MANONMANIAM SUNDARANAR UNIVERSITY,
TIRUNELVELI-12

SYLLABUS

PG - COURSES – AFFILIATED COLLEGES

Course Structure for M. Sc. Zoology
(Choice Based Credit System)
(with effect from the academic year 2026-2027 onwards)

Semester-I				
Part	**Subject Status**	**Subject Title**	**Subject Code**	**Credit**
III	CORE I	STRUCTURE AND FUNCTION OF INVERTEBRATES	TZOC11	5
III	CORE II	COMPARATIVE ANATOMY OF VERTEBRATES	TZOC12	5
III	PRACTICAL	LAB COURSE IN INVERTEBRATES & VERTEBRATES	TZOL11	2
III	ELECTIVE I	BIOCHEMISTRY	TZOE11	3
III	ELECTIVE II	SERICULTURE	TZOE12	3
III	PRACTICAL	LAB COURSE IN BIOCHEMISTRY & SERICULTURE	TZOL12	2

Total Marks: 100 Internal Exam: 25 marks + External Exam: 75 marks

A. **Scheme for internal Assessment**:
Maximum marks for written test: **20 marks**
3 internal tests, each of **I hour** duration shall be conducted every semester.
To the average of the **best two** written examinations must be added the marks scored in. The **assignment** for 5 marks.

The break up for internal assessment shall be:
Written test- 20 marks; Assignment -5 marks Total - 25 marks

B. Scheme of External Examination
3 hrs. examination at the end of the semester
A – Part : 1 mark question two - from each unit
B – Part : 5 marks question one - from each unit
C – Part : 8 marks question one - from each unit

- **Conversion of Marks into Grade Points and Letter Grades**

S.No	Marks	Letter Grade	Grade point (GP)	Performance
1	90-100	O	10	Outstanding
2	80-89	A+	9	Excellent
3	70-79	A	8	Very Good
4	60-69	B+	7	Good
5	50-59	B	6	Above Average
6	40-49	C	5	Pass
7	0-39	RA	-	Reappear
8	0	AA	-	Absent

- **Cumulative Grade Point Average (CGPA)**

$$\mathbf{CGPA} = \frac{\mathbf{\Sigma\,(GP \times C)}}{\mathbf{\Sigma C}}$$

- **GP** = Grade point, **C** = Credit
- CGPA is calculated only for Part-III courses
- CGPA for a semester is awarded on cumulative basis

- **Classification**
  a) First Class with Distinction : CGPA $\geq$ 7.5*****
  b) First Class : CGPA $\geq$ 6.0
  c) Second Class : CGPA $\geq$ 5.0 and $<$ 6.0
  d) Third Class : CGPA$<$ 5.0

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: Molecular taxonomy, DNA barcoding, cladistics, and phylogenetic systematics 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 and osmoregulation. Nervous system: Primitive nervous system: Coelenterata and Echinodermata; Advanced nervous system: Annelida, Arthropoda (Crustacea and lnsecta) 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. Organization and general characters of Minor Phyla: Rotifera, Sipuncula, Echiura, Onychophor

Reading list

1. Barrington, E. J.W. 1979. Invertebrate Structure and Function. The English Language Book Society and Nelson, pp-765.

Recommended texts

1. Barnes, R. D. 1974. Invertebrate Zoology, (Second Edition), Holt-Saunders International Edition, pp-1024.
2. Barnes, R. S. K., P. Calow, P. J. W. Olive, D. W. Golding, J. J. Spicer. 2013. The
2. Invertebrates: A Synthesis. Third Edition. John Wiles & Sons Inc., Hoboken. New Jersey, New Delhi.
3. Dechenik, J. A. 2015. Biology of Invertebrates (Seventh Edition). Published by McGraw Hill Education (India) Private Limited, pp-624.

COMPARATIVE ANATOMY OF VERTEBRATES

Unit I

Origin of vertebrates: Concept of Protochordata; The nature of vertebrate morphology; scope and significance of vertebrate morphology; molecular and evolutionary approaches in vertebrate morphology; 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 derivatives and their adaptive significance; Pigmentation, chromatophores and colouration in vertebrates.

