



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
 (An Autonomous Institution Affiliated to Madurai Kamaraj University)
 Virudhunagar – 626 001.

Course Name : Bachelor of Science
Discipline : Zoology
 (For those who joined in June 2024 and after)
COURSE SCHEME:

I year B.Sc. ZOOLOGY

Semester	Part	Subject Name	Hours	Credit	Int + Ext =Total	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject Code	Revised / New / No Change / Interchanged & Percentage of Revision
I	Part I	Tamil	6	3	25+75=100												U24PT11	New
	Part II	English	6	3	25+75=100												U23PE11	No Change
	Core	Invertebrata	6	4	25+75=100	✓				✓	✓	✓	✓	✓		✓	U24ZYC11	Revised -10%
	Core	LAB: Invertebrata	2	-	--	✓				✓	✓	✓	✓	✓		✓	--	--
	Allied	General Chemistry I	4	3	25+75=100												U24CHAY11	Mark Change
	Allied	LAB: Volumetric Analysis	2	-	--												--	---
	SBE	Animal Diversity and Adaptations-I	2	2	25+75=100	✓					✓	✓		✓	✓	✓	U24ZYS11	New
	SBE	Applied Zoology-I	2	2	25+75=100	✓					✓	✓		✓	✓	✓	U24ZYS12	New
Total			30	17														
II	Part I	Tamil	6	3	25+75=100												U24PT21	New
	Part II	English	6	3	25+75=100												U23PE21	No Change
	Core	Chordata	6	4	25+75=100	✓							✓	✓	✓	✓	U24ZYC21	Revised - 10%
	Core	LAB: Invertebrata and Chordata	2	2	40+60=100	✓							✓	✓	✓	✓	U24ZYCP21	Revised - 10%
	Allied	General Chemistry II	4	3	25+75=100												U24CHAY21	Mark Change
	Allied	LAB: Chemistry – Volumetric Analysis	2	2	40+60=100												U22CHAYP21	No Change
	SBE	Animal Diversity and Adaptation-II	2	2	25+75=100												U24ZYS21	Revised 5%



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

SBE	Applied Zoology-II	2	2	25+75=100														U24ZYS22	New
Total		30	21																

Year	Part	Subject	Credit	Int = Total	Code
I & II	Part V	NSS / NCC / Physical Education/ YRC / RRC	3	100 = 100	U22NS4 / U22NC4 / U22PS4 / U22YR4 / U22RR4

TENTATIVE SYLLABUS STRUCTURE TABLE

III Semester				
I	Language	Tamil	6	3
II	Language	English	6	3
III	Core	Cell Biology	4	4
III	Core	Lab - Cell Biology	2	0
III	Allied	General Chemistry III	4	4
III	Allied	Lab – Chemistry III	2	0
III	Allied	Sericulture I	4	4
III	Allied	Lab – Sericulture I	2	0
III	SL	Value Education		3
			Total	30
				21
IV Semester				
I	Language	Tamil	6	3
II	Language	English	6	3
III	Core	Developmental Biology	4	4
III	Core	Lab - Cell Biology and Developmental Biology	2	2



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

III	Allied	General Chemistry IV	4	4
III	Allied	Sericulture II	4	4
III	Allied	Lab - Chemistry III and IV	2	2
III	Allied	Lab - Sericulture I and II	2	2
IV		Internship/ Industrial training	0	2
IV		Environmental Studies	0	2
V		NSS/ NCC/ YRC/ RRC/ Physical Education	0	2
Total			30	30

V Semester				
III	Core	Genetics and Biostatistics	5	5
III	Core	Biochemistry	5	5
III	Core	Microbiology and Immunology	5	5
III	Core	Lab - Genetics and Biostatistics	2	0
III	Core	Lab - Biochemistry	2	0
III	Core	Lab - Microbiology and Immunology	2	0
III	Allied	Sericulture III	4	4
III	Allied	Lab - Sericulture III	2	0
IV	SBE	Employability Skills	1	1
IV	SBE	NME – Ornamental Fish Culture	2	2
Total			30	22
VI Semester				
III	Core	Animal Physiology	5	5
III	Core	Ecology and Evolution	5	5



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

III	Core	Biotechnology	4	4
III	Core	Lab - Genetics and Biostatistics, and Animal Physiology	2	2
III	Core	Lab - Biochemistry, and Ecology and Evolution	2	2
III	Core	Lab - Microbiology and Immunology, and Biotechnology	2	2
III	Allied	Sericulture IV	4	4
III	Allied	Lab - Sericulture III and IV	2	2
IV	SBE	NME – Human Biology	2	2
IV	SBE	Project	2	2
		Total	30	30



SEMESTER I

CORE: 1 INVERTEBRATA	
Contact hours per Week – 6 hours	Credits: 4
Contact hours per Semester – 90 hours	Subject Code: U24ZYC11
Course Outcomes:	
CO 1: Students able to identify the animals by its taxonomy.	
CO 2: Understand the various organs and organ system in the animals.	
CO 3: Acquires the knowledge of morphology of the animals.	
CO 4: Students distinguish the difference between the animals belonging to different taxa.	
CO 5: Characterize the animals and cite the examples of different taxa.	

