PSGR
Krishnammal College for Women

College of Excellence, nirf 2023-4th Rank
Autonomous and Affiliated to Bharathiar University
Reaccredited with 'A++' grade by NAAC, An ISO 9001: 2015 Certified Institution
Peelamedu, Coimbatore-641004

DEPARTMENT OF ZOOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOMES-BASED CURRICULAR FRAMEWORK (LOCF)
(I Semester)

(For the students admitted during the academic year 2023-24 onwards)

BACHELOR OF ZOOLOGY
2023 – 2026 BATCH

DEPARTMENT OF ZOOLOGY
CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOME BASED CURRICULAR FRAMEWORK (LOCF)
BACHELOR OF ZOOLOGY – 2023-2026 BATCH
(I Semester)

(For the students admitted during the academic year 2023-24 onwards)

Sem	Part	Subject code	Title of the Paper		Instruction Hours/Week	Contact Hours	Tutorial	Duration of Examination	Examination Marks			Credits
									CA	ESE	Total	
I	I	TAM2301/ HIN2301/ FRE2301	**Language** Tamil Paper I / Hindi Paper I / French Paper I	Lang	6	88	2	3	25	75	100	3
	II	ENG2301	English Paper I	English	6	88	2	3	25	75	100	3
	III A	AS23C01	Core Paper I – Invertebrata	CC	6	88	2	3	25	75	100	5
	III A	AS23CP1	Core Practical I	CC	3	45	-	-	-	-	-	-
	III A	CE23A01	Allied - Chemistry for Biologists - Paper I	GE	4	58	2	3	20	55	75	4
	III A	CE23AP1	Allied - Chemistry Practical for Biologists Paper I	GE	3	45	-	-	-	-	-	-
	IV	**Non Tamil Students**		AECC	2	28	2		100	-	100	2
		NME23B1/ NME23A1	Basic Tamil I/ Advanced Tamil I									
	IV	**Students with Tamil as Language**		AECC	2	30	-		100	-	100	2
		NME23ES/ NME23WS	Foundation Course I - Introduction to Entrepreneurship / Women Studies									

*Not considered for Grand Total and CGPA
**outside regular class hours

CC – Core Courses
GE – Generic Elective
AEC – Ability Enhancing Course

CA – Continuous Assessment
ESE - End Semester Examination

QUESTION PAPER PATTERN

Examination System

One test for continuous assessment will be conducted on pre-determined dates i.e., commencing on the 50th day from the date of reopening. The Model exam will be conducted after completing 85th working days. Marks for ESE and CA with reference to the maximum for the courses will be as follows:

23-24 BATCH ONWARDS

CA Question Paper Pattern and distribution of marks UG

Core and Allied - (First 3 Units)

CA Question from each unit comprising of

One question with a weightage of 2 Marks	:2 × 3 = 6
One question with a weightage of 5 Marks (Internal Choice at the same CLO level)	:5 × 3 =15
One question with a weightage of 8 Marks (Internal Choice at the same CLO level)	:8 × 3 =24
Total	**: 45 Marks**

End Semester Examination – Question Paper Pattern and Distribution of Marks

Core and Allied courses:

ESE Question Paper Pattern: 5 × 15 = 75 Marks

Question from each unit comprising of

One question with a weightage of 2 Marks : 2 × 5=10

One question with a weightage of 5 Marks (Internal Choice at the same CLO level): 5 × 5 =25

One question with a weightage of 8 Marks (Internal Choice at the same CLO level): 8 × 5 =40

Continuous Internal Assessment Pattern

Theory

I Year UG (23 Batch)

CIA Test	:5 marks (conducted for 45 marks after 50 days)
Model Exam	:7 marks(Conducted for 75 marks after 85 days (Each Unit 15 Marks))
Seminar/Assignment/Quiz	: 5 marks
Class Participation	: 5 marks
Attendance	: 3 marks
Total	**: 25 Marks**

Practical

Lab Performance : 7 marks
Regularity : 5 marks
Model Exam : 10 marks
Attendance : 3 marks

Total : 25 marks

ESE Practical Pattern

The End Semester Examination will be conducted for a maximum of 75 marks respectively with a maximum 15 marks for the record and other submissions if any.

WEIGHTAGE ASSIGNED TO VARIOUS COMPONENTS OF CONTINUOUS INTERNAL ASSESSMENT

Theory

	CIA I	Model Exam	Seminar/Assignment/ Quiz	Class Participation	Attendance	Max Marks
Core / Allied	5	7	5	5	3	25

Practical

	Model Exam	Lab Performance	Regularity in Record Submission	Attendance	Maximum Marks
Core / Allied	10	7	5	3	25

RUBRICS

Assessment/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

CLASS PARTICIPATION

Maximum - 20 Marks (converted to 5 marks)

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	Student rarely displays disruptive behavior	Student occasionally displays disruptive behavior	Student often displays disruptive behavior	Student almost always displays disruptive	

	behavior during class	during class	during class	during class	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 PLOS WITH CLOS

COURSE	**PROGRAMME OUTCOMES**				
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**
COURSE – AS23CO1					
CLO1	S	S	M	M	L
CLO2	S	S	M	M	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	M
COURSE – AS23CP1					
CLO1	S	S	S	S	S
CLO2	S	S	S	S	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

COURSE NO	COURSE NAME	Category	L	T	P	Credit
AS23CO1	INVERTEBRATA	Theory	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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the distinguished characteristics, the biodiversity, habitat, adaptation, organization and taxonomic status of invertebrates	K_1
CLO2	Understand the importance of multicellularity significant to anatomical and physiological up gradation of the invertebrates	K_2
CLO3	Identify the evolution of organ systems and differences in functional morphology of higher invertebrates	K_3
CLO4	Analyze the advancement in systemic organization of invertebrates and connecting link to Chordates. Infer the application of Recent emerging technologies in learning and research in Zoology	K_4

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	L
CLO2	S	S	M	M	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	M

S- Strong; M-Medium; L-Low

INVERTEBRATA – AS23CO1 (86 Hrs)

Unit 1 **(19 hrs)**

Phylum Protozoa

General characteristics and Classification up to classes

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 and Reproduction in Protista
- *Life cycle and pathogenicity of *Plasmodium vivax* and *Entamoeba histolytica*
- Evolution of symmetry and segmentation of Metazoa

Phylum Porifera

General characteristics and Classification up to classes

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 **(19 hrs)**

Phylum Coelenterata

General characteristics and Classification up to classes

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

General Essays

- *Corals, coral reefs and coral bleaching
- *Polymorphism in Coelentrates

Phylum Helminthes

General characteristics and Classification up to classes

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. Life cycle and pathogenicity of *Taenia solium*

General Essays

- *Life cycle and pathogenicity of: a) *Wuchereria bancrofti,* b) *Drancunculus medinensis,* c) *Ancylostoma duodenale*
- *Parasitic adaptations in Helminthes.

Unit 3 **(19 hrs)**

Phylum Annelida

General characteristics and Classification up to classes

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.

Phylum Arthropoda

General characteristics and Classification up to classes

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.
- Metamorphosis in Insects
- *A Brief Account on Apiculture.

Unit 4 **(19 hrs)**

Phylum Mollusca

General characteristics and Classification up to classes

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

General characteristics and Classification up to classes

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.
- Affinities with Chordates

Unit 5 **(10 hrs)**

Introduction to technologies in Industrial 4.0, Applications –Automated taxonomic Identification of invertebrates, Confocal Image processing of invertebrates for identification and classification, Bio mimicry/biomimetics of invertebrates –Ant colony optimization algorithms, Beekeeping using Machine learning, Detection and identification of Stored –Grain insects using Deep learning, IOT based smart monitoring for sericulture, *Virtual e-museum.

***-Blended Mode**

Text Books:

S. No.	Authors	Title of the Book	Publishers	Year of Publication
1	Jordan E.L and Verma P.S	Invertebrate Zoology	S. Chand and Co	2014
2	N. C. Nair, N. Soundara Pandian, S. Leelavathy, T. Murugan	A Text Book of Invertebrates	Saras Publications	2013
3	P. Kaliraj, T. Devi, Higher Education for Industry 4.0 and Transformation to Education 5.0			

Reference Books:

S. No.	Authors	Title of the Book	Publishers	Year of Publication
1.	Dhami P.S. and Dhami J.K	Invertebrate Zoology	S. Chand & Co	2012, 5th edition
2.	EkambaranathaAyyar, M. & Ananthakrishnan,T.N	Manual of Zoology Vol-I (Invertebrata) Part I & II	Vishwanathan (p) Ltd. Chennai	2010
3.	FatikBaran Mandal	Invertebrate Zoology	Eastern Economy Edition	2012, 1st Edition
4.	Kotpal R.L., Agarwal S.K and Ketarpal R.P.R	Modern Text Book of Zoology Invertebrates	Rastogi Publications	12th Edition 2019
5.	Barrington EJW	Invertebrate Structure and Function	ELBS and Nelson	1979, 2nd edition
6.	Ruppert and Barnes, R.D.	Invertebrate Zoology	Holt Saunders International	2006
7.	Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. an d Spicer, J.I.	The Invertebrates: A New Synthesis	Blackwell Science	2002, 3rd Edn.
8.	Jan A. Pechenik	Biology of the Invertebrates	McGraw-Hill Companies	2014, 7th Revised Edition
9	Fatik, Mandal, Baran,	Biology of non-chordates	Publisher: PHI learning Private Limited , Delhi	2018
10.	Fatma El-Bawab	Invertebrate Embryology and Reproduction	Academic Press	2020
11.	John H. Byrne	The Oxford Handbook of Invertebrate Neurobiology	Oxford University Press	2019

Related Online Contents

1. Introduction to Industry 4.0 and Industrial Internet of Things by Prof. Sudip Mishra, IIT Kharagpur.
2. A Complete Guide to Industry 4.0-Udemy

Reference

1. https://academic.oup.com/sysbio/article/68/6/876/5368535
2. https://besjournals.onlinelibrary.wiley.com/doi/10.1111/2041-210X.13428
3. https://www.mdpi.com/2313-7673/4/3/62/htm
4. https://www.bio-mar.com/biological-materials-biomimetics
5. https://www.sciencedirect.com/science/article/abs/pii/S1568494609000672
   https://www.hyperhyve.com/post/beekeeping-using-machine-learning
6. https://www.researchgate.net/publication/322958397_Detection_of_stored-grain_insects_using_deep_learning
7. https://www.ijrte.org/wp-content/uploads/papers/v8i2/B1801078219.pdf

COURSE NO AS23CP1	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

CLO Number	CLO Statement	Knowledge Level
CLO1	To understand the basic concepts of zoological classification and identify the invertebrates and chordates	K_1
CLO2	To distinguish the diversity and relationships between major groups of invertebrates and Chordates.	K_2
CLO3	To examine the morphology and anatomy of invertebrates and Chordates	K_3
CLO4	To relate the diversity and culture/rearing of invertebrates and chordates and infer their economic utility.	K_4

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	S	S	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

CORE PRACTICAL - I AS23CPI (90 Hrs)

Dissections (35 **hrs)**

1. **Cockroach**
   - a. Digestive system (3 hrs)
   - b. Nervous system, (3 hrs)
   - c. Male & Female Reproductive systems (3 hrs)
2. **Fish**
   - a. Viscera, (3 hrs)
   - b. Digestive system, (3 hrs)
   - c. Reproductive system, (3 hrs)
   - d. Brain and Cranial nerves system (4 hrs)
3. **Earthworm**
   - a. Digestive system, (3 hrs)
   - b. Nervous system (4 hrs)
   - c. Reproductive system (3 hrs)
4. **Prawn** – Nervous system (3 hrs)

Mounting (**15 hrs)**

1. Mounting of scales of fishes (2 hrs)
2. Mounting of gill arch (2 hrs)
3. Mounting of earthworm setae (2 hrs)
4. Mounting of mouth parts of cockroach/mosquito/honey bee (3 hrs)
5. Mounting of Prawn appendages (3 hrs)
6. Whole mount of Euglena, Amoeba and Paramecium (3 hrs)

Spotters

Classify giving reasons:-Paramecium, Leucosolenia, Obelia colony, Prawn, Octopus, Star fish, Ascidian, Shark, Salamander, Pigeon, Bat **(2 hrs)**

Draw labelled sketches:-T.S. of Tape worm, Leech, Amphioxus, Frog – Skull, Pectoral girdle, Pelvic girdle, Fore limb and Hind limb **(2 hrs)**

Relate Structure and function: - Gemmule, Entire & Scolex of tapeworm, Nereis -parapodium, Heteronereis, Honey bee-Queen, Drone, Worker; Quill feather, Tortoise, Narcine-Electric organ **(2 hrs)**

Write descriptive notes:- Nauplius larva, Pila, Bipinnaria larva, Balanoglossus, Echeneis - Sucker fish, Draco - Flying lizard, Rat snake, Cobra, Hyla **(2 hrs)**

