



PSGR Krishnammal College for Women



DEPARTMENT OF ZOOLOGY

**CHOICE BASED CREDIT SYSTEM &
OUTCOME BASED EDUCATION SYLLABUS**

BACHELOR OF ZOOLOGY

2020 – 2021 Batch



PROGRAMME OUTCOMES

- PO1:** Acquire quality life science education to turn into an outstanding researcher/teacher/career woman/entrepreneur and a responsible citizen
- PO2:** Appreciate the complexities of various levels of organization in the living forms and address controversial biological issues in a scientific way
- PO3:** Assess the scope of animal biology, opt relevant areas for inter-disciplinary and trans-disciplinary studies
- PO4:** Imbibe transformational impact on the quality of education, and to adopt scientific temper and live with scientific values
- PO5:** Understand and apply the core strands of the knowledge acquired in various disciplines of life sciences to become a potential entrepreneur

PROGRAMME SPECIFIC OUTCOME

The students at the time of graduation will

- PSO1:** Gain the knowledge of Zoology through theory and practicals.
- PSO2:** Analyze the relationships among animals with their ecosystems.
- PSO3:** Learn to classify the major groups of organisms under different phyla, understanding the functioning of organisms, compare and contrast anatomical and physiological characteristics of animals.
- PSO4:** Understand good laboratory practices as per laboratory standards, handling the sophisticated instruments/equipment to develop technical skills, research oriented skills about research methodologies, effective communication and skills of problem solving methods.
- PSO5:** Understand the applications of zoological knowledge in Agriculture, Medical and daily life and apply the knowledge for employment- Indian Forest Service, Sericulture, Fisheries, Veterinary, Clinical Laboratory, Museum Curator, departments and Entrepreneurship. They can go for Indian Forest Service and other competitive examinations.



DEPARTMENT OF ZOOLOGY

**CHOICE BASED CREDIT SYSTEM & OUTCOME BASED EDUCATION
SYLLABUS & SCHEME OF EXAMINATION
BACHELOR OF ZOOLOGY
2020 – 2021 Batch**

Programme & Branch B. Sc – Zoology											
Scheme of Examination (Applicable to students admitted during the academic year 2020- 2021onwards)											
Semester	Part	Subject code	Title of the Paper	Instruction Hours/Week	Contact Hours	Tutorial	Duration of Examination	Examination Marks			Credits
								CA	ESE	Total	
I	I	TAM2001/ HIN2001/ FRE2001	Language T/H/F Paper I	6	86	4	3	40	60	100	3
	II	ENG2001/ ENG20F1	English Paper-I/ Functional English Paper –I	6	86	4	3	40	60	100	3
	III	AS20C01	Invertebrata Paper I	6	86	4	3	40	60	100	5
		AS20CP1	Zoology Practical I	3	45		-	-	-	-	-
		CE20A01	Allied Chemistry Paper I	4	56	4	3	20	55	75	4
	CE20AP1	Allied Chemistry Practical	3	45		-	-	-	-	-	
	IV	NME16B1/ NME16A1/ NME12W/ NME12AS/ NME12GS/ NME18ES	Basic Tamil / Advanced Tamil / Women Studies/ Ambedhkar Studies/ Gandhian Studies Entrepreneurship	2/2/ 2	28/26 / 26	2/4/4	-/2/-	50/ 50/ 100	50/ 50/-	100/ 100/ 100	2
II	II	TAM2002/ HIN2002/ FRE2002	Language T/H/F Paper – II	6	86	4	3	40	60	100	3
	II	ENG2002/ ENG20F2	English Paper-II / Functional English Paper –II	6	86	4	3	40	60	100	3
	III	AS20C02	Chordata Paper II	5	71	4	3	40	60	100	5

II	III	AS20CP1	Zoology Practical I	3	45		3	40	60	100	4
		CE20A02	Allied Chemistry Paper II	5	71	4	3	20	55	75	4
		CE20AP1	Allied Chemistry Practical I	3	45		3	20	30	50	2
	IV	OPS1601	Open Course - Self Study Online Courses	-	-	-	-	-	-	-	-
		NME16B2/ A2	Basic Tamil/Advanced Tamil**	-	-	-	-	-	-	-	-
		REG16EE	Effective English Communication	2	27	3		50	50	100	2
VI	NM12GAW	(General Awareness)	Self study (Online)							Grade	
III	I	TAM1903/ HIN1903/ FRE1903	Language T/H/F Paper III	6	86	4	3	40	60	100	3
	II	ENG2003 / ENG20F3	English Paper III / Functional English Paper III	5	71	4	3	40	60	100	3
	III	AS19C03	Ecology and Embryology Paper III	4	56	4	3	40	60	100	4
		AS17CP2	Zoology Practical II	3	45		-	-	-	-	-
		AS19A01 PL19A01	Invertebrata and Chordata Allied Botany Paper I	5	71	4	3	20	55	75	4
		AS19AP1 PL17AP1	Allied Zoology Practical Allied Botany Practical I	2	30		-	-	-	-	-
		AS19SB01	Skill Based - Sericulture I	3	29	1	2	-	-	-	-
		AS19SBP1	Skill Based Subject Practical- Sericulture Practical-I		15	-	-	-	-	-	-
	IV	NM14VHR	Value Education and Human Rights	2	26	4	-	-	-	100	2
	VI	JOB1993	Job Oriented Course Apiculture		After 12.30 PM 60 h		GRADE **				
IV	I	TAM1904/ HIN1904/ FRE1904	Language T/H/F Paper – IV	5	71	4	3	40	60	100	3
	II	ENG2004 / ENG20F4	English Paper IV/ Functional English Paper IV	6	86	4	3	40	60	100	3
	III	AS19C04	Cell Biology and Biochemistry Paper IV	4	56	4	3	40	60	100	4
		AS17CP2	Zoology Practical II	3	45		3	40	60	100	4

IV	III	AS19A02 PL19A02	General Principles in Zoology Allied Botany Paper-II	5	71	4	3	20	55	75	4
		AS19AP1 PL17AP1	Allied Zoology Practical Allied Botany Practical	2	30		3	20	30	50	2
		AS19SB01	Skill Based - Sericulture I	3	29	1	2	25	75	100	4
		AS19SBP1	Skill Based Subject Practical- Sericulture Practical-I		15	-		40	60	100	2
	IV	NM10EVS	Environmental Studies	2	26	4	2	-	-	100	2
		INST1	Internship (4 Weeks)						100	100	2
	V		NSS/NCC/YRC/SPORTS & GAMES	-			-	-	100	100	1

*Not considered for Grand Total and CGPA

**outside regular class hours

QUESTION PAPER PATTERN

CORE & ALLIED PAPERS

Continuous Internal Assessment: 50 Marks

SECTION	MARKS	TOTAL
A – 5 × 2 Marks	10	50
B – 4 × 5 Marks	20	
C - 2/3 × 10 Marks	20	

End Semester Examination: 100 Marks

SECTION	WORD LIMIT	MARKS	TOTAL
A-11/13 × 2 Marks	One or two sentences	22	100
B - 5/7 × 6 Marks	250	30	
C - 4/6 × 12 Marks	500	48	

WEIGHTAGE ASSIGNED TO VARIOUS COMPONENTS OF CONTINUOUS INTERNAL ASSESSMENT

Theory

	CI A I	CI A II	Model Exam	Assignment / Class Notes	Seminar	Quiz	Class Participation	Library Usage	Attendance	Max. Marks
Core / Allied	5	5	6	4	5	4	5	3	3	40
SBS	5	5	15	-	-	-	-	-	-	25
ALC		10	15	-	-	-	-	-	-	25
Information Security	40	40		10		10				100

Practical

	Model Exam	Lab Performance	Regularity in Record Submission	Attendance	Maximum Marks
Core / Allied / SBS	12	20	5	3	40

