



**PSGR
Krishnammal College for Women**



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

End Semester Examination – Question Paper Pattern and Distribution of Marks

Core and Allied courses:

ESE Question Paper Pattern: $5 \times 15 = 75$ Marks

Question from each unit comprising of

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

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 AS23CO1	COURSE NAME INVERTEBRATA	Category	L	T	P	Credit
		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

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) *Dracunculus 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, 5 th 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, 1 st Edition
4.	Kotpal R.L., Agarwal S.K and Ketarpal R.P.R	Modern Text Book of Zoology Invertebrates	Rastogi Publications	12 th Edition 2019
5.	Barrington EJW	Invertebrate Structure and Function	ELBS and Nelson	1979, 2 nd 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. and Spicer, J.I.	The Invertebrates: A New Synthesis	Blackwell Science	2002, 3 rd Edn.
8.	Jan A. Pechenik	Biology of the Invertebrates	McGraw-Hill Companies	2014, 7 th 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)	: $2 \times 3 = 6$
One question with a weightage of 5 Marks (Internal Choice at the same CLO level)	: $5 \times 3 = 15$
One question with a weightage of 8 Marks (Internal Choice at the same CLO level)	: $8 \times 3 = 24$
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: **$5 \times 15 = 75$ Marks**

Question from each unit comprising of

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

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 TANSCH 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 *Balanoglossus* 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- 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 mammals
- 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, 3 rd Edn.
5	Pough H.	Vertebrate life	Pearson International	9 th Edn.
6	Darlington P.J.	The Geographical Distribution of Animals	R.E. Krieger Pub Co.,	3 rd Edn.
7	Hall B.K. and Hallgrimsson B.	Strickberger's Evolution	Jones and Bartlett Publishers Inc.	4 th Edn.
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 to Instructions

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 (TANSCH)	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

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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

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	G r.
I - V	VI	16BONL1 16BONL2	Online Course Online Course		-	-	-	-	-	-	-	-
	VI	JOB1993	Job Oriented Course			After the class hours						

L – Language

CC – Core Courses

GE – Generic Elective

E – English

CA – Continuous Assessment

ESE - End Semester Examination

AEC – Ability Enhancement Course
ACC-Additional Credit Course
- Self Study

SEC- Skill Enhancement Course
AECC- Ability Enhancement Compulsory Course,

€ - 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) : $2 \times 3 = 6$
One question with a weightage of 5 Marks (Internal Choice at the same CLO level) : $5 \times 3 = 15$
One question with a weightage of 8 Marks (Internal Choice at the same CLO level) : $8 \times 3 = 24$

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: $5 \times 15 = 75$ Marks

Question from each unit comprising of

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

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

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 15 th edition
2	Verma P.S., Agarwal., V.K	Environmental Biology	S. Chand & Company	2000 and 10 th 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 5 th edition
2	Berrill, N.J	Developmental Biology	Tata Mc Graw Hill Publication Co.Ltd	1986 and 4 th edition
3	Clarke,G.L.	Elements of Ecology	John Wiley & Son Inc. New York & London	1954 and 1 st edition
4	Kotpal,R.L. and Bali,N.P.	Concepts of Ecology	Vishal Publication, Delhi	1986 and 2 nd 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 7 th 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 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 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 3 rd edition
2	Lal S. S., A	Textbook of Practical Zoology Vertebrate	Rastogi Publication	2004 and 12 th edition
3	Lal S. S., A	Textbook of Practical Zoology Invertebrate	Rastogi Publication	2004 and 12 th 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 – Perihæmal and Hæmal 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 1 st Edition.
3	Jan A Pechenik	Biology of the Invertebrates	McGraw-Hill Companies,	2014 and 7 th Revised Edition
4	Barrington EJW	Invertebrate Structure and Function	ELBS and Nelson,	1979 and 2 nd Edition
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 12 th edition
3	Lal S S	Textbook of practical Zoology Vertebrate	Rastogi Publication	2020 and 12 th 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	40 th Edn, 1990



**PSGR
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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**



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	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

CC – Core Courses

GE – Generic Elective

AEC – Ability Enhancement Course

ACC-Additional Credit Course

SS - Self Study

€ - CA conducted for 25 and converted into 20, ESE conducted for 75 and converted into 55

E – English

CA – Continuous Assessment

ESE - End Semester Examination

SEC- Skill Enhancement Course

AECC- Ability Enhancement Compulsory Course,

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) : $2 \times 3 = 6$
One question with a weightage of 5 Marks (Internal Choice at the same CLO level) : $5 \times 3 = 15$
One question with a weightage of 8 Marks (Internal Choice at the same CLO level) : $8 \times 3 = 24$

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: $5 \times 15 = 75$ Marks

Question from each unit comprising of

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

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	8 th Edition
2	Verma P.S., Agarwal., V.K	Cytology	S. Chand & Company	2012	8 th 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	2 nd Edition
2	De Robertis, E.D.P. and De Robertis, E.M.F	Cell and Molecular Biology	Lippincott Williams and Wilkins, Philadelphia	2017	8 th Edition
3	Satyanarayana U and Chakrapani U	Essentials of Biochemistry	Book and Allied (P) Ltd.	2019	3 rd Edition
4	Karp, G	Cell and Molecular Biology: Concepts and Experiments	John Wiley & Sons. Inc.	2015	8 th Edition

Pedagogy

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

Course Designers

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

Course 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 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 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	3 rd Edition
2	Lal S. S., A	Textbook of Practical Zoology Vertebrate	Rastogi Publication	2020	12 th Edition
3	Lal S. S., A	Textbook of Practical Zoology Invertebrate	Rastogi Publication	2020	12 th 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 Learning 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	8 th Edition
5	Verma. P.S. and Agarwal. V.K.	Chordate Embryology	S. Chand and Co. Ltd., New Delhi	2010	4 th 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	12 th Edition
2	Sarada Subrahmanyam., Madhavan Kutty , K., & Singh H.D.	Text Book of Human Physiology, Reprint	S. Chand & Co,	2010	8 th Edition
3	De Rebertis EDP & De Robertis EMF	Cell & Molecular Biology.	BI Wauerly Pvt. Ltd, New Delhi.	2017,	8 th 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	5 th 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	3 rd Edition
2	Lal S S	Textbook of practical Zoology Invertebrate	Rastogi Publication	2019	12 th Edition
3	Lal S S	Textbook of practical Zoology Vertebrate	Rastogi Publication	2004	12 th Edition