Give biological significance: - Chaetopterus, Peripatus, Limulus, Scorpion, Pearl oyster, Hippocampus male and female, Exocetus – Flying fish, Chameleon **(2 hrs)**

Field observations combined with photography and/or videography

1) Study of live water specimens in nearby water bodies/pond ecosystem **(5 hrs)**
2) Study of insect fauna in the college campus **(5 hrs)**
3) Visit to a sericulture farm/ Apiary/Museum **(5 hrs)**
4) Study of six common birds from different orders **(5 hrs)**

Culture Methods

1) Culture of unicellular organisms (Amoeba/Paramecium/Euglena)
2) Culture of multicellular organisms (Earthworm) **(10 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

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DEPARTMENT OF ZOOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOMES-BASED CURRICULAR FRAMEWORK (LOCF)
(II Semester)

(For the students admitted during the academic year 2023-24 onwards)

BACHELOR OF ZOOLOGY
2023 – 2026 BATCH

DEPARTMENT OF ZOOLOGY
CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOME BASED CURRICULAR FRAMEWORK (LOCF)
BACHELOR OF ZOOLOGY – 2023-2026 BATCH
(II Semester)

(For the students admitted during the academic year 2023-24 onwards)

Sem	Part	Subject code	Title of the Paper		Instruction Hours/Week	Contact Hours	Tutorial	Duration of Examination	Examination Marks			Credits
									CA	ESE	Total	
II	II	TAM2302/ HIN2302/ FRE2302	Language T/H/F Paper – II	Language	6	88	2	3	25	75	100	3
	II	ENG2302	English Paper II	English	5	73	2	3	25	75	100	3
	III A	AS23C02	Chordata Paper II	CC	6	88	2	3	25	75	100	5
	III A	AS23CP1	Core Practical I	CC	3	45	-	3	25	75	100	5
	III A	CE23A02	Allied-Chemistry for Biologists-II	GE	5	73	2	3	20	55#	75#	4
	III A	CE23AP1	Allied -Chemistry Practical for Biologists	GE	3	45	-	3	15	25#	50#	2
	IV		Online Self Study Courses	-	-	-	-	-	-	-	-	-
		NME23B2/ NME23A2	Basic Tamil/Advanced Tamil**	AEC	2	-	-	-	100	-	100	Grade*
	III B	NM23GAW	Foundation Course –1 (General Awareness)	-	Self study (Online)				100	-	100	Grade*
	V	23PELS1	Professional English (Science /Management/ Humanities/Commerce)	AEC	2	25	5	-	100	-	100	2

*Not considered for Grand Total and CGPA

**outside regular class hours

CA conducted for 25 converted to 20, ESE conducted for 100 converted to 55

CC – Core Courses
GE – Generic Elective
AEC – Ability Enhancing Course

CA – Continuous Assessment
ESE - End Semester Examination

QUESTION PAPER PATTERN

Examination System

One test for continuous assessment will be conducted on pre-determined dates i.e., commencing on the 50th day from the date of reopening. The Model exam will be conducted after completing 85th working days. Marks for ESE and CA with reference to the maximum for the courses will be as follows:

2023-2024 BATCH ONWARDS

CA Question Paper Pattern and distribution of marks UG
Language and English

Section A 5 x 1 (No choice) : 5 Marks
Section B 4 x 5 (4 out of 6) : 20 Marks (250 words)
Section C 2 x 10 (2 out of 3) : 20 Marks (500 words)
Total : 45 Marks
Core and Allied - (First 3 Units)

CA Question from each unit comprising of

One question with a weightage of 2 Marks (No choice) :2 × 3 = 6
One question with a weightage of 5 Marks (Internal Choice at the same CLO level) :5 × 3 =15
One question with a weightage of 8 Marks (Internal Choice at the same CLO level) :8 × 3 =24
Total : 45 Marks

End Semester Examination – Question Paper Pattern and Distribution of Marks
Language and English

Section A 10 x 1 (10 out of 12) : 10 Marks
Section B 5 x 5 (5 out of 7) : 25 Marks (250 words)
Section A 4 x 10 (4 out of 6) : 40 Marks (600 - 700 words)
Total : 75 Marks

Core and Allied courses:
ESE Question Paper Pattern: 5 × 15 = 75 Marks
Question from each unit comprising of
One question with a weightage of 2 Marks : 2 × 5=10
One question with a weightage of 5 Marks (Internal Choice at the same CLO level): 5 × 5 =25
One question with a weightage of 8 Marks (Internal Choice at the same CLO level): 8 × 5 =40

Continuous Internal Assessment Pattern
Theory
I Year UG (23 Batch)

CIA Test :5 marks (conducted for 45 marks after 50 days)
Model Exam :7 marks(Conducted for 75 marks after 85 days (Each Unit 15 Marks))
Seminar/Assignment/Quiz : 5 marks

Class Participation	: 5 marks
Attendance	: 3 marks
Total	**: 25 Marks**

Practical

Lab Performance	: 7 marks
Regularity	: 5 marks
Model Exam	: 10 marks
Attendance	: 3 marks
Total	**: 25 marks**

ESE Practical Pattern

The End Semester Examination will be conducted for a maximum of 75 marks respectively with a maximum 15 marks for the record and other submissions if any.

Part IV

Introduction to Entrepreneurship / Women Studies / Value education / Environmental Studies / Design Thinking

Quiz : 50 marks
Assignment : 25marks
Project / Case study : 25 marks
Total : 100 Marks

Professional English

The course offered in alignment with TANSCHE norms with 2 credits.
Quiz (5 x 20 Marks) : 100 Marks

WEIGHTAGE ASSIGNED TO VARIOUS COMPONENTS OF CONTINUOUS INTERNAL ASSESSMENT

Theory

	CIA I	Model Exam	Seminar/Assignment/ Quiz	Class Participation	Attendance	Max Marks
Core / Allied	5	7	5	5	3	25

Practical

	Model Exam	Lab Performance	Regularity in Record Submission	Attendance	Maximum Marks
Core / Allied	10	7	5	3	25

RUBRICS FOR CLASS PARTICIPATION

Level of Engagement in Class : 2 Marks
Listening Skills : 2 Marks
Behavior : 1 Marks
Preparation : 2 Marks
Total : 7 Marks

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
Criteria	**7 MARKS**	**6 MARKS**	**5 MARKS**	**4 MARKS**	**3 MARKS**
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 by offering ideas and asks questions occasionally.	Student 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

MAPPING OF PLOS WITH CLOS

COURSE	PROGRAMME OUTCOMES				
	PLO1	PLO2	PLO3	PLO4	PLO5
COURSE – AS23CO2					
CLO1	S	S	M	M	L
CLO2	S	S	M	M	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	M
COURSE – AS23CP1					
CLO1	S	S	S	S	S
CLO2	S	S	S	S	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

COURSE NO AS23CO2	COURSE NAME CHORDATA	Category	L	T	P	Credit
		Theory	88	2	-	5

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Identify the general and specific characteristics of the different classes and the organization of the representative types.	K_1
CLO2	Recognize and describe the major groups of chordates	K_2
CLO3	Interpret the unique features, taxonomy and functional morphology of different classes of chordates	K_3
CLO4	To examine chordate diversity, systematics, their affinities, adaptations to different modes of life, evolutionary relationships of the major taxa and their economic importance.	K_4

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	L	S	M	M	M
CLO2	L	S	M	M	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

CHORDATA-AS23CO2 (88 hrs)

UNIT I: (20 Hrs)

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

PROTOCHORDATA- General Characters and affinities of Balanoglosuss and Herdmania

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
- General characters of Agnatha and its affinities
- Overview of Phylogenetic analysis using Machine learning

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

- Types of Fins and Scales of fishes
- *Accessory respiratory organs in fishes
- Migration, Osmoregulation and Parental care in fishes
- General account of a) *Oreochromis mossambicus* b) *Labeo rohita* c) *Catla catla*
- *Virtual E-museum to identify and learn different species of Pisces

UNIT II: AMPHIBIA (17 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- Tango receptors, Taste buds, Olfactory organs, Internal structure and functions of Eye and Ear, Urinogenital system

General Essays

- Regeneration in amphibians (Axolotls)
- Origin of Tetrapoda (Evolution of terrestrial ectotherms)
- *Parental care in Amphibia
- Neoteny and Paedogenesis in Amphibia
- Outline on Image processing for taxonomic classification

UNIT III: REPTILIA **(17 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.
- Extinct Reptiles
- Conservation of reptiles (Turtles and Crocodiles)
- Overview of artificial intelligence for modelling to study Reptile behaviour

UNIT IV: AVES **(17 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
- Beaks and wing adaptation in birds
- *Flightless birds, Migration in birds.
- GPS Tracking systems to study bird behaviour and predict their migration

UNIT V: MAMMALIA **(17 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
- Dentition in mammalss
- Egg laying and flying mammals
- *Aquatic adaptations in mammals.
- *GPS Tracking systems for monitoring the locomotion of wild animals.

***-Blended Mode**

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. Prasannakumar 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, 3rdEdn.
5	Pough H.	Vertebrate life	Pearson International	9thEdn.
6	Darlington P.J.	The Geographical Distribution of Animals	R.E. Krieger Pub Co.,	3rdEdn.
7	Hall B.K. and Hallgrimsson B.	Strick berger's Evolution	Jones and Bartlett Publishers Inc.	4thEdn.
8.	Malcolm Jollie	Chordate Morphology	Franklin Classics Trade Press	2017
9.	Marshall and Williams Edited by Veer Baala Rastogi	Parker and Haswell Textbook of ZOOLOGY - Vertebrates -	Medtech Science Press	Volume I 2021
10.	Neil Shubin, Kenneth P. Dial, Elizabeth L. Brainerd	Great Transformations in Vertebrate Evolution	University of Chicago Press	2015
11.	Kevin Padian, Vivian de Buffrénil, Armand J. de Ricqlès, Louise Zylberberg	Vertebrate Skeletal Histology and Paleohistology	CRC Press	2021
12.	Ezra Samberg	Vertebrate Zoology	Syrawood Publishing House	2018

References

1. https://www.biorxiv.org/content/10.1101/2020.01.10.902239v4.full
2. https://www.sciencedirect.com/science/article/abs/pii/S0920548919300935
3. https://link.springer.com/article/10.1007/s10336-012-0908-1
4. https://wildlifeact.com/about-wildlife-act/monitoring-tracking-technology/
5. http://emuseum.psgrkcw.com/

COURSE NO 23PELS1	COURSENAME SEMESTER– II PROFESSIONAL ENGLISH FOR LIFE SCIENCES	Category	L	T	P	Credit
		-	25	5	--	2

Objectives

1. To develop the language skills of students by offering adequate practice in professional contexts.
2. To enhance the lexical, grammatical and socio-linguistic and communicative competence of first year physical sciences students
3. To focus on developing students' knowledge of domain specific registers and the required language skills.
4. To develop strategic competence that will help in efficient communication
5. To sharpen students' critical thinking skills and make students culturally aware of the target situation.

Course outcome

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

CLO Number	CO Statement	Knowledge Level
CLO1	Recognize their own ability to improve their own competence in using the language	K1
CLO2	Use language for speaking with confidence in an intelligible and acceptable manner	K2
CLO3	Read independently unfamiliar texts with comprehension and understand the importance of reading for life	K3
CLO4	Understand the importance of writing in academic life	K3
CLO5	Write simple sentences without committing error of spelling or grammar	K3

(Outcomes based on guidelines in UGC LOCF – Generic Elective)

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	M	M
CLO2	S	S	S	M	M
CLO3	S	S	M	M	S
CLO4	S	S	M	M	M
CLO5	S	S	S	S	S

S- Strong; M-Medium

Syllabus

UNIT 1: Communication (5 hrs)

Listening: Listening to audio text and answering question Listening toInstructions
Speaking: Pair work and small group work.
Reading: Comprehension passages –Differentiate between facts and opinion
Writing: Developing a story with pictures**.**
Vocabulary: Register specific - Incorporated into the LSRW tasks

UNIT 2: Description (5 hrs)

Listening: Listening to process description.-Drawing a flow chart.
Speaking: Role play (formal context)
Reading: Skimming/Scanning- Reading passages on products, equipment and gadgets.
Writing: Process Description –Compare and Contrast Paragraph-Sentence Definition and Extended definition- Free Writing.
Vocabulary: Register specific -Incorporated into the LSRW tasks.