RUBRICS

Assignment/ Seminar

Maximum - 20 Marks (converted to 4 marks)

Criteria	4 Marks	3 Marks	2 Marks	1 Mark
Focus Purpose	Clear	Shows awareness	Shows little awareness	No awareness
Main idea	Clearly presents a main idea.	Main idea supported throughout	Vague sense	No main idea
Organisation: Overall	Well planned	Good overall organization	There is a sense of organization	No sense of organization
Content	Exceptionally well presented	Well presented	Content is sound	Not good
Style: Details and Examples	Large amounts of specific examples and detailed description	Some use of examples and detailed descriptions	Little use of specific examples and details	No use of examples

Criteria	5 Marks	4 Marks	3 Marks	2 Marks	1 Mark	Points scored
Level of Engagement in Class	Student proactively contributes to class by offering ideas and asks questions more than once per class.	Student proactively contributes to class by offering ideas and asks questions once per class	Student contributes to class and asks questions occasionally	Student rarely contributes to class by offering ideas and asking no questions	Student never contributes to class by offering ideas	
Listening Skills	Student listens when others talk, both in groups and in class. Student incorporates or builds off of the ideas of others.	Student listens when others talk, both in groups and in class.	Student listens when others talk in groups and in class occasionally	Student does not listen when others talk, both in groups and in class.	Student does not listen when others talk, both in groups and in class. Student often interrupts when others speak.	
Behavior	Student almost never displays disruptive behavior during class	Student rarely displays disruptive behavior during class	Student occasionally displays disruptive behavior during class	Student often displays disruptive behavior during class	Student almost always displays disruptive behavior during class	
Preparation	Student is almost always prepared for class with required class materials	Student is usually prepared for class with required class materials	Student is occasionally prepared for class with required class materials	Student is rarely prepared for class with required class materials	Student is almost never prepared for class.	
					Total	

MAPPING OF POS WITH COS

COURSE	PROGRAMME OUTCOMES				
	PO1	PO2	PO3	PO4	PO5
COURSE – AS20CO1					
CO1	S	S	M	M	L
CO2	S	S	M	M	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	M	M
COURSE – AS20CO2					
CO1	L	S	M	M	M
CO2	L	S	M	M	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S
COURSE – AS20CP1					
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
COURSE – AS19CO3					
CO1	S	S	M	M	M
CO2	S	S	M	M	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	M	M
COURSE – AS19C04					
CO1	S	S	S	M	M
CO2	S	S	S	M	M
CO3	S	S	S	S	S
CO4	M	S	S	S	S
CO5	S	S	S	S	S
COURSE – AS16CP2					
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
COURSE – AS19SB01					
CO1	S	S	S	M	M
CO2	S	S	S	M	M

CO3	S	S	S	S	S
CO4	L	S	S	S	S
CO5	S	S	S	S	S
COURSE – AS19SBP1					
CO1	S	S	S	M	M
CO2	S	S	S	M	M
CO3	S	S	S	S	S
CO4	L	S	S	S	S
CO5	S	S	S	S	S
COURSE – AS19A01					
CO1	L	L	L	M	M
CO2	S	S	M	M	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	M	S
COURSE – AS19A02					
CO1	L	L	L	M	M
CO2	S	S	M	M	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	M	S
COURSE – AS19AP1					
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	M	M
CO4	S	S	S	M	M
CO5	S	S	S	S	M

COURSE NO AS20CO1	COURSE NAME INVERTEBRATA	Category	L	T	P	Credit
		Core	86	4	-	5

Preamble

To understand the basic classification, structure and functional details of invertebrates and to appreciate the diversity of life on earth with respect to invertebrates.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1.	Describe the distinguishing characteristics of the major taxa Explain the basic aspects of classification details of invertebrates Understand biodiversity, habitat, adaptation organization and taxonomic status of invertebrates	K ₁ , K ₂ , K ₃ , K ₄
CO2.	Recall certain morphological attributes and physiological processes that are distinct and significant to each Phyla	K ₁ , K ₂ , K ₃ , K ₄
CO3.	Understand the systemic and functional morphology of various groups of invertebrates Explain the basic aspects of structural and functional details of Invertebrates	K ₁ , K ₂ , K ₃ , K ₄
CO4.	To compare and understand the general and specific characteristics within each Phyla	K ₁ , K ₂ , K ₃ , K ₄
CO5.	Interpret the affinities, evolutionary relationships and adaptation of the major taxa and to explain their economic importance with respect to Non-Chordates	K ₁ , K ₂ , K ₃ , K ₄

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1.	S	S	M	M	L
CO2.	S	S	M	M	M
CO3.	S	S	S	S	M
CO4.	S	S	S	S	M
CO5.	S	S	S	M	M

S- Strong; M-Medium; L-Low

Unit 1

18 hours

Phylum Protozoa

Type Study: *Paramecium caudatum* –External features, Nutrition, Locomotion- effective stroke, recovery stroke, Metachronal rhythm, Reproduction-Asexual- Binary fission ,Sexual reproduction – Conjugation, Autogamy, Endomixis, Hemimixis and Cytogamy.

General Essays: Locomotion in Protozoa
Protozoan human diseases

Phylum Porifera

Type Study: *Leucosolenia botryoides*- External features, Body wall, Spicules, Canal System, Nutrition, Reproduction.

General Essays: Canal System in sponges
Economic importance of sponges

Unit 2

17 hours

Phylum Coelenterata

Type Study: *Obelia geniculata* - External features, Histology of the colony, Cnidoblast and its functions, Life History of Obelia, Metagenesis.

General Essays: Corals & coral reefs
Polymorphism in Coelentrates

Phylum Helminthes

Type Study: *Taenia solium*- External features, Body wall, Feeding, Respiratory system, Excretory system-flame cells, Nervous system, Reproductive system, Life cycle- Onchosphere and Cysticercus larvae.

General Essays: 1. Brief account on a) *Wuchereria bancrofti*, b) *Dracunculus medinensis*, c) *Ancylostoma duodenale*
2. Parasitic adaptation in Helminthes.

Unit 3

17 hours

Phylum Annelida

Type Study: *Megascolex mauritii* - External features, Body wall, Coelom, Locomotion, Digestive system, Respiratory system, Excretory system-Meganephridia, Micronephridia, Pharyngeal nephridia, Nervous system, Reproductive system.

General Essays: Metamerism in annelids.
A Brief Account on vermiculture.

Unit 4

17 hours

Phylum Arthropoda

Type study: *Periplaneta americana* - External features, Body wall, Mouthparts, Digestive system, Respiratory system, Circulatory system, Nervous system, Sense organs, Excretory system, Reproductive system.

General Essays: Peripatus- Affinities as a living fossil.

A Brief Account on Apiculture.

Unit 5

17 hours

Phylum Mollusca

Type Study: *Pila globosa* - External features, Shell, Digestive system, Respiratory system, Circulatory system, Nervous system, Sense organs- Eyes, Osphradium, Statocyst, Tentacles, Excretory system, Reproductive system..

General Essays: Torsion in Mollusca.

A Brief Account on Pearl Culture.

Phylum Echinodermata

Type Study: *Asterias rubens*.- External features, Pedicellaria-Structure and Function, Digestive system, Respiratory system, Water vascular system-Structure and Function, Circulatory system-Perihaemal and Haemal system, Nervous system, Sense organs, Excretory system, Reproductive system.

General Essays: Larval forms of Echinoderms and their evolutionary significance.

Economic importance in Echinoderms.

Text Book

1. Jordan.E.L and Verma.P.S, Invertebrate Zoology Revised Edn., S.Chand and Co. Ltd. Ram Nagar, New Delhi, 2014.
2. N. C. Nair, N. Soundara Pandian, S. Leelavathy, T. Murugan, A Text Book of Invertebrates, Saras Publications ,2013.