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



**PSGR
Krishnammal College for Women**



**College of Excellence,  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

^{\$}- Credits applicable to candidates who take up Advanced Level Course examination

CA – Continuous Assessment

ESE - End Semester Examination

SEC- Skill Enhancement Course

AECC- Ability Enhancement Compulsory Course

Gr-Grade

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 – AS23C05					
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, 9 th Edn.
2	Verma P.S and Agarwal V. K	Cell Biology, Genetics, Molecular Biology, Evolution and Ecology	S. Chand & Co	2005, 1 st 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, 9 th Edn.
2	Robert H. Tamarin	Principles of Genetics	Tata McGraw Hill	2014, 7 th Edn.
3	Starr C, Taggart R, Evers C, Starr L	Biology: The Unity and Diversity of Life	Cengage Learning	2017, 15 th Edn.
4	Benjamin A. Pierce	Genetics: A Conceptual Approach	W. H. Freeman	2020, 7 th Edn.
5	Strickberger W Monroe	Genetics	Prentice Hall of India	2002, 3 rd Edn.
6	Ricki Lewis	Human Genetics	WM.C. Brown Publishers	2020, 12 th 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

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, 1 st Edn.
3	Mani K and Vijayaraj N	Bioinformatics for Beginners	Kalaikathir Achchagam, Tamil Nadu	2002, 1 st 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, 4 th Edn.
6	Roy R N	A Textbook of Biophysics	Publisher, New Central Book Agency	200, 2 nd Edn.
7	Snedecor G.W. and W.G. Cochran	Statistical Methods	Oxford & IBH Publishing, New Delhi	2001, 6 th Edn.

Reference Books:

S. No.	Authors	Title of the Book	Publishers	Year & Edition
1	Arthur. M. Lesk	Introduction to Bioinformatics	Oxford University Press	2003, 2 nd Edn.
2	Prakash S. Lohar	Bioinformatics	MJP Publishers Chennai, India	2019, 1 st Edn.
3	Gupta S P	Statistical Methods	S. Chand & Sons	2008, 46 th Edn.
4	Zar J.H	Biostatistical analysis	Prentice Hall Inc., New Jersey, USA	1974, 4 th 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; 2 nd Edn.
2	Dubey R.C.	A textbook of Biotechnology	S. Chand & Co., Ltd., New Delhi	2015; 5 th Edn.
3	Kumaresan, V.	Biotechnology	Saras Publications, Nagercoil	2005; 5 th Edn.
4	Bhatia, S.C.	Textbook of Biotechnology	Atlantic Publications	2006; 1 st 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; 2 nd Edn.
2	Glick, B.R., Pasternak, J.J.	Molecular Biotechnology	ASM Publisher	2010; 4 th Edn.
3	Jogdand, S.N.	Environmental Biotechnology	Himalaya Publishing House, Bombay	2015, 4 th Edn.
4	Old, R.W. and Primrose, S.B.	Principles of Gene manipulation	Blackwell Scientific Publications	2006; 7 th Edn.
5	Das, H.K.	Textbook of Biotechnology	Wiley-India Publications	2017, 2 nd Edn.
6	Sangita Malvee	Biotechnology-An Introduction	SBS Publishers and Distributors	2007; 1 st Edn.
7	Prakash, M.	Textbook of Biotechnology	Sonali Publication	2021; 1 st 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, 1 st Edn.
2	Gupta S P	Statistical Methods	S. Chand & Sons	2008, 1 st Edn.
3	Pranab Kumar Banerjee	Introduction to Biostatistics	S. Chand Publishers	2011, 3 rd Edn.
4	Kanai, L Mukherjee	Medical Laboratory Technology	Tata McGraw Hill Publishing Company Ltd., New Delhi	2017, 3 rd Edn.
5	Ramnick Sood, M. D	Medical Laboratory Technology	Medical Publishers(P)Ltd	2009, 6 th Edn.
6	Sathish Gupte	Short Textbook of Medical Laboratory for Technicians	Jaypee Brothers, Medical Publishers	2021, 3 rd Edn.
7	Jhingran V.G	Fish and fisheries of India	Hindustan Publishing Corporation, New Delhi	1991, 3 rd 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

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 lamblia*, *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, 1 st Edn.
2	Godker, P. B. and Darshan, P, Godker	Text book of medical Laboratory Technology	Bhalani Publishing House	2011, 2 nd Edn.
3	Ramnik Sood M D	Medical Laboratory Technology	Medical Publishers(P)Ltd	1985, 1 st Edn.

Reference Books:

S. No.	Authors	Title of the Book	Publishers	Year & Edition
1	Arumugam.N	Microbiology (General & Applied)	Saras Publication	2000, 5 th Edn.
2	Madhavan Kutty,K	Text Book of Medical Laboratory Technology	Medcen Poonthanam	1992, 1 st Edn.
3	Mary Ellen Wedding, Sally A Toenjas	Medical Laboratory Procedures	Jaypee Brothers Medical Publishers	1992, 2 nd Edn.
4	Samuel, K.M	Notes on Clinical Lab Techniques	Published by M.K.Gopalan, Chrompet	1999, 1 st Edn.
5	Sathish Gupte	Short Textbook of Medical Laboratory for Technicians	Jaypee Brothers, Medical Publishers	1998, 1 st Edn.
6	Baker F.J. And Silverton R.E	Introduction to Medical Laboratory Technology	Hodder Education Publishers	1998, 7 th 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 3 rd Edition.
4	Dasman, 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, 1 st Edn.
2	Sundara Rajan, S	College Microbiology – Vol. I to IV	Vardhana Publications, Bangalore	2002, 1 st 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, 5 th Edn.
2	Atlas, R.M.	Principles of Microbiology	Mosby-Year Book, Inc., Missouri.,	1995, 1 st Edn.
3	Barry L. Batzing	Microbiology-An Introduction	Wadsworth Group	2000, 1 st Edn.
4	Lansing M. Prescott, John P. Harley, Donald A. Klein.	Microbiology	McGraw Hill Companies	1999, 4 th Edn.
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 Biocincenerators 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, 1 st Edn.
2	Krupakar Parthasarathy	Translational Research in Biomedical Sciences: Recent Progress and Future Prospects	Springer	2024, 1 st Edn.
3	Cheng Wang	Translational Animal Models in Drug Discovery and Development	Bentham Science Publishers	2013, 1 st 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, 1 st Edn.
5	David Robertson, Gordon H. Williams	Clinical and Translational Science: Principles of Human Research	Academic Press	2008, 1 st 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, 1 st Edn.
2	Robert A. McArthur	Animal and Translational Models for CNS Drug Discovery, Vol. 1	Academic Press	2008, 1 st Edn.
3	Peter Greaves	Histopathology of Preclinical Toxicity Studies: Interpretation and Relevance in Drug Safety Evaluation	Academic Press	2011, 4 th Edn.

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

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



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DEPARTMENT OF ZOOLOGY

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

BACHELOR OF SCIENCE -ZOOLOGY 2023 – 2026 BATCH VI Semester

PROGRAMME LEARNING OUTCOMES (PLO's)

After completion of the programme, the student will be able to

PLO1: Appreciate the complexities of various levels of organization in the living forms and address controversial biological issues in a scientific way

PLO2: Imbibe transformational impact on the quality of education, and to adopt scientific temper and live with scientific values

PLO3: Assess the scope of animal biology, opt relevant areas for inter-disciplinary and trans- disciplinary studies

PLO4: Understand and apply the core strands of the knowledge acquired in various disciplines of life sciences to become a potential entrepreneur

PLO5: Acquire quality life science education to turn into an outstanding researcher/teacher/career woman/entrepreneur and a responsible citizen

PROGRAMME SPECIFIC OUTCOME (PSO's)

The students at the time of graduation will

PSO1: Gain the knowledge of Zoology through theory and practical's.

PSO2: Analyze the relationships among animals with their ecosystems.

PSO3: Learn to classify the major groups of organisms under different phyla, understanding the functioning of organisms, compare and contrast anatomical and physiological characteristics of animals.

PSO4: Understand good laboratory practices as per laboratory standards, handling the sophisticated instruments/equipment to develop technical skills, research-oriented skills about research methodologies, effective communication and skills of problem-solving methods.

PSO5: Understand the applications of zoological knowledge in Agriculture, Medical and daily life and apply the knowledge for employment- Indian Forest Service, Sericulture, Fisheries, Veterinary, Clinical Laboratory, Museum Curator, departments and Entrepreneurship. They can go for Indian Forest Service and other competitive examinations.

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

Sem	Part	Course code	Title of the Course	Course type	Instruction Hours/W eek	Con tact Hours	Tutorial	Duration of Examination	Examination Marks			Credits
									CA	ESE	Total	
VI	III	AS23C08	Physiology and Endocrinology	CC	6	86	2	3	25	75	100	5
		AS23C09	Immunology	CC	5	73	2	3	25	75	100	5
		AS23C10	Human Genetics and Counseling	CC	5	73	2	3	25	75	100	5
		AS23E03/	Applied Fishery Biology/	DSE	5	73	2	3	25	75	100	5
		AS23E04	Dairy Science									
		AS23CP3	Zoology Practical III	CC	6	90	-	3	25	75	100	5
		AS23SB03	Advance Techniques in Science Video Content Creation through Multimedia Integration	SEC	3	43	2	-	100	-	100	3
		AS21AC3/ AS21AC4	Industrial Biotechnology/ Applied Zoology	ACC	SS	-	-	3	25	75	100	5*
I-V	VI	16BONL1 16BONL2	Online Course Online Course	ACC	-	-	-	-	-	-	-	-

CC – Core Courses

GE – Generic Elective

DSE-Discipline Specific Elective

ACC-Additional Credit Course

CA – Continuous Assessment

ESE - End Semester Examination

SEC - Skill Based Course

SS-Self study

Examination 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

End semester practical 75

marks Total 100

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/ Practical Courses

Test I : 30 Marks (conducted for 50 Marks and converted to 30 Marks)

Test II : 50 Marks

Lab performance : 10 Marks

Regularity : 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

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 Mar

MAPPING OF PLOs WITH CLOs

COURSE	PROGRAMME LEARNING OUTCOMES				
	PLO1	PLO2	PLO3	PLO4	PLO5
COURSE – AS23C08					
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 – AS23C09					
CLO1	S	S	S	M	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	S
COURSE – AS23C10					
CLO1	M	S	M	S	M
CLO2	M	S	S	M	M
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S
COURSE – AS23E03					
CLO1	S	S	M	M	M
CLO2	S	S	S	M	S
CLO3	S	S	S	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	M	M
CLO4	S	S	S	M	M
COURSE – AS23SB03					
CLO1	S	S	S	M	M
CLO2	S	S	S	M	M
CLO3	S	S	S	S	S
CLO4	L	S	S	S	S

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
AS23CO8	PHYSIOLOGY AND ENDOCRINOLOGY	THEORY	86	2	-	5

Preamble

To make the students understand the interconnectedness of organ systems and endocrine signaling providing a foundation for understanding vital physiological processes.