UNIT 3: Negotiation Strategies (5 hrs)

Listening: Listening to interviews of specialists / Inventors in fields (Subject specific)
Speaking: Brainstorming. (Mind mapping).Small group discussions (Subject- Specific)
Reading: Longer Reading text.
Writing: Essay Writing (250 words)
Vocabulary: Register specific - Incorporated into the LSRW tasks

UNIT 4: Presentation Skills (5 hrs)

Listening: Listening to lectures.
Speaking: Short talks.
Reading: Reading Comprehension passages
Writing: Writing Recommendations Interpreting Visuals inputs
Vocabulary: Register specific - Incorporated into the LSRW tasks

UNIT 5: Critical Thinking Skills (5 hrs)

Listening: Listening comprehension- Listening for information.
Speaking: Making presentations (with PPT- practice).
Reading : Comprehension passages –Note making.Comprehension: Motivational article on Professional Competence, Professional Ethics and Life Skills)
Writing: Problem and Solution essay– Creative writing –Summary writing
Vocabulary: Register specific - Incorporated into the LSRW tasks

Textbooks

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	TamilNadu State Council for Higher Education (TANSCHE)	English for Life Sciences Semester 1	--	--

Reference Books

S.No.	Authors	Title of the Book	Publishers	Year of Publication
1	Sreedharan, Josh	The Four Skills for Communication	Foundation books	2016
2	Pillai, G Radhakrishna, K Rajeevan, P Bhaskaran Nair	Spoken English for you	Emerald	1998
3	Pillai, G radhakrishna, K Rajeevan, P Bhaskaran Nair	Written English for you	Emerald	1998

COURSE NO AS23CP1	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

CLO Number	CLO Statement	Knowledge Level
CLO1	To understand the basic concepts of zoological classification and identify the invertebrates and chordates	K_1
CLO2	To distinguish the diversity and relationships between major groups of invertebrates and Chordates.	K_2
CLO3	To examine the morphology and anatomy of invertebrates and Chordates	K_3
CLO4	To relate the diversity and culture/rearing of invertebrates and chordates and infer their economic utility.	K_4

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	S	S	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

CORE PRACTICAL - I AS23CPI (90 Hrs)

Dissections (35 **hrs)**

1. **Cockroach**
a. Digestive system (3 hrs)
b. Nervous system, (3 hrs)
c. Male & Female Reproductive systems (3 hrs)
2. **Fish**
a. Viscera, (3 hrs)
b. Digestive system, (3 hrs)
c. Reproductive system, (3 hrs)
d. Brain and Cranial nerves system (4 hrs)
3. **Earthworm**
a. Digestive system, (3 hrs)
b. Nervous system (4 hrs)
c. Reproductive system (3 hrs)
4. **Prawn** – Nervous system (3 hrs)

Mounting (**15 hrs)**

1. Mounting of scales of fishes (2 hrs)
2. Mounting of gill arch (2 hrs)
3. Mounting of earthworm setae (2 hrs)
4. Mounting of mouth parts of cockroach/mosquito/honey bee (3 hrs)
5. Mounting of Prawn appendages (3 hrs)
6. Whole mount of Euglena, Amoeba and Paramecium (3 hrs)

Spotters
Classify giving reasons:-Paramecium, Leucosolenia, Obelia colony, Prawn, Octopus, Star fish, Ascidian, Shark, Salamander, Pigeon, Bat **(2 hrs)**

Draw labelled sketches:-T.S. of Tape worm, Leech, Amphioxus, Frog – Skull, Pectoral girdle, Pelvic girdle, Fore limb and Hind limb **(2 hrs)**

Relate Structure and function: - Gemmule, Entire & Scolex of tapeworm, Nereis -parapodium, Heteronereis, Honey bee-Queen, Drone, Worker; Quill feather, Tortoise, Narcine-Electric organ **(2 hrs)**

Write descriptive notes:- Nauplius larva, Pila, Bipinnaria larva, Balanoglossus, Echeneis - Sucker fish, Draco - Flying lizard, Rat snake, Cobra, Hyla **(2 hrs)**

Give biological significance: - Chaetopterus, Peripatus, Limulus, Scorpion, Pearl oyster, Hippocampus male and female, Exocetus – Flying fish, Chameleon **(2 hrs)**

Field observations combined with photography and/or videography
1) Study of live water specimens in nearby water bodies/pond ecosystem **(5 hrs)**
2) Study of insect fauna in the college campus **(5 hrs)**
3) Visit to a sericulture farm/ Apiary/Museum **(5 hrs)**
4) Study of six common birds from different orders **(5 hrs)**

Culture Methods

1) Culture of unicellular organisms (Amoeba/Paramecium/Euglena)
2) Culture of multicellular organisms (Earthworm) **(10 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.

PSGR Krishnammal College for Women

College of Excellence, nirf 2023-4th Rank
Autonomous and Affiliated to Bharathiar University
Reaccredited with 'A++' grade by NAAC, An ISO 9001: 2015 Certified Institution
Peelamedu, Coimbatore-641004

DEPARTMENT OF ZOOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOMES- BASED CURRICULAR FRAMEWORK (LOCF)
(III Semesters)

BACHELOR OF ZOOLOGY
2023 – 2026 BATCH

PSGR Krishnammal College for Women

DEPARTMENT OF ZOOLOGY
CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOME BASED CURRICULAR FRAMEWORK (LOCF)
BACHELOR OF ZOOLOGY – 2023-2026 BATCH

Sem	Part	Course code	Title of the Course	Course type	Instruction Hours/Week	Contact Hours	Tutorial	Duration of Examination	Examination Marks			Credits
									CA	ESE	Total	
III	I	TAM2303/ HIN 2303/ FRE2303	**LANGUAGE III** T/H/F Paper III	L	6	88	2	3	25	75	100	3
	II	ENG2303	English Paper-III	E	5	73	2	3	25	75	100	3
	III	AS23C03	Ecology and Embryology	CC	4	58	2	3	25	75	100	4
		AS23CP2	Zoology Practical II	CC	3	45	-	-	-	-	-	-
		AS23A01/ PL23A01	Invertebrata and Chordata/ Fundamentals of Botany I	GE	5	73	2	3	20	55	75	4
		AS23AP1/ PL23AP1	Zoology Practical/ Botany Practical I	GE	2	30		-	-	-	-	-
III	III	AS23CE1/ CS23SBGP	Coursera – Insect human Interaction/ GEN-AI	DSE /SEC	3	45/44	-/1	-	100	-	100	3
IV	IV	NM23DTG	Design Thinking	AEC	2	30	-	-	100	-	100	2
	IV	NM22UHR	Universal Human Values and Human Rights #		-	-	-	-	100	-	100	Gr.
I - V	VI	16BONL1 16BONL2	Online Course Online Course		-	-	-	-	-	-	-	-
	VI	JOB1993	Job OrientedCourse			After the class hours						

L – Language **E – English**
CC – Core Courses **CA – Continuous Assessment**
GE – Generic Elective **ESE - End Semester Examination**

AEC – Ability Enhancement Course **SEC- Skill Enhancement Course**
ACC-Additional Credit Course **AECC- Ability Enhancement Compulsory Course,**
- **Self Study**
€ - CA conducted for 25 and converted into 20, ESE conducted for 75 and converted into 55

QUESTION PAPER PATTERN

Examination System

One test for continuous assessment will be conducted on pre-determined dates i.e., commencing on the 50th day from the date of reopening. The Model exam will be conducted after completing 85th working days. Marks for ESE and CA with reference to the maximum for the courses will be as follows:

2023-2024 BATCH ONWARDS

CA Question Paper Pattern and distribution of marks UG

Language and English

Section A 5 x 1 (No choice) : 5 Marks
Section B 4 x 5 (4 out of 6) : 20 Marks (250 words)
Section C 2 x 10 (2 out of 3) : 20 Marks (500 words)

Total : 45 Marks

Core and Allied - (First 3 Units)

CA Question from each unit comprising of

One question with a weightage of 2 Marks (No choice) :2 × 3 = 6
One question with a weightage of 5 Marks (Internal Choice at the same CLO level) :5 × 3 =15
One question with a weightage of 8 Marks (Internal Choice at the same CLO level) :8 × 3 =24

Total : 45 Marks

End Semester Examination – Question Paper Pattern and Distribution of Marks

Language and English

Section A 10 x 1 (10 out of 12) : 10 Marks
Section B 5 x 5 (5 out of 7) : 25 Marks (250 words)
Section A 4 x 10 (4 out of 6) : 40 Marks (600 - 700 words)

Total : 75 Marks

Core and Allied courses:

ESE Question Paper Pattern: 5 × 15 = 75 Marks

Question from each unit comprising of

One question with a weightage of 2 Marks : 2 × 5=10
One question with a weightage of 5 Marks (Internal Choice at the same CLO level): 5 × 5 =25
One question with a weightage of 8 Marks (Internal Choice at the same CLO level): 8 × 5 =40

Evaluation pattern for Gen-AI

Quiz : 50 Marks (5 quizzes with each 10 marks)
Case study : 25 Marks
Online Exam : 25 Marks (Departments to plan and conduct the exam)
Total **:100 Marks**

WEIGHTAGE ASSIGNED TO VARIOUS COMPONENTS OF CONTINUOUS INTERNAL ASSESSMENT

Theory

	CA	Model Exam	Seminar/Assignment/ Quiz	Class Participation	Attendance	Max. Marks
Core / Allied	5	7	5	5	3	25

Practical

	Model Exam	**Lab Performance**	**Regularity in Record Submission**	**Attendance**	**Maximum Marks**
Core / Allied	10	7	5	3	25

Part IV
Value education / Environmental Studies / Design Thinking

Quiz : : 50marks
Assignment : 25marks
Project / Case study : 25marks
Total : 100 Marks

Course Number	Course Name	Category	L	T	P	Credit
AS23CO3	ECOLOGY AND EMBRYOLOGY	Theory	58	2	-	4

Preamble

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

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the basic aspects of ecology and Gametogenesis, Organogenesis in frog and Human Reproduction.	K1
CLO2	Understand the concepts of ecological attributes and physiological processes in Embryology that are distinct and significant	K2
CLO3	Apply the systemic and functional morphology of various aspects of ecology and embryology	K3
CLO4	Analyze the general and specific characteristics within and other environments in relation to abiotic & biotic factors, stages and development of an embryo	K4

Mapping with Programme Learning Outcomes

CLO	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	L	S	M	M	S
CLO2	S	S	M	M	S
CLO3	S	S	S	S	M
CLO4	S	S	S	S	M

S- Strong; M-Medium; L-Low

ECOLOGY AND EMBRYOLOGY – AS23CO3 (58 Hrs)

Syllabus

Unit I (11 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 (12 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 (12 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, Regeneration**

Unit V (12 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. ***In vitro fertilization and its ethics**.

***Denotes Blended Learning**

TEXT BOOKS

S. No.	Author	Title of the Book	Publisher and Edition	Year of Publication and Edition
1	Arumugam, N	A Text Book of Embryology	Saras Publication	2014 and 15th edition
2	Verma P.S., Agarwal., V.K	Environmental Biology	S. Chand & Company	2000 and 10th edition

REFERENCE BOOKS

S. No.	Author	Title of the Book	Publisher	Year of Publication and Edition
1	Balinsky, B.I	Introduction to Embryology	Saunders College Publishing	1981 and 5th edition
2	Berrill, N.J	Developmental Biology	Tata Mc Graw Hill Publication Co.Ltd	1986 and 4th editioin
3	Clarke,G.L.	Elements of Ecology	John Wiley & Son Inc. New York & London	1954 and 1st edition
4	Kotpal,R.L. and Bali,N.P.	Concepts of Ecology	Vishal Publication, Delhi	1986 and 2nd edition
5	Odum, E.P.	Basic Ecology	Saunders College Publishing , New York	1983 and Revised, Subsequent edition
6	Scott F. Gilbert,	Developmental Biology	Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts	1997 and 7th edition
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

Dr. M. Sheeba

Course Number	Course Name	Category	L	T	P	Credit
AS23CP2	**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 Laerning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall 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.	K1
CLO2	Understand the 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.	K2
CLO3	Application of the acquired skills and adopting it for future research.	K3
CLO4	Analyze the practical knowledge on cell biology, environmental and developmental biology and develop practical biological skills.	K4

Mapping with Programme Outcomes

CLO	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	L	S	S	S	S
CLO2	S	M	S	S	S
CLO3	S	S	M	S	M
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

ZOOLOGY PRACTICAL II – AS23CP2 **(90 Hrs)**

Syllabus

CELL BIOLOGY **(12 Hrs)**

1. Squash preparation of onion root tip.
2. Mounting of giant chromosomes in Drosophila larva**.**

BIOCHEMISTRY **(6 Hrs)**

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.
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 and Edition
1	Sinha. J, Chatterjee. A. K, Chattopadhyay. P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2014 and 3rd edition
2	Lal S. S., A	Textbook of Practical Zoology Vertebrate	Rastogi Publication	2004 and 12th edition
3	Lal S. S., A	Textbook of Practical Zoology Invertebrate	Rastogi Publication	2004 and 12th edition

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
AS23A01	INVERTEBRATA AND CHORDATA	Theory	73	2	-	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 Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	To recall the various types of animals, habits, habitat and general characteristic features and classification based on their diversity into invertebrates and chordates	K1
CLO2	To understand the need for taxonomic position of invertebrates and chordates based on their distribution	K2
CLO3	To apply the knowledge of systematics, morphology, functional, and structural modification in invertebrates & chordates during the course of evolution and their significance	K3
CLO4	To analyse the knowledge of anatomy of invertebrates and chordates comparatively to recognize their history, evolutionary trends and significance	K4

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	L	L	L	M	M
CLO2	S	S	M	M	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

INVERTEBRATA AND CHORDATA AS23A01 (73 hrs)

Outline classification of Kingdom Animalia upto class level with two examples, one 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 vulgaris*- 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 2 **(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 3 **(15 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 4 **(15 hrs)**

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

Class Pisces: ***Scoliodon sorrakowah***- *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: ***Rana hexadactyla***- 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 versicolor***- 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 5 **(15 hrs)**

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

Class Aves: ***Columba livia domestica***- 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: ***Oryctolagus cuniculus domesticus***- 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.

