SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

[An Autonomous College Affiliated to Periyar University, Salem, Tamil Nadu]

[Accredited by NAAC with 'A' Grade with CGPA of 3.27]

[Recognized 2(f)& 12(B) Statuvs under UGC Act. 1956]

Katteri – 636 902, Uthangarai (Tk), Krishnagiri (Dt)

Tamil Nadu, India

Website:www.svmcugi.comE-mail:svmzoologyug@gmail.com

BACHELOR OF SCIENCE IN ZOOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS&OBES)

REGULATIONS AND SYLLABUS FOR

B.Sc. ZOOLOGY PROGRAMME

(SEMESTER PATTERN)

(For Students Admitted in the College from the Academic Year 2020-2021 Onwards)

Programme Outcomes (POs)

PO1	Apply the knowledge of various branches of Zoology and General biology meant both for a graduate terminal course and for higher studies.
PO2	Acquire basic skills in the observation and study of nature, biological techniques, experimental skills and scientific investigation.
PO3	Learning handling DNA sequence data and its analysis which equip students to get employed in R&D in the industry involved in DNA sequencing services, diagnostics, and microbiome analysis.
PO4	Development of theoretical and practical knowledge in handling the animals and using them as model organism
PO5	Development of an understanding of zoological science for its application in medical entomology, Apiculture, Aquaculture, Agriculture and Modern medicine.

Programme Specific Outcomes (PSOs)

PSO1	Identify and list out common animals in vertebrate and non-vertebrate Explain various physiological and biochemical changes in human
PSO2	Students can apply the knowledge and relate the information gained from the allied subjects *viz;* Botany and Chemistry, to explain and conclude through the Interdisciplinary approaches.
PSO3	The students enhance knowledge on the pathways of metabolisms and Explain the role and impact of different environmental conservation programmes
PSO4	Understanding the importance of genetic engineering new tools
PSO5	Identify animals beneficial to humans and Use tools of information technology for all activities related to zoology

SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

Bachelor of Science (B.Sc.) in Zoology

Programme Pattern and Syllabus (CBCS)

(For Students Admitted in the College from the Academic Year 2020-2021 Onwards)

Sl. No.	Part	Nature of the Course	Subject Code	Title of the Paper	Hours / Week	Credits	Marks		
							CIA	ESE	Total
SEMESTER-I									
1	I	Language	20UTA1F01	Tamil - I	6	3	25	75	100
2	II	Language	20UEN1F01	English-I	6	3	25	75	100
3	III	Core-I	20UZO1C01	Invertebrate I	5	5	25	75	100
4		Allied-I	20UCH1A01	Allied Chemistry - I	5	4	25	75	100
			20UBO1A01	Allied Botany - I					
5		Core Practical-I	20UZO2P01	Lab Course-I (Covering core I-II)	3	-	-	-	-
6		Allied Practical-I	20UCH2AP01	Allied Chemistry Lab Course-I	3	-	-	-	-
			20UBO2AP01	Allied Botany Lab Course-I					
7	IV	Value Education	20UVE101	Yoga	2	2	25	75	100
Total					**30**	**17**	**125**	**375**	**500**
SEMESTER-II									
8	I	Language	20UFTA202	Tami l- II	6	3	25	75	100
9	II	Language	20UFEN202	English -II	6	3	25	75	100
10	III	Core-II	20UZO2C02	InvertebrateII	5	5	25	75	100
11		Allied-II	20UCH2A02	Allied Chemistry - II	5	4	25	75	100
			20UBO2A02	Allied Botany - II					
12		Core Practical-I	20UZO2P01	Lab Course-I (Covering core I-II)	3	4	40	60	100
13		Allied Practical-I	20UCH2AP01	Allied Chemistry Lab Course-II	3	3	40	60	100

			20UBO2AP01	Allied Botany Lab Course-II					
14	IV	Common Paper	20UES201	Environmental Studies	2	2	25	75	100
Total					**30**	**24**	**205**	**495**	**700**
SEMESTER-III									
15	I	Language	20UFTA303	Tami l- III	5	3	25	75	100
16	II	Language	20UFEN303	English –III	5	3	25	75	100
17	III	Core-III	20UZO3C03	Chordata	5	5	25	75	100
18		Allied –III	20UCH3A03	Allied Chemistry - III	5	4	25	75	100
			20UBO3A03	Allied Botany - III					
19		Core Practical-II	20UZO2P02	Lab Course-II (Covering core II-III)	3	-	-	-	-
20		Allied Practical-III	20UCH4AP02	Allied Lab Course-III Chemistry	3	-	-	-	-
21			20UBO4AP02	Allied Lab Course-III Botany					
22	IV	SBEC-I	20UZO3S01	Aquaculture	2	2	25	75	100
23		NMEC-I		Non Major Elective Course – I	2	2	25	75	100
Total					**30**	**19**	**150**	**450**	**600**
SEMESTER-IV									
24	I	Language	20UFTA404	Tami l- IV	5	3	25	75	100
25	II	Language	20UFEN404	English -IV	5	3	25	75	100
26	III	Core-IV	20UZO4C04	Cell Biology	5	5	25	75	100
27		Allied –IV	20UCH4A04	Allied Chemistry - IV	5	4	25	75	100
28			20UBO4A04	Allied Botany - IV					
29	IV	SBEC-II	20UZO4S02	Sericulture and Apiculture	2	2	25	75	100
30		NMEC-II		Non Major Elective Course – II	2	2	25	75	100
31	III	Core Practical-II	20UZO4P02	Lab Course-II (Covering core II-III)	3	4	40	60	100
32			20UCH4AP02	Allied Lab Course - IV Chemistry					