Course Learning Outcomes

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the basic functions of body systems and the mechanisms by which they maintain physiological balance	K1
CLO2	Explain and illustrate the interdependence of different organ systems in normal physiological processes	K2
CLO3	Apply the principles of structure–function relationships to interpret how physiological mechanisms operate in health	K3
CLO4	Analyze and evaluate the responses of organ systems to stress, disease, and environmental challenges	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

PHYSIOLOGY AND ENDOCRINOLOGY – AS23CO8 (86 Hrs)

Unit I

(18 Hrs)

NUTRITION

Nutrition in animals, mechanisms of food intake in different animals; Digestion and absorption of nutrients; Metabolism of carbohydrates, proteins & lipids; Role of vitamins and minerals (iron, calcium, iodine, vitamin D) in nutrition; deficiency disorders Indigenous fasting rituals and physiological impacts.

RESPIRATION

Types of respiration in animals; Surfactants in respiration; Exchange and transport of respiratory gases; Respiratory Quotient; Bohr's effect, Chloride shift/ Hamburger's phenomenon; Control of respiration – role of medulla oblongata and chemoreceptors; Respiratory pigments; Foetal and neonatal respiration; Respiration at High altitude and during Diving. Pranayama (yogic breathing) and respiratory efficiency.

Unit II

(17 Hrs)

CIRCULATION

Composition and functions of blood; Blood clotting; Types of heart - chambered heart, neurogenic and myogenic heart, Cardiac Cycle; Origin and regulation of heart beat; Cardiac output; Blood pressure; ECG and its principles, Traditional techniques for managing hypertension.

EXCRETION

Classification of animals based on excretory products - ammonotelic, ureotelic, uricotelic; Structure and function of nephron; Countercurrent mechanism and role of aquaporins; Physiology and hormonal regulation of urine formation; Dialysis and common kidney disorders (renal failure, nephritis, kidney stones); Osmoregulation in freshwater, marine and terrestrial animals. Traditional kidney health practices.

Unit III

(17 Hrs)

NERVE PHYSIOLOGY

Structure and types of neurons; Ionic basis of action potential (Na^+/K^+ channels, refractory period); Electrical transmission of impulse; Synaptic transmission of impulse; Neuromuscular Junction; Neurotransmitters-types and functions; Neural plasticity – learning and memory; Autonomic nervous system; Neural disorders – Alzheimer's, Parkinson's; EEG, MRI - principles and applications. Role of yoga/meditation in nervous health.

Unit IV**(17 Hrs)****MUSCLE PHYSIOLOGY**

Structure and ultrastructure of skeletal muscle; Types of muscles - skeletal, smooth and cardiac; Muscle proteins; Mechanism of muscle contraction and relaxation; Muscle twitch, tetanus, tonus, fatigue, oxygen debt; Exercise and muscle performance; Electromyography (EMG) and its principles; Red and white muscles; Catch muscle and fibrillar muscle. Traditional practices (yoga/martial arts) for muscle strength.

Unit V**(17 Hrs)****ENDOCRINOLOGY**

Endocrine glands: Pituitary, Thyroid, Parathyroid, Pancreas, Adrenal and Gonads – locations, secretions, basic functions; Neuroendocrine regulation – role of hypothalamus and feedback mechanisms. Traditional and Ayurvedic perspectives on hormonal balance.

Text Books:

S. No.	Authors	Title of the Book	Publishers	Year and Edition
1	A K Berry	A Textbook of Animal Physiology with Related Biochemistry	Emkay Publications	2019 and 13th Edn.
2	H R Singh	Animal Physiology and Biochemistry	Vishal Publishing	2022 and 7th Edn.
3	A K Jain	Textbook of Physiology (Vol. I & II)	APC Books	2023 and 10th Edn.

Reference Books:

S. No.	Authors	Title of the Book	Publishers	Year and Edition
1	Lauralee Sherwood	Human Physiology	Thomson Brooks, United States	2016 and 10 th Edn.
2	Tortora and Derrickson	Principles of Anatomy and Physiology	John Wiley and Sons, Inc	2017 and 15 th Edn.
3	Guyton and Hall	Textbook of Medical Physiology	Prism Books, Pvt. Ltd	2020 and 14 th Edn.
4	Ganong	Review of Medical Physiology	McGraw Hill, New Delhi	2020 and 14 th Edn.
5	Schmidt-Nielson	Animal Physiology	Prentice Hall, India Ltd	2007 and 6 th Edn.

E-books:

Free Anatomy and Physiology 2e Textbook for Download - OpenStax

<https://open.umn.edu/opentextbooks/textbooks/169?utm>

<https://pressbooks.bccampus.ca/dcbiol110311092nded/?utm>

Pedagogy

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

Course Designers:

Dr. P.Susheela.

Course content and Lecture Schedule

Module No.	Topic	No. of periods	CLOs	Content delivery methods	Learning Methods
	Unit I((18 Hrs)				
1	NUTRITION Nutrition in animals Mechanisms of food intake in different animals, Digestion and absorption of nutrients	3	CLO1 CLO2 CLO3	Lecture, PPT	Participatory Learning
2	Metabolism of carbohydrates Metabolism of proteins, Metabolism of lipids	3	CLO1 CLO2 CLO3	Lecture, PPT	Blended learning
3	Role of vitamins and minerals (iron, calcium, iodine, vitamin D) in nutrition, Deficiency disorders, Indigenous fasting rituals and physiological impacts	3	CLO2 CLO3 CLO4	Lecture, PPT, Article Review	Problem-based Learning
4	RESPIRATION Types of respiration in animals, Surfactants in respiration, Exchange and transport of Oxygen, Exchange and transport of carbon-di-oxide, Respiratory Quotient and Bohr's effect	3	CLO2 CLO3 CLO4	Lecture, PPT, Article Review	Participatory Learning
5	Chloride shift/Hamburger's phenomenon, Control of respiration – role of medulla oblongata and chemoreceptors, Respiratory pigments	3	CLO2 CLO3 CLO4	Lecture, PPT OER	Problem-based Learning
6	Foetal and neonatal respiration, Respiration at High altitude and during Diving, Pranayama (yogic breathing) and respiratory efficiency	3	CLO2 CLO3 CLO4	Lecture, PPT OER	Blended learning
	Unit II (17 Hrs)				
7	CIRCULATION Composition and functions of blood, Blood clotting	2	CLO1 CLO2 CLO3	Lecture, PPT	Participatory Learning
8	Types of heart - chambered heart, neurogenic and myogenic heart, Cardiac Cycle, Origin and regulation of heart beat	3	CLO2 CLO3 CLO4	Lecture, PPT, Video	Experiential Learning