*** Denotes Blended Learning**

Text Books

S. No.	Authors	Title of the Book	Publishers	Year of Publication and Edition
1	Jordon. E L & Verma PS	Invertebrate Zoology	1 st edition, S. Chand & Co., New Delhi	2015 and revised edition
2	Jordan E L and Verma PS	Chordate Zoology	S. Chand & Co, New Delhi	2013 and 14 revised editions

REFERENCE BOOKS:

S. No.	Authors	Title of the Book	Publishers	Year of Publication and Edition
1	Ekambaranatha Ayyar M	Outlines of Zoology	Viswanathan Publication	1992
2	Fatik Baran Mandal	Invertebrate Zoology	Eastern Economy Edition	2012 and 1st Edition.
3	Jan A Pechenik	Biology of the Invertebrates	McGraw-Hill Companies,	2014 and 7th Revised Edition
4	Barrington EJW	Invertebrate Structure and Function	ELBS and Nelson,	1979 and 2nd Edtion
5	Waterman, Allyn J	Chordate structure and Function	Mac Milan & Co., New York	2006 and 4 th edition

Pedagogy: Chalk and Talk method, Seminar, Quiz, Group discussion, Powerpoint presentation, videos, e-contents, etc.

Course Designer(s)

Dr. Susheela.P
Dr. G. Sasikala

COURSE NO	COURSE NAME	CATEGORY	L	T	P	CREDIT
AS23AP1	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 Learning Outcome

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

CLO Number	CO Statement	Knowledge Level
CLO1	To recall the general taxonomic rules on animal classification and general characteristics of animals	K_1
CLO2	To understand the basic concepts of Zoology, categorize the diversity found in the animal groups and their evolutionary significance	K_2
CLO3	To apply the practical skills towards the handling different organisms, use of various tools, technologies and fieldwork modalities	K_3
CLO4	To analyse and interpret the diversity of organisms, functioning of organ system, and observation and study of nature and develop experimental skills for scientific investigation	K_4

Mapping with Programme Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	S	S	S
CLO3	S	S	S	M	M
CLO4	S	S	S	M	M

S- Strong; M-Medium; L-Low

ZOOLOGY PRACTICAL – AS2AP1 (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 and edition
1	Sinha J, Chatterjee A K, Chattopadhyay P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2011 and 1 st edition
2	Lal S S	Textbook of practical Zoology Invertebrate	Rastogi Publication	2020 and 12th edition
3	Lal S S	Textbook of practical Zoology Vertebrate	Rastogi Publication	2020 and 12th edition

Pedagogy: Observation of slides, specimens and models; field visit, dissection

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	40th Edn, 1990

PSGR
Krishnammal College for Women

College of Excellence, nirf 2023-4th Rank
Autonomous and Affiliated to Bharathiar University
Reaccredited with 'A++' grade by NAAC, An ISO 9001: 2015 Certified Institution
Peelamedu, Coimbatore-641004

DEPARTMENT OF ZOOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOMES- BASED CURRICULAR FRAMEWORK (LOCF)
(IV Semester)

BACHELOR OF ZOOLOGY
2023 – 2026 BATCH

PSGR Krishnammal College for Women

DEPARTMENT OF ZOOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOME BASED CURRICULAR FRAMEWORK (LOCF)

BACHELOR OF ZOOLOGY – 2023-2026 BATCH

SEMESTER IV

Sem	Part	Course code	Title of the Course	Course type	Instruction Hours/Week	Contact Hours	Tutorial	Duration of Examination	Examination Marks			Credits
									CA	ESE	Total	
IV	I	TAM2304/ HIN2304/ FRE2304	Tamil Paper IV Hindi Paper IV French paper IV	L	5	73	2	3	25	75	100	3
	II	ENG2304	English Paper-IV	E	6	88	2	3	25	75	100	3
	III	AS23C04	Cell Biology and Biochemistry	CC	4	58	2	3	25	75	100	4
		AS23CP2	Zoology Practical II	CC	3	45	-	3	25	75	100	4
		AS23A02/ PL23A02	General principles in zoology/ Fundamentals of Botany II	GE	5	73	2	3	20	55	75	4
		AS23AP1/ PL23AP1	Zoology Practical/ Botany Practical	GE	2	30	-	3	15	35	50	2
III/IV	III	AS23SCE1/ CS23SBGP	Insect human Interaction/ GEN-AI	SEC	3	45	-	-	100	-	100	3
	IV	NM23EII	Entrepreneurship and Innovation (Ignitex)	AECC	2	30	-	-	100	-	100	2
	IV	NM23EVS	Environmental Studies	AECC	SS	-	-	-	100	-	100	Gr.
I - IV	V	COCOACT	Co-Curricular Activities		-			-	-	100	100	1
	VI	COM15SER	Community Service 30 Hours	GC	-	-	-	-	-	-	-	-
I - V	VI	16BONL1 16BONL2	Online Course 1 Online Course 2	ACC	-	-	-	-	-	-	-	-

L – Language
E – English
CC – Core Courses
CA – Continuous Assessment
GE – Generic Elective
ESE - End Semester Examination
AEC – Ability Enhancement Course
SEC- Skill Enhancement Course
ACC-Additional Credit Course
AECC- Ability Enhancement Compulsory Course,
SS - Self Study
€ - CA conducted for 25 and converted into 20, ESE conducted for 75 and converted into 55

QUESTION PAPER PATTERN

Examination System

One test for continuous assessment will be conducted on pre-determined dates i.e., commencing on the 50th day from the date of reopening. The Model exam will be conducted after completing 85th working days. Marks for ESE and CA with reference to the maximum for the courses will be as follows:

2023-2024 BATCH ONWARDS

CA Question Paper Pattern and distribution of marks

UGLanguage and English

Section A 5 x 1 (No choice) : 5 Marks
Section B 4 x 5 (4 out of 6) : 20 Marks (250 words)
Section C 2 x 10 (2 out of 3) : 20 Marks (500 words)
Total: 45 Marks

Core and Allied - (First 3 Units)

CA Question from each unit comprising of

One question with a weightage of 2 Marks (No choice) :2 × 3 = 6
One question with a weightage of 5 Marks (Internal Choice at the same CLO level) :5 × 3 =15
One question with a weightage of 8 Marks (Internal Choice at the same CLO level) :8 × 3 =24

Total : 45 Marks

End Semester Examination – Question Paper Pattern and Distribution of Marks

Language and English

Section A 10 x 1 (10 out of 12) : 10 Marks
Section B 5 x 5 (5 out of 7) : 25 Marks (250 words)
Section A 4 x 10 (4 out of 6) : 40 Marks (600 - 700 words)
Total : 75 Marks

Core and Allied courses:

ESE Question Paper Pattern: 5 × 15 = 75 Marks

Question from each unit comprising of

One question with a weightage of 2 Marks : 2 × 5=10
One question with a weightage of 5 Marks (Internal Choice at the same CLO level): 5 × 5 =25
One question with a weightage of 8 Marks (Internal Choice at the same CLO level): 8 × 5 =40

Part IV

Entrepreneurship and Innovation Assessment Pattern:

Components	Marks
3 Quizzes (25 questions in each quiz)	50
30 Venture Activities (Assignment)	30
Milestone 3 (pitch deck presentation)	20
Total	100

Environmental Studies

Quiz : : 50marks
Assignment : 25marks
Project / Case study : 25marks
Total **: 100 Marks**

WEIGHTAGE ASSIGNED TO VARIOUS COMPONENTS OF CONTINUOUS INTERNAL ASSESSMENT

Theory

	CA	Model Exam	ar/Assignment/ Quiz	Class Participation	Attendance	Max. Marks
Core / Allied	5	7	5	5	3	25

Practical

	Model Exam	**Lab Performance**	**Regularity in Record Submission**	**Attendance**	**Maximum Marks**
Core / Allied	10	7	5	3	25

Course Code	Course Title	Category	L	T	P	Credit
AS23C04	CELL BIOLOGY AND BIOCHEMISTRY	Theory	58	2	-	4

Preamble

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

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	To impart knowledge about different areas of cell biology, including cell structure, functions, its organelles and fundamentals of biochemical sciences.	K1
CLO2	Develop a comprehensive understanding of the cellular membranes and matrices	K2
CLO3	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	K3
CLO4	Interpret and evaluate evidence for hypotheses about cell structure and function	K4

Mapping with Programme Learning Outcomes

CLO s	PLO1	PLO 2	PLO 3	PLO 4	PLO 5
CLO 1	S	S	S	M	M
CLO 2	S	S	S	M	M
CLO 3	S	S	S	S	S
CLO 4	M	S	S	S	S

S- Strong; M- Medium; L-Low

CELL BIOLOGY AND BIOCHEMISTRY – AS23C04 (58 Hrs)

UNIT I (13 Hrs)

Diversity of cell size and shape. Cell theory, Protoplasm theory. Basic properties of cells; Different classes of cells – Prokaryotic and eukaryotic cells, Various models of plasma membrane structure and function. Microscopes – Principle and Uses of Light microscope, Phase Contrast and Electron Microscope.

UNIT II (11 Hrs)

Structure and Functions: Endoplasmic Reticulum, Golgi apparatus, Lysosomes, ribosomes. Centrioles, Mitochondria – Structure and Functions - Glycolysis, Krebs cycle and oxidative phosphorylation.

UNIT III (11 Hrs)

Structure of Nucleus: Nuclear envelope, nucleolus, functions. DNA – Structure, Watson and Crick model, Replication, super coiling. DNA Repair Mechanism.Giant chromosomes – polytene, lamp brush chromosomes.

UNIT IV (11 Hrs)

RNA - Structure, Types, tRNA structure, Transcription and translation. Cell cycle and its regulation - Mitosis, Meiosis.Cancer – Types and Properties of Cancer Cells; Theories on Carcinogenesis.

UNIT V (12 Hrs)

Scope of Biochemistry–Proteins– Types of Aminoacids, Primary, Secondary, Tertiary, quaternary Structure of Proteins and functions. Classification of carbohydrates. Structure and functions. Lipids classification, structure and functions. Enzymes classification, Michaelis–Menten Equation.Enzyme action – Factors Affecting Enzyme Action, Mechanism of Enzyme Action.

TEXT BOOKS

S. No.	Author	Title of the Book	Publisher	Year of Publication	Edition
1	Ambika Shanmugam	Fundamentals of Biochemistry for Medical Students	Wolters Kluwer (India) Pvt Ltd, New Delhi	2016	8th Edition
2	Verma P.S., Agarwal., V.K	Cytology	S. Chand & Company	2012	8th Edition
3	Veer Bala Rastogi	Introduction to Cytology	Introduction to Cytology	2003	

REFERENCE BOOKS

S. No.	Author	Title of the Book	Publisher	Year of Publication	Edition
1	Albert L Lehninger	Biochemistry, Second Edition	Kalyani Publishers, New Delhi	2013	2nd Edition
2	De Robertis, E.D.P. and De Robertis, E.M.F	Cell and Molecular Biology	Lippincott Williams and Wilkins, Philadelphia	2017	8th Edition
3	Satyanarayana U and Chakrapani U	Essentials of Biochemistry	Book and Allied (P) Ltd.	2019	3rd Edition
4	Karp, G	Cell and Molecular Biology: Concepts and Experiments	John Wiley & Sons. Inc.	2015	8th Edition

Pedagogy

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

Course Designers

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

ouse Code	Course Title	Category	L	T	P	Credit
AS23CP2	ZOOLOGY PRACTICAL II	Practical	-	-	45	4

Preamble

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

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall 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.	K1
CLO2	Understand the components of the ecosystem and their interactions and inter-relationships to sustain life on earth. Analyse the different ecological parameters and to analyse themechanisms that intervene in developmental alterations.	K2
CLO3	Application of the acquired skills and adopting it for future research.	K3
CLO4	Analyze the practical knowledge on cell biology, environmental and developmental biology and develop practical biological skills.	K4

Mapping with Programme Learning Outcomes

CLO	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	L	S	S	S	S
CLO2	S	M	S	S	S
CLO3	S	S	M	S	M
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

ZOOLOGY PRACTICAL II – AS23CP2 (90 Hrs)

CELL BIOLOGY (12 Hrs)

1. Squash preparation of onion root tip.
2. Mounting of giant chromosomes in Drosophila larva**.**

BIOCHEMISTRY (6 Hrs)

1. Qualitative analysis of carbohydrates, proteins and lipids.

ENVIRONMENTAL BIOLOGY (42 Hrs)

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.
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	Edition
1	Sinha. J, Chatterjee. A. K, Chattopadhyay. P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2014	3rd Edition
2	Lal S. S., A	Textbook of Practical Zoology Vertebrate	Rastogi Publication	2020	12th Edition
3	Lal S. S., A	Textbook of Practical Zoology Invertebrate	Rastogi Publication	2020	12th Edition

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 Code	Course Title	Category	L	T	P	Credit
AS23A02	GENERAL PRINCIPLES IN ZOOLOGY	Allied	73	2	-	4

Preamble

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

Course Leraning 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.