Reference Books

1. Jan A. Pechenik, Biology of the Invertebrates. McGraw-Hill McGraw-Hill Companies, 7th Revised Edition, 2014
2. Dhami P.S. and Dhami J.K, Invertebrate Zoology 5 th edition S. Chand & Co., New Delhi, 2012.
3. Ekambaranatha Ayyar, M. & Ananthakrishnan, T.N Manual of Zoology Vol-I (Invertebrata) Part I & II Vishwanathan (p) Ltd.Chennai, 2010
4. Fatik Baran Mandal, Invertebrate Zoology Ist Edn., Eastern Economy Edition, 2012.
5. Kotpal R.L., Agarwal S.K and Ketarpal R.P.R, Modern Text Book of Zoology – Invertebrates, Rastogi Publications, 2011.
6. Rober D. Barnes, Invertebrate Zoology. 6th Edn. Brooks W.B.Saunders Company. Philadelphia, 1994.
7. Barrington EJW, Invertebrate Structure and Function II Edn, ELBS and Nelson, 1979.

COURSE NO	COURSE NAME	Category	L	T	P	Credit
		Theory	71	4	-	5

AS20CO2

CHORDATA

Preamble

To understand basic classification, structural and functional details of chordates and to interpret the evolutionary relationships among the major taxa

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Identify the general and specific characteristics of the different classes and the organization of the representative types.	K ₁ , K ₂ , K ₃ , K ₄
CO2	Recognize and describe the major groups of chordates	K ₁ , K ₂ , K ₃ , K ₄
CO3	Understand the diversity of Chordates and its outline systematic. Discuss their affinities and adaptations to different modes of life.	K ₁ , K ₂ , K ₃ , K ₄
CO4	Understand the unique features, taxonomy and functional morphology of different classes of chordates	K ₁ , K ₂ , K ₃ , K ₄
CO5	To infer the affinities, evolutionary relationships and adaptation of the major taxa and to explain their economic importance with respect to Chordates.	K ₁ , K ₂ , K ₃ , K ₄

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

CHORDATA- AS20CO2 (71 hrs)

UNIT I:

(15 Hrs)

Phylum Chordata Introduction, Three fundamental Chordate characters, Advancements of Chordates over other phyla. Brief classification of chordate with characters.

PROTOCHORDATA- General Characters

Type study: Amphioxus- Affinities and Systematic Position, Habits and Habitat, External features, Body wall, Coelom, Atrium, Digestive System, Respiratory mechanism, Circulatory system, excretory system and Reproductive system.

General Essays

- Dipnoi- lung fishes-affinities and systematic Position
- Retrogressive metamorphosis in Urochordata

PISCES- General Characters

General characteristics of Chondrichthyes and Osteichthyes, classification up to order

Type study: Shark - Systematic Position, Habits and Habitat, External features, Exoskeleton-Placoid Scales, Digestive System, Respiratory system & Mechanism of respiration, Circulatory system -Blood, Heart and pericardium, Arterial system, Venous system, Nervous system-Brain, Spinal cord, cranial nerves and spinal nerves. Sense organs-Olfactory organs, Eyes, Internal ears, Neuromast or lateral line system, Ampullae of Lorenzini. Urinogenital system.

General Essays

- Accessory respiratory organs in fishes
- Migration, Osmoregulation and Parental care in fishes
- General account of a) *Oreochromis mossambicus* b) *Labeo rohita* c) *Catla catla*

UNIT II: AMPHIBIA

(14 hrs)

General characteristics and classification up to order

Type study: Frog- Systematic Position, Habits and Habitat, External features, Sexual dimorphism, Digestive System, Respiratory system- Cutaneous respiration, Buccal respiration and Pulmonary respiration. Respiratory mechanism-inspiration and expiration. Circulatory system-Blood, Heart-Internal structure, Arterial system, Venous system. Nervous system-Brain, Spinal cord, cranial nerves and spinal nerves. Sense organs- Tangoreceptors, Tastebuds, Olfactory organs, Internal structure and functions of Eye and Ear, Urinogenital system

General Essays

- Origin of *Tetrapoda* (Evolution of terrestrial ectotherms)
- Parental care in Amphibia
- Neoteny in Amphibia

UNIT III: REPTILIA

(14 hrs)

General characteristics and classification up to order

Type study: Calotes - Systematic Position, Habits and Habitat, External features, Digestive System, Respiratory system- Respiratory mechanism, Circulatory system-Blood,Heart-Internal structure, Arterial system, Venous system. Nervous system- Brain, Spinal cord, cranial nerves and spinal nerves. Sense organs, Jacobson's organs, Internal structure and functions of Eye and Ear, Urinogenital system

General Essays

- Affinities of *Sphenodon*
- Poison apparatus and Biting mechanism in snakes, First aid treatment for snake bite.
- Common poisonous and non – poisonous snakes in India.

UNIT IV: AVES

(14 hrs)

General characteristics and classification up to order

Type study: Pigeon -Systematic Position, Habits and Habitat, External features, Feathers- Structure of a typical feather in Pigeon, Types of feathers in pigeon .Muscular System- Flight muscles, Digestive System, Respiratory system- Syrinx and voice production, Air sacs and functions. Respiratory mechanism, Circulatory system-Blood, Heart-Internal structure, Arterial system, Venous system. Nervous system-Brain, Spinal cord, cranial nerves and spinal nerves, Structure and function of Eye and Ear, Urinogenital system.

General Essays

- *Archaeopteryx*—a connecting link
- Flightless birds, Migration in birds.

UNIT V: MAMMALIA

(14 hrs)

General characteristics and classification up to order

Type study: Rabbit- Systematic Position, Habits and Habitat, External features, Digestive System, Respiratory system, Circulatory system-Blood, Heart-Internal structure, Arterial system, Venous system. Nervous system-Brain, Spinal cord, cranial nerves and spinal nerves. Structure and function of Eye and Ear, Excretory system, Reproductive system.

General Essays

- Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages
- Aquatic adaptations in mammals.

Text Books:

S. No.	Authors	Title of the Book	Publishers	Year of Publication
1	Jordan.E.L and Verma.P.S	Chordate Zoology	S.Chand & Co	2014
2	A. Thangamani S. Prasanna kumar L.M. Narayanan N. Arumugam,	A Text Book of Chordates	Saras Publications	2013

Reference Books:

S. No.	Authors	Title of the Book	Publishers	Year of Publication
1	Ekambaranatha Ayyar.M & Ananthakrishnan.T.N	A Manual of Zoology Vol.II- Part I & II	S.Vishwanathan Pvt. Ltd	2010
2	Kotpal R.L	Modern Text Book of Zoology – Vertebrates	Global Media Publications	2012
3	B Waterman, Allyn J	Chordate Structure and Function	Mac Milan & Co.,	1971
4	Young, J. Z	The Life of Vertebrates	Oxford university press	2004, 3 rd Edn.
5	Pough H.	Vertebrate life	Pearson International	9 th Edn.
6	Darlington P.J.	The Geographical Distribution of Animals	R.E. Krieger Pub Co.,	3 rd Edn.
7	Hall B.K. and Hallgrimsson B.	Strickberger's Evolution	Jones and Bartlett Publishers Inc.	4 th Edn.

Pedagogy: Chalk and Talk method, Seminar, Quiz, Group discussion, power point presentation.

Course Designer(s)

Dr. P. Susheela

1. Dr. G.Sasikala

2.

