re-Accredited with 'A++' Grade by NAAC B.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Department of –Zoology Programme code:UZO

Course Code	Course Title	Category	L	Т	Р	Credit
UZ0238T21A	Ornamental Fish Farming and	SEC1	2	-	-	2
020235121A	Management					

L-Lecture. T-Tutorial. P-Practicals

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

The course provides opportunity to learners to understand ornamental fish culture in relation to entrepreneurship development

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected Proficiency %	Expected Attainment %
CO1	Identify, culture, maintain and market the commercially important ornamental fishes	70	60
CO2	Elaborate on the techniques of ornamental fish breeding and rearing	70	60
CO3	Prevent and Manage disease occurrence	70	60
CO4	Design and Construct an aquarium	70	60
CO5	Develop entrepreneur skills by theoretical learning	60	60

K1: Knowledge K2: Understand K3: Apply

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Μ	-	Μ	Μ	S
CO2	Μ	-	Μ	Μ	S
CO3	Μ	-	Μ	Μ	S
CO4	S	-	Μ	Μ	S
CO5	L	-	-	L	S

Mapping of Course Outcomes with Programme Outcomes

PO1	PO2	PO3	PO4	PO5	PO6
S	Μ	-	S	Μ	S
S	Μ	-	S	Μ	S
S	Μ	-	S	Μ	S
S	Μ	-	S	M	S
S	Μ	-	S	Μ	S
	PO1 S S S S	PO1PO2SMSMSMSMSM	PO1 PO2 PO3 S M - S M - S M - S M - S M - S M - S M - S M -	PO1 PO2 PO3 PO4 S M - S S M - S S M - S S M - S S M - S S M - S S M - S S M - S	PO1 PO2 PO3 PO4 PO5 S M - S M S M - S M S M - S M S M - S M S M - S M S M - S M S M - S M

Strong –S (+++) Medium-M (++) Low-L (+)

Blooms taxonomy: Assessment Pattern

		CA	End of
	First	Second	Semester
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Course Title:Ornamental Fish Farming and Management

Unit I:

Introduction ,Scope and importance of ornamental fish culture. Domestic and global scenario of ornamental fish trade and export potential. Commercially important ornamental fishes - Indigenous and exotic varieties.

Unit II:

Biology of egg layers and live bearers. Food and feeding in ornamental fishes. Formulated feed and Live feed; Live feed culture. Breeding, hatchery and nursery management of egg layers (eg. Goldfish) and live bearers (eg. Guppy).

Unit III:

Aquarium design and construction; Accessories - aerators, filters and lighting.

Aquarium plants and their propagation.

Maintenance of aquarium and water quality management.

Ornamental fish diseases, their prevention, control and treatment methods.

Unit IV

Conditioning, packing, transport and quarantine methods. Economics, trade regulations, domestic and export marketing strategies.

Practical

1) Identification of locally available ornamental fishes - Egg layers and live bearers.

2) Identification of locally available live feed organisms.

References:

1. Swain SK., Sarangi N. and Ayyappan S. 2010. Ornamental fish farming. ICAR, New Delhi.

2. Living Jewels – A handbook on freshwater ornamental fish, MPEDA, Kochi.

3. Dey V.K.A. 1997. A handbook on aquafarming ornamental fishes. MPEDA, Kochi.

4. Ahilan, B., Felix N. and Santhanam R. 2008. Text book of aquariculture. Daya Publishing House, New Delhi.

Thiagarajar College, Madurai – 9 Re-Accredited with 'A++' Grade by NAAC B.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Department of –Zoology

Programme code:UZO

Course Code	Course Title	Category	L	Т	Р	Credit
UZO23ST21B	Aquarium keeping	SEC1	2	-	-	2
TT (

L-Lecture. T-Tutorial. P-Practicals

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

To learn the basic principles, themes and steps needed to set-up and maintain an aquarium. The course provides opportunity to the learners to develop potential in the field of aquarium and get self-employment

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Expected Proficiency %	Expected Attainment %
CO1	Comprehend the key skills needed to set up an aquarium	70	60
CO2	Elaborate on the techniques of ornamental fish breeding and	70	60
	rearing		
CO3	Elaborate on different ornamental fishes and Manage disease	70	60
	occurrence		
CO4	Design and Construct an aquarium	70	60
CO5	Develop entrepreneur skills by theoretical learning	60	60

K1: Knowledge K2: Understand K3: Apply

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	М	-	Μ	М	S
CO2	Μ	-	Μ	Μ	S
CO3	Μ	-	Μ	Μ	S
CO4	S	-	Μ	Μ	S
CO5	L	-	-	L	S

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	Μ	-	S	Μ	S
CO2	S	Μ	-	S	Μ	S
CO3	S	Μ	-	S	Μ	S
CO4	S	Μ	-	S	Μ	S
CO5	S	Μ	-	S	Μ	S

Blooms taxonomy: Assessment Pattern

	CA		End of
	First	Second	Semester
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Course Title:Ornamental Fish Farming and Management

UNIT I

Introduction and scope - Aquarium fish keeping as hobby and cottage industry. Commercial aspects like national and international market. To create knowledge on self employment opportunity.