Total					**30**	**26**	**230**	**570**	**800**
SEMESTER-V									
34	III	Core- V	20UZO5C05	Animal Physiology	5	5	25	75	100
35		Core- VI	20UZO5C06	Principles of Genetics	5	5	25	75	100
36		Core- VII	20UZO5C07	Biochemistry	5	4	25	75	100
37		Elective –I		Group-A	5	3	25	75	100
38	IV	SBEC-III	20UZO5S03	Biotechnology	2	2	25	75	100
39		SBEC-IV	20UZO5S04	Vermitechnology	2	2	25	75	100
40	III	Core Practical-III	20UZO6P03	Lab Course-III (Covering Core V-VII)	3	-	-	-	-
41		Core Practical-IV	20UZO6P04	Lab Course-IV (Covering Core VIII-X)	3	-	-	-	-
Total					**30**	**21**	**150**	**450**	**600**
SEMESTER-VI									
42	III	Core-VIII	20UZO6C08	Ecology and Ethology	5	5	25	75	100
43		Core-IX	20UZO6C09	Evolution	5	5	25	75	100
44		Core-X	20UZO6C10	Developmental Biology	5	5	25	75	100
45		Elective-II	20UZO6E03	Group-B	5	3	25	75	100
46	IV	SBEC-V	20UZO6S05	Public Health and Hygiene	2	2	25	75	100
47		SBEC-VI	20UZO6S06	Poultry Science	2	2	25	75	100
48	III	Core-Practical-III	20UZO6P03	Lab Course-III (Covering Core V-VII)	3	4	40	60	100
49		Core-Practical-IV	20UZO6P04	Lab Course-IV (Covering Core VIII-X)	3	4	40	60	100
				Extension activities	-	1	-	-	100
Total					**30**	**31**	**230**	**570**	**900**
GRAND TOTAL					**180**	**140**	**1090**	**2910**	**4100**
33		Allied Practical-II	20UBO4AP02	Allied Lab Course-IV Botany	3	3	40	60	100

Note

CBCS – Choice Based Credit system

CIA – Continuous Internal Assessment

ESE – End of Semester Examinations

SWAYAM – Study Webs of Active-Learning for Young Aspiring Minds

NPTEL – National Programme on Technology Enhanced

Major Elective Courses

Semester	Course Code	Paper Title	Credits
Group – A			
Semester -V	20UZO5E01	Medical Laboratory Techniques	3
	20UZO5E02	Biostatics and computational Biology	3
Group – B			
Semester –VI	20UZO6E03	Immunology and Microbiology	3

Non-Major Elective Courses

Semester	Course Code	Paper Title	Credits
Semester III	20UZO3N01	Poultry Science	2
Semester IV	20UZO4N02	Sericulture	2

PROGRAMME SYLLABUS

Program: B.Sc. Zoology				
Core – I		**Course Code:** 20UZO1C01	**Course Title:** Invertebrate – I	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	5	75	5	100

Course Objectives

1. To obtain the knowledge of the taxonomical and characteristics of Invertebrates.
2. To understand the morphological and anatomical features of selected Invertebrate.
3. To create awareness about the harmful parasites and their economic importance.

UNIT-I

Taxonomy: Classification - Significance of Classification - Brief history of Classification. Nomenclature of organisms. **Protozoa:** General Characters and Classification. Type study: *Paramecium caudatum*– Structure - Reproduction and Development.**General Topic:** Pathogenic protozoa of Humans – *Plasmodium vivax, Leishmania donovani*.

UNIT-II

Porifera: General Characters and Classification. Type study: *Leucosolenia* – External Morphology – Physiology and Development. **General Topic**: Canal system in sponges.

UNIT-III

Coelenterata: General Characters and Classification. Type study: *Obelia* – External Morphology – Reproduction – Life cycle. **General Topic:** Polymorphism of Halistemma.

UNIT-IV

Platyhelminthes: General Characters and Classification. Type study: *Taenia solium* – External Morphology – Digestive system and Lifecycle.**General Topic:** Human Helminthes Parasite

UNIT– V

Aschelminthes: General characters and classification. Type of study**:** *Ascaris lumbricoides* – External Morphology – Digestive System –Reproduction and Development. **General Topic:** Diseases caused, Symptoms and Control measures of parasitic Worms *Wuchereria bancrofti*,

Dracunculus medinensis.

Text Books

1. Ekambaranatha Ayyar M, Anantha krishnan T N, and Viswanathan S (1981). Manual of Zoology, Vol. 1 & 2, Printers & Publishers Pvt. Ltd.,Chennai.
2. Jordan E .L and Verma P. S (2000). Invertebrate Zoology, S. Chand &Co.
3. Kotpal R. L (2015). Modern Text Book of Zoology, Invertebrate, Rastogi Publication, Meerut.
4. Nair N. C, Leelavathi S, Soundrapandian N, Murugan T and Arumugam. N (2013). A Text Book of Invertebrates. Saras Publication.