Unit – I (18 Hours)

Outline classification, - Taxonomy - Definition- Principles of classification- Levels of organization-Binomial Nomenclature - Rules of nomenclature and advantages – Salient features of invertebrates - Invertebrate Phylogeny – origin of Metazoa, Annelida and Arthropoda.

Unit – II (18 Hours)

General Characters and classifications of phylum Protozoa up to classes
Paramecium - General organization, nutrition and feeding mechanism, locomotion, Osmoregulation and Conjugation;
Structure, pathology, prevention and control measures of *Entamoeba histolytica* and Plasmodium (*Vivox*).
General Characters and classifications of phylum Porifera upto classes
Olynthus - General organization, spicules, Gemmules, Reproduction and life cycle.

Unit – III (18 Hours)

General Characters and classifications of phylum Coelenterata upto classes
Obelia - Structure of *Obelia* colony, Histology of the colony, nutrition, Reproduction and life cycle (Metagenesis)
Helminthes - General Characters and classifications of phyla upto classes
Fasciola hepatica - External characters, Digestive system, Flame cells, Reproductive system and Life cycle.
Ascaris – External characters, Respiration, Reproduction, Pathology and control measures of *Ascaris*

Unit – IV (18 Hours)

Annelida- General Characters and classifications of phyla upto classes
Earthworm - morphology, Digestive system, excretory system, Nervous system, Reproductive system and development.
Arthropoda- General Characters and classifications of phyla upto classes
Cockroach - Morphology, Mouth parts, Digestive system, Respiratory system, Nervous system, Reproductive system and life cycle.



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

Unit – V

(18 Hours)

Mollusca- General characters and classifications of phyla upto classes

Pila globosa- Morphology, torsion, Digestive system, Respiratory system, Reproductive system and development.

Echinodermata- General Characters and classifications of phyla upto classes

Star fish - Morphology, Pedicellaria, Water vascular system, Digestive system, Reproductive system and development.

Text book

1. N.C. Nair, S. Leelavathy, N. Soundarapandian, T. Murugan & N. Arumugam, “A Text Book of Invertebrata”, Saras Publications, Nagercoil, 2017.

Unit I: Page NO: 01 - 09

Unit II: Page NO: 11 - 115

Unit III: Page NO: 130 - 250

Unit IV: Page NO: 160 - 430

Unit V: Page NO:571 - 670

Reference books

1. T.C. Majupuria, “Invertebrate Zoology”, Pradeep Publications, Jalandar, 2001.
2. M. Ekambaranatha Ayyar & T.N. Ananthkrishnan, “A Manual of Zoology”, S. Viswanathan publishers, Chennai, 2003 Reprint.
3. E.L. Jordon & P.S. Verma, “Invertebrate Zoology”, S. Chand and Company, New Delhi, 2005 Reprint.
4. R.L. Kotpal, “Invertebrate Zoology”, Rakesh Kumar Rastogi for Rastogi Publications, Meerat, Third Edition, 2005 Reprint.
5. P.S. Dhami & J.K. Dhami, “Invertebrate Zoology”, R. Chand and Company, New Delhi, 2003.

e- Resources:

1. <https://microbiologynote.com/binomial-nomenclature/>
 2. <https://www.healthline.com/health/amebiasis/>
 3. <https://www.msdmanuals.com/en-in/professional/infectious-diseases/nematodes-roundworms/ascariasis>
 4. <https://www.vedantu.com/biology/morphology-and-anatomy-of-cockroach>
 5. <https://courses.lumenlearning.com/wm-biology2/chapter/phylum-echinodermata/>
-

SEMESTER I

Part III — Allied Subject — GENERAL CHEMISTRY-I for Biological Science

Hours per week: 4

Subject Code: U24CHAY11

Credits: 3

(For those who joined from June 2024 onwards)

Course Outcomes

CO1: To study fundamental ideas on organic chemistry.

CO2: To know the basic properties of hydrogen, hydrides & oxides

CO3: To search out an idea on colloids.

CO4: To learn some important petroleum processes and fertilizers

CO5: To acquire a knowledge on polymers.



Unit I: Basic concepts of organic chemistry **12 Hours**

Organic compounds — general properties and classification of organic compounds — functional groups — homologous series. Isomerism — structural isomerism and stereoisomerism — examples — Types of organic reactions: substitution, addition and elimination with examples.