UNIT II

External morphology of a typical fish. Exotic and endemic varieties of ornamental fishes.

UNIT III

Aquarium preparation and maintenance - Kinds of tanks, tank setting, biological filter and aeration, water management, planting, lighting and feeds. Budget for setting up an Aquarium Fish Farm as a Cottage Industry

UNIT IV

Live fish transport- handling, feeding and forwarding techniques of fish. Fish Diseases and their control.

UNIT V

Breeding – Common characters and sexual dimorphism of Fresh water and Marine aquarium ornamental fish varieties such as Guppies, Mollies, Sword tails, Platy, Siamese fighters and Gold fish, Butterfly fish, Blue morph and Anemone fish.

Reference Books

1. Santhanam, P., Sukumaran, N. & P. Natarajan, A manual of freshwater aquaculture 1999, Oxford & IBH Publishing Company Pvt., Ltd., New Delhi.

2. Cliff Harrison, A colour guide to Tropical Fish 1980, Chartwell Books, INC, Cerkshire, printed in Hon Kong.

- 3. O'Connell, R. F., The freshwater aquarium 1977, Arco Publishing Company, INC New York.
- 4. JingranV.G., 1991: Fish and Fisheries in India Hindustan Publ.co. New Delhi
- 5. Mill Dick, 1993: Aquarium Fish, Daya Pub.co., New Delhi

Generic Elective (Allied Papers)

Offered by Zoology Department

GenericElectivecourseSyllabus ForBotany MajorStudents–w.e.f.2023June

Major	Year	Sem	Code	TitleofthePaper	Cont Hrs/W	Credit
Botany	Ι	Ι	UZO23GT11B	Applied ZoologyI	3	3
		II	UZO23GT21B	Applied Zoology II	3	3
		II	UZO20GL21B	Lab in Applied Zoology	2	2

SchemeofExaminarion

MarkStatements :	Internal(CA)	External(Sum)
Theory:	25	75
Practical:	25	75

Minimum Marks required

	Internal(CA)	External(Sum)	CA +SUM
Theory	Nil	27 /75	35%
Practical	Nil	21 /60	35%

Thiagarajar College, Madurai – 9 Re-Accredited with 'A' Grade by NAAC B.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Department of –Zoology Programme code:UZO (Forthosejoined B.Sc., BotanyonorafterJune2023)

Course Code	CourseTitle	Category	L	Т	Р	Credit
UZO23GT11B	Applied Zoology I	GenericElective	3	-	-	3

Year	Semester	Int.Marks	Ext.Marks	Total
FirstBot./Se condChem	Firstfor Botany/Third forChemistry	25	75	100

Preamble

Acquire a basic knowledge of diversity and organization of animals. Comprehend the special features in some select animal forms

CourseOutcomes

Onthecompletionofthecoursethestudentwillbeableto

		Proficiency	Expected
		Expected %	Attainment %
CO1 Recall the characteristic f	eatures invertebrates and chordates.	60	70
CO2 Classify invertebrates up order level.	to class level and chordates up to	60	70
CO3 Explain and discuss the st of some invertebrates and	ructural and functional organisation chordates.	60	70
CO4 Relate the adaptations and	habits of animals to their habitat.	60	70
CO5 Elaborates on the speci invertebrate and chorda	al features in some select te forms.	60	70

K1:Knowledge K2:Understand K3: Apply

MappingofCourseOutcomes withProgrammeOutcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	Μ	-	S	S	L
CO2	S	Μ	-	S	Μ	L
CO3	S	S	-	Μ	L	L
CO4	S	S	-	Μ	Μ	L
CO5	Μ	Μ	-	S	L	S

Strong-S(+++)Medium-M(++)Low-L(+)

MappingofCourseOutcomeswithProgrammeSpecificOutcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S			Μ	S
CO2	S	L	Μ	S	M
CO3	Μ			S	M
CO4	S	Μ	Μ	S	S
CO5			Μ	S	S

Strong–S(+++)Medium-M(++)Low-L(+)

Bloomstaxonomy:AssessmentPattern

	CA		End of
	First	Second	Semester
Knowledge	40%	40%	40%
Understan	40%	40%	40%
d			
Apply	20%	20%	20%

CourseTitle:Applied Zoology I

UnitI

Principles of taxonomy.

Criteria for classification – Symmetry and Coelom– Binomial nomenclature. Classification of Protozoa, Coelenterata, Helminthes and Annelida upto classes with two examples.