Reference Books

1.Agarwal V .K (2000). Invertebrate Zoology, S. ChandCompany.
2. Ekambaranatha Ayyar M and Viswanathan S (1954). A Manual of Zoology, Part I. Invertebrata. No.11, McNichols Road Chetput, Madras-31.
3.Kashyap V (1997). Life of Invertebrates. Vikas Publishing House Pvt. Ltd., New Delhi.
4.Kotpal R L (2003). Modern Text Book of Zoology, Rastogi Publications, Meerut. New Delhi.
5.Moore R C, Lalicker C. G, and Fischer A G (1952). Invertebrate Palaeontology, McGraw Hill Book Co.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define the evolution any history of phylum.	K1
CO2	Understand about the Invertebrates animals.	K2
CO3	Understand the external as well as internal characters of Invertebrates.	K3
CO4	Investigate the economic importance of Invertebrates animals.	K6

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

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	M	M	M
CO3	S	M	S	S	S
CO4	S	S	M	M	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Zoology				
Core – II	**Course Code:** 20UZO2C02		**Course Title:** Invertebrate –II	
Semester II	**Hours/Week** 5	**Total Hours** 75	**Credits** 5	**Total Marks** 100

Course Objectives

1. To obtain the knowledge of the taxonomical and characteristics of Invertebrates.
2. To understand the morphological and anatomical features of selected Invertebrates.
3. To create awareness about the harmful parasites and their economic importance of Invertebrates.

UNIT-I

Annelida: General Characters and Classification. Type study: *Lampito mauritii* – External Morphology - Digestive system - Reproduction and Development. **General Topic**: Excretion in Annelids.

UNIT-II

Arthropoda-I: General Characteristics and Classification up to Classes. Type study: *Penaeus indicus* – External Morphology and Reproduction. **General topic:** Economic importance of Insects.

UNIT-III

Arthropoda-II: Type study: Cockroach – External Morphology and Reproduction. **General Topic:** Mouth Parts of Insects.

UNIT-IV

Mollusca: General Characters and Classification up to Classes. Type study: *Pila globosa*– Morphology - Respiratory System – Locomotion - Excretory System and Reproduction.
General Topic: Economic importance of Molluscs.

UNIT-V

Echinodermata: General Characters and Classification up to Classes. Type study: *Asterius*

rubens (Star fish) – External Morphology and Water vascular System. **General Topic:** Larval forms of Echinoderms.

Tex Books

1. Jordan E L and Verma P S (2000). Invertebrate Zoology, S. Chand &Co.
2. Kotpal R L (2015). Modern Text Book of Zoology, Invertebrate, Rastogi Publication, Meerut.
3. Nair N C, Leelavathi S, Soundrapandian N, Murugan T and Arumugam N (2013). A Text Book of Invertebrates. Saras Publication.

Reference Books

1. Agarwal V K (2000). Invertebrate Zoology, S. Chand Company.
2. Ekambaranatha Ayyar M (1973). A Manual of Zoology, Part I. Invertebrata. S. Viswanathan Pvt. Ltd,
3. Kashyap V (1997). Life of Invertebrates. Vikas Publishing House Pvt. Ltd., New Delhi.
3. Kotpal RL (2003). Modern Text Book of Zoology. Rastogi Publications,Meerut.
4. Moore R C, Lalicker and Fischer A G (1952). Invertebrate Palaeontology, McGraw Hill Book Co. Inc., New York.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define the internal and external morphology of the animal.	K1
CO2	Understand the concepts of Metamorphosis, regeneration and autonomy.	K2
CO3	Demonstrate the Mouthparts of insects.	K3
CO4	Distinguish the economic importance of Molluscs.	K4
CO5	Investigate the Water vascular System in *Asterius rubens*	K6

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

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	M	M	S	M
CO3	S	M	S	S	S
CO4	M	S	M	S	S
CO5	M	M	S	M	M

S – Strong **M–Medium** **L –Low**

Program: B.Sc. Zoology				
Core Practical – I	**Course Code:** 20UZO2P01		**Course Title:** Invertebrate I & II	
Semester I & II	**Hours/Week** 3	**Total Hours** 45	**Credits** 4	**Total Marks** 100

Course Objectives

1. To observe various Invertebrate specimens by using Microscope.
2. To know the various systems (Digestive system, Nervous system and Reproductive system) of animals.
3. To inculcate the significance of various Invertebrate animals.

I. Major Practicals

Cockroach digestive system - Nervous system - Reproductive system and Prawn Nervous system

II. Minor Practicals

Prawn Appendages - Mouth parts – Honey bee - Mosquito and Cockroach.

III. Spotters

Classify and giving reasons: Paramecium – Sycon - Obelia colony - *Taenia solium* - Earth worm – Leech - Sea cucumber - Star fish - freshwater mussel – Prawn and Neries

Draw labelled sketches: T.S. of Ascaris (Male and Female) - T.S. of Hydra - T.S. of *Taenia solium* proglottid and T .S of Fasciola.

Biological significance: Gemmule - Spicules – Limulus – Leech - Bipinnaria larva and Physalia.

Relate structure and function: *Taenia scolex* - Earthworm body setae - Star fish – Tube feet - Peneus – Petasma and Nereis – Parapodium.

Submission of Practical Record

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Identified invertebrates specimen slides under compound microscope.	K2
CO2	Examine the various anatomical system of invertebrates animal.	K4
CO3	Evaluate the biological significance and structure and functions of various animals.	K5

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

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	M
CO2	S	M	S	S	M
CO3	S	M	M	S	S

S – Strong M–Medium L –Low

Program: B.Sc. Zoology				
Allied Zoology (For Other Department)	**Course Code:** 20UZO1A01		**Course Title:** Allied Zoology– I	
Semester I	**Hours/Week** 5	**Total Hours** 75	**Credits** 3	**Total Marks** 100

Course Objectives

1. To learn about the taxonomy and characteristics of Invertebrate.
2. To obtain the knowledge of morphology and anatomy of the animals.