COURSE NUMBER AS20CP1	COURSE NAME CORE PRACTICAL I	Category	L	T	P	Credit
		Practical	-	-	90	4

Preamble

- To enable the students to expose practically
- To learn the taxonomy of invertebrates and Chordates.
- To understand the relationships between invertebrates, Chordates and their environment.
- To learn the location and appearance of internal organs in a typical insect.
- To understand the structure and functional organization of animals.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the basic concepts of zoological classification, the diversity and relationships between major groups of invertebrates and Chordates. Dissection helps to distinguish among different types of tissues within an insect's body.	K2
CO2	Analyse invertebrates and Chordates in laboratory and field conditions, and use taxonomic keys for identification.	K4
CO3	Application of the skills necessary for self-employment in adopting Field observations of sericulture and Apiary farm.	K3
CO4	To compare and contrasts the life processes in different phyla.	K5

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	S	S	S	S	S	S
CO3	S	S	S	S	S	S
CO4	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

CORE PRACTICAL - I AS20CPI

(90 Hrs)

Dissections

(10 hrs)

1. Cockroach Digestive system, Nervous system, Male & Female Reproductive systems
2. Fish (*Tilapia*) - Viscera, Digestive system, Reproductive system
3. Earthworm- Digestive system, Nervous system
4. Digital Dissection

Mounting:

1. Mounting of scales of a marketable fish.
2. Mounting of gill arch.
3. Mounting of earthworm setae (7 hrs)
4. Mounting of mouth parts of cockroach
5. Mounting of Prawn appendages
6. Whole mount of Euglena, Amoeba and Paramecium, Binary fission and Conjugation in Paramecium

Spotters:

Classify giving reasons:-Paramecium, Leucosolenia, Obelia colony, Prawn, Octopus, Star fish, Ascidian, Shark, Salamander, Pigeon, Bat (8 hrs)

Draw labelled sketches:-T.S. of Tape worm, Leech, Amphioxus, Frog – Skull, Vertebrae - typical, VIII, IX, X, Pectoral girdle, Pelvic girdle, Fore limb and Hind limb (8 hrs)

Relate Structure and function: - Gemmule, Scolex of tapeworm, Nereis -parapodium, Heteronereis, Prawn - Appendages, Honey bee-Queen, Drone, Worker; Quill feather, Tortoise – Carapace and plastron, Narcine – Electric organ, Placoid scale, Snake poison apparatus. (6 hrs)

Write descriptive notes:- Nauplius larva , Pila, Bipinnaria larva, Balanoglossus, Echineis - Sucker fish, Draco - Flying lizard, Rat snake, Cobra, Hyla (7 hrs)

Give biological significance: - Tape worm entire, Chaetopterus, Peripatus, Limulus, Scorpion, Pearl oyster, Hippocampus male and female, Exocetus – Flying fish, Chameleon (6hrs)

Study of six common birds from different orders (2 hrs)

Observations on the Metamorphosis of silkworm (1hr)

Field observations combined with photography and/or videography

- 1) Study of live water specimens in nearby water bodies (5 hrs)
- 2) Study of insect fauna in the college campus (5 hrs)
- 3) Visit to a sericulture farm (5 hrs)
- 4) Visit to an Apiary (5 hrs)
- 5) Visit to a Museum (5 hrs)
6. Study of pond ecosystem (5 hrs)

Culture Methods

- 1) Culture of unicellular organisms (Amoeba, Paramecium, and Euglena)
- 2) Culture of multicellular organisms (Earthworm) (5 hrs)

Reference Books:

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	Sinha. J, Chatterjee. A. K, Chattopadhyay. P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2011
2	Lal S. S.	Textbook of Practical Zoology Vertebrate	Rastogi Publication	2004
3	Lal S. S.	Textbook of Practical Zoology Invertebrate	Rastogi Publication	2004

Pedagogy:

Demonstration, practical, dissection, slides, spotters, field visit, culture methods, power point presentation, e-content, group discussion.

Course Number	Course Name	Category	L	T	P	Credit
AS19CO3	ECOLOGY AND EMBRYOLOGY	Core	56	4	-	4

Preamble

To understand the basic concepts of ecology & Embryology and to understand the functional details of environments and embryo & its stages.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Explain the basic aspects of classification details of ecology Understand biodiversity, habitat, adaptation organization and flora & fauna of soil & water. effect of light and temperature on living things	K ₁ , K ₂ , K ₃ , K ₄
CO2	Recall certain morphological attributes and physiological processes that are distinct and significant to each chapter	K ₁ , K ₂ , K ₃ , K ₄
CO3	Understand the systemic and functional morphology of various concepts of ecology and embryology Explain the basic aspects of structural and functional details of environments and embryo & its stages.	K ₁ , K ₂ , K ₃ , K ₄
CO4	To compare and understand the general and specific characteristics within and other environments in relation to abiotic & biotic factors and stages and development of an embryo	K ₁ , K ₂ , K ₃ , K ₄
CO5	Interpret the major environments and to explain their ecological importance with respect to abiotic & biotic, with animal relationships and different changes in stages of embryo in its development.	K ₁ , K ₂ , K ₃ , K ₄

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

ECOLOGY AND EMBRYOLOGY - AS19CO3

(56 Hrs)

Syllabus

Unit I (12 Hrs)

Scope of Environmental Biology, Abiotic factors – Soil, Water, Light, Temperature. Biotic factors, Animal Relationships: Symbiosis, Mutualism, Commensalism, Antagonism, Parasitism, Predation, Competition, Population attributes: natality, mortality, population growth, population density, growth curves, Age pyramids, Biotic potential, Population regulation.

*Biogeochemical cycles – Carbon, Oxygen, Nitrogen, Phosphorus and Sulphur cycles.

Unit II (11 Hrs)

Community ecology – Definition, Types and Characteristics of community, Ecotone and Edge Effect, Ecological niche, Concepts of community, Ecological succession – sere and climax, Significance of succession. Habitat ecology – Marine Habitat – Definition, Stratification, Pelagic region – communities, plankton, Pelagic adaptations; Intertidal seashore – rocky, muddy, sandy – biota and adaptations.

*Mangroves – Definition, Mangrove fauna and flora, Ecological conditions of mangroves.

Unit III (11 Hrs)

Scope of Developmental Biology – definition, sub-divisions (Descriptive, Comparative, Experimental and Chemical). Early history of embryology. (Preformation and Epigenesis, Recapitulation theory or Biogenetic law, Germplasm theory (Weisman). Gametogenesis – Spermatogenesis – Spermiogenesis, Structure and types of sperms; Oogenesis – Growth of oocyte, vitellogenesis, organization of egg cytoplasm, Polarity and Symmetry, Maturation of egg, egg envelopes, Structure of Ovum; Fertilization – Definition, External and internal fertilization, Mechanism of fertilization. Cleavage – Patterns of cleavage – radial, spiral and bilateral; Types of cleavage – meroblastic and holoblastic. Blastulation – Types of Blastula; Fate map of frog, Gastrulation in frog. Morphogenetic movements – epiboly and emboly. *Types of eggs.

Unit IV (11 Hrs)

Organogenesis in frog – Development of eye, ear, brain & heart. Organizer concept: Embryonic Induction, Role of organizers in development – Transplantation experiments of Spemann and Mangold. Chemistry of organizers. Extra-embryonic membranes in chick. Placentation in mammals – Classification of placenta based on Nature of contact, Mode of implantation, Histological intimacy of foetal and maternal tissue. Functions of placenta.

* Metamorphosis in frog

Unit V (11 Hrs)

Human Reproduction: Puberty, Menstrual cycle, Reproductive Hormones Menopause, Pregnancy, Parturition, Lactation, Infertility, Artificial insemination, Cryopreservation, Embryo transfer, Amniocentesis, Artificial Reproductive Technology – ZIFT, GIFT and IVF. Birds eye view of stem cells

*Test-tube baby and its Merits & Demerits.