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 accounlopt of jaw suspensorium, Vertebral column; Limbs and girdles; Evolution of Urinogenital system in vertebrate series. Adaptive radiation of limbs and Aquatic skeletal adaptations

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.

Reading list

1. Swayam Prabha https://www.swayamprabha.gov.in/index.php/program/archive/9
2. Yong, J. Z. 1981. The life of Vertebrates, English language Book society, London, pp- 645.
3. Romer, A.S. 1971. The Vertebrate body, W.B.S. Saunders, Philadelphia, pp-600.

Recommended texts

1. Waterman, A.J. 1972. Chordate Structure and Function, MacMillan Co., New York, pp.587.
2. Parker T. J. and W. A. Haswell. 1962. A text book of Zoology, Vol. 2, Vertebrates, 7th Edition, Mac Millan Press, London, pp-750.

3. Ekambaranatha Ayyar and T. N. Ananthakrishnan. 2009. Manual of Zoology, Vol – II, S. Viswanathan Pvt. Ltd. Chennai.
4. Kotpal, 2019. R.L. Modern Text Book of Zoology Vertebrates, 4th Edition, Rastogi Publications, Meerut, pp-968.

LAB COURSE IN INVERTEBRATES & VERTEBRATES

INVERTEBRATES

Dissection / Virtual

Earthworm : Nervous system

Cockroach : Nervous system

Grasshopper : Digestive system and mouth parts

Prawn : 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 / Virtual

1. Nervous system of Scoliodon laticaudatus – 5th or Trigeminal nerve
2. Nervous system of Scoliodon laticaudatus – 9th and 10th or Glossopharyngeal & Vagus nerve

Study of the following specimens with special reference to their salient features and their modes of life:

1. Amphioxus sp. (Lancelet)
2. Ascidia sp. (sea squirt)
3. Scoliodon laticaudatus (Indian dog shark)
4. Trygon sp. (Sting ray)
5. Torpedo sp. (Electric ray)
6. Arius maculatus (Cat fish)
7. Belone cancila (Flute fish)
8. Exocoetus poecilopterus (Flying fish)
9. Mugil cephalus (Mullet)
10. Tilapia mossambicus (Tilapia)
11. Rachycentron canadum (Cobia)
12. Tetrodon punctatus (Puffer fish)
13. Dendrophis sp. (Tree snake)

Study of the different types of scales in fishes

1. Cycloid scale
2. Ctenoid scale
3. Placoid scale

Study of the frog skeleton system (Representative samples) 1. Entire skeleton 2. Skull

Text Books:

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

Reference Books:

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

BIOCHEMISTRY

Unit I

Basics of biophysical chemistry and biochemistry: Structure of atoms, molecules and chemical bonds - Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).

Unit II

Biomolecular interactions and their properties: Stabilizing interactions (Vander Waals, electrostatic, hydrogen bonding, hydrophobic interaction etc. - Composition, structure, metabolism and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).

Unit III

Bioenergetics and enzymology: Bioenergetics, glycolysis, Electron transport chain, Oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers - Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isoenzymes

Unit IV

Structural conformation of proteins and nucleic acids: Conformation of proteins (Ramachandran plot, secondary, tertiary, and quaternary structure; domains; motifs and folds)- Conformation of nucleic acids (A-, B-, Z-DNA), t- RNA, micro-RNA).

Unit V

Metabolic regulation and integration; Biochemical role of vitamins, coenzymes and cofactors. Stability of protein and nucleic acid structures; protein folding; Metabolic disorders and biochemical basis of diseases.

Reading list

1. Berg, J. M., J. L. Tymoczko and L. Stryer 2002. Biochemistry. 5th Ed., W.H. Freeman & Co., New York, pp-1050.
2. Kuchel P.W. and G. B. Ralston. 2008. Biochemistry. McGraw Hill (India) Private Limited, UP, pp-580.
3. McKee T. and J. R. McKee. 2012. Biochemistry: The Molecular Basis of Life. (7th Edition). Oxford University Press, US, pp-793.
4. Nelson D.L. and M.M. Cox. 2012. Lehninger's Principles of Biochemistry. (6th Edition). W. H. Freeman Publishers, New York, pp-1158.
5. Satyanarayana U. and U. Chakrapani, 2006. Biochemistry. (3rd Edition). Books and Allied (P) Ltd. Calcutta, pp-695.