9	Cardiac output, Blood pressure, ECG and its principle, Traditional techniques for managing hypertension	3	CLO2 CLO3 CLO4	Research Article Review	Problem-based Learning
10	EXCRETION Classification of animals based on excretory products, Structure and function of nephron, Countercurrent mechanism and role of aquaporin	3	CLO1 CLO2 CLO3	Lecture, PPT, Article Review	Experiential Learning
11	Physiology and hormonal regulation of urine formation, Common kidney disorders (renal failure, nephritis, kidney stones)	3	CLO1 CLO2 CLO3	Research Article Review	Blended learning
12	Osmoregulation in freshwater, marine and terrestrial animals, Traditional kidney health practices	3	CLO2 CLO3 CLO4	Lecture, PPT, Video	Experiential Learning
Unit III (17 Hrs)					
13	NERVE PHYSIOLOGY Structure and types of neurons, Ionic basis of action potential (Na^+/K^+ channels),	3	CLO1 CLO2 CLO3	Lecture, PPT, Article Review	Participatory Learning
14	Ionic basis of action potential (refractory period), Electrical transmission of impulse	2	CLO2 CLO3 CLO4	Research Article Review	Blended learning
15	Synaptic transmission of impulse, Neuromuscular Junction	3	CLO2 CLO3 CLO4	Research Article Review	Experiential Learning
16	Neurotransmitters-types and functions, Neural plasticity – learning and memory	3	CLO1 CLO2 CLO3	Lecture, PPT, Article Review	Experiential Learning
17	Autonomic nervous system, Neural disorders – Alzheimer's, Parkinson's disorder	3	CLO2 CLO3 CLO4	Research Article Review	Blended learning
18	EEG, MRI – principles and applications, Role of yoga/meditation in nervous health	3	CLO2 CLO3 CLO4	Lecture, PPT, Article Review	Experiential Learning
Unit IV (17 Hrs)					
19	MUSCLE PHYSIOLOGY Structure of muscle, Ultrastructure of skeletal muscle	2	CLO1 CLO2 CLO2	Lecture, PPT, Video	Participatory Learning
20	Types of muscles - skeletal, smooth and cardiac, Muscle proteins	3	CLO2 CLO3 CLO4	Lecture, PPT, Video	Blended learning

21	Muscle contraction, relaxation,	2	CLO2 CLO3 CLO4	Lecture, PPT, Video	Experiential Learning
22	Muscle twitch, tetanus, tonus, fatigue, oxygen debt	2	CLO2 CLO3 CLO4	Lecture, PPT, Article Review	Problem-based Learning
23	Exercise and muscle performance, Electromyography (EMG) and its principles	3	CLO2 CLO3 CLO4	Lecture, PPT, Article Review	Blended learning
24	Red and white muscles; Catch muscle and fibrillar muscle,	3	CLO2 CLO3 CLO4	Lecture, PPT, Video	Experiential Learning
25	Traditional practices (yoga/martial arts) for muscle strength	2	CLO2 CLO3 CLO4	Seminar, Quiz, Discussion	Participatory Learning
Unit V (17 Hrs)					
26	ENDOCRINOLOGY Endocrine glands: – locations, secretions, basic functions of Pituitary	2	CLO2 CLO3 CLO4	Lecture, PPT, Video	Participatory Learning
27	Locations, secretions, basic functions of Thyroid, Parathyroid	3	CLO2 CLO3 CLO4	Lecture, PPT, Article Review	Problem-based Learning
28	Locations, secretions, basic functions of Pancreas, Adrenal	3	CLO2 CLO3 CLO4	Lecture, PPT, Video	Participatory Learning
29	Locations, secretions, basic functions of Gonads-Testes, Ovaries	3	CLO2 CLO3 CLO4	Lecture, PPT, Article Review	Experiential Learning
30	Neuroendocrine regulation – role of hypothalamus and feedback mechanisms	3	CLO2 CLO3 CLO4	Lecture, PPT, Article Review	Experiential Learning
31	Traditional and Ayurvedic perspectives on hormonal balance	3	CLO2 CLO3 CLO4	Lecture, PPT, Article Review	Experiential Learning

Learning Methodology

S.No	Learning Methodology	Percentage (%)
1	Participatory Learning	30
2	Experiential Learning	30
3	Problem-based Learning	30
4	Blended learning	10

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
AS23C09	IMMUNOLOGY	THEROY	73	2	-	5

Preamble

To understand the basic immunological principles, structural and functional basis of immunoglobulins, the mechanism, and application of antigen-reaction in the immune system.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Comprehend the basic immunological principles and techniques	K1
CLO2	Understand the mechanisms and differences between lymphoid organs, immune cells, immune responses and their relevance to immunizations	K2
CLO3	Apply the acquired knowledge on the immune response to explain defense mechanisms against infectious agents, tumors, grafts, autoimmune disorders	K3
CLO4	Interpret the principles of immunology and its application in biological Systems	K4

Mapping with Programme Learning Outcomes

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

S- Strong; M-Medium

IMMUNOLOGY - AS23C09 (73 Hrs)

UNIT I

(15 Hrs)

History & Scope of Immunology, Types of Immunity- Innate, Acquired, Cell Mediated Immunity, Humoral Mediated Immunity. Active & Passive Immunity. Vaccines. Lymphoid Organs – Primary, Secondary & Tertiary Lymphoid Organs.