UnitII

Classification of Arthropoda, Mollusca and Echinodermata upto class level with two examples.

UnitIII

Classification of Prochordata, Pisces and Amphibia upto orders giving two examples.: Indigenous and modern methods.

UnitIV

Classification of Reptilia, Aves and Mammalia upto orders giving two examples.).

UnitV

Special adaptive features in invertebrates and chordates:

Locomotion and feeding habits in protozoa. Insects mouth parts and types. Characteristic features of venomous snakes, poison apparatus and biting mechanism. Flight adaptation and migration in birds. Embryonic development in mammals - monotreme, marsupial, and placental.

Text Books

- 1. EkambaranathaIyer, M.andAnanthakrishnan, T.N.2003. AManualofZoology, ViswanathanPublic ations, Chennai.
- 2. Jordon, E.L. and Verma, P.S. 2005. Invertebrate Zoology, S. Chand & Co. New Delhi
- 3. JordanELandVerma PS(2013)Chordate Zoology,S.Chand&CoLtd.,NewDelhi
- 4. AyyarE(1982)ManualofZoologyVol.II-.S.Viswanathan(Printers&Publishers)Pvt.Ltd.,Chennai.

Reference Books

- 1. Kotpal, R.L.2005. Invertebrate Zoology, Rastogi Publications, Meerut.
- 2. Dhami, P.S. and Dhami, J.K. 2003. Invertebrate Zoology, R. Chand & Co. New Delhi.
- 3. RomerAS(1992)Thevertebratebody,3rdEdition,Vakils, FeferandSimonsPvt. Ltd,Mumbai.
- $4. \ KotpalRL (2014) Modern text book of Zoology Vertebrates. 3rd Edition Rastogi Publications, Meerut.$
- 5. Saxena RK and Saxena S (2008) Comparative anatomy of vertebrates. Viva books Pvt.Ltd.,NewDelhi

Thiagarajar College, Madurai – 9 Re-Accredited with 'A' Grade by NAAC B.Sc., Zoology Course Structure (w.e.f. 2023 batch onwards) Department of –Zoology

Programme code:UZO

(Forthose joinedB.ScBotanyonorafterJune 2023)

Course Code	CourseTitle	Category	L	Т	Р	Credit
UZO23GT21B	Applied Zoology II	Generic	3	-	-	3
		Elective				

Year	Semester	Int.Marks	Ext.Marks	Total
First Botany	Second	25	75	100

Preamble

Acquire a basic knowledge basic concepts relating to aspects of respiratory, circulatory, excretory nervous and sensory physiology

${\it On the completion of the course the student will be able to}$

CourseOutcomes

	Courseoutcomes	Proficiency	Expected
		Expected	Attainment
		%	%
CO1	Recall the parts and working mechanism of body organs	60	60
CO2	Analyse and elaborate on the different stages in	60	60
	development process		
CO3	Analyse the working of body and immune systems	60	60
CO4	Elaborate the genetics of inheritance	60	60
CO5	Elaborate the rearing methods of beneficial insects- an	60	60
	economic perspectives		

K1:Knowledge K2:Understand K3: Apply

MappingofCourseOutcomes withProgrammeOutcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	L	-	S	Μ	Μ
CO2	S	S	-	S	Μ	L
CO3	S	S	-	S	Μ	L
CO4	S	S	Μ	S	S	L
CO5	S	S	Μ	S	S	Μ

Strong–S(+++)Medium-M(++)Low-L(+)

MappingofCourseOutcomeswithProgrammeSpecificOutcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
C01	L		Μ		Μ
CO2	Μ	L	S	L	L
CO3	Μ	L	L	Μ	Μ
CO4	Μ		Μ	Μ	Μ
CO5		Μ	S	S	Μ

Bloomstaxonomy:AssessmentPattern

	(CA	End
	Firs t	Secon d	ofSemes ter
Knowledge	40%	40%	40%
Understan d	40%	40%	40%
Apply	20%	20%	20%

Course Title : Applied Zoology II

UnitI

Animal Physiology: Respiration- Respiratory pigments and transport of gases. Mechanism of blood clotting. Types of excretory products–ornithine cycle. Structure of neuron–Conduction of nerve impulse, Mechanism of vision and hearing.

Unit II

Embryology: Structure and types of male and female gametes. Fertilization, Cleavage, Gastrulation and Organogenesis of Frog; Placentation in mamma

Unit III

Immunology: Innate and Acquired - Active and Passive; Antigens and Antibodies; Immunological organs-responses in humans; Vaccination schedule.

Unit IV

Human Genetics: Human Chromosomes – Sex Determination in Humans; Patterns of Inheritance: Autosomal Dominant, Autosomal Recessive, X-linked (colour blindness), Y-linked (hairy pinna in males), Multiple Allelic (Blood group); Genetic Counselling

UnitV

Apiculture – types of honey bees, beekeepingmethods and nutritional values of honey.Sericulture - types of silk (mulberry and non-mulberry), life cycle & rearing (mulberrysilkworm) and economic importance. Lac culture - strains of Lac insects, life cycle, rearingandeconomicimportance.