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the fundamentals of cell biology, genetics, animal physiology, embryology and evolution which contribute to form tissue, organs, and organ systems and their functions, diversity and evolutionary relationships among animals	K1
CLO2	Understand how organisms function at the level of the gene, genome, cell, tissue, organ and organ-system.	K2
CLO3	Analyze different laws of genetics, physiology of nutrition and digestion, process of reproduction and theories of evolution	K3
CLO4	Apply the knowledge of evolutionary theories to explain unity and diversity of life and significant adaptations to explore animal physiology, embryology and endocrinology	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	L	L	L	M	M
CLO2	S	S	M	M	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

GENERAL PRINCIPLES IN ZOOLOGY- AS23A02 (73 Hrs)

Syllabus

UNIT I Cell Biology & Genetics (15 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 (15 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	Edition
1	Verma P.S., Agarwal., V.K.	Cytology	S. Chand and Company	2012	Reprint Edition
2	Arumugam, N.	Cell Biology, Genetics, Embryology	S. Chand and Company	2014	Reprint Edition
3	Arumugam, N	Cell Biology, Genetics & Evolution Volume-3.	Saras Publication	2014	Reprint Edition

4	Verma P.S. & Tyagi B.S.	Animal Physiology,	S. Chand and Company	2012	8th Edition
5	Verma. P.S. and Agarwal. V.K.	Chordate Embryology	S. Chand and Co. Ltd., New Delhi	2010	4th Edition

REFERENCE BOOKS

S. No.	Authors	Title of the Book	Publishers	Year of Publication	Edition
1	Berry, A.K.	A Text Book of Animal Physiology with related Biochemistry	Emkay Publications	2020	12th Edition
2	Sarada Subrahmanyam., Madhavan Kutty , K., & Singh H.D.	Text Book of Human Physiology, Reprint	S. Chand & Co,	2010	8th Edition
3	De Rebertis EDP & De Robertis EMF	Cell & Molecular Biology.	BI Wauerly Pvt. Ltd, New Delhi.	2017,	8th Edition
4	Berrill, N.J.	Developmental Biology	McGraw Hill, New Delhi.	1971	
5	Bodmer, Modern Embryology, Hold Rinefiar & Winston. N.Y. Balinsky	Introduction to Embryology International student edition,	Saunders Philadelphia.	2012	5th Edition

Pedagogy

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

Course Designers: 1**.** Dr. P.Susheela., 2. Dr. G. Sasikala

Course Code	Course Title	Category	L	T	P	Credit
AS23AP1	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 Learning Outcome

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

CLO Number	CLO Statement	Knowledge Level
CLO1	To recall the general taxonomic rules on animal classification and general characteristics of animals	K1
CLO2	To understand the basic concepts of Zoology, categorize the diversity found in the animal groups and their evolutionary significance	K2
CLO3	To apply the practical skills towards the handling different organisms, use of various tools, technologies and fieldwork modalities	K3
CLO4	To analyse and interpret the diversity of organisms, functioning of organ system, and observation and study of nature and develop experimental skills for scientific investigation	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	S	S	S
CLO3	S	S	S	M	M
CLO4	S	S	S	M	M

S- Strong; M-Medium; L-Low

ALLIED ZOOLOGY PRACTICAL – AS23AP1 (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	Edition
1	Sinha J, Chatterjee A K, Chattopadhyay P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2014	3rd Edition
2	Lal S S	Textbook of practical Zoology Invertebrate	Rastogi Publication	2019	12th Edition
3	Lal S S	Textbook of practical Zoology Vertebrate	Rastogi Publication	2004	12th Edition

Pedagogy: Observation of slides, specimens and models; field visit, dissection

PSGR
Krishnammal College for Women

College of Excellence, nirf 2023-4th Rank
Autonomous and Affiliated to Bharathiar University
Reaccredited with 'A++' grade by NAAC
Peelamedu, Coimbatore-641004

DEPARTMENT OF ZOOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)
LEARNING OUTCOMES- BASED CURRICULUM FRAMEWORK (LOCF)

BACHELOR OF SCIENCE-
ZOOLOGY 2023 – 2026 BATCH
V Semester

BACHELOR OF SCIENCE - ZOOLOGY
CHOICE BASED CREDIT SYSTEM (CBCS)
LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)
SYLLABUS & SCHEME OF EXAMINATION
2023-2026 BATCH
SEMESTER V

Sem	Part	Course code	Title of the Course	Course type	Instruction Hours/Week	Contact Hours	Tutorial	Duration of Examination	Examination Marks			Credits
									CA	ESE	Total	
V	III	AS23C05	Genetics and Evolution	CC	4	58	2	3	25	75	100	4
		AS23C06	Biophysics, Biostatistics & Bioinformatics	CC	4	58	2	3	25	75	100	4
		AS23C07	Biotechnology	CC	4	58	2	3	25	75	100	4
		AS23CP3	Zoology Practical III	CC	6	90	-	-	-	-	-	-
		AS23E01/ AS23E02	Pathology and Medical Laboratory Technology/ Wildlife and Conservation Biology	DSE	4	58	2	3	25	75	100	4
		AS23PROJ	Project and Viva voce	DSE	3	45	-	-	25	75	100	5
		AS23SB01	Introductory course on Translational Research and Preclinical Studies	SEC	3	41	4	-	-	-	100	3

V	III	AS21AC1/ AS21AC2	Microbiology/ Public Health and Hygiene	ACC	SS	-	-	3	25	75	100	5[$]
	IV	NM21CS1	Cyber Security I	AECC	2	30	-	-	100	-	100	Gr.
	IV	AS23INST	Field work/ Institutional training	DSE	-	-	-	-	100	-	100	2
	IV	AS23COM	Comprehensive Examination	GC	-	-	-	-	100	-	100	Gr.
I-IV	VI	COM15SER	Community Services 30 hours	GC	-	-	-	-	-	-	-	-
I-V	VI	16BONL1 16BONL2	Online Course Online Course	ACC	-	-	-	-	-	-	-	-

CC – Core Courses
DSE –Discipline Specific Elective
AEC – Ability Enhancement Course
ACC-Additional Credit Course
GC- General Courses
SS-Self study
CA – Continuous Assessment
ESE - End Semester Examination
SEC- Skill Enhancement Course
AECC- Ability Enhancement Compulsory Course
Gr-Grade

[$-] Credits applicable to candidates who take up Advanced Level Course examination

Examination System Pattern:

Semester system will be followed. A semester consists of a minimum of 90 working days excluding the days of conduct of ESE. There will be Continuous Internal Assessment (CA) to evaluate the performance of students in each course and the End Semester Examination will be held at the end of every semester.

Weightage assigned to various components of Continuous Internal Assessment

Theory

CIA Test	: 5 marks **(conducted for 45 marks after 50 days)**
Model Exam	: 7 marks **(Conducted for 75 marks after 85 days)**
Seminar/Assignment/Quiz	: 5 marks
Class Participation	: 5 marks
Attendance	: 3 marks
Total	**: 25 Marks**

Practical

Lab Performance	: 7 marks
Regularity	: 5 marks
Model Exam	: 10 marks
Attendance	: 3 marks
Total	**: 25 marks**

Question Paper Pattern and distribution of marks

Core and Elective (first 3 units)

CA Question Paper Pattern: 3 x 15 = 45 Marks

CA Question from each unit comprising of

One question with a weightage of 2 Marks :2 x 3 = 6

One question with a weightage of 5 Marks (Internal Choice at the same CLO level) :5 x 3 =15

One question with a weightage of 8 Marks (Internal Choice at the same CLO level) :8 x 3 =24

ALC

Section A (Paragraph answer) (4 out of 6) 4 x 4	: 16 Marks
Section B (Essay type) 1 out of 2	: 9 Marks
Total	**: 25 Marks**

Skill Based Subject Theory Courses

Test I	: 30 Marks (conducted for 50 Marks and converted to 30 Marks)
Test II	: 50 Marks
Assignment	: 10 Marks
Seminar	: 10 Marks
TOTAL	**: 100 Marks**

Students securing very low marks in internal assessment, only ESE marks will be considered as passing criteria from the third attempt and onwards

Cyber Security I

Quiz	: 60 Marks
Case Study	: 20 Marks
Poster	: 20 Marks
TOTAL	**: 100 Marks**

Field Work / Institutional Training

Attendance	: 10 Marks
Work diary	: 15 Marks
Report	: 50 Marks
Viva Voce	: 25 Marks
Total	**: 100 Marks**

Project and Viva Voce

Internal	: 25 marks
External	: 75 marks
TOTAL	**: 100 Marks**

Project (CA)

I Review - Selection of the field of study, Topic & literature collection	: 5 Marks
II Review - Research Design & Data Collection	: 10 Marks
III Review - Analysis & Conclusion, Preparation of rough draft	: 10 Marks
Total	**: 25 Marks**

End Semester Examination

Core and Elective

ESE Question Paper Pattern: 5 x 15 = 75 Marks

Question from each unit comprising of

One question with a weightage of 2 Marks: 2 x 5=10

One question with a weightage of 5 Marks (Internal Choice at the same CLO level): 5 x 5 =25

One question with a weightage of 8 Marks (Internal Choice at the same CLO level): 8 x 5 =40

ALC

Section A: 5 questions out of 8 - open choice 5x5	: 25 marks
Section B: 5 questions out of 8-open choice 5x10	: 50 marks
Total	**: 75 marks**

Criteria for Attendance:

3 Marks (Attendance 75% - 80% - 1 Marks, 81% - 90% - 2 Marks, 91% - 100% - 3 Marks)

Mapping PLOs with CLOs

COURSE	PROGRAMME OUTCOMES				
	PO1	PO2	PO3	PO4	PO5
COURSE – AS23CO5					
CLO1	S	S	M	M	M
CLO2	S	S	M	M	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S
COURSE – AS23C06					
CLO1	S	S	M	M	M
CLO2	S	S	M	M	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	M
COURSE – AS23C07					
CLO1	S	L	M	S	M
CLO2	S	M	M	S	S
CLO3	L	S	M	S	S
CLO4	S	S	S	S	S
COURSE – AS23CP3					
CLO1	S	S	S	S	S
CLO2	S	S	S	S	S
CLO3	S	S	S	S	S
CLO4	S	S	S	M	M
COURSE – AS23E01					
CLO1	S	S	S	M	M
CLO2	S	S	S	M	M
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S
COURSE – AS23E02					
CLO1	S	S	M	M	M
CLO2	S	S	M	M	S
CLO2	S	S	S	S	S
CLO4	S	S	S	S	S
COURSE – AS23SB01					
CLO1	S	S	S	M	M
CLO2	S	S	S	M	M
CLO3	S	S	S	M	S
CLO4	S	S	S	S	S

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
AS23CO5	GENETICS AND EVOLUTION	Theory	58	2	-	4

Preamble

To understand the fundamental concepts of genetics, the principles and mechanism of inheritance and the origin and evolutionary process of organisms

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Demonstrate knowledge of fundamental genetic terminology, key principles of inheritance, and core concepts of evolution	K1
CLO2	Comprehend classical and modern experimental approaches in genetics and explain the origin of life and evolutionary processes	K2
CLO3	Apply genetic principles to human health, genetic variation, and population genetics for scientific and medical advancements	K3
CLO4	Analyze and synthesize genetic concepts across interdisciplinary scientific fields, including evolutionary biology, biotechnology, and environmental science.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	M
CLO2	S	S	M	M	S
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium

GENETICS AND EVOLUTION - AS23CO5 **58 Hrs**

UNIT I **11 Hrs**

Mendelian Principles – Monohybrid and Dihybrid Crosses, Interaction of genes: Supplementary genes, Complementary genes, Epistasis, Atavism; Linkage in *Drosophila*: Complete and Incomplete Linkage, Theories of Linkage, Factors Affecting Linkage; Crossing Over: Types, Cytological Basis – Stern's Experiment, Significance and Factors Affecting Crossing Over.