UNIT II

(14 hrs)

Cells of the Immune System–Hematopoiesis – Lymphocytes (T & B Cells). Macrophage, Granulocyte, Natural Killer Cells, Dendritic cells, Mast cells, Cell specific immune receptors, Opsonization. Cytokines, Lymphokines, Interleukins.

UNIT III

(14 hrs)

Antigens – Structure and Types. B-Cell receptor, Clonal selection. Antibodies – Immunoglobulins Family of Proteins – Types, structure and functions of Antibodies. Antigen-Antibody Interaction and Immunodiagnostics – ELISA, WIDAL, and Blood grouping. Basics of Monoclonal and Polyclonal antibody.

UNIT IV

(15 hrs)

T- Cells – T-Cell Receptor – Antigen Processing and presentation – MHC – HLA. Complement System. Immune response to tumor. Immune response against diseases- an overview.

UNIT V

(15 hrs)

Transplantations. Types of Grafts, Graft Rejection – Acute and Chronic rejection – Graft Vs Host rejection, Immunosuppressive Drugs. Autoimmune Diseases – Addison's disease, Rheumatoid Arthritis. Hypersensitivity – I, II, III & IV.

Text Books:

S.No.	Authors	Title of the Book	Publishers	Year and Edition
1	P. Madhavee Latha	A Text Book of Immunology	S.Chand	2020 and 1 st Edn.

Reference Books:

S.No.	Authors	Title of the Book	Publishers	Year and Edition
1	Kuby, J	Immunology	W.H. Freeman and Company, New York	2019 and 8 th Edn.
2	Roitt, I.M.	Essentials of Immunology	Wiley-Blackwell	2016 and 13 th Edn.
3	Kenneth Murphy	Janeway's Immunobiology	W W Norton & Co Inc	2022 and 10 th Edn.

Pedagogy

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

Course Designers:

Dr. P.B.Harathi

Course content and Lecture Schedule

Module No.	Topic	CLOs	No. of Hours	Content delivery methods	Learning methods
Unit I (15 Hrs)					
1.	History & Scope of Immunology	CLO1, CLO2, CLO3	3	Link, Chalk & Talk, PPT Videos, Flipped class	Participatory learning, Experiential learning
2.	Types of Immunity- Innate, Acquired, Cell Mediated Immunity	CLO1, CLO2	4	Link, Chalk & Talk, PPT Videos	Participatory Learning, Problem Based learning
3.	Humoral Mediated Immunity. Active & Passive Immunity. Vaccines	CLO2, CLO3	4	Link, Chalk & Talk, PPT Videos, Case Study	Participatory Learning, Problem-based learning, Blended Learning
4.	Lymphoid Organs – Primary, Secondary & Tertiary Lymphoid Organs.	CLO3, CLO4	4	Link, Chalk & Talk, PPT Videos, Case Study	Participatory learning, Blended Learning
Unit II (14 Hrs)					
5.	Cells of the Immune System–Hematopoiesis – Lymphocytes (T & B Cells). Macrophage, Granulocyte, Natural Killer Cells, Dendritic cells, Mast cells	CLO1, CLO2, CLO3	6	Link, Chalk & Talk, PPT Videos	Participatory learning, Experiential learning
6.	Cell specific immune receptors, Opsonization	CLO3, CLO4	4	Link, Chalk & Talk, PPT Videos	Problem Based Learning, Blended Learning
7.	Cytokines, Lymphokines, Interleukins.	CLO2, CLO3, CLO4	4	Link, Chalk & Talk, PPT Videos	Participatory learning, Problem Based learning
Unit III (14 Hrs)					

8.	Antigens – Structure and Types. B-Cell receptor, Clonal selection	CLO1, CLO2, CLO3	3	Link, Chalk & Talk, PPT Videos	Participatory learning, Experiential learning
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9.	Antibodies – Immunoglobulins Family of Proteins – Types, structure and functions of Antibodies.	CLO1 CLO2, CLO3	4	Link, Chalk & Talk, PPT Videos, Flipped Class	Participatory, learning Experiential learning, Blended Learning
10.	Antigen-Antibody Interaction and Immunodiagnostics – ELISA, WIDAL, and Blood grouping	CLO2, CLO3, CLO4	4	Link, Chalk & Talk, PPT Videos, Flipped Class	Experiential learning, Problem-based Learning
11.	Basics of Monoclonal and Polyclonal antibody.	CLO3, CLO4	3	Link, Chalk & Talk, PPT Videos, Case studies	Experiential learning, Problem-based Learning

Unit IV (15 Hrs)

12.	T- Cells – T-Cell Receptor	CLO1, CLO2, CLO3	3	Link, Chalk & Talk, PPT Videos	Participatory Learning, Experiential Learning
13.	Antigen Processing and presentation – MHC – HLA.	CLO3, CLO4,	4	Link, Chalk & Talk, PPT Videos, Flipped Class, Case study	Problem Based Learning, Blended Learning
14.	Complement System	CLO1, CLO2, CLO3	3	Link, Chalk & Talk, PPT Videos	Experiential Learning, Problem Based Learning
15.	Immune response to tumor. Immune response against diseases- an overview.	CLO2, CLO3, CLO4	5	Link, Chalk & Talk, PPT Videos,	Participatory Learning, Experiential Learning, Problem Based Learning

Unit V (15 Hrs)

16.	Transplantations. Types of Grafts, Graft Rejection – Acute and Chronic rejection – Graft Vs Host rejection	CLO2, CLO3, CLO4	5	Link, Chalk & Talk, PPT Videos	Participatory Learning, Experiential Learning, Blended Learning
17.	Immunosuppressive Drugs.	CLO1, CLO2, CLO3, CLO4	3	Link, Chalk & Talk, PPT Videos	Experiential Learning, Problem Based Learning