Unit II: Hydrogen, Hydrides and Oxides **12 Hours**

Hydrogen:

Isotopes of hydrogen — preparation, properties and uses of heavy hydrogen — ortho and para hydrogen.

Hydrides:

Definition — classification of hydrides (Saline hydrides, Metallic hydrides, Molecular hydrides and Polymeric hydrides.) — Nature of hydrides and position of hydrogen in the periodic table.

Oxides:

Definition — classification — examples.

Unit III: Colloids **12 Hours**

Colloidal state of matter — various types — classification. Sols — dialysis — electroosmosis- electrophoresis — stability of colloids — protective action — Hardy Schulze law — gold number.

Emulsion: types of emulsion — emulsifier.

Gels: Classification, preparation — application of colloids.

Unit IV: Petroleum and fertilizers **12 Hours**

Refining of petroleum — composition and uses of petroleum fractions — thermal and catalytic cracking — octane number, cetane number — antiknocking agents - unleaded petroleum — petrochemicals — synthetic petrol.

Fertilizers — classification — important manures — manufacture and uses of urea — super phosphate — calcium ammonium nitrate (CAN) fertilizer.

Unit V: Polymers **12 Hours**

Polymers — general characteristics — plastics — elastomers and fibres — thermoplastics and thermosetting plastics - methods of polymerization — bulk — suspension and solution polymerization. Uses of polycarbonates — polyurethanes — epoxy resins and teflons (PTFE).

Text Books

Unit I

1. B.S.Bah1 and Arun Bah1, Advanced Organic Chemistry, S.Chand & Co., Ltd., 2008.

Unit II & III

1. B.R.Puri, L.R.Sharma and K.C.Kalia, Principles of Inorganic Chemistry, Villabh Publishing, 2003.

Unit-IV & V

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011.

Reference Books:

Unit I

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011.



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

Unit II

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co., Ltd., 2008.
2. P.L.Soni and Mohan Katiyal, Textbook of Inorganic Chemistry, Sultan Chand & Sons, 2008.

Unit III

1. P.L.Soni, Textbook of Physical Chemistry, Sultan Chand & Sons, 2008.

Unit IV

1. K.S.Tewari, N.K.Vishnoi and S.N.Mehrota, A Text book of Organic Chemistry, 2nd revised edition, Vikas publishing house PVT LTD, New Delhi, 2005.

Unit V

1. P.L.Soni, Textbook of Physical Chemistry, Sultan Chand & Sons, 2008.

e-Resources:

1. <https://www.priyamstudycentre.com/chemistry/organic-compound>
2. <https://youtu.be/XklMKuEAWdU>
3. <https://www.adichemistry.com/inorganic/hydrogen/H2/hydrogen.html>
4. https://en.m.wikipedia.org/wiki/Isotopes_of_hydrogen
5. <https://byjus.com/jee/colloids/>
6. <https://youtu.be/QAH-cCK1bS8>
7. https://en.m.wikipedia.org/wiki/Petroleum_refining_processes
8. https://youtu.be/Dmn1X_z985A
9. <https://www.britannica.com/science/polymer/Synthetic-polymers>
10. <https://youtu.be/t9UtS70GR44>

SBE: 1 ANIMAL DIVERSITY AND ADAPTATION - I	
<i>Contact hours per Week – 2 hours</i>	<i>Credits: 2</i>
<i>Contact hours per Semester – 30 hours</i>	<i>Subject Code: U24ZYS11</i>
Course Outcomes:	
CO1: To understand the animal diversity and adaptation of various groups of invertebrates.	
CO2: To acquire knowledge about the marine animals.	
CO3: To build up the familiarity among the students regarding the adaptive radiations in animals	
CO4: Acquires the knowledge on morphological difference of mouth parts of various animals.	
CO5: To transfer the information about the advanced invertebrates and its larval forms.	

Unit – I

(6 Hours)

Locomotion in protozoa, Economic importance of protozoa- Canal system in sponges, Skeleton in sponges.

Unit – II

(6 Hours)

Polymorphism in Coelenterata., Nematocysts. Corals – Types. Coral reefs–types and its formation.



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

Unit – III (6 Hours)
Parasitic adaptations of helminthes, Life cycle of *Taenia solium*, Adaptive radiation of Annelida, Metamerism in Annelida, Economic importance of Annelida.

Unit – IV (6 Hours)
Mouth parts in insects (Butterfly and Mosquito) -Larval forms of Crustacea- Arthropod vectors (House fly and Mosquito) – commercial products of insects - Social life in insects.