* Denotes self study

TEXT BOOKS

S. No.	Author	Title of the Book	Publisher	Year of Publication
1	Arumugam, N	A Text Book of Embryology	Saras Publication	2003
2	Verma P.S., Agarwal., V.K	Environmental Biology	S. Chand & Company	2000

REFERENCE BOOKS

S. No.	Author	Title of the Book	Publisher	Year of Publication
1	Balinsky, B.I	Introduction to Embryology	Saunders College Publishing	1981
2	Berrill, N.J	Developmental Biology	Tata Mc Graw Hill Publication Co.Ltd	1986
3	Clarke,G.L.	Elements of Ecology	John Wiley & Son Inc. New York & London	1954
4	Kotpal,R.L. and Bali,N.P.	Concepts of Ecology	Vishal Publication, Delhi	1986
5	Odum, E.P.	Basic Ecology	Saunders College Publishing , New York	1983
6	Scott F. Gilbert,	Developmental Biology	Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts	1997
7	Vijayaraghavan Nair K & P.V. George	A Manual of Developmental Biology	Academica	-
8	Vincent Terrence Robello, John P.C. and Prema A K	Developmental Biology	Zoological Society Study Material Series, Zoological Society of Kerala, Kottayam	2012

Pedagogy

- Lecture by chalk and talk, power point presentation, e-content, group discussion, assignment, quiz, peer learning, seminar

Course Designers

1. Dr. N. Ezhili
2. Dr. M. Sheeba

Course Number	Course Name	Category	L	T	P	Credit
AS19C04	CELL BIOLOGY AND BIOCHEMISTRY	Core	56	4	-	4

Preamble

To enable the students to explore the intricacies of cell architecture and their complex biochemical interactions.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	To impart knowledge about the prokaryotic and eukaryotic cell, its complex organization, biosynthesis of cellular membranes and organelles and the unified role it plays for the ultimate sustainability of the organisms	K ₁ , K ₂ , K ₃ , K ₄
CO2	Rigorous foundation in the principles of molecular and cellular biology give insights into the mechanisms involved in the synthesis and function of macromolecules such as DNA, RNA, and proteins	K ₁ , K ₂ , K ₃ , K ₄
CO3	Ability to make connections between the molecular mechanisms, holistic understanding of biological organisation and function from the molecules to cells, tissues, organs and entire organism	K ₁ , K ₂ , K ₃ , K ₄
CO4	Studying biochemistry and molecular cell biology trains the students to think logically, critically and quantitatively	K ₁ , K ₂ , K ₃ , K ₄
CO5	Learn to interpret statements made in the scientific literature, as well as in non-science areas, based on evidence, not anecdotes	K ₁ , K ₂ , K ₃ , K ₄

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	S	M	M
CO3	S	S	S	S	S
CO4	M	S	S	S	S
CO5	S	S	S	S	S

S- Strong; M- Medium; L-Low

Syllabus**UNIT I****(12Hrs)**

Scope of Cell Biology; Cell theory, General Characteristics of Prokaryotes, Structure of a Typical Animal Cell and its Organelles, Plasma Membrane - Structure, Fluid Mosaic Model, Unit Membrane Model – Functions- Active Transport, Passive Transport - Cytoskeleton
*Microscopes – Principle and Uses of Optical, Phase Contrast and Electron Microscope

UNIT II**(11Hrs)**

Golgi Bodies – Ultra Structure and Functions, Endoplasmic Reticulum - Ultrastructure, Types and Functions, Lysosomes - Ultrastructure and Functions, Polymorphism in Lysosomes, Ribosomes – Structure and Functions Cell centre - Structure and Functions
* Cancer – Types and Properties of Cancer Cells; Theories on Carcinogenesis

UNIT III**(11Hrs)**

Mitochondria – Ultrastructure, mDNA and functions, Mitochondrial enzymes, Oxidative phosphorylation, Krebs's cycle, Fatty acid oxidation, ATP production. Ultrastructure of Interphase Nucleus and Nucleolus; Chromosome – structure, organization, types and functions.
*Giant chromosomes – polytene, lamp brush chromosomes.

UNIT IV**(11Hrs)**

DNA – Structure, Chemical Composition, Watson and Crick, Replication; RNA - Structure, Chemical Composition, Types – mRNA, tRNA, rRNA; DNA Repair Mechanism – Enzymatic Photo reactivation, Excision Repair, Recombination Repair; cell cycle.
* Cell Cycle and Cell Division

UNIT V**(11Hrs)**

Scope of Biochemistry–Classification-Aldoses, Ketoses, Monosaccharide, Disaccharides, Polysaccharides (homo,hetero). Proteins–Types of Aminoacids, Primary, Secondary, Tertiary Structure of Proteins. Lipids – Simple lipids, Complex lipids, Phospholipids, Glycolipids, Lipoproteins. Enzymes– Michaelis–Menten Equation
*Enzyme action – Factors Affecting Enzyme Action, Mechanism of Enzyme Action
* Denotes self study.

TEXT BOOKS

S. No.	Author	Title of the Book	Publisher	Year of Publication
1	Ambika Shanmugam	Fundamentals of Biochemistry for Medical Students	Wolters Kluwer (India) Pvt Ltd, New Delhi	2012
2	Verma P.S., Agarwal., V.K	Cytology	S. Chand & Company	2012

3	Veer Bala Rastogi	Introduction to Cytology	Introduction to Cytology	2003
---	-------------------	--------------------------	--------------------------	------

REFERENCE BOOKS

S. No.	Author	Title of the Book	Publisher	Year of Publication
1	Albert L Lehninger	Biochemistry, Second Edition	Kalyani Publishers, New Delhi	2 nd Edition
2	De Robertis, E.D.P. and De Robertis, E.M.F	Cell and Molecular Biology	Lippincott Williams and Wilkins, Philadelphia	8 th Edition
3	Satyanarayana U and Chakrapani U	Essentials of Biochemistry	Book and Allied (P) Ltd.	2009
4	Karp, G	Cell and Molecular Biology: Concepts and Experiments	John Wiley & Sons. Inc.	6 th Edition, 2010

Pedagogy

- Chalk and Talk method, Seminar, Quiz, Group discussion, Power point presentation

Course Designers

1. Dr. P.B. Harathi
2. Dr. M. Sheeba

Course Number	Course Name	Category	L	T	P	Credit
AS16CP2	ZOOLOGY PRACTICAL II	Practical	-	-	90	4

Preamble

To provide practical knowledge on cell biology, environmental and developmental biology and to develop practical biological skills.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the basic concepts biology-based knowledge on the life of animal forms and the environment. To understand the concepts of natural habitats and the effects of ecological parameters. To understand the process by which organisms grow and develop.	K2
CO2	Analyse basic components of the ecosystem and their interactions and inter-relationships to sustain life on earth. Analyse the different ecological parameters and to analyse the mechanisms that intervene in developmental alterations.	K4
CO3	Application of the acquired skills and adopting it for future research.	K3
CO4	To compare the practical knowledge on cell biology, environmental and developmental biology and develop practical biological skills.	K4

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

ZOOLOGY PRACTICAL II - AS16CP2

(90 Hrs)

Syllabus

CELL BIOLOGY

(12 Hrs)

1. Squash preparation of onion root tip.
2. Squash preparation of Grasshopper Testis/ Tradescantia anther.
3. Mounting of giant chromosomes in Drosophila larva.

BIOCHEMISTRY

(6Hrs)

1. Qualitative analysis of carbohydrates, proteins and lipids.

ENVIRONMENTAL BIOLOGY

(42Hrs)

1. Estimation of dissolved oxygen in water samples by Winkler's method.
2. Estimation of salinity, pH and temperature in water samples.
3. Estimation of free carbon dioxide in water samples.
4. Mounting and identification of Marine and Fresh water plankton.
5. Identification and study of inter tidal, rocky sandy and muddy shore fauna.
6. Estimation of total alkalinity of water and soil.
7. Estimation of total hardness of water.
8. Trip to a terrestrial ecosystem

DEVELOPMENTAL BIOLOGY

(30 Hrs)

Spotters

1. Observation of different types of eggs – Amphioxus, frog, hen's egg, ovum of mammal
2. Observation of different types of sperms- Sperm of frog, sperm of man.
3. Embryology of Frog – Cleavage, Blastula, Gastrula, Yolk plug.
4. Chick embryo whole mount – 24, 48, 72 & 96 hours.
5. Metamorphosis in frog.
6. Placenta of mammals - pig, sheep and man.