UNIT-I

Protozoa: *Paramecium caudatum*– Structure – Digestion and Reproduction. **Porifera**: Leucosolenia- Structure. General Topic: Protozoan diseases and Canal system in sponges

UNIT-II

Platyhelminthes: *Fasciola hepatica* – Morphology and Reproduction. **Annelida:** Leech- Structure and Digestive system. General Topic: Human Helminth Parasites- *Taenia* and *wuchereria*

UNIT -III

Arthropoda: *Periplanata Americana* – Structure and Reproduction. **Mollusca**: Fresh water mussel - External characters and Digestive system. **Echinodermata**: Starfish –External characters. General Topic: Water vascular system in Star fish.

UNIT-IV

Chordata - Cephalochordata: Amphioxus - External characters and digestive system. **Pisces**: Shark - External characters and digestive system. **Amphibia**: Frog - External characters and respiratory system. **Reptilia**: Calotes - External characters and Urinogenetal system .

General topic: Parental care in Amphibia

UNIT –V

Aves: Pigeon- External characters and Urinogenetal system. **Mammalia:** Structure and Digestive system of Rabbit. General Topic: Migration of birds – Dentition in Rabbit.

Text Books

1. Ekambaranatha Ayyar M and. Ananthakrishnan T N Viswanathan S (1981). Manual of Zoology Vol. 1 & 2, Printers & Publishers Pvt. Ltd.,Chennai.
2. Jordan E L & P S Verma (2000) Invertebrate Zoology S. Chand &Co.
3. Kotpal R L, (2015). Modern Text Book of Zoology, Invertebrate, Rastagi Publication, Meerut,India.
4. Nair N C, Leelavathi S, Soundrapandian N, Murugan T, N Arumugam (2013) AText Book of Invertebrates, Saras Publication.
5. Jordan E L and Verma P S (2013). Chordate Zoology S Chand & Company Ltd., NewDelhi.
6. Kotpal R L (2012). Morden Text Book of Zoology, Vertebrates Rastogi Publication, Meerut.
7. Nigam H C (1972). Zoology of Chordates. (5thEdn.,), S. Nagin& Co. Publishers, Delhi.

Reference Books

1. Agarwal V K (2000). Invertebrate Zoology, S. Chand Company.
2. EkambaranathaAyyar M. (1973). A Manual of Zoology, Part I. Invertebrata. S. Viswanathan Pvt. Ltd.
3. Kashyap V (1997). Life of Invertebrates. Vikas Publishing House Pvt. Ltd., New Delhi.
4. Kotpal R L (2003). Modern Text Book of Zoology- Rastogi Publications, Meerut. India.
5. Moore R C, Lolicker and Fischer A G (1952). Invertebrate Palaeontology, McGraw Hill Book Co. Inc., NewYork.
6. Kotpal R L (2012) Morden Text Book of Zoology, Vertebrates Rastogi Publication. Meerut.
7. Nigam H C(1972). Zoology of Chordates (5thEdn.,), S.Nagin & Co. Publishers, Delhi.
8. Thangamani A, Prasannakumar S,Narayanan L M and Arumugam N (2009). Chordates, Saras Publication.

9. Waterman A J (1971). Chordate Structure and Function. Macmillan Company, New Delhi.
10. Young J Z (1981). The Life of the Vertebrates. (3rdEdn.,), Oxford University Press, Great Britain.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	List of the classification in various organisms.	K1
CO2	Describe the morphology and anatomy on chordates.	K2
CO3	Explain the biological significance of non-chordates and chordates.	K2
CO4	Discuss the parental care of fishes and amphibians.	K2
CO5	Investigate the Parasitic and protozoan diseases.	K6

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

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	M
CO2	S	M	S	M	S
CO3	S	M	S	S	M
CO4	M	S	S	S	M
CO5	S	M	S	M	S

S – Strong M–Medium L –Low

Program: B.Sc. Zoology				
Allied Zoology (For Other Department)	**Course Code:** 20UZO2A02		**Course Title:** Allied Zoology– II	
Semester II	**Hours/Week** 5	**Total Hours** 75	**Credits** 4	**Total Marks** 100

Course Objectives

1. To acquire the knowledge about the cytology and developmental biology of living animals.
2. To understand the physiology and of digestion.
3. To create the awareness about the environmental pollution and learn about the evolutionary modification.

UNIT-I

Cell biology: Structure of an animal cell – Structure and functions of Mitochondria – Golgi body – Centrosome – Lysosomes and Nucleus. **Genetics:** Mendel's laws of Monohybrid and Dihybrid

UNIT-III

Developmental Biology: Types of eggs. Cleavage – Blastulaion and Gastrulation in Frog.

Animal Physiology: Digestion and Excretion in man.

UNIT-IV

Ecology: Pond Ecosystem and its components - Food chain - Energy flow - Pollution of water - Air and Noise.