* Sex-Linked Inheritance: X Linked Inheritance - Eye Colour in *Drosophila*, Colour Blindness and Hemophilia in Humans; Y-Linked Inheritance: Hypertrichosis (Hairy Ears); Sex-Limited inheritance; Mitochondrial Inheritance

UNIT II **11 Hrs**

Fine Structure of a Gene; Lac Operon, Genetic Code Genetic Mutation-Molecular Basis, Tautomerism, Base Analogues, Spontaneous and Induced mutations. Detection of mutation by CLB method; Chromosomal Aberrations-Intra-Chromosomal Aberrations and Inter-Chromosomal Aberrations. * Mutagens: Physical and Chemical

UNIT III **12 Hrs**

Animal Breeding - Inbreeding and Outbreeding, Inborn Errors of Metabolism - Phenylketonuria (PKU), Galactosaemia, Alkaptonuria, Albinism; Eugenics- Positive and Negative Eugenics, Euphenics and Euthenics; Genetic Disorders in Man: Autosomal Disorders - Klinefelter's Syndrome, Turner's Syndrome; Autosomal Disorders - Down's Syndrome; Inherited single gene disorder - Sickle cell Anaemia, Cystic Fibrosis, Duchenne Muscular Dystrophy; Sex determination – Heterogametic male and Homogametic female. Geneic balance theory of Bridges.

* Gene Therapy

UNIT IV **12 Hrs**

Origin of Life: Theories of Origin of Life - Abiogenesis vs. Biogenesis, Oparin-Haldane, Miller-Urey Experiments; Lamarckism and Neo-Lamarckism, Darwinism and Neo-Darwinism, Modern Synthetic Theory; Geological Time Scale; Fossil Formation and Types of Fossils, Dating of Fossils, Causes and Role of Extinction in Evolution.

*Human Evolution, Cultural and Cognitive Evolution of Early Humans

UNIT V **12 Hrs**

Population Genetics - Gene pool, gene frequency, Factors affecting Hardy - Weinberg Law; Forces of Evolution – mutation, gene flow, genetic drift, and natural selection; Reproductive Isolation: Premating and Post mating isolating mechanisms; Evolutionary Processes: Microevolution, Macroevolution, Co-evolution; Modes of Speciation: Allopatric, Sympatric, Parapatric, Quantum speciation; Adaptive Radiation; Continental Drift – distribution of animal species.

*Origin of Indian continent and its Mega diversity

***Denotes self study**

Text Books

S. No.	Authors	Title of the Book	Publishers	Year & Edition
1	Verma P.S and Agarwal V. K	Genetics	S. Chand & Co	2009, 9th Edn.
2	Verma P.S and Agarwal V. K	Cell Biology, Genetics, Molecular Biology, Evolution and Ecology	S. Chand & Co	2005, Ist Edn.

Reference Books:

S. No.	Authors	Title of the Book	Publishers	Year & Edition
1	Gardner, E.J. and Snustad, D. P	Principles of Genetics	Wiley Eastern Pvt. Ltd	2015, 9th Edn.
2	Robert H. Tamarin	Principles of Genetics	Tata McGraw Hill	2014, 7th Edn.
3	Starr C, Taggart R, Evers C, Starr L	Biology: The Unity and Diversity of Life	Cengage Learning	2017, 15th Edn.
4	Benjamin A. Pierce	Genetics: A Conceptual Approach	W. H. Freeman	2020, 7th Edn.
5	Strickberger W Monroe	Genetics	Prentice Hall of India	2002, 3rd Edn.
6	Ricki Lewis	Human Genetics	WM.C. Brown Publishers	2020, 12th Edn.

Pedagogy: Chalk and Talk method, Seminar, Quiz, Group discussion, PowerPoint presentation

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
AS23C06	BIOPHYSICS, BIOSTATISTICS & BIOINFORMATICS	Theory	58	2	-	4

Preamble

Develop a fundamental understanding of basic concepts and tools in biophysics, biostatistics and bioinformatics

Course Learning Outcome

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall Fundamental concepts in biophysics, statistical concepts and to get introduced to the basic concepts of Bioinformatics and its significance in biological data analysis.	K1
CLO2	Understand the concept of physics in biology; principle and methodology of various analytical techniques in biophysics and various statistical methods, Types of biological databases	K2
CLO3	Apply core concepts of biology and how they interconnect in biophysical systems; demonstrate the working of analytical instrumentation; Apply hypothesis testing to the data; Exposure to various tools in bioinformatics	K3
CLO4	Analyse the relevance of biophysics to many different areas of life sciences; Statistical techniques incorporated in research; comparing, analysing and interpreting genetic and genomic data	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	M
CLO2	S	S	M	M	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	M

S- Strong; M-Medium

BIOPHYSICS, BIOSTATISTICS & BIOINFORMATICS – AS23C06 58 Hrs

UNIT I 11 Hrs

Biophysics

Light- components – its effect on living organisms – Vision, Pigmentation, Bioluminescence. Laws of Thermodynamics - Living systems, Free energy, Internal Energy, Entropy, Enthalpy, State of Equilibrium. Radioactivity: Isotopes – General properties of radioactive reactions – Alpha, Beta and Gamma radiation – Half-life, Unit of radioactivity. *Uses of Radioactivity

UNIT II – Biophysics 11 Hrs

PH meter: Digital, Analog - Colorimetry and Spectrophotometry: Principle, Instrument description and Application - Chromatography: Paper, Thin Layer chromatography, Ion exchange chromatography and Applications - Electrophoresis: Paper and Gel electrophoresis - Principle and Applications. Centrifuge - Basic Principle of Centrifugation, Instrumentation of Ultracentrifuge
* Colloids-description, types, properties and separation.

UNIT III – Biostatistics 12 Hrs

Organization of Statistical investigation- object and scope - Data: Sources, primary and secondary methods of collection, tabulation - Types of variables: Continuous and discontinuous variables, Qualitative and quantitative-variables. Diagrammatic representation: line, bar, pie, pictogram, cartogram – Graphic representation: Histogram, Frequency polygon, Frequency curve, Ogive Frequency distribution. (Direct Method), Introduction to SPSS. *Frequency graphs.

UNIT IV – Biostatistics 12 Hrs

Arithmetic mean - Standard deviation - Standard error - Chi – square test - Students ‘t’ test - Regression – Correlation – ANOVA one way (Direct Method). *Basics of Research Methodology.

UNIT V – Bioinformatics 12 Hrs

Introduction to Bioinformatics – Biological Databases-Nucleic acid - NCBI, EMBL, Protein-PDB, UNIPROT, Genome and structural databases -DDBJ & CATH. Comparison of sequences: pairwise -FASTA, BLAST and multiple alignments – MEGA 11. Molecular visualization tools: RasMol. *Applications of Bioinformatics in the field of Biology; Medical Transcription.

***Denotes self-study**

Text Books:

S. No.	Authors	Title of the Book	Publishers	Year & Edition
1	Daniel M	Basic Biophysics for Biologists	Wiley International, New Delhi	1992
2	Das D	Biophysics and Biological Chemistry	Academic Publishers, Calcutta	1996, 1st Edn.
3	Mani K and Vijayaraj N	Bioinformatics for Beginners	Kalaikathir Achchagam, Tamil Nadu	2002,1st Edn.
4	Palanichamy S and M. Manoharan	Statistical methods for Biologists	Paramount Publications	2009
5	Pranab Kumar Banerjee	Introduction to Biostatistics	**S.** Chand Publishers	201, 4th Edn.
6	Roy R N	A Textbook of Biophysics	Publisher, New Central Book Agency	200, 2nd Edn.
7	Snedecor G.W. and W.G. Cochran	Statistical Methods	Oxford & IBH Publishing, New Delhi	2001, 6th Edn.

Reference Books:

S. No.	Authors	Title of the Book	Publishers	Year & Edition
1	Arthur. M. Lesk	Introduction to Bioinformatics	Oxford University Press	2003, 2nd Edn.
2	Prakash S. Lohar	Bioinformatics	MJP Publishers Chennai, India	2019, 1st Edn.
3	Gupta S P	Statistical Methods	S. Chand & Sons	2008, 46th Edn.
4	Zar J.H	Biostatistical analysis	Prentice Hall Inc., New Jersey, USA	1974, 4th Edn.

Pedagogy: Chalk and talk, PPT, Numerical exercise, group discussion, peer learning, seminar

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
AS23C07	BIOTECHNOLOGY	Theory	58	2	-	4

Preamble

Upon successful completion of this course the students recognize the foundation of modern biotechnology, principles and the different applications of biotechnology. Though Biotechnology has ancient roots, recent developments in genetic engineering has made this subject more attractive.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	To recall the concepts, principles, and processes for the production of products, development of technologies for the well-being of animals and human	K1
CLO2	To understand the fundamental concepts, principles, processes, and applications of interdisciplinary areas in biotechnology involved in the processes of genetic engineering, microbial and animal cell culture, diagnosis of diseases etc.	K2
CLO3	To apply the principles and technologies developed in various fields of biotechnology for the benefit of mankind from the sectors of pharmaceuticals, livestock, fisheries etc.	K3
CLO4	To synthesize new products based on the understanding of concepts learnt from the interdisciplinary areas such as cell biology, genetics, environmental biology, developmental biology etc.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	L	M	S	M
CLO2	S	M	M	S	S
CLO3	L	S	M	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

BIOTECHNOLOGY AS23C07 **58 Hrs**

UNIT I **10 Hrs**

Introduction to Biotechnology

Definition and landmarks in the history of Biotechnology. Scope of Biotechnology. Basic principles of genetic engineering- rDNA technology. Enzymes: Cutting enzymes, Joining enzymes, Modifying enzymes.

*Major areas of Biotechnology.

UNIT II **12 Hrs**

Gene Cloning

Vectors: plasmids, Phage vectors, bacterial artificial chromosomes (BACs), yeast artificial chromosomes (YACs) and mammalian artificial chromosomes (MACs), Expression vectors, shuttle vectors and Transposons. Technique of genetic engineering – Gene transfer – introduction of rDNA into host cells.

*Microinjection, Electroporation, Microprojectile bombardment, Shotgun method, Ultrasonication, Liposome fusion, Microlaser

UNIT III **12 Hrs**

Identification of Recombinants

Polymerase chain reaction. Restriction enzyme analysis. Blotting Techniques- Northern and Southern blotting, in-situ hybridization. Radioisotope labeling, DNA probes. cDNA library. DNA Fingerprinting, Methods of DNA profiling.

*Genomic library

UNIT IV **12 Hrs**

Animal Tissue and Cell Culture

Principles and techniques of animal tissue culture: Sterilization, Requirements for animal cell, tissue and organ culture – Primary and cell line culture. Cultivation of animal cell in bioreactor – Organ culture – Manipulation of reproduction in animals – Invitro fertilization and gene transfer in Humans

*Gene sequencing- Next – Generation Sequencing (NGS),Human Genome project.

UNIT V **12 Hrs**

Applications of Biotechnology

Applications in Agriculture: Nitrogen fixation by symbiotic and non-symbiotic bacteria nodule formation, Cloning of nif genes. Application in human welfare: Insulin, Antibiotics and vaccines, Monoclonal antibodies production, Transgenic animals -Transgenic Fish, Sheep, Cryobiology Antenatal diagnosis. Application in industry: Biosensors – Types of biosensors, Biochips - Principles of Biochips - Applications of biochips, *Transgenic Pig – Molecular Pharming.

***Denotes self study**

Text Books

S. No.	Authors	Title of the Book	Publishers	Year & Edition
1	Ignacimuthu, S.	Biotechnology	Tata McGraw Hill Publishing Company Ltd., New Delhi	2012; 2nd Edn.
2	Dubey R.C.	A textbook of Biotechnology	S. Chand & Co., Ltd., New Delhi	2015; 5th Edn.
3	Kumaresan, V.	Biotechnology	Saras Publications, Nagercoil	2005; 5th Edn.
4	Bhatia, S.C.	Textbook of Biotechnology	Atlantic Publications	2006; 1st Edn.