Text Books

- 1. S C Rastogi, 2019. Essentials of Animal Physiology^{II}, New Age international Publishers, New Delhi ,India
- **2.** Chattopadhyay, S. 2017. An Introduction to Developmental Biology. Books and Allied (P) Ltd,Kolkata, India
- **3.** Verma, P.S and V.K. Agarwal. 2016. Genetics, 9th Edition, S.ChandPublications.NewDelhi.Inida
- **4.** Shetty, N 1993Immunology Introductory Text Book, second edition, Wiley Eastern Limited, New Delhi.India
- **5.** David,B.V.,andT.Kumaraswami,2000.ElementsofEconomicEntomology,PopularBookDePS Ot, Chennai.

6. Ravindranathan,K.R.,2005.AtextbookofEconomicZoology,Dominantpublisheranddistributor s(P)Ltd.,NewDelhi.

Reference Books

- 1. Verma, P.S., Tyagi, B.S, Agarwal, V.K. 2000. Animal Physiology, S.Chand Publishers
- 2. Balinsky, B.I. and B.C. Fabian. 2012. An Introduction to Embryology. Fifth Edition, CengageLearning India Private Limited, New Delh
- 3. Gardner Eldon, J., D. Peter Snustad. 2006. Principles of Genetics, 8th Edition. John Wiley &Sons,London, UK
- 4. Ahsan, J.and S.P.Sinha, 1985. Ahandbook EconomicZoology, Thirdedition, S.Chand&company(P)Ltd., NewDelhi

on

Thiagarajar College (Autonomous):: Madurai – 625 009 **DepartmentofZoology**

(Forthosejoined B.Sc., Botanyon or after June 2020)

Course Code	CourseTitle	Category	L	Т	Р	Credit
UZO23GL21B	Lab in Applied Zoology	Generic electivelab	-	-	2	1

Year	Semester	Int.Marks	Ext.Marks	Total
First	First&Second	25	75	100

Preamble

Proficient in dissection and display of parts of organs of selected animals.

CourseOutcomes

Onthecompletionofthecoursethestudentwillbeableto

	Course outcomes	Expected	Expected
		Proficiency	Attainment
CO1	Proficientindissectionanddisplayofselected animals.	60	70
CO2	Efficient in mounting of parts of organs.	60	70
CO3	Identify the preserved specimens, models and elaborate on	60	70
	its importance		
CO4	Explainthe morphology, lifehistory of lac	60	70
	insect, honeybees and silk worm		
CO5	Makea fieldstudyinanecosystem	60	70
K1·Kn	owledge K2:Understand K3: Apply		

К.5: Арріу Understand

MappingofCourseOutcomes withProgrammeOutcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	-	S	Μ	M
CO2	S	S	L	S	S	Μ
CO3	S	S	Μ	S	Μ	Μ
CO4	S	S	-	S	Μ	L
CO5	Μ	S	L	S	Μ	Μ

Strong–S(+++)Medium-M(++)Low-L(+)

MappingofCourseOutcomeswithProgrammeSpecificOutcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	Μ		L	L	L
CO2	Μ			S	L
CO3	L		Μ	S	L
CO4	L			M	M
CO5	S		Μ	Μ	M

S-Strong,M-Medium,L-low

Bloomstaxonomy:AssessmentPattern

	(CA	End
	Firs t	Secon d	ofSemes ter
Knowledge	40%	40%	40%
Understan d	40%	40%	40%
Apply	20%	20%	20%

- 1. Identification of Venomous and Non-Venomous snakes
- 2. Human blood grouping
- 3. Estimation of Haemoglobin content in blood.
- 4. Study of polygenic inheritance using finger print.
- 5. Demonstration of Colour Blindness
- 6. Demonstration of Human/Bull sperm motility & ovum.
- 7. Demonstration-Newton's Bee hive
- 8. Identification of different types of honey bees.
- 9. External morphology of *Bombyxmori*
- 10. Demonstration-Dissection of Bombyxmorisilkgland.
- 11.Demonstration- Mounting of *Bombyxmori* spiracles
- 12. Commercially important Prawns and Shrimps.

Spotters and Museum specimens

- a) Protozoa- Paramaceium and Euglena
- b) Colenterata- Hydra and Physalia
- c) Helminthes- Taenia and Ascaris
- d) Arthropoda- Prawn and Scorpion
- e) Mollusca- Sepia and Octopus
- f) Echinodermata- Star fish and Sea urchin
- g) Amphibian-Salamender
- h) Embryonic development of Frog.
- i) Reptilia-Calotus
- j) Aves-Pigeon.