UNIT-V

Evolution: Evidences of Evolution – Lamarkism - Darwinism and De-Vries - Mutation theory.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Acquire the knowledge about the cytology and developmental biology of living animals.	K1
CO2	Understand the physiological function of organisms.	K2
CO3	Analyze the evolutionary significance of animals	K4
CO4	Create the awareness about the environmental pollution and learn about the evolutionary modification. .	K6

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

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	S
CO2	S	M	S	M	M
CO3	S	S	M	M	M
CO4	M	M	S	M	S

S – Strong **M–Medium** **L –Low**

Program: B.Sc. Zoology				
Allied Practical		**Course Code:** 20UZO2AP01		**Course Title:** Allied Zoology Practical
Semester I & II	**Hours/Week** 3	**Total Hours** 45	**Credits** 3	**Total Marks** 100

Course Objectives

1. To observe the various anatomical systems of animals using virtual laboratory.
2. To educate the students about the cell division and genetic disorders.
3. To know the developmental stages of frog and Plankton analysis.

I.Major Practicals

Cockroach – Digestive - Nervous and Reproductive systems. Prawn – Nervous system.

II. Minor Practicals

1. Mouth parts of Honey Bee and Mosquito.
2. Prawn –Appendages.

III. Spotters

Amoeba - Paramecium – Aurelia - *Fasciola hepatica* – Ephyra larva– *Taenia solium- Taenia scolex*- Fasciola – C.S of Ascaris - Male and Female. Sea anemone Hermit crab – Star fish – Redia larava – Cercaria larava – Nauplius larava and Mysis larva. Amphioxus – Shark – Cobra - Pigeon, Blastula of frog – 24 hours Chick embryo – Peripatus – Archaeopteryx.

Submission of Practical Record Note

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Apply knowledge to study various anatomical system of invertebrates animal	K1
CO2	Focus invertebrates specimen slides under compound microscope.	K2
CO3	Evaluate the biological significance and structure and functions of various animals.	K5

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

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	**M**	**M**	**S**	**S**	**S**
CO2	**S**	**S**	**S**	**S**	**S**
CO3	**M**	**M**	**S**	**S**	**S**

S – Strong M–Medium L –Low

Program: B.Sc. Zoology				
Core – III	**Course Code:** 20UZO3C03		**Course Title:** Chordata	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	5	75	5	100

Course Objectives

1. To obtain comprehensive knowledge on the taxonomy and Characteristics of Chordates.
2. To understand the morphological and anatomical features of Chordates.
3. To study the general features distribution and economic importance of Chordates.
4. To study the flight adaptation and migration of birds.
5. To study Prototheria, Metatheria and dentition in mammals.
6. To study the detailed information about Amphioxus, Scoliodon, Frog, Pigeon and Rat.

UNIT-I

Outline classification of Chordates.

Prochordata: Classification and Characteristics up to Classes with suitable examples.

Type study: *Branchiostoma lanceolatum* (Amphioxus) – Digestive system -Respiratory system and Urinogenital system.

Pisces: Classification and Characteristics (Chondrichthyes, Osteichthyes)

Type study: *Scoliodon sorrakowah* – Digestive system – Respiratory system – Circulatory system and Urinogenital system.

General Topic: Migration of Fishes

UNIT-II

Amphibians: Classification and General Characteristics of Amphibians.

Type study: *Rana hexadactyla* – External Morphology – Digestive system – Respiratory system – Circulatory system and Urinogenital system.

General Topic: Parental care in Amphibians.

UNIT-III

Reptilia: Classification and General Characteristics.

Type study: *Calotes versicolor* – External Morphology – Digestive system – Respiratory system – Circulatory system and Urinogenital system.

General Topic: Identification of poisonous and Non-poisonous Snakes.

UNIT-IV

Aves: Classification and characteristics.

Type study: *Columba livia* – External Morphology – Digestive system – Respiratory system – Circulatory system and Urinogenital system.

General Topics: Migration in Birds and Flight adaptation.

UNIT-V

Mammals: Classification and General Characteristics of Mammals.

Type study: *Oryctolagus cunniculus* – External Morphology – Digestive system – Respiratory system – Circulatory system and Urinogenital system

General Topic: Dentition in Mammals (Rabbit & Human).

Text Books

1. Ekambaranatha Ayyar M, Ananthakrishnan T N and Viswanathan S (1981). Manual of Zoology Vol.1 & 2 Printers & Publishers Pvt.Ltd.,
2. Jordan E L and Verma P S (1965). Chordate Zoology & Elements of Physiology, Meerut.
3. Jordan E L and Verma P S (2013). Chordate Zoology S Chand & Company Ltd., NewDelhi.
4. Kotpal R L (2012). Morden Text Book of Zoology, Vertebrates Rastogi Publication, Meerut.
5. Nigam H C (1972). Zoology of Chordates. (5thEdn.,), S. Nagin& Co. Publishers, Delhi.
6. Thangamani A, Prasannakumar S, Narayanan L M and Arumugam N (2009). Chordates, Saras Publication.
7. Young J Z (1981). The Life of the Vertebrates. (3rdEdn.,), Oxford University Press, Great Britain.

Reference Books

1. Dhami P S and Dhami J K (1982). Chordate Zoology, R.Chand& Co. Publishers, New Delhi.
2. Ekambaranatha Ayyar M, Ananthakrishnan T N and Viswanathan S (1981). Manual of Zoology Vol.1 & 2 Printers & Publishers Pvt. Ltd.,Chennai.
3. Jordan E L and P S Verma(2013). Chordate Zoology, S Chand & Company Ltd., New Delhi.
4. Jordan E L and Verma P S (1965). Chordate Zoology & Elements of Physiology, Meerut.
5. Kotpal R L (1996). Modern Text Book of Zoology Vertebrates. Rastogi Publications, New Delhi.