REFERENCE BOOKS

S. No.	Author	Title of the Book	Publisher	Year of Publication
1	Sinha. J, Chatterjee. A. K, Chattopadhyay. P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2011
2	Lal S. S., A	Textbook of Practical Zoology Vertebrate	Rastogi Publication	2004
3	Lal S. S., A	Textbook of Practical Zoology Invertebrate	Rastogi Publication	2004

Pedagogy

- Demonstration, practical, dissection, slides, spotters, field visit, culture methods, power point presentation, e-content, group discussion.

Course Designers

1. Dr. G. Sasikala
2. Dr. M. Sheeba

Course No	Course Name	Category	L	T	P	Credit
AS19SB01	SERICULTURE I	Core	43	2	-	3

Preamble

This course aims to understand the fundamental concepts of Sericulture and to impart scientific & entrepreneurial principles and techniques involved in silkworm production etc.

CO Number	CO Statement	Knowledge Level
CO1	To recall the historical perspective of sericulture, concepts of its origin, scope and significance. To understand the economic advantages of sericulture and its role towards rural development and employment.	K ₁ , K ₂
CO2	To acquaint the general aspects of sericulture industry. To study the biodiversity of silkworms in India and worldwide and importance of sericulture byproducts.	K ₁ , K ₂
CO3	To understand the classification of biology of silkworm <i>Bombyx mori</i> . To study the morphology of silkworm and its anatomical features.	K ₁ , K ₂
CO4	To understand the biology and rearing of non-mulberry silkworms. To gain knowledge on silkworm rearing techniques	K ₁ , K ₂
CO5	To familiarize with the common diseases and pests of non-mulberry silkworms and their management.	K ₂ , K ₃

Mapping with Programme Outcomes

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

S- Strong; M- Medium; L-Low

SERICULTURE I - AS19SB01

(43 Hrs)

Syllabus

UNIT I

(8 Hrs)

Introduction to sericulture – Origin and history of Sericulture – Silk Road, spread of Sericulture to Europe, South Korea, Japan, India and other countries. Sericulture map of India and World: Components of Sericulture. Employment generation in sericulture-Role of women in sericulture. Role of silk fibers amongst natural fibers

UNIT II

(8 Hrs)

Classification and Taxonomic characters: Phylum, class, order, family, genus and Species- Distribution and varieties of silkworms – Mulberry & non-mulberry – Tasar, Eri, Muga worms. Distribution and Races: Geographical distribution in the world and India and Exotic and indigenous races.

UNIT III

(9 Hrs)

Egg: External and internal morphology and colour change. Larvae: Mouth parts, legs, prolegs, spiracles, eyes, claspers and integumentary hair and sexual markings. Pupa: Male and Female Morphology and sexual dimorphism Adult: Mouth parts, antenna, wings, external genitalia. Digestive system: Alimentary canal and physiology of digestion. Silk glands: Structure, development and mechanism of silk synthesis. Circulatory system: Dorsal vessel, haemolymph and haemocytes.

UNIT IV

(9 Hrs)

Reproductive system: Male and female systems, mechanism of egg development. Life cycle of *Bombyx mori* – Reproductive system, Morphology of egg, larva, pupa and adult life span and bionomics, circadian rhythm, and behavior and growth rate of *Bombyx mori*. Exocrine glands: Structure, morphology and secretion of exocrine glands. Pheromone: sex attractants and their role in mating.

UNIT V**(9 Hrs)**

Diseases of silkworms – Viral, bacterial, fungal, and protozoan: pathogens –Flacherie, Grasserie, Muscardine, Pebrine. Causes of various diseases, precaution Measures, control of diseases – disinfection methods. Disinfection and maintenance of hygiene during silkworm rearing

REFERENCE BOOKS

S. No.	Author	Title of the Book	Publisher	Year of Publication
1	Ganga, G and Sulochana Chetty	An Introduction to Sericulture	Oxford and IBH Publishing Co., Pvt., Ltd., New Delhi	1991
2	Venkata Narasiah	Sericulture in India	Ashesh Publishing House, New Delhi	2003
3	Dr. N. G. Djha and Dr.Priyan Panday	Silk Production	APH publishing Corporation, New Delhi	2004

Pedagogy

- Lecture by chalk and talk, power point presentation, demonstration, field visit, e-content, doing experiments, group discussion, assignment, peer learning, seminar.

Course Designer

1. Mrs. Susheela.P

Course Number	Course Name	Category	L	T	P	Credit
AS19SBP1	SERICULTURE PRACTICAL - I	Practical	-	-	45	2

Preamble

To enable the students to understand the life cycle and morphological features of different types of silkworms, types of silk, pests of silkworm, learn the anatomical features of *Bombyx mori* and its rearing and various diseases that affect the silkworms and their management.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	To learn the history and distribution of sericulture in India and world.	K ₁
CO2	To distinguish between the properties of different types of silk	K ₂ , K ₃
CO3	To understand the characteristic features of young age and late age silkworms	K ₂ , K ₃
CO4	To correlate the production of silk and other fibres in India and other countries of the world	K ₂ , K ₃
CO5	To give scientific knowledge about silkworm rearing techniques so as to enable entrepreneurship skill.	K ₂ , K ₃

Mapping with Programme Outcomes

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

S- Strong; M- Medium; L-Low

SERICULTURE PRACTICAL I - AS19SBP1

(43 Hrs)

Spotters:

1. Morphology and Life cycle of the mulberry silkworm - *Bombyx mori*.
2. Identification of different types of silk.
3. Pests and diseases of silkworm.
4. Microscopic and physical properties of natural fibres-cotton, silk.
5. Morphology and life cycle of Eri silkworm.
6. Morphology and life cycle of Tasar silkworm.
7. Morphology and life cycle of Muga silkworm.

Dissection:

8. Dissection of the digestive systems in silkworm
9. Dissection of nervous system and silk glands in silkworm
10. Dissection of male and female reproductive systems of silk moths

Sericulture maps:

11. World maps and Silk Road.
12. Sericulture map of India and Tamil Nadu.

Preparation of histograms and pie charts on:

13. Production of textile fibers in India.
14. World silk production.
15. Pie chart on mulberry and non-mulberry silk production in India

Field visit:

16. Visit to a Sericulture unit and submission of report

Course Number	Course Name	Category	L	T	P	Credit
AS19A01	INVERTEBRATA AND CHORDATA	Allied	71	4	-	4

Preamble

An introduction to basic concepts in biology through study of the major lineages of invertebrate and vertebrate animals, with emphasis on the ontogeny, structure, and function of organ systems in an evolutionary context in allied Zoology to understand biodiversity, adaptation, organization and taxonomic position, explaining the basic aspects of classification, structural and functional details of the invertebrates and chordates.

Course Outcomes

On the successful completion of the course, students will be able to fill up the lacunae in the study of natural sciences.

CO Number	CO Statement	Knowledge Level
CO1	To understand the systematics, morphology, functional, and structural modification in various groups of invertebrates & chordates.	K ₁ , K ₂ , K ₃ , K ₄
CO2	Recollection of certain morphological and physiological processes that are distinctive and important to each Phyla	K ₁ , K ₂ , K ₃ , K ₄
CO3	To understand the structure and physiology of the types included with special emphasis on the adaptations to their modes of life and environment.	K ₁ , K ₂ , K ₃ , K ₄
CO4	To compare and understand the general and specific characteristics within each Phyla, Develop some of the general principles of zoology as they are encountered in the survey of the animal kingdom.	K ₁ , K ₂ , K ₃ , K ₄
CO5	Develop a general familiarity with all major groups of animals, including specific information about selected representatives of each group, Learning Zoology will lead to discuss the diversity of both invertebrate and vertebrate animal life and the fascinating adaptations that enable animals to inhabit nearly all conceivable ecological niches	K ₁ , K ₂ , K ₃ , K ₄

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

INVERTEBRATA AND CHORDATA - AS19A01

(71 Hrs)

Syllabus

Outline classification of animal kingdom upto class level with two examples each. Type study under each phylum to deal with structure, organization and life cycle.