Reference Books:

S. No.	Authors	Title of the Book	Publishers	Year & Edition
1	Alexander, N. Glazer and Hiroshi Nikado	Microbial Biotechnology: Fundamentals of Applied Microbiology	Cambridge University Press	2007; 2nd Edn.
2	Glick, B.R., Pasternak, J.J.	Molecular Biotechnology	ASM Publisher	2010; 4th Edn.
3	Jogdand, S.N.	Environmental Biotechnology	Himalaya Publishing House, Bombay	2015, 4th Edn.
4	Old, R.W. and Primrose, S.B.	Principles of Gene manipulation	Blackwell Scientific Publications	2006; 7th Edn.
5	Das, H.K.	Textbook of Biotechnology	Wiley-India Publications	2017, 2nd Edn.
6	Sangita Malvee	Biotechnology-An Introduction	SBS Publishers and Distributors	2007; 1st Edn.
7	Prakash, M.	Textbook of Biotechnology	Sonali Publication	2021; 1st Edn.

Pedagogy: Chalk and Talk method, Seminar, Quiz, Group discussion, PowerPoint presentation, e-content, videos etc.

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
AS23CP3	ZOOLOGY PRACTICAL III	Practical	-	-	180	5

Preamble

The curriculum will reflect on the current changing needs of the students which includes basic as well as advanced concepts in Zoology to provide hands-on experience of the latest techniques, skill development for continuing higher education, to aspire as an entrepreneur, employability in Industries, Educational and research Institutes.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	To recall the knowledge about various animal sciences from primitive to highly evolved animal groups and principles of biological techniques, their importance and applications	K1
CLO2	To understand the fundamental genetics, tools and techniques related to biotechnology, various aspects of biostatistics, evolutionary biology, and aquaculture techniques and skills related to laboratory as well as field-based Studies	K2
CLO3	To apply knowledge towards handling of important instruments, conduct basic clinical lab experiments, apply statistical analysis for problem solving and select future course of their career development in higher education and research	K3
CLO4	To analyse and interpret experimental data and demonstrate laboratory skills in various subjects of Zoology and to enhance the interest and employability opportunities	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	S	S	S
CLO3	S	S	S	M	M
CLO4	S	S	S	M	M

S- Strong; M-Medium

ZOOLOGY PRACTICAL III AS23CP3 **180 Hrs**

GENETICS, STATISTICS, BIOINFORMATICS **35 Hrs**

1. Drosophila handling, culture and experimentation. Study of phenotypic characters of drosophila (Individual activity) 10-12 days
2. Preparation and identification of salivary gland polytene chromosomes from Drosophila /Chironomus larva (Individual activity) 3 Hrs
3. Observation of Barr body in human epithelia (Individual activity) 3 Hrs
4. Study of frequency of Mendelian traits in a population (tongue rolling and folding, use of hands – left, right) (Individual activity) 3 Hrs
5. Pedigree analysis - Problems (Individual activity) 3 Hrs
6. Literature retrieval from NCBI & PubMed database. (Individual activity) 3 Hrs
7. Retrieval of gene or protein sequences of microbial species in FASTA format from NCBI database (Individual activity) 3 Hrs
8. Application of sequence similarity search using BLASTn and BLASTp of a gene of interest. (Individual activity) 3 Hrs
9. Multiple sequence alignment and phylogenetic tree construction using Clustal Omega. (Individual activity) 3 Hrs

PHYSIOLOGY & ENDOCRINOLOGY, EVOLUTION AND BIOTECHNOLOGY **60 hrs**

1. Qualitative analysis of excretory products – Ammonia, Urea, Uric acid (Individual activity) 3 Hrs
2. Isolation and estimation of genomic DNA (Group activity) 6 Hrs
3. Techniques of sterilization - dry and wet (Group activity) 6 Hrs
4. Preparation of medium – nutrient agar, nutrient broth (Group activity) 6 Hrs
5. Distribution of microbes in soil, air and water (Group activity) 9 Hrs
6. Demonstration of antibiotic sensitivity and interpretation of results (Group activity) 3 Hrs
7. Determination of microbiological quality of milk using MBR test (Individual activity) 5 Hrs
8. Determine the concentration of the unknown sample using the standard curve plotted (Individual activity) 3 Hrs
9. Colorimetric estimation of glucose in the given solution (Group activity) 3 Hrs

10. Quantitative estimation of protein by modified Lowry's colorimetric method (Individual activity) 3 Hrs
11. Separation of proteins by SDS-PAGE (Group activity) 3 Hrs
12. Visit to biotechnological/aquaculture industry/research institute- A report to be submitted. 10 Hrs

SPOTTERS **10 Hrs**

Spirulina; *Bacillus thuringiensis*- Biopesticide; Mushroom seed; Yeast; Antibiotic Erythromycin/ Streptomycin; Azolla-Biofertilizer; Test kits – Widal Test kit, Agarose electrophoresis kit, Instruments used such as autoclave, air filter, centrifuge, Endocrinology-Pituitary gland, Islets of Langerhans, thyroid, adrenal gland (slides)**,** Homologous organs – Fore and Hind limb skeleton of vertebrates, Analogous organs-wings of butterfly, bird, bat.

MEDICAL LABORATORY TECHNOLOGY **40 hrs**

1.	Bleeding Time	2 Hrs
2.	Clotting Time	2 Hrs
3.	Blood group in man (ABO and Rh)	3 Hrs
4.	Estimation of Haemoglobin	3 Hrs
5.	Enumeration of RBC using Neubauer Counting Chamber	3 Hrs
6.	Enumeration of WBC using Neubauer Counting Chamber	3 Hrs
7.	Preparation of Haemin Crystals in human blood	3 Hrs
8.	Differential Count of White Blood Cells (WBC)	3 Hrs
9.	Estimation of Specific Gravity of urine	3 Hrs
10.	Qualitative test of Sugar in urine	3 Hrs
11.	Qualitative test of Albumin in urine	3 Hrs
12.	Gram Staining	3 Hrs
13.	Motility of bacteria using Hanging drop method	3 Hrs
14.	Identification of urine crystals in urine sample	3 Hrs

SPOTTERS **5 hrs**

Entamoeba histolytica, Malarial Parasite (*Plasmodium*), Pinworm (*Enterobius vermicularis*), Hookworm (*Ancylostoma duodenale*), *Ascaris lumbricoides*, Filarial Parasite (*Wuchereria bancrofti*); Instruments - Albuminometer, Haemocytometer, Urinometer, Haemoglobinometer, ESR Tube, Sphygmomanometer, Stethoscope, Glucometer

APPLIED FISHERY BIOLOGY **30 Hrs**

1. Setting up and maintenance of a freshwater pond/aquarium tank, Aquarium accessories (Aerator, Under Gravel Filter, Internal Filter, External/Canister Filter, Food dispensers) and equipment. (Group activity) 8 Hrs
2. Identification of commercially important cultivable fish species, ornamental fishes. (Individual activity) 3 Hrs
3. Estimation of total RBC in fish blood (Demonstration). 9 Hrs
4. Identification of commercially available fish in the local market and write a report on the characteristics and nutritional value (Group activity) 10 Hrs

Reference Books

S. No.	Authors	Title of the Book	Publishers	Year & Edition
1	Sinha J, Chatterjee A K, Chattopadhyay P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2011, 1st Edn.
2	Gupta S P	Statistical Methods	S. Chand & Sons	2008, 1st Edn.
3	Pranab Kumar Banerjee	Introduction to Biostatistics	**S.** Chand Publishers	2011, 3rd Edn.
4	Kanai, L Mukherjee	Medical Laboratory Technology	Tata McGraw Hill Publishing Company Ltd., New Delhi	2017, 3rd Edn.
5	Ramnick Sood, M. D	Medical Laboratory Technology	Medical Publishers(P)Ltd	2009, 6th Edn.
6	Sathish Gupte	Short Textbook of Medical Laboratory for Technicians	Jaypee Brothers, Medical Publishers	2021, 3rd Edn.
7	JhingranV.G	Fish and fisheries of India	Hindustan Publishing Corporation, New Delhi	1991, 3rd Edn.

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
AS23E01	PATHOLOGY & MEDICAL LABORATORY TECHNOLOGY	Theory	58	2	-	4

Preamble

Upon successful completion of this course the student will be able to understand the technical and procedural aspects of laboratory testing for laboratory samples and perform various staining techniques for bacteria.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the fundamental analytical principles and processes used in clinical laboratory testing for gastric juice, urine and faecal matter. Understand the concepts and safety measures of clinical laboratory instruments.	K1
CLO2	Understand the Acquired technical skills will help the students for collecting and processing biological specimens for analysis.	K2
CLO3	Application of medical laboratory procedures will enable the students to distinguish normal and abnormal microscopic pathogens.	K3
CLO4	Analyze the clinical laboratory procedures, interpret data and predict diagnosis.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	M	M
CLO2	S	S	S	M	M
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M- Medium

PATHOLOGY & MEDICAL LABORATORY TECHNOLOGY - AS23E01 58 Hrs

Unit I 11 Hrs

Essential pre – requisites of a medical laboratory

Introduction, Scope of CLT, Collection of Specimens-Collection of blood, CSF & other fluids and Urine. Maintenance of Laboratory records and preparation of reports. Cleaning, maintenance and care of glassware. Different methods of sterilization: Heat, radiation, filtration, chemical methods. Disposal of specimens and infected materials, Biosafety Levels 1, 2, 3 & 4.

Laboratory instruments

Method of measuring liquids and weighing solids, General laboratory equipment - Principle, use and maintenance of the following instruments/apparatus – Balance, Centrifuge and its types, homogenizer, desiccators, vortex mixer, magnetic stirrer. *Spectrophotometry.

Unit II 11 Hrs

Clinical haematology

Blood and its constituents, Collection of blood –capillary and venous blood collection, various anticoagulants and their uses. Total count of RBCs, WBC. Haemoglobin estimation by Sahli's method. Erythrocyte Sedimentation Rate (ESR) (Wintrobe and Westergren method). Bleeding time, clotting time. Blood transfusion – Indication, universal donor and recipient concept. Compatibility test (Coombs test) and its significance, A – B – O Grouping: Tile method, Standard tube technique. *Rhesus grouping techniques

Unit III 12 Hrs

Gastric & liver function tests

Composition, collection and stimulation of gastric juice secretion. Augmented histamine test; Estimation of titratable free and total acidity and inference. Functions of Liver, Fouchest test, Qualitative test for urine urobilinogen. Scheleringer's test for urine urobilin. Disease of the liver- Jaundice, acute and chronic hepatitis, Cirrhosis, Cholestasis etc.

Urine Analysis

Urine composition, volume, appearance, color, collection and preservation. Physical and chemical examination of urine- Heat and acetic acid test, Sulfosalicylic acid test. Microscopic examination of organized and unorganized deposits and blood; Urine test for bile salts. Detection of protein in urine (Bence Jones protein test); Determination of specific gravity using urinometer.

Faecal Examination

Collection and preservation, examination of faeces for color, mucus, consistency, ova, amoeba, cysts, parasites, pus cells, RBC and crystals. Detection of occult blood in stool - Benzedine test, Guaiac test, Orthotolidine test. Stool concentration methods- Sodium chloride and formaldehyde methods for concentration of parasites. Staining of faecal smears and blood films. Examination of faeces for adult helminth worms. *Examination of faeces ova and cysts of *Entamoeba coli, E. histolytica, Giardia lambia, Enterobius vermicularis.*

Unit IV **12 Hrs**

Microbiological Examination

Microscopic examination of bacteria smearing; Hanging drop preparation and wet preparation. Staining *Corynebacterium diphtheriae*. Examination of sputum. Volume, Consistency, Appearance and color. Examination of throat swab. Collection and preparation of smears. Bacteriological examination of urine. VDRL – test. Brief biology and pathology of *Vibrio cholerae, Corynebacterium diphtheriae, Mycobacterium tuberculosis, M. leprae, Treponema pallidum, Salmonella typhi* and *Clostridium tetani.** Hanging drop preparation–gram's staining +ve and –ve; Outline biology of fungi

Unit V

Microorganisms and pathology **12 Hrs**

Collection of microbiological specimens and precautionary measures for investigation. Bacterial toxins and their effects Routine mycological methods. Laboratory diagnosis of mycotic infection. Superficial wounds and pathology of Poliomyelitis, Rhinovirus group, Influenza virus, Measles virus (Rubella), Meningitis virus, Serum hepatitis virus (HBV). *Indigenous microbial flora of man- Its significance in health and diseases of man.

*** Denotes self-study.**

Text Books

S. No.	Authors	Title of the Book	Publishers	Year & Edition
1	Kanai, L Mukherjee	Medical Laboratory Technology	Tata McGraw Hill Publishing Company Ltd., New Delhi	1998, 1st Edn.
2	Godker, P. B. and Darshan, P, Godker	Text book of medical Laboratory Technology	Bhalani Publishing House	2011, 2nd Edn.
3	Ramnik Sood M D	Medical Laboratory Technology	Medical Publishers(P)Ltd	1985, 1st Edn.