6. Kotpal R L (2012) Morden Text Book of Zoology, Vertebrates Rastogi Publication. Meerut.
7. Nigam H C(1972). Zoology of Chordates (5th Edn.,), S.Nagin & Co. Publishers, Delhi.
8. Thangamani A, Prasannakumar S,Narayanan L M and Arumugam N (2009). Chordates, Saras Publication.
9. Waterman A J (1971). Chordate Structure and Function. Macmillan Company, New Delhi.
10. Young J Z (1981). The Life of the Vertebrates. (3rd Edn.,), Oxford University Press, Great Britain.

Course Outcomes(COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	List out the taxonomy and characteristics of chordates.	K1
CO2	Understand the morphological and anatomical features of chordates.	K2
CO3	Distinguish the Economic importance of chordates.	K4
CO4	Investigate the various systems, adaptation and dentition in Mammals.	K5

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

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	S
CO2	S	S	S	M	M
CO3	S	M	S	S	M
CO4	S	S	M	M	S

S – Strong M–Medium L –Low

Program: B.Sc. Zoology				
SBEC – I	**Course Code:** 20UZO3S01		**Course Title:** Aquaculture	
Semester III	**Hours/Week** 2	**Total Hours** 30	**Credits** 2	**Total Marks** 100

Course Objectives

1. To study the water quality management.
2. To study the culture Techniques of important freshwater fishes.
3. To study the culture techniques of Ornamental fish culture.
4. To the disease management during aquaculture.

UNIT-I

Scope of Aquaculture in India – Types of aquaculture – Extensive – Intensive and Semi Intensive – Culture – Monoculture - Poly culture – Integrated farming – Pond culture - Pen and Cage culture.

UNIT-II

Cultivable species – Indian Major carp (Catla, Rohu and Mirgal), Crustaceans and Molluscs. Pond preparation – Basic fish farm design – Selection of site – Water and soil and Types of Pond.

UNIT-III

Fresh water Prawn culture (*Macrobrachium rosenbergii*) and Marine Prawn culture (*Penaeus monodon*). Ornamental fish culture (Black molly and Guppy) and Construction of home aquarium.

UNIT-IV

Water quality maintenance – Seed selection and health analysis – Molecular techniques in aquaculture – Importance and composition of feeds – Types of feed – Molecular techniques in aquaculture – Importance and composition of feeds Formulation of artificial diets. Live feeds – Probiotics in aquaculture.

UNIT-V

Harvesting - Methods of fishing – Transportation and Marketing of fish – Methods of preservation – Curing – Drying – Mono curing - Smoking - Icing - Freezing and Canning.

Text Books

1. Ayyappan S J, Jena J, Gopalakrishnan A and Pandey A .K (2011). Handbook of fisheries and aquaculture. Indian Council of Agricultural Research. Directorate of Information and Publications on Agriculture, Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research, New Delhi, India.
2. Santhanam R (1990). Fisheries Science, Daya publishing House, NewDelhi.
3. Srivasta C B L (2002). A text book of fishery science and Indian fisheries, KitabMahal, Allahabad.

Reference Books

1. Annan J F, Smiterman R O and Tehebenoglous G (1983). Principles and practices of Pond Aquaculture Oregan State University, U.S.A.
2. Aquaculture. FAO Fisheries Tech. Paper 361, FAO.
3. James P M (1983). Handbook of Mariculture. Vol. I. Crustacean Aquaculture. CRC Press.
4. Jhingran V G (1982). Fish and Fisheries in India, Hindustan Publishing Corporation, New Delhi.
5. Lavens P & Sorgeloos P (1996). Manual on the Production and Use of Live Food for
6. Shankar K M & Mohan C V (2002). Fish and Shellfish Health Management. UNESCO, Publisher.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define fish health management for successful production of fishes.	K1
CO2	Understand the breeding and culture techniques.	K2
CO3	Design the fish farm and construction of aquarium	K6
CO4	Formulate the feed and nutrition management for betterment of ornamental fish culture	K6

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

Mapping of COs with POs

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	M
CO2	S	S	M	M	M
CO3	S	S	S	M	M
CO4	S	S	M	M	S

S – Strong **M–Medium** **L –Low**

Program: B.Sc. Zoology				
NMEC – I	**Course Code:** 20UZO3NMEC01		**Course Title:** Poultry Science	
Semester III	**Hours/Week** 2	**Total Hours** 30	**Credits** 2	**Total Marks** 100

Course Objectives

1. To impart training on Modern Poultry Farming Technology
2. To create knowledge on Self –Employment opportunity.

UNIT –I

Introduction to poultry keeping – Poultry Industry in India – Important breeds of Poultry – Desi, – Chittagong and Leghorn

UNIT -II

Construction of Poultry House – Deep litter system – Cage system – Broiler house.

UNIT –III

Poultry Feeds – Essential Nutrients – Ration for Chick and Broiler.

UNIT -IV

Management of Broilers – Nutritive value of egg and meet – Incubation and Hatching of Eggs.

UNIT –V

Common diseases of poultry – Raniket- Fowl Pox -Coccidiosis and Coryza, Vaccination programme.

Text Books

1. Keith Wilson (2007). A Hand Book of Poultry Practice. (2nd Edn), Agrobios (India), Jodhpur.
2. Norris Elye (2005). The Poultry Science L.C.R. Biotech books. Delhi.