Unit 1

(14 Hrs)

Phylum Protozoa : Structure and life cycle of *Paramecium caudatum* –External features, Nutrition, Locomotion- effective stroke, recovery stroke, Metachronal rhythm, Reproduction- Asexual- Binary fission ,Sexual reproduction –Conjugation, Autogamy, Endomixis, Hemimixis and Cytogamy.

Phylum Porifera: Structure and life cycle of *Leucosolenia botryoides*- External features, Body wall, Spicules, Canal System, Nutrition, Reproduction.

Phylum Coelenterata : Structure and life cycle of Hydra- External features, Histology of body wall, Cnidoblast and its functions, Nutrition, locomotion, Respiration, Excretion and Osmoregulation, Nervous System, Reproduction – asexual – budding; sexual – testis and spermatogenesis, ovary and oogenesis, fertilization, development, hatching - regeneration in Hydra.

Unit II

(14 Hrs)

Phylum Helminthes: Structure and life cycle of *Taenia solium* - External features, Body wall, Feeding, Respiratory system, Excretory system-flame cells, Nervous system, Reproductive system, Life cycle- Onchosphere and Cysticercus larvae.

Phylum Annelida- Structure and life cycle of *Megascolex mauritii* - External features, Body wall, Coelom, Locomotion, Digestive system, Respiratory system, Excretory system- Meganephridia, Micronephridia, Pharyngeal nephridia, Nervous system, Reproductive system.

Phylum Arthropoda- Structure and life cycle of *Periplaneta americana* - External features, Body wall, Mouthparts, Digestive system, Respiratory system, Circulatory system, Nervous system, Sense organs, Excretory system, Reproductive system.

Unit III

(14 Hrs)

Phylum Mollusca- Structure and life cycle of *Pila globosa* - External features, Shell, Digestive system, Respiratory system, Circulatory system, Nervous system, Sense organs- Eyes, Osphradium, Statocyst, Tentacles, Excretory system, Reproductive system..

Phylum Echinodermata- Structure and life cycle of *Asterias rubens*.- External features, Pedicellaria-Structure and Function, Digestive system, Respiratory system, Water vascular system-Structure and Function, Circulatory system-Perihaemal and Haemal system, Nervous system, Sense organs, Excretory system, Reproductive system.

Unit IV

(14 Hrs)

Phylum Chordata-Morphology and organ systems of Shark & Frog (Excluding endoskeleton)

Class Pisces: Shark - Systematic Position, Habits and Habitat, External features, Exoskeleton-Placoid Scales, Digestive System, Respiratory system & Mechanism of respiration, Circulatory system, Nervous system, Sense organs-Olfactory organs, Eyes, Internal ears, Neuromast or lateral line system, Ampullae of Lorenzini. Urinogenital system.

Class Amphibia: Frog- Systematic Position, Habits and Habitat, External features, Sexual dimorphism, Digestive System, Respiratory system, Circulatory system, Nervous system-Sense organs- Tangoreceptors, Tastebuds, Olfactory organs, Internal structure and functions of Eye and Ear, Urinogenital system

Class Reptilia: Calotes- Systematic Position, Habits and Habitat, External features, Digestive System, Respiratory system- Respiratory mechanism, Circulatory system-Blood, Heart-Internal structure, Arterial system, Venous system. Nervous system- Brain, Spinal cord, cranial nerves and spinal nerves. Sense organs, Jacobson's organs, Internal structure and functions of Eye and Ear, Urinogenital system

Unit V

(15 hrs)

Phylum Chordata - Morphology and organ systems of Pigeon & rabbit (excluding endoskeleton)

Class Aves: Pigeon -Systematic Position, Habits and Habitat, External features, Feathers-Structure of a typical feather in Pigeon, Types of feathers in pigeon .Muscular System- Flight muscles, Digestive System, Respiratory system- Syrinx and voice production, Air sacs and

functions. Respiratory mechanism, Circulatory system-Nervous system, Structure and function of Eye and Ear, Urinogenital system.

Class Mammalia: Rabbit- Systematic Position, Habits and Habitat, External features, Digestive System, Respiratory system, Circulatory system, Nervous system. Structure and function of Eye and Ear, Excretory system, Reproductive system.

TEXT BOOKS

S. No.	Authors	Title of the Book	Publishers	Year of Publication
1	Jordon. E.L & Verma, P.S.	Invertebrate Zoology	S. Chand & Co., New Delhi	1993
2	Jordan. E.L and Verma.P.S.	Chordate Zoology	S. Chand & Co, New Delhi	2014

REFERENCE BOOKS

S. No.	Authors	Title of the Book	Publishers	Year of Publication
1	Ekambaranatha Ayyar, M.	Outlines of Zoology	Viswanathan Publication	1992
2	Fatik Baran Mandal	Invertebrate Zoology Ist Edn	Eastern Economy Edition	2012
3	Jan A. Pechenik	Biology of the Invertebrates 7th Revised Edition	McGraw-Hill Companies,	2014
4	Barrington EJW,	Invertebrate Structure and Function II Edn	ELBS and Nelson,	1979
5	Waterman, Allyn J.	Structure and Function,	Mac Milan & Co., NewYork	1971

Pedagogy

- Chalk and Talk method, Seminar, Quiz, Group discussion, Power point presentation.

Course Designers

1. Mrs. Susheela. P
2. Dr. G. Sasikala

Course Number	Course Name	Category	L	T	P	Credit
AS19A02	GENERAL PRINCIPLES IN ZOOLOGY	Allied	71	4	-	4

Preamble

The course imparts knowledge and understanding of basic cell structure and function, genetics, developmental biology, physiology, and evolution.

Course Outcomes

On the successful completion of the course, students will be able to understand the structural-functional relationships of living organisms. Students will come to appreciate and enjoy the subject of zoology and be able to place the subject in the larger context of human knowledge and experience on a global scale.

CO Number	CO Statement	Knowledge Level
CO1	Learn that the cells are the basic units of life, which contribute to form tissue, organs, and organ systems and their functions, diversity and evolutionary relationships among animals	K ₁ , K ₂ , K ₃ , K ₄
CO2	Recognize and understand the fundamentals of cell biology, genetics, animal physiology and evolution	K ₁ , K ₂ , K ₃ , K ₄
CO3	Understand the diversity of Chordates and its outline systematic. Discuss their affinities and adaptations to different modes of life.	K ₁ , K ₂ , K ₃ , K ₄
CO4	Students will be able to explain how organisms function at the level of the gene, genome, cell, tissue, organ and organ-system. Drawing upon this knowledge, they will be able to give specific examples of the physiological adaptations, development, reproduction and behavior of different forms of life	K ₁ , K ₂ , K ₃ , K ₄
CO5	Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped animal morphology, physiology, life history, and behavior.	K ₁ , K ₂ , K ₃ , K ₄

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

GENERAL PRINCIPLES IN ZOOLOGY AS19A02

(71 Hrs)

Syllabus

UNIT I Cell Biology & Genetics

(14 Hrs)

Cell concept-life and living things, cell history, cell theory, cell diversity, internal organization, cell structure and function, Cell types-Prokaryotic, Eukaryotic cell (plant and animal cell), Eukaryotic Animal cell – Structure and functions of Plasma membrane, Golgi apparatus, Mitochondria, Nucleus, Cell cycle - Cell division, Mitosis, Meiosis.