Reference Books:

S. No.	Authors	Title of the Book	Publishers	Year & Edition
1	Arumugam.N	Microbiology (General & Applied)	Saras Publication	2000, 5th Edn.
2	Madhavan Kutty,K	Text Book of Medical Laboratory Technology	Medcen Poonthanam	1992, 1st Edn.
3	Mary Ellen Wedding, Sally A Toenjas	Medical Laboratory Procedures	Jaypee Brothers Medical Publishers	1992, 2nd Edn.
4	Samuel, K.M	Notes on Clinical Lab Techniques	Published by M.K.Gopalan, Chrompet	1999, 1st Edn.
5	Sathish Gupte	Short Textbook of Medical Laboratory for Technicians	Jaypee Brothers, Medical Publishers	1998, 1st Edn.
6	Baker F.J. And Silverton R.E	Introduction to Medical Laboratory Technology	Hodder Education Publishers	1998, 7th Edn.

Pedagogy: Chalk and talk, PPT, group discussion, assignment, quiz, peer learning, seminar.

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
AS23E02	WILDLIFE AND CONSERVATION BIOLOGY	Theory	58	2	-	4

Preamble

To enable the students to understand the introduction of wildlife management, management of vertebrate pest and wildlife utilization and conservation.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	To recall the main concepts of wildlife management and wildlife conservation	K1
CLO2	To understand the management techniques to achieve desired goals in wildlife conservation	K2
CLO2	To apply the knowledge of animal interaction with natural environment	K3
CLO4	To analyse the planning, preparation, techniques so as to interpret wildlife conservation management information.	K4

Mapping with Programme Learning outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	M
CLO2	S	S	M	M	S
CLO2	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium; L-Low

WILDLIFE AND CONSERVATION BIOLOGY -AS23E02 **58 Hrs**

Unit I **11 Hrs**

Definition of Wildlife: Causes of wildlife depletion; Economic importance of wildlife; need for wildlife conservation; rare, endangered, threatened and endemic species of fishes, amphibians, reptiles, birds and mammals in India-India as a mega wildlife diversity country.

Unit II **11Hrs**

Forest types in India- identification, dendrology; Deforestation & Impacts; Forest Inventory; Natural and artificial regeneration of forests; nursery techniques-seed-technology- Collection, storage, pre-treatment and germination, establishment and tendings, Silviculture

Unit III **12 Hrs**

Harmful Insects and their role in forest economy: Insect pests of important trees of India -Teak, Sal and Bamboo; Beneficial Insects and their role in forest economy: Scavenger insects- dung beetles; Pollinators, Predatory insects, and parasitic insects on insect pests; control of forest insects.

Unit IV **12 Hrs**

Vegetative analyses – Point Centered Quadrat, Quadrat, Strip transect; GIS and Remote sensing in wildlife habitat surveys-Habitat manipulation: food, water, shade improvement; impact and removal of invasive alien species.Geotagging of wild animals for conservation

Unit V **12 Hrs**

In-situ and ex-situ conservation: Wildlife Sanctuaries, National Parks, Tiger Reserves and Biosphere reserves: Definition, formation, management and administration; Wildlife Projects: Tiger, Elephant, Lion and Hangul; Zoos and Zoological Parks: Definition- Aims of Zoos-Formation and Management of Zoos and Zoological Parks; Role of Government and Non-Governmental organizations in conservation. IUCN and Red Data list status regarding endangered species

Reference Books:

S. No.	Authors	Title of the Book	Publishers	Year & Edition
1	Saharia, V.B.	Wildlife in India	Nataraj Publishers, DehraDun	1982
2	Seshadri, B.	India's Wildlife reserves	Sterling Publishers Pvt. Ltd., New Delhi	1986
3	Giles, R.H. Jr. (Ed)	Wildlife Management Techniques	Nataraj Publishers, Dehradun. India	1984 3rd Edition.
4	Dasmann, R. F	Wildlife Biology	John and Wiley and sons New York	1964

Advance Learners Course
MICROBIOLOGY

Subject Code: AS21AC1 **Credit: 5**

Preamble:
Knowledge of different aspects of Microbiology has become crucial and indispensable to everyone in the society.

UNIT I

Introduction: History and scope of Microbiology; Classification and biology of virus, bacteria, fungi; Application of microbes in food, industry, genetic engineering, biotechnology, agriculture, environment, medicine, pollution.

UNIT II

Culture techniques: Sterilization techniques- physical and chemical agents in control. Nutrient requirements: types of microorganisms, growth factors. Culture media: types, collection of samples, methods of isolation, identification and maintenance of culture; Culture media- Simple and Special nutritional media. Nutrient broth. Microbial growth: pattern, factors, measurement of growth-growth curve.

UNIT III

Food Microbiology: Food spoilage-intrinsic and extrinsic factors; food preservation – filtration, low or high temperature, chemicals and radiation; food borne diseases- fermented food products – wine and beer. Probiotics; Botulism, Microbial toxins/Food borne toxins/endotoxins.

UNIT IV

Environmental Microbiology: Microbial Analysis of Water, Sanitary Test for Coliforms-Sewage Treatment, Bioremediation - Petroleum Prospecting and Formation of Oil Spills, Wastewater Treatment, Chemical Degradation, Heavy Metals – Indicator Microorganism in Polluted Water.

UNIT V

Medical Microbiology: Viral diseases Chickenpox, Measles, Influenza, Rubella, Yellow Fever, Rabies, Hepatitis, Poliomyelitis, Aids. Bacterial Diseases- Diphtheria, Tuberculosis, Pertussis, Leprosy, Gonorrhoea, Syphilis, Cholera and Salmonellosis. Fungal Diseases – Superficial, Cutaneous, Subcutaneous, Systemic and Opportunistic Mycoses.

Text Books:

S.No.	Authors	Title of the Book	Publishers	Year & Edition
1	Dubey, R.C. and Maheswari, D.K.	A TextBook of Microbiology	S. Chand and Company Ltd.,	2006, 1st Edn.
2	Sundara Rajan, S	College Microbiology – Vol. I to IV	Vardhana Publications, Bangalore	2002, 1st Edn.

Reference Books:

S. No	Authors	Title of the Book	Publishers	Year & Edition
1	Alcamco, I.D.	Fundamentals of Microbiology	The Benjamin Cummings Publishing Co.,	1997, 5thEdn.
2	Atlas, R.M.	Principles of Microbiology	Mosby-Year Book, Inc., Missouri.,	1995, 1stEdn.
3	Barry L. Batzing	Microbiology-An Introduction	Wadsworth Group	2000, 1stEdn.
4	Lansing M. Prescott, John P. Harley, Donald A. Klein.	Microbiology	McGraw Hill Companies	1999, 4thEdn.
5	Mani, A., Selvaraj, A.M., Narayanan, L.M. and Arumugam, N.	Microbiology – General and Applied	Saras Publications	1999
6	Powar, C.B. and Daginawala, H.F.	General Microbiology	Himalaya Publishing House	2001

Advance Learners Course

PUBLIC HEALTH AND HYGIENE

Subject Code: AS21AC2 **Credit: 5**

Preamble: to train human resources in the science of public health, with a firm understanding of the determinants of health and the public health system in the country, the community context, the determinative influences of globalization, urbanization, global and national policies and a strong foundation in research methodology.

UNIT-I

Determinants of health. Health indicators; Personal hygiene; Public health; health - Dynamics of disease transmission – host, agents, environment.

UNIT-II

Concepts of Health and Disease. Nutrition and Health: Classification of foods – Nutritional deficiencies - Vitamin and Mineral deficiencies - Balanced diet - Nutritional requirements of special groups.

UNIT III

Environment and Health: Types of Pollution - Air Pollution, Water Pollution, Soil Pollution, Noise Pollution Radiation – effects; Classification of wastes, Segregation of wastes, Disposal of biological wastes; Impact of pollutants on Health. Disposal of biological wastes, Disposal of chemicals in schools and Bioincenerators on waste disposal for public health COVID related diseases

UNIT IV

Communicable Diseases: Measles, Cholera, Amoebiasis, Malaria, Filariasis, Japanese encephalitis, Swine flu, STD and AIDS. Non-Communicable Diseases: Coronary Heart Disease. Hypertension, Diabetes, Obesity, Stroke, Cancer.

UNIT V

Health Education: Health care services in India. Health planning in India. Health Programmes in India, WHO, Non-Governmental Voluntary Health organizations. First Aid and Nursing: Methods, Dressing, Care, Duties, Preparations

Text Books:

S. No	Authors	Title of the Book	Publishers	Year & Edition
1	Park and Park.	Textbook of Preventive and Social Medicine	Banarsidas Bhanot Publishers, Jabalpur	1995
2	Verma, S.	Medical Zoology	Rastogi Publications	1998

COURSE CODE	COURSE TITLE	Category	L	T	P	Credit
AS23SB01	Introductory course on Translational Research and Preclinical Studies	Theory	41	4	-	3

Preamble

The course introduces the principles of translational and preclinical research, bridging laboratory discoveries to clinical applications. It emphasizes animal models, ethical practices, and innovative approaches in drug development and biomedical science.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the meaning of translational research and phases of drug discovery and the importance of preclinical studies.	K1
CLO2	Understand the principles of ethical animal use, selection and relevance of different animal models, organ-specific toxicity and the basics of pharmacokinetics and pharmacodynamics.	K2
CLO3	Apply criteria for selecting appropriate animal or alternative models for disease studies. Identify the knowledge of legal and ethical compliance in managing animal facilities and handling,	K3
CLO4	Compare in vivo, in vitro, and in silico approaches and evaluate their complementarity in research and analyze the causes of failure in clinical translation and assess the limitations of animal models.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	M	M
CLO2	S	S	S	M	M
CLO3	S	S	S	M	S
CLO4	S	S	S	S	S

S- Strong, M-Medium

Introductory course on Translational Research and Preclinical Studies -AS23SB01 41Hrs

Unit 1: Introduction to translational and Preclinical Research 9 Hrs

Overview of translational research in biomedical sciences-"bench to bedside", Importance of preclinical studies, Drug discovery phases, Role of animal models in efficacy, and safety, Real world examples – treatments from models to Human trials, In silico vs in vitro vs in vivo: complementarity in research.

Unit 2: Animal Models in translation research 7 Hrs

Mammalian and Non-Mammalian- Selection and validation of animal models, Disease-specific models: cancer, diabetes, CNS disorders, genetically modified animal models: knockout mice.

Unit 3: Histopathology and Organ-Specific Toxicity Studies 9 Hrs

Introduction to toxicology studies, Target organ toxicity: liver, kidney, heart, reproductive system, Dose selection and scaling, Blood/tissue sampling and endpoint selection, Role of biomarkers in early decision-making, Overview of In vivo pharmacokinetics and pharmacodynamics.

Unit 4: Challenges and Alternatives in translational research 7 Hrs

Species differences and limitations in translation, Failures in clinical translation due to poor model selection, 3Rs principle. Organoids, microfluidics, Immunocompromised and humanized mouse models, Large clinical datasets, AI and computational modelling in replacing or refining animal models.

Unit 5: Ethical Frameworks and career in translational research 9 Hrs

Overview of CPCSEA (India) & IACUC (USA), Institutional Animal Ethics Committee (IAEC): structure and function, Animal facility management and health monitoring, Animal handling, Legal frameworks and compliance documentation. Career opportunities exist in translational/preclinical research, Intellectual property and patenting in biomedical research, Collaborative research, publication ethics, and data integrity.

Text Books

S. No.	Author	Title of the Book	Publisher	Year & Edition
1	Stephen C. Aronoff	Translational Research and Clinical Practice: Basic Tools for Medical Decision Making and Self-Learning	Oxford University Press	2010, 1st Edn.
2	Krupakar Parthasarathy	Translational Research in Biomedical Sciences: Recent Progress and Future Prospects	Springer	2024, 1st Edn.
3	Cheng Wang	Translational Animal Models in Drug Discovery and Development	Bentham Science Publishers	2013, 1st Edn.
4	Ezekiel J. Emanuel, Christine C. Grady, Robert A. Crouch, Reidar K. Lie, Franklin G. Miller, David Wendler	The Oxford Textbook of Clinical Research Ethics	Oxford University Press	2011, 1st Edn.
5	David Robertson, Gordon H. Williams	Clinical and Translational Science: Principles of Human Research	Academic Press	2008, 1st Edn.

Reference Books

S. No.	Author	Title of the Book	Publisher	Year & Edition
1	Jessica A. Bolker	Animal Models in Translational Research: Rosetta Stone or Stumbling Block?	BioEssays	2017, 1st Edn.
2	Robert A. McArthur	Animal and Translational Models for CNS Drug Discovery, Vol. 1	Academic Press	2008, 1st Edn.
3	Peter Greaves	Histopathology of Preclinical Toxicity Studies: Interpretation and Relevance in Drug Safety Evaluation	Academic Press	2011, 4th Edn.

Course Designers: Dr.S.Gandhimathy & Dr.P.Susheela

Pedagogy: Chalk and talk, PPT, group discussion, assignment, peer learning, seminar