Unit – V (6 Hours)
Torsion in Mollusca - Cephalopods as advanced molluscs - Economic importance of Mollusca - Larval forms of Echinodermata – Phylogeny of Echinodermata

Text book:

1. N.C. Nair, S. Leelavathy, N. Soundarapandian, T. Murugan & N. Arumugam, “A Text Book of Invertebrata”, Saras Publications, Nagercoil, 2017.

Unit I: Page No: 67-71, 86-87, 105-113

Unit II: Page No: 162-170, 211-215

Unit III: Page No: 240-241, 299-305, 320-321

Unit IV: Page No: 481-485, 495-497, 519-522, 524-527

Unit V: Page No: 582-587, 641-647, 693-694.

Reference books:

1. T.C. Majupuria, “Invertebrate Zoology”, Pradeep Publications, Jalandar, 2001.
2. M. Ekambaranatha Ayyar & T.N. Ananthakrishnan, “A Manual of Zoology”, S. Viswanathan publishers, Chennai, 2003 Reprint.
3. E.L. Jordon & P.S. Verma, “Invertebrate Zoology”, S. Chand and Company, New Delhi, 2005 Reprint.
4. R.L. Kotpal, “Invertebrate Zoology”, Rakesh Kumar Rastogi for Rastogi Publications, Meerat, Third Edition, 2005 Reprint.
5. P.S. Dhama & J.K. Dhama, “Invertebrate Zoology”, R. Chand and Company, New Delhi, 2003.

e-Resources:

1. <https://www.youtube.com/watch?v=7M61NV4y5wo>
2. <https://www.studyandscore.com/studymaterial-detail/phylum-porifera-canal-system-in-sponges-types-of-canal-systems-in-sponges-functions-of-water-current>
3. <https://www.youtube.com/watch?v=POsXZ5BdSrg>
4. <https://www.studyandscore.com/studymaterial-detail/phylum-platyhelminthes-general-characters-classification-and-parasitic-adaptations>

SBE: 2		APPLIED ZOOLOGY-I	
<i>Contact hours per Week – 2 hours</i>		<i>Credits: 2</i>	
<i>Contact hours per Semester – 30 hours</i>		<i>Subject Code: U24ZYS12</i>	
Course Outcomes:			
CO1: To give the student a broad understanding about the role of animals in human life.			
CO2: To understand the values of useful insects and their economic importance.			



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

CO3: To understand the requirements for keeping and breeding of various animals for commercial purpose.
CO4: To generate motivation for Self-Employment.
CO5: Imparts knowledge about the culture techniques of invertebrates.

Unit– I (6 hours)

Vermiculture - Morphology of Earthworm, Collection of earthworm, manual method; Vermicomposting methods-Pit system, Wedge system- Applications of vermicompost.

Unit– II (6 hours)

Lac culture- Biology and life cycle of Lac insect; harvesting and processing of lac- Enemies of Lac insect - Uses of Lac- Problems in Lac culture.

Unit– III (6 hours)

Apiculture-Types of honey bees- *Apis dorsata*, *A. cerana*, *A. mellifera*, *A. florea*, *Trigona iridipennis*; Bee colony -Caste system; Modern methods of Bee Keeping -Newton's hive, Bee keeping equipments ; medicinal values of honey - Enemies and diseases of bee - Wax moth and Acarine disease.

Unit– IV (6 hours)

Fresh water Prawn culture - Seed collection from natural habitat and controlled breeding; harvesting and preservation - culture methods-Batch and continuous culture.

Unit– V (6 hours)

Pearl oyster culture – Pearl culture– types of pearls- composition and formation of pearls – Pearl culture techniques.

Text Books:

1. N.Arumugam, T. Murugan, Johnson Rajeswar and R. Ram Prabhu , “Applied Zoology”, Saras Publication, Nagercoil. 2017.

Unit I: Page No: 3-34

Unit II: Page No: 191-196

Unit III: Page No: 35-42, 73-91

Unit IV: Page No: 316-320

Unit V: Page No: 370-372

Reference Books:

1. Jawaid Ahsan and Subhas Prasad Sinha, “A Hand book on Economic Zoology”, S. Chand Publications, New Delhi, 2009.
2. N. Arumugam, T. Murugan, Johnson Rajeswar and R. Ram Prabhu , “Economic Zoology”, Saras Publication, Nagercoil,2012.
3. Tarit Kumar Banerjee, “Applied Zoology”, New Central Book Agency (P) Ltd, London, 2016.
4. S.Sarkar, G. Kundu and K.K.Chaki, “Introduction to Economic Zoology”, New Central Book Agency (P) Ltd, London. 2016.

e- Resources:

1. <https://youtu.be/4nNQEO8ZQR0>
2. <https://www.rpcau.ac.in/wp-content/uploads/2020/03/Morphology-and-biology-of-lac-insect-and-different-strain.pdf>
3. <http://eagri.org/eagri50/ENTO232/lec02.pdf>



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

- https://agritech.tnau.ac.in/fishery/fish_freshwaterprawn.html
- http://eprints.cmfri.org.in/3208/1/Special_Publication_No_20.pdf
- <https://youtu.be/E1SSwWrMISM>

SEMESTER: II

CORE: 2		CHORDATA	
<i>Contact hours per Week – 6 hours</i>		<i>Credits: 4</i>	
<i>Contact hours per Semester – 90 hours</i>		<i>Subject Code: U24ZC21</i>	
Course Outcomes:			
On completion of the course, the students will be able -			
CO 1: Students able to identify the animals by its taxonomy.			
CO 2: Understand the various organs and organ system in the animals.			
CO 3: Acquires the knowledge of morphology of the animals.			
CO 4: Students distinguish the difference between the animals belonging to different taxa.			
CO 5: Characterises the animals and cite the examples of different taxa.			

Unit – I (18 hours)

Chordata: Characteristics, Outline classification of Chordata with examples.
Prochordata – *Ascidian* – External Characters and Digestive System
Amphioxus - External Characters and Digestive System
Balanoglossus -External Characters and Reproductive System and development

Unit – II (18 hours)

Agnatha – General characters, Petromyzon - External characters
Gnathostomata - General Characteristics and Classification of Pisces up to order with examples
Shark – Morphology, Lateral line sense organs, Digestive system, and Reproductive system
General Characteristics and Classification of Amphibia up to order with examples
Frog - Morphology, Digestive system, Respiratory system and Reproductive system

Unit – III (18 hours)

General Characteristics and Classification of Reptilia up to order with examples
Calotes- Morphology, Digestive system, Circulatory system, skeletal system (Skull, Pectoral, Pelvic girdles) and Reproductive system.

Unit – IV (18 hours)

General Characteristics and Classification of Aves up to super order with examples
Pigeon – Morphology, Feathers of pigeon, Pectoral and Pelvic girdles, synsacrum, Digestive system, Respiratory system, circulatory system and Reproductive system.

Unit – V (18 hours)

General Characteristics and Classification of Mammalia up to order with examples
Rabbit - Morphology, Structure and types of teeth and Dental formula, Digestive System, structure of brain and Reproductive system.



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

Text book:

1. A.Thangamani, S.Prasannakumar, L.M. Narayanan & N. Arumugam, “A text book of Chordates”, Saras Publication, Nagercoil, Seventh edition:2019.

Unit I: Page NO: 01-58

Unit II: Page NO: 01, 78, 88-173,299-353

Unit III: Page NO: 420-478

Unit IV: Page NO: 558-610

Unit V: Page NO: 644-709

Reference books:

1. M. Ekambaranatha Ayyar & T.N. Ananthakrishnan, “A manual of Zoology”, Voume II, Chordata, S. Visvanathan (Printers and Publishers) Pvt. Ltd., Chennai, 2005 Reprint.
2. R.L. Kotpal, “Vertebrate Zoology”, Third Edition Published by Rakesh Kumar Rastogi for Rastogi Publishers, Ganapathi Shivaji Road, Meerut – 250 002, 2005 Reprint.
3. R. MCN. Alexander, “The Chordates”, II International Edition Cambridge University Press, New Delhi, 1981.
4. R.S. Romer & T.S. Parson, “The Vertebrate Body”, VII Edition, W.B. Saunders, Philadelphia, 1986.
5. E.L. Jordon & P.S.Verma, “Chordate Zoology”, Published by S.Chand and Co. 7361, Ram Nagar, New Delhi – 110 055, ISBN : 81-219-1839-9, 2006 Reprint.
6. P.S. Dhami & J.K. Dhami, “Chordate Zoology”, R. Chand and Company, New Delhi, 2006 Reprint.

e-Resources:

1. <https://www.notesonzoology.com/phylum-chordata/classification-of-phylum-chordata-with-characters-zoology/7166>
2. <https://www.dfo-mpo.gc.ca/species-especies/sharks/anatomy-eng.html>
3. <https://www.onlinebiologynotes.com/frog-characteristic-features-and-morphology/>
4. <https://www.biologydiscussion.com/vertebrates/reptilia/reptilia-classification-and-features-animal-kingdom/69835>
5. <https://todaysveterinarynurse.com/articles/rabbit-dentistry/>

CORE: 3	LAB: INVERTEBRATA AND CHORDATA
<i>Contact hours per Week – 2 hours</i>	<i>Credits: 2</i>
<i>Contact hours per Semester – 30 hours</i>	<i>Subject Code: U24ZYCP21</i>
Course Outcomes:	
CO1: Student able to identify the Invertebrate animal.	
CO2: Acquires the knowledge of anatomy of the organisms.	
CO3: Expertise in dissecting the animals.	