Reference Books

1. Gnanamani M R (1978). Poultry Keeping, Deepana Publications.
2. Shukla G S and Upadhay V B (2004). Economic Zoology, Rastogi Publication.
3. Sing R A (1996). Poultry production. Kalyan publishers.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	List out the formulate diets for poultry.	K1
CO2	Understand the specific areas of poultry production including breeding, nutrition, health, welfare and product quality.	K2
CO3	Evaluate the quality of poultry meat and eggs.	K5
CO4	Investigate the diseases in poultry industry.	K6

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

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	M	M	M
CO3	S	M	S	M	S
CO4	S	S	M	M	S

S – Strong M–Medium L –Low

Program: B.Sc. Zoology				
Core – IV	**Course Code:** 20UZO4C04		**Course Title:** Cell Biology	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	5	75	5	100

Course Objectives

1. To provide the fundamental knowledge on cell types and characters.
2. To enhance the knowledge on cell organelles and their role in metabolic activities.
3. To understand the cell division and genetic makeup of the cell and its significance.

UNIT-I

Microscopy: Compound and Electron Microscopes – Microtomy- Stains – Nuclear and Cytoplasmic stains and Staining Techniques- Structure of Prokaryotes and Eukaryotes cells.

UNIT-II

Structure and function of Plasma membrane – Lysosomes and its Polymorphism – Golgi bodies and Ribosomes.

UNIT-III

Structure – Functions and Origin of Endoplasmic reticulum – Mitochondria – Nucleus and Nucleolus – Structure and Chemical composition of Peroxisomes and glyoxysomes.

UNIT-IV

Giant Chromosome: Polytene and Lampbrush Chromosomes – Structure and functions of Centrosomes. Cell cycle – Mitosis and Meiosis and Significance of Meiosis.

UNIT-V

Nucleic acids: Structure of DNA and RNA - DNA replication – Transcription – RNA types - Genetic code and Protein synthesis.

Cancer biology: Study of cancer cells – Oncogenes and Chemotherapy.

Text Books

1. Ambrose E J and Easty D M – Cell Biology (ELBS).
2. Arumugam N (2007). Cell Biology (6thEdn.,) Saras Publications, Kanyakumari.

3. Loewy A G and Seikovitz P (1969). Cell structure and function (Half Rinchart and Winstion)
4. Swanson C F and Waster P L (1978). The cell (4thEdn), Prentice Hall of India.
5. Verma P S and Agarval V K (1999). Text Book of Cytology, S. Chand & Company (Pvt.) Ltd., New Delhi.

Reference Books

1. Ambrose E J and Dorothy M Easty (1970). Cell Biology, (2ndEdn), The English Language Book Society & Nelson, Great Britain at the Camelot Press Ltd., Southampton.
2. Dorothy M, Ambrose E J, Easty (1970). Cell Biology, (2ndEdn.,), The English Language Book Society & Nelson, Great Britain at the Camelot Press Ltd.,
3. Gerald Karp and Nancy L Pruitt (1998). Cell and Molecular Biology: Concepts and Experiments. Publisher John Wiley &Sons.
4. Power C B (2009). Cell Biology, Himalaya Publishing House, Mumbai.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define the principles and techniques of molecular biology.	K1
CO2	Understand the cell organelles and their role in metabolic activities	K2
CO3	Analyze the chromosomal arrangements during cell Division	K4
CO4	Investigate the Cell aging, oncogenes and chemotherapy.	K6

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

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	M	S	S	S
CO3	M	S	M	S	S
CO4	S	S	M	M	S

S – Strong M–Medium L –Low

Program: B.Sc. Zoology				
SBEC – II	**Course Code:** 20UZO4S02		**Course Title:** Sericulture & Apiculture	
Semester IV	**Hours/Week** 2	**Total Hours** 30	**Credits** 2	**Total Marks** 100

Course Objectives

1. To create a self-employment opportunity among student.
2. To equip the skills of rearing of silkworms.
3. To create better breeding and grainage techniques.

UNIT – I

History and scope of Sericulture – Types of Silkworm- Tasar, Muga and Eri – Morphology and Life cycle of *Bombyx mori* – Races of mulberry silkworm – Diseases of Silkworm – Pebrine – Flachere - Grasserie.

UNI – II

Mulberry Cultivation: Mulberry Varieties – Preparation of land – Propagation of mulberry plants – Irrigation and Pruning – Harvesting and Storage of mulberry leaves and Pests of mulberry plants

Rearing of Techniques: Rearing room – Cleaning – Incubation of eggs – Rearing of worms. Rearing appliances – Feeding – Spacing – Mounting and Harvesting of Cocoon.

UNIT – III

Silk Reeling: Silk Reeling and Appliances – Silk properties – Organic Silk - Dyeing of silk.

UNIT – V

Apiculture: Scope of Apiculture – .Types of Honey Bees (*Apis dorsata, Apis florae, Apis indica* and *Dammer bee)* – Life Cycle (*Apis indica*) – Bee Keeping and Equipment – Social Behaviors of Honey Bee

UNIT – V

Newton'shive Extraction of Honey – Chemical composition of Honey – Nutritional value and medicinal value – Bee wax and Bee venom – Bee enemies and Diseases – Nosima – Acarine – Septecaemia.