Recommended texts

1. Buchanan, B.B., W. Gruissem and R.L. Jones. 2015. Biochemistry and Molecular Biology of Plants. John Wiley and Sons Ltd., UK, pp-1280.

2. Murray, R.K., D.K. Granner, P.A. Mayes and V.W. Rodwell. 2003. Harper's Illustrated Biochemistry (26th Edition), The McGraw-Hill Companies, Inc., USA, pp-704.
3. Palmer, T. 2004. Enzymes. Affiliated East-West Press Pvt. Ltd., New Delhi, pp 416.
4. Voet D. and J.G. Voet. 2011. Biochemistry. (4th Edition). John Wiley & Sons (Asia) Pvt. Ltd., pp-1428.

SERICULTURE

Unit I

Introduction to textile fibers; types- natural and synthetic fibers; sources of silk fiber- Tasar, Muga, Anaphe, Gonometa, Fagara, spider and mussel; properties and importance of silk fiber. History, development, status, characteristics and advantages of sericulture in India.

Unit II

Host plants; Moriculture- distribution, morphology, propagation- seedling, cutting, grafting, layering and micropropagation methods, maintenance- irrigation, manuring and pruning, pests and diseases of mulberry.

Unit III

Biology and physiology of Bombyx mori; Races and voltinism. Structure of egg, larva, pupa and adult. Sexual dimorphism- larva, pupa and adult. Silk gland – Structure and Significance- Silk protein. Neuroendocrine system, neuro secretary cells, Corpora allata, Corpora cardiaca, ecydysial gland. Hormonal control of moulting and metamorphosis. Exocrine glands and pheromones.

Unit IV

Grainage technology: Breeding Stations - methods of industrial egg production, mother moth examination, diapausing and non-diapausing eggs. Incubation and transport of eggs. Silk worm - Rearing: Rearing House (CSB- model) and Rearing appliances. Rearing operation- Disinfection, brushing, maintenance of optimum conditions, feeding, bed cleaning, spacing, care during moulting, mounting, and Harvesting. Rearing methods: Chawki rearing and rearing of late age and mature larvae- Mounting practices.

Unit V

Physical and commercial characteristics of cocoons. Cocoon harvesting, processing and marketing. By-products of sericulture industry. Reeling operation: reeling appliances- types - raw silk – raw silk testing. Diseases of Silkworm: Fungal, Viral, Bacterial diseases; Pest of silkworm – Uzi fly and Dermestid beetles - causative agent, symptoms, prevention and control measures.

Reading list

1. G.Ganga and J. Sulochana Chetty. 2019. An introduction to sericulture, 2nd edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. M.Johnson and M. Kesary. 2019. Sericulture, Saras publication, Tamilnadu.
3. Singh, Amardev & Ravinder Kumar. 2013. Sericulture handbook Vol 1, Biotech.
4. M.Madan Mohan Rao. An Introduction to Sericulture, 2nd edition, BS Publications.

Recommended websites

1. https://agritech.tnau.ac.in/sericulture/
2. https://csb.gov.in/

LAB COURSE IN BIOCHEMISTRY & SERICULTURE

Biochemistry Practicals

1. Salivary amylase activity in relation to substrate concentration
2. Salivary amylase activity in relation to enzyme concentration
3. Chromatographic separation of amino acid
4. Quantitative analysis of protein – Lowry/Biuret method
5. Preparation of standard graph for carbohydrate
6. Preparation of standard graph for Protein

Spotter/Chart

Kreb's cycle, β oxidation, ketogenesis, structure of protein, haemoglobin, amino acid – lysine and alanine

Sericulture Practicals

1. Dissection: Silkworm digestive system, silk gland
2. Morphology of larva pupa and moth, sex separation in pupa and moth
3. Mouth parts of silkworm
4. Identification and study of sericulture products
5. Rearing appliances: rearing tray, leaf chamber
6. Mountage – Chandrike
7. Diseases of Silkworm –bacterial, fungal
8. Types of mulberry leaves (MR2, K2) and diseases of mulberry (fungal and Nematode