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

CO4: Understand the mounting of Appendages of the animals.

CO5: Understand the mounting of Fish Scales.

INVERTEBRATA

DISSECTIONS

Earthworm: Nervous System

Cockroach: Digestive System and Nervous System

Pila: Digestive system – Book plate/ Model

MOUNTINGS

Paramecium: Wet mounting

Earthworm: Body Setae

Cockroach: Mouth parts, Salivary gland, and Trachea

Prawn: Appendages

Mosquito: Mouth Parts

Pila: Radula – Book plate/ Model

SPOTTERS

Protozoa: *Paramecium* – Conjugation; *Euglena*, *Entamoeba*, *Plasmodium*.

Porifera: Simple *Sponge*; *Sponge* – Gemmule; *Sponge* – Spicules

Coelenterata: *Obelia* colony, *Obelia* medusa, *Aurelia*, *Physalia*, *Sea anemone*

Helminthes: Liver fluke, *Redia* larva, *Cercaria* larva, *Ascaris* (Male and Female)

Annelida: *Earthworm*, *Nereis*, *Heteronereis*, Leech, *Chaetopterus*

Arthropoda: Cockroach, Scorpion, Centipede, Peripatus

Mollusca: *Pila*, Fresh water mussel, Chiton, Sepia, Solen

Echinodermata: Starfish, Sea-urchin, Sea-cucumber, Brittle star, Bipinnaria larva

CHORDATA

DISSECTIONS

Fish (Tilapia) – Digestive system

Frog- Digestive system- Book plate/ Model only

Calotes– Arterial System and Venous System – Book plate/ Model only

Chick – Digestive system

MOUNTINGS

Fish (Tilapia): Gill Lamella and Air Bladder

Fish: Scales from an edible fish available in the market

Rabbit: Brain – Book plate/ Model

Birds: Quill feather-Barbs, Barbules and Hooklets

Chick – Brain

SPOTTERS

Prochordata: *Amphioxus*, *Balanoglossus*, *Ascidian*

Agnatha: *Petromyzon*

Pisces: *Narcine*, *Echeneis*, *Hippocampus*, *Eel*, *Catla*, *Tilapia*

Amphibia: *Bufo*, *Rhacophorus*, *Ichthyophis*, *Salamander*

Reptilia: *Poisonous snakes:* Cobra, Krait and Viper: *Non – Poisonous Snakes:*

Dryophis and *ptyas*; *Calotes*, *Chameleon* and *Draco*

Aves: *Pigeon*, Pectoral and Pelvic girdle of *Pigeon*, *Archaeopteryx*

Mammals: *Bat*, *Loris*



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

- Industrial Visit or Study tour to different Environments to collect specimens and visit to ornamental fish farm, vermiculture farm. Report must be submitted along with Practical Record notebook during the practical examination and the same should be assessed externally.

SEMESTER II

Part III — Allied subject II — GENERAL CHEMISTRY —II for Biological science

Hours per week: 4

Credits: 3

Subject Code: U24CHAY21

Course Outcome:

- CO1:** To study the separation of chemicals by chromatography techniques.
CO2: To know the classification of proteins, structure and function of nucleic acids and Hormones, and the basics of vitamins
CO3: To learn the basics of chemical calculation
CO4: To acquire a knowledge on detection and estimation of elements
CO5: To gain adequate knowledge on dyes

Unit I: Chromatography

12 Hours

Basic principles of common types of chromatography — Paper chromatography — thin layer chromatography — column chromatography — Ion exchange chromatography. Applications of each technique.

Unit II: Protein, Nucleic acids, Hormones and vitamins

12 Hours

Definition — classification of proteins — colour reaction of proteins — Nucleic acids — nucleoside — nucleotides and general structure of DNA. Hormones — classification — structure of some sex hormones — oestrone and testosterone. Vitamins — classification of vitamins — sources and deficiencies of Vitamins A, B1, C, D, E and K (structural elucidation not required).

Unit III: Basic chemical calculation

12 Hours

Significant numbers — SI Units— calculation of formula weight—understanding Avogadro number — mole concept — mole fraction of the solvent and solute — conversion of grams into moles and moles into grams — stoichiometric equations. Methods of expressing concentration of the solution: normality, molarity and molality — calculations based on principle of volumetric analysis.

Unit IV: Detection and estimation of elements

12 hours

Detection of nitrogen, halogens and sulphur (Lassaigne's test) — estimation of carbon and hydrogen (Liebig's method), sulphur and halogens (Carius method) — Determination of empirical and molecular formula — structural formula.