Text Books

1. Dandan S B (2004). Hand book of new sericulture technologies, Central Silk Board Bangalore.
2. Ganga G and Sulochana Chetty J (2010). An Introduction to Sericulture, (2nd Edn), Oxford and IBH Publishing House Co. Pvt. Ltd., New Delhi.
3. Jayashree K V, Thara Devi C S and Arumugam N (2015). Apiculture, Saras Publication, Kanyakumari, TamilNadu.
4. Kumar A and Nigam P M (2008). Economic and Applied Entomology, Emkay Publications.
5. Madan MohanRao M (1998). A Text Book of Sericulture, B.S. Publications, Hyderabad.
6. Pradip V Jabde (1993). Text book of Applied Zoology, Discovery publishing house, New Delhi.
7. Shukla G S and V B Upadhyay (2008). Economic Zoology, (4th Edn). Rastogi Publication, Meerut.
8. Upadhyay V B and Shukla G S (2014). Applied and Economic Zoology,(5th Edn), Rastogi Publications, Meerut.
9. Venkatanarasaiah P (2002). Sericulture, Daya Publishing House, New Delhi.

Reference Books

1. Fenemore P G and Prakash A (2002). Applied Entomology, New age international (P) publishers, New Delhi.
2. Fred V Theobald (1989). Economic Zoology, Print well Publisher. Jaipur. India.
3. ManjuYadav (2003) Economic Zoology, Discovery Publishing House, New Delhi.
4. Nayar K K, Anathakrishnan T N and David B V (1983). General and Applied Entomology, Tata McGraw Hill publishing Co. Ltd., New Delhi.

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain the mulberry and non-mulberry silkworms.	K1
CO2	Understand the various silkworm rearing techniques.	K2
CO3	Analyze the control measures of silkworm diseases.	K4
CO4	Investigate the silkworm breeding and grainage techniques.	K6

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

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	M
CO2	S	S	M	M	S
CO3	S	M	S	M	S
CO4	S	S	M	S	M

S – Strong M–Medium L –Low

Program: B.Sc. Zoology				
NMEC – II	**Course Code:** 20UZO4NMEC02		**Course Title:** Sericulture	
Semester IV	**Hours/Week** 2	**Total Hours** 30	**Credits** 2	**Hours/Week** 2

Course Objectives

1. To create a self-employment opportunity among student.
2. To equip the skills of rearing of silkworms.
3. To create better breeding and grainage techniques.

UNIT – I

Types of silk worms – Mulberry – Tasar – Muga and Eri. Morphology and life cycle of mulberry silk worm.

UNIT – II

Mulbeery cultivation in India - Selection of land – Mulberry varieties – Methods of planting – Organic and in organic manure application

UNIT – III

Disinfection of rearing houses and appliances - Egg transportation and incubation – Egg handing – Hatching – Brushing – Silk worm rearing techniques.

UNIT – IV

Pest and diseases of silk worm and preventive measures. Harvesting of cocoon and cocoon assessment.

UNIT – V

Reeling methods - Re-reeling – Silk examination – Cleaning – Lacing – Skeining - Book making – Grading of silk.

Text Books

1.Madan Mohan Rao M (2008) A text book of sericulture B.S Publications,Hyderabad.

2. Ganga &Sulochanachetty G (2006) An introduction to sericulture. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

Reference Books

1. Ullal .S.R and M.N Narasimhanna(1977) Hand book of Practical Sericulture Published by Shri .A.R S. Gopalachar Secretary ,Central silk board ,.Meghdoot,Bombay.

2. Rangaswami.G and S. Manjeet. Jolly. (1988) Sericulture Manual –I , Mulberry Cultivation Published by Mohan Primlani for Oxford & IBH publishing CO. Pvt.Ltd. New Delhi

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain the mulberry and non-mulberry silkworms.	K1
CO2	Understand the various silkworm rearing techniques.	K2
CO3	Analyze the control measures of silkworm diseases.	K4
CO4	Investigate the silkworm breeding and grainage techniques.	K6

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

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	M	M
CO2	S	S	M	M	S
CO3	S	M	S	M	S
CO4	S	S	M	S	M

S – Strong M–Medium L –Low

Program: B.Sc. Zoology				
Core Practical – II	**Course Code:** 20UZO4P02		**Course Title:** Chordata and Cell Biology	
Semester III & IV	**Hours/Week** 3	**Total Hours** 45	**Semester** III & IV	**Hours/Week** 3

Course Objectives

1. To obtain the knowledge of morphology and anatomy of the chordates animals.
2. To impart the practical knowledge on Haematological studies.
3. To understand mitotic and meiotic cell divisions.

I. Major Practicals

1. Total Count of RBC using Haemocytometer.
2. Total Counting of WBC using Haemocytometer.
3. Study of mitotic division using onion root tips.

II. Minor Practicals

1. Blood Smear preparation in man.
2. Preparation of Human Buccal smear.
3. Human blood groups.

III. Spotters

Classify and giving reasons: Shark, Amphioxus, Hyla, *Naja Naja*, Pigeon and Rabbit.

Draw labelled sketches: Frog - Pelvic, Pectoral girdle, Hyoid apparatus and Draco.

Biological significance: Chameleon, Bat, Ichthyophis, Petromyzon and Echenesis.

Relate structure and function: Skull of Rabbit and Dog.

Submission of Practical Record

Course Outcomes (COs)

On successful completion of the course, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	To state that cell and its functions.	K1
CO2	Describe the morphology and anatomy on chordates	K2
CO3	To examine the mitotic and meiotic cell divisions.	K4
CO4	Investigate the bioinstrumentation in medical laboratory.	K6

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

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	M
CO2	S	S	M	M	M
CO3	S	S	S	S	S
CO4	S	S	M	S	S

S – Strong M– Medium L –Low