UNIT II Genetics and Physiology

(14 Hrs)

Mendel's Laws of inheritance-Punnett square, Types of genetic cross-Monohybrid and dihybrid cross, Sex determination in man.

Nutrition in man – food types, vitamins and minerals. Digestion and absorption of food in man, balanced diet.

UNIT III Embryology

(14 Hrs)

Gametogenesis – spermatogenesis and oogenesis, Fertilization, cleavage-study of cleavage patterns. Radial and spiral cleavage- Early cleavage in frog- uncleaved egg, two cell stage, morula stage, Blastulation, Gastrulation in Frog - study of different types of eggs- Classification based on amount and distribution of yolk

UNIT IV Endocrinology

(14 Hrs)

Structure, secretions and functions of pituitary- Anterior pituitary and posterior pituitary, thyroid, pancreas and reproductive glands – testes, ovary.

UNIT V Evolution

(15 Hrs)

Origin of life and evolution of cell- Theories on evolution by Lamarck, Charles Darwin & De Vries, living fossils, organic evolution, Evidences of evolution - fossil evidence, morphological, comparative anatomy, embryological, vestigial structures, biochemical and paleontological evidences. Origin of India and its Mega diversity.

TEXT BOOKS

S. No.	Authors	Title of the Book	Publishers	Year of Publication
1	Verma P.S., Agarwal., V.K.	Cytology Reprint Edition	S. Chand and Company	2012
2	Arumugam, N.	Cell Biology, Genetics, Embryology	S. Chand and Company	2012
3	Arumugam, N	Cell Biology, Genetics & Evolution Volume-3.	Saras Publication	1999
4	Verma P.S. & Tyagi B.S.	Animal Physiology,	S. Chand and Company	2012
5	Verma. P.S. and Agarwal. V.K.	Chordate Embryology	S. Chand and Co. Ltd., New Delhi	1998

REFERENCE BOOKS

S. No.	Authors	Title of the Book	Publishers	Year of Publication
1	Berry, A.K.	A Text Book of Animal Physiology with related Biochemistry	Emkay Publications	1993
2	Sarada Subrahmanyam., Madhavan Kutty , K., & Singh H.D.	Text Book of Human Physiology, Reprint	S. Chand & Co,	2012
3	De Rebertis EDP & De Robertis EMF	Cell & Molecular Biology. 8 th Ed.	BI Wauerly Pvt. Ltd, New Delhi.	1996
4	Berrill, N.J.	Developmental Biology	McGraw Hill, New Delhi.	1986
5	Bodmer, Modern Embryology, Hold Rinefiar & Winston. N.Y. Balinsky	Introduction to Embryology International student edition, 3 rd Edition	Saunders Philadelphia.	1981

Pedagogy

- Chalk and Talk method, Seminar, Quiz, Group discussion, Power point presentation

Course Designers

1. Mrs.Susheela.P
2. Dr. G. Sasikala

Course Number	Course Name	Category	L	T	P	Credit
AS19AP1	ALLIED ZOOLOGY PRACTICAL	Practical	-	-	60	2

Preamble

Topics related to fundamentals of zoology, including exposure to diversity in animal groups based on the zoological areas are covered. The practical course is aimed to equipped the students with skills required for animal identification and classification and also applications of zoology in the various allied fields

Course Outcome

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

CO Number	CO Statement	Knowledge Level
CO1	Understand general taxonomic rules on animal classification and general characteristics of animals	K ₁
CO2	Appreciate basic concepts of developmental biology and cell biology	K ₁ , K ₂
CO3	Learn fieldwork modalities & Temporary slides are prepared from fresh water culture medium	K ₃
CO4	Dissections of invertebrate animal will aid the students to understand different systems	K ₃
CO5	Prepared slides are studied to understand the structures and arrangement Study of museum specimens which are present in the departmental museum helps the students to have practical knowledge	K ₁ , K ₂

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	M	M
CO4	S	S	S	M	M
CO5	S	S	S	S	M

S- Strong; M-Medium; L-Low

ALLIED ZOOLOGY PRACTICAL - AS19AP1

(60 Hrs)

1. Dissections:

(30 Hrs)

1. Cockroach Digestive system, Nervous system, Male & Female Reproductive systems
2. Fish (*Tilapia*) - Digestive system
3. Prawn- Nervous system

Mounting:

1. Mounting of scales of a marketable fish.
2. Mounting of gill arch.
3. Mounting of earthworm setae
4. Mounting of mouth parts of cockroach
5. Mounting of Prawn appendages

2. Spotters

(12 Hrs)

- Paramecium – Entire, binary fission, conjugation
- Leucosolenia
- Hydra vulgaris – Entire
- Taenia solium – Entire, T.S
- Ascaris -male,female
- Earth worm
- Pila
- Star fish
- Amphioxus
- Shark
- Frog
- Skeleton of frog- Skull, Vertebrae-Typical, VIII, IX, X, Girdles& Limbs
- Calotes
- Pigeon
- Quill feather
- Rabbit
- Mitosis stages

Frog embryology

- Egg

- Sperm
- Blastula
- Gastrula

3. Field observations combined with photography and/or videography (4 Hrs)

Study of insect fauna in the college campus

4. Culture methods (2 Hrs)

Culture of unicellular organisms.

5. Models (12 Hrs)

- Animal Cell
- Mitochondria
- DNA
- RNA
- Chromosomes
- Alimentary Canal of Man
- Male Reproductive Tract
- Female Reproductive Tract
- Human Placenta
- Protein Structure

REFERENCE BOOKS

S. No	Authors	Title of the Book	Publishers	Year of Publication
1	Sinha J, Chatterjee A K, Chattopadhyay P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2011
2	Lal S S	Textbook of practical Zoology Invertebrate	Rastogi Publication	2004
3	Lal S S	Textbook of practical Zoology Vertebrate	Rastogi Publication	2004

Pedagogy

- Observation of slides, specimens and models; field visit, dissection

Course Designer:

1. Dr. P. B. Harathi

Semester : III & IV

Paper : Job Oriented Course

Title : Apiculture

Subject Code : JOB1993

Lecture Hours: 60

Unit I

(8 Hrs)

Bee keeping down the ages - Present status of Apiculture in India - Classification and Biology of Honey Bees. Embryology and life history - Anatomy and Physiology of honeybee. Social Organization of Bee Colony

Unit II

(8 Hrs)

Types of beehives - structure - location, care and management - Genetic studies - breeding of stocks - winter broods. Artificial Bee rearing (Apiary), Bee Pasturage. Selection of Bee Species for Apiculture. Bee Keeping Equipment.

Unit III

(8 Hrs)

Bee foraging: Pollen and nectar yielding plants. Honey extraction, seasonal maintenance, swarming and supersedure - pheromone. Natural enemies and diseases of honey bees and control methods. Bee poisoning and utility of bees in toxicity studies. Apiculture Management

Unit IV

(8 Hrs)

Uses of honey and beeswax in Indian medicine. Bee Products and Marketing of Bee products. Economics of bee keeping: Economics in small scale and large scale bee keeping. Economic Value of Commercial Beekeeping.

Unit V**(8 Hrs)**

Preparing bankable bee keeping project: Steps involved in starting a beekeeping project, Prospects of apiculture as self-employment venture. Funding sources for beekeeping projects. Funds mobilization from state and national banks. Grant Resource and utilization.

FIELD VISIT: To Apiary unit**(10 Hrs)****INTERNSHIP****(10 Hrs)****REFERENCE BOOKS**

S. No	Authors	Title of the Book	Publishers	Year of Publication
1	Sardar Singh	Bee keeping in India	Indian council of Agricultural Research, New Delhi	1962
2	Sharma P.L. and Singh, S.H.,	Hand book of Bee keeping	Controller Printing and Stationery, Chandigarh	1987
3	Roger, A. Morse,	The ABC and XYZ of Bee culture	A.I. Root & Co., Medina, Ohio	40 th Edn, 1990