Unit V: Dyes

12 Hours

Dyes - colour and constitutions — chromophore - auxochrome theory - classification of dyes by structure and methods of applications - preparation of methyl red, Bismarck brown, Malachite green, Indigo and Congo red.

Text Books:

Unit – I

1. B.R.Puri, L.R.Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2004.

Unit – II

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011.



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

Unit – III

1. P.L.Soni and Mohan Katiyal, Textbook of Inorganic Chemistry, Sultan Chand & Sons, 2008.

Unit – IV

1. P.L.Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, 2008.

Unit – V

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011
2. B.S.Bahl and Arun Bahl, Advanced Organic Chemistry, S.Chand & Co., Ltd., 2008.

Reference Books:

Unit - I

1. B.R.Puri, L.R.Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2004.

Unit - II

1. P.L.Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, 2008.

Unit - III

1. K.S.Tewari, N.K. Vishnoi and S.N.Mehrotra, textbook of organic Chemistry, Vikas house PVT Ltd, New Delhi, 1998.

Unit - IV

1. B.S.Bahl and Arun Bahl, Advanced Organic Chemistry, S.Chand & Co., Ltd., 2008.

Unit - V

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co., Ltd., 2008.

e-Resources:

1. <https://microbenotes.com/chromatography-principle-types-and-applications/>
 2. <https://youtu.be/8m7CeObsTIk>
 3. <https://youtu.be/AUMJwjLXh1M>
 4. <https://simple.m.wikipedia.org/wiki/Vitamin>
 5. https://en.m.wikipedia.org/wiki/Significant_figures
 6. <https://chemistryonline.guru/normality-molarity-molality-3/>
 7. https://youtu.be/aH-Cjyn8V_Y
 8. <https://www.adichemistry.com/organic/basics/analysis/lassaignes/lassaignes-test.html>
 9. <https://youtu.be/MhBEj32wZqE>
 10. <https://www.britannica.com/technology/dye>
-

Part III — Allied Chemistry Lab I — LAB: VOLUMETRIC ANALYSIS
Hours per week: 2 Subject Code: U22CHAYP21 Credits: 2

Course Outcome:

CO1: To acquire the basic principles of volumetric titration,

CO2: To understand the basic knowledge on standard solution, molar and the indicator

CO3: To get the knowledge on the titration between acidimetry and alkalimetry



CO4: To develop the basic knowledge on permanganometry

CO5: To know the fundamental knowledge on iodometry.

(Exam to be conducted at the end of even Semester)

A double titration involving making up of the solution to be estimated or single titration involving making up of the solution to be estimated and the preparation of standard solution.

(a) Acidimetry and alkalimetry

1. Titration between a strong acid and strong base.
2. Titration between a strong acid and weak base.
3. Titration between a weak acid and strong base.

(b) Permanganometry

1. Titrations between potassium permanganate and oxalic acid, ferrous sulphate and ferrous ammonium sulphate.

(c) Iodometry

1. Titrations between sodium thiosulphate with potassium permanganate and potassium dichromate (demonstration only)

SBE: 3 ANIMAL DIVERSITY AND ADAPTATION - II	
<i>Contact hours per Week – 2 hours</i>	<i>Credits: 2</i>
<i>Contact hours per Semester – 30 hours</i>	<i>Subject Code: U24ZYS21</i>
Course Outcomes:	
CO1: To understand the animal diversity and adaptation of various groups of vertebrates.	
CO2: To acquire knowledge about the adaptations in the Terrestrial animals.	
CO3: Students are able identify the poisonous and non-poisonous reptiles.	
CO4: Acquires the knowledge on different types of feeding in various animals.	
CO5: To transfer the information about the flight adaptations in the aerial mode of living in animals.	

Unit – I (6 hours)

Retrogressive metamorphosis in Ascidian - Affinities of Balanoglossus and Amphioxus- Migration of Petromyzon.

Unit –II (6 hours)

Accessory respiratory organs in fishes - Scales of fishes: Ctenoid, placoid, and Cycloid scales – fins of fishes - Economic importance of fishes – Migration of fishes.

Unit – III (6 hours)

Parental care in Amphibia- Neoteny in Amphibia- types and factors causing Neoteny- Terrestrialization of Amphibia - Metamorphosis in Amphibia.



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

Unit – IV (6 hours)

Identification of Poisonous and Non-Poisonous snakes– Poison apparatus, Biting Mechanism– First aid for snake bite – Origin, dominance and decline of dinosaurs.

Unit – V (6 hours)

Flight adaptations of birds- Migration of birds- Dentition in Mammals- Adaptations of aquatic Mammals.

Text book:

- Thangamani, S. Prasannakumar, L.M. Narayanan and N. Arumugam, “A text book of Chordates”, Saras Publication, 7th edition: Nagercoil, 2019.

Unit I: Page No: 28-29, 41-43, 59-61, 80

Unit II: Page No: 265-268, 277-283, 291-293

Unit III: Page No: 407- 419

Unit IV: Page No: 521-524, 543-547

Unit V: Page No: 628- 635, 730-735, 746-749

Reference books:

1. M. Ekambaranatha Ayyar and T.N. Ananthakrishnan, Manual of Zoology- Voume II, Chordata, S. Visvanathan (Printers and Publishers) Pvt. Ltd., Chennai. 2005 Reprint.
2. R.L. Kotpal, Vertebrata, Third Edition, Rastogi Publishers, Meerut. 2005 Reprint.
3. R. Alexander, The Chordates, (1981), II International Edition Cambridge University Press, New Delhi.
4. R.S. Romer and T.S. Parson, The Vertebrate Body, –VII Edition, W.B. Saunders, Philadelphia. 1986.
5. E.L. Jordon and P.S. Verma , Chordate Zoology, S. Chand and Co. New Delhi. 2006 Reprint.
6. P.S. Dhami and J.K. Dhami., Chordate Zoology, R. Chand and company, New Delhi. 2006 Reprint.

SBE: 4	APPLIED ZOOLOGY - II
<i>Contact hours per Week – 2 hours</i>	<i>Credits: 2</i>
<i>Contact hours per Semester – 30 hours</i>	<i>Subject Code: U24ZYS22</i>
Course Outcomes:	
CO1: To gain knowledge and skill in the fundamentals of animal.	
CO2: To disseminate information on economic aspects of culture skill and animal farming.	
CO3: To inculcate knowledge on physiology and pathology of fishes.	
CO4: Provides knowledge of animal breeding which is highly professional and attractive avenue for youth.	
CO5: To generate motivation for Self-Employment.	
CO6: To gain skill on value added products.	

Unit–I 6 hours

Edible fish culture - Common edible fishes- *Catla, Rohu, Mrigal*; Types and Construction of fish pond – Hypophysation - Fish feed formulation and types of feed– Economic importance of fishes.



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

Unit– II

6 hours

Ornamental fish culture - Common ornamental fishes- Guppy, Gold fish and Angel fish; Construction of fish tank , Accessories of fish tank ; Fish diseases and treatment -White spot, Gill rot and Vertical scale; Ectoparasite - *Argulus*.

Unit– III

6 hours

Poultry Science - Common breeds of fowls , sexing of one day old chick; Poultry house , deep litter system , cage system ; Nutritive value of chick and eggs; poultry diseases - Raniket, fowl fox ; Poultry pests – ticks and mites.

Unit– IV

6 hours

Dairy farming - Dairy animals - Indigenous -Gir, Buffalo; Exotic - Jersey, Holstein Friensian breeds - Management of model farm ; Diseases of livestock - foot and mouth disease ; Nutritive value of milk - Byproducts of milk.

Unit– V

6 Hours

Sheep farming - varieties of Goat - Jamunapari, Malabari, Sheep breeds -Nellore, Chokla - Feed Formulation - Maintenance of Goat & Sheep - First aid and treatment of Goat & Sheep diseases (Blue tongue and Sheep pox) - Characteristics and uses of Wool and Leather.

Text Books:

1.N.Arumugam, T.Murugan, Johnson Rajeswar and R. Ram Prabhu, “Applied Zoology”, Saras publication, Nagercoil, 2017.

Unit I	197-205 250-278
Unit II	338-353
Unit III	410-432
Unit IV	373-408
Unit V	379-381

Reference Books:

1. Jawaid Ahsan and Subhas Prasad Sinha, “A Hand book on Economic Zoology”, S. Chand Publications, New Delhi,2009.
2. N. Arumugam, T. Murugan, Johnson Rajeswar and R. Ram Prabhu, “ Economic Zoology”, Saras publication, Nagercoil,2012.
- 3.Tarit Kumar Banerjee, “Applied Zoology”, New Central Book Agency (P) Ltd, London, 2016.
4. S.Sarkar, G.Kundu and K.K.Chaki, “Introduction to Economic Zoology”, New Central Book Agency (P) Ltd, London,2016.

e-Resources:

1. <https://www.fao.org/3/AC169E/AC169E00.htm>
2. https://agritech.tnau.ac.in/fishery/fish_cul_ornamental.html
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6470839/>
4. <https://youtu.be/ZD3auEylazQ?list=PLbRMhDVUMngd9ZQul3t-OUxD4713C7QCh>
5. <https://youtu.be/nbTrlHaoQA8>
6. http://www.dairysociety.org/pdf/Souvenir_Seminar.pdf