18.	Autoimmune Diseases – Addison’s disease, Rheumatoid Arthritis.	CLO3, CLO4, CLO5	4	Link, Chalk & Talk, PPT Videos	Experiential Learning, Problem Based Learning
19.	Hypersensitivity – I, II, III & IV.	CLO3, CLO4, CLO5	3	Link, Chalk & Talk, PPT Videos	Participatory Learning, Experiential Learning, Problem Based Learning

Learning Methodology

S.No	Learning Methodology	Percentage (%)
1	Participatory Learning	30
2	Experiential Learning	30
3	Problem-based Learning	30
4	Blended learning	10

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
AS23C10	HUMAN GENETICS AND COUNSELING	THEROY	73	2	-	5

Preamble

To make the students understand the central and unifying position of genetics in biological services and to create awareness for a better community

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the role of genetics as the underlying cause of various disorders of the human body	K1
CLO2	Understand the methods of testing genetic disorders and principles of genetic counselling	K2
CLO3	Apply the knowledge of identifying genetic disease and responsibilities of genetic counsellors as health professionals	K3
CLO4	Compare and diagnose the genetic disorders at different stages of life and examine the counselling techniques	K4

Mapping with Programme Learning Outcomes

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

S- Strong; M-Medium

HUMAN GENETICS AND COUNSELLING (AS23C10) (73 hrs)

UNIT I: Human Chromosomes & Cytogenetics

(14 hrs)

Human chromosomes: structure, classification, nomenclature. Lyon's hypothesis, Barr body, sex chromatin. Chromosomal study techniques: leukocyte culture, karyotyping, banding (C, R, Q, G). Chromosomal microarray, Next-Generation Sequencing (NGS).

UNIT II: Chromosomal Aberrations & Genetic Disorders

(14 hrs)

Structural abnormalities: deletions, duplications, translocations, inversions. Numerical abnormalities: aneuploidy, polyploidy. Syndromes: Down's, Klinefelter's. Single-gene disorders: Sickle cell anemia, Sex-linked disorders: Hemophilia, Uses of chromosomal analysis in diagnosis.

UNIT III: Population Genetics & Disease Risk

(14 hrs)

Blood groups: ABO, MN, Rh factor. Twins: monozygotic, dizygotic, conjoined. Population genetics basics: gene pool, panmixis, Hardy-Weinberg Law. Factors affecting equilibrium: mutation, migration, selection, genetic drift. Predictive genomics. Overview of Optical genome mapping. Cancer genetics: Oncogenes, tumor suppressors, genetic basis of cancer.

UNIT IV: Genetic Counselling & Ethics

(15 hrs)

Pedigree analysis: construction, interpretation. Principles of genetic counselling: goals, process, types (directive, non-directive). Marriage genetics: consanguinity, carrier risk, counselling in disputed parentage, adoption. Psychosocial aspects: communication skills, cultural sensitivity, patient support. Ethical, legal, and social issues (ELSI): Genetic discrimination & privacy. Embryo screening, IVF genetics. Laws & guidelines (international and Indian context).

UNIT V: Diagnostic & Future Approaches

(14 hrs)

Diagnosis of genetic diseases: Thalassemia, Alkaptonuria. Molecular tools: Blotting techniques (Southern, Northern, Western), PCR. Prenatal diagnosis: Amniocentesis, CVS, cordocentesis, NIPT. Stem cells: embryonic and induced pluripotent stem cells (iPSCs). Emerging technologies: CRISPR & gene editing (introductory), AI in variant interpretation, mitochondrial donation ("three-parent babies"). Embryo screening, IVF genetics, and eugenics debates.

Text Books

S.No.	Authors	Title of the Book	Publishers	Year and Edition
1	Bhatnagar S M, Kothari Lopa M L.	Essentials of Human Genetics	Orient Longman (P) Ltd.,	2004 and 4 th Edn.
2	Mandal S	Fundamentals of Human Genetics	New Central Book Agency	2001 and 2 nd Edn.

Reference Books:

S.No.	Authors	Title of the Book	Publishers	Year and Edition
1.	Benjamin Lewin	Genetics VIII	Person Prentice Hall International	2004 and 8 th Edn.
1	Monre. W. Stick Berger	Genetics	Eastern Economy	2003 and 3 rd Edn.
2	Rickie Lewis	Human genetics – Concept and application	Tata Mc. Graw Hill	2011and 2 nd Edn.
3	Robert. H Tamarain	Principles of Genetics	Tata Mc. Graw Hill	2004 and 7 nd Edn.
4	Snustad, D.P. & Simmons, M.J.	Principles of Genetics	Wiley	2021 and 8 th Edn.
5	Gardner, R.J.M., Sutherland, G.R., & Shaffer, L.G.	Chromosome Abnormalities and Genetic Counseling	Oxford University Press.	2018 and 5 th Edn.
6	Turnpenny, P., Ellard, S., & Cleaver, R.	Emery's Elements of Medical Genetics	Elsevier.	2022 and 1 st Edn.

Pedagogy

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

Course Designers:

Dr. S.Gandhimathy

Course content and Lecture Schedule

Module No.	Topic	CLOs	No. of Hours	Content Delivery Methods	Learning Methods
Unit I (14 Hrs)					
1.	Human Chromosomes: Structure, Classification & Nomenclature Lyon's hypothesis, Barr body, sex chromatin.	CLO1 CLO2 CLO3	5	Lecture, PPT, Video illustration	Participatory Learning Problem based Learning
2.	Chromosomal Study Techniques: Leukocyte Culture & Karyotyping	CLO1 CLO2 CLO3 CLO4	3	Lecture, Demonstration video, Lab-based simulation	Participatory Learning Experiential Learning
3.	Chromosomal Banding & Advanced Techniques (C, R, Q, G,	CLO1 CLO2 CLO3 CLO4	3	Lecture, PPT, Video demonstration	Participatory Learning Experiential Learning Problem based learning
4.	Microarray, Next generation sequencing (NGS)	CLO1 CLO2 CLO3 CLO4	4	Lecture, PPT, Video	Participatory Learning Experiential Learning
Unit II (14 Hrs)					
5.	Structural Chromosomal Abnormalities: Deletions, Duplications, Translocations, Inversions	CLO1 CLO2 CLO3 CLO4	3	Lecture, PPT, Diagrammatic representation	Participatory Learning Experiential Learning
6.	Numerical Abnormalities: Aneuploidy & Polyploidy	CLO1 CLO2 CLO3 CLO4	3	Lecture, Case examples	Participatory Learning Experiential Learning
7.	Human Syndromes: Down's, Klinefelter's, Turner's	CLO1 CLO2 CLO3 CLO4	4	Lecture, Video, Case studies	Blended learning
8.	Single-Gene and Sex-linked Disorders: Sickle Cell Anemia, Hemophilia, Uses of chromosomal analysis in diagnosis.	CLO1 CLO2 CLO3 CLO4	4	Lecture, PPT, Interactive quiz	Participatory Learning Experiential Learning
Unit III (14 Hrs)					
9.	Blood Groups & Twins: ABO, MN, Rh; Monozygotic, Dizygotic, Conjoined	CLO1 CLO2 CLO3 CLO4	3	Lecture, PPT, Group activity	Participatory Learning Experiential Learning

10.	Population Genetics Basics: Gene Pool, Panmixis, Hardy–Weinberg Law	CLO1 CLO2 CLO3 CLO4	3	Lecture, PPT, Problem-solving	Problem based learning Participatory Learning Experiential Learning
11.	Factors Affecting Equilibrium: Mutation, Migration, Selection, Genetic Drift	CLO1 CLO2 CLO3 CLO4	2	Lecture, Chart illustration, Simulation	Participatory Learning Experiential Learning Problem based learning
12.	Predictive Genomics, Optical Genome Mapping	CLO1 CLO2 CLO3 CLO4	3	Lecture, Video, Case study	Problem based learning
13.	Cancer Genetics: Oncogenes, tumor suppressors, genetic basis of cancer.	CLO1 CLO2 CLO3 CLO4	3	Lecture, Video, Case study	Participatory Learning Experiential Learning Problem based learning

Unit IV (15 Hrs)

14.	Pedigree Analysis: Construction & Interpretation	CLO1 CLO2 CLO3 CLO4	3	Lecture, Activity, PPT	Participatory Learning Experiential Learning Problem based learning
15.	Principles of Genetic Counselling: Goals, Process, Types	CLO1 CLO2 CLO3 CLO4	4	Lecture, Role-play, Case study	Participatory Learning Experiential Learning Problem based learning
16.	Marriage Genetics & Psychosocial Aspects	CLO1 CLO2 CLO3 CLO4	3	Lecture, Group discussion	Participatory Learning Experiential Learning
17.	Ethical, Legal, and Social Issues (ELSI): Genetic discrimination & privacy. Embryo screening, IVF genetics,	CLO1 CLO2 CLO3 CLO4	2	Lecture, Debate, Documentary	Participatory Learning Problem based learning Blended learning
18.	Laws & guidelines (international and Indian context).	CLO1 CLO2 CLO3 CLO4	2	Lecture, Debate,	Participatory Learning Problem based learning Blended learning

Unit V (14 Hrs)

19.	Diagnosis of Genetic Diseases: Thalassemia, Alkaptonuria	CLO1 CLO2 CLO3 CLO4	3	Lecture, PPT, Case-based learning	Blended learning
20.	Molecular Tools: Blotting Techniques & PCR	CLO1 CLO2 CLO3 CLO4	2	Lecture, Video demonstration	Participatory Learning Experiential Learning Problem based learning
21.	Prenatal Diagnosis: Amniocentesis CVS,	CLO1 CLO2	4	Lecture, Video contents	Participatory Learning Experiential Learning

	Cordocentesis, NIPT	CLO3 CLO4			Problem based learning
22.	Stem cells: embryonic and induced pluripotent stem cells (iPSCs). Emerging technologies: CRISPR & gene editing	CLO1 CLO2 CLO3 CLO4	3	Lecture, PPT, Research article discussion, debates	Participatory Learning Experiential Learning Problem based learning Blended learning
23.	AI in variant interpretation, mitochondrial donation (“three-parent babies”). Embryo screening, IVF genetics, and eugenics debates.	CLO1 CLO2 CLO3 CLO4	2	Lecture, PPT, Research article discussion, debates	Participatory Learning Experiential Learning Problem based learning Blended learning

Learning Methodology

S.No	Learning Methodology	Percentage (%)
1	Participatory Learning	30
2	Experiential Learning	30
3	Problem-based Learning	30
4	Blended learning	10

COURSE CODE	TITLE OF THE COURSE	CATEGORY	L	T	P	CREDIT
AS23E03	APPLIED FISHERY BIOLOGY	THEROY	73	2	-	5

Preamble

This multidisciplinary course aims to educate the understanding and managing fisheries. It includes biology, physiology, nutrition, processing, value addition, by-products, aquatic pollution and technology. After completion of this course, students will have many career opportunities.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the various techniques, culture practices used in fishery and polyculture practices, scientific terms, concepts, facts, phenomenon & their interrelationship of fish	K1
CLO2	Understand and demonstrate the interrelations among the abiotic and biotic factors, and an overview of the application of biotechnological tools in fish breeding, feed, health, processing and other issues in fisheries. Application of knowledge in Fisheries for nutrition, agriculture & livestock	K2
CLO3	Apply in depth knowledge gained for sustainable pisciculture practices including formulation of fish feed, nutritional biochemistry, culture, prevention and treatment of diseases etc.	K3
CLO4	Analyse and explain the taxonomy, morphology, pathology and host- parasite relation of common parasites of aquatic organisms and to understand the significance of parasites in fish health	K4

Mapping with Programme Learning Outcomes

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

S- Strong; M- Medium

APPLIED FISHERY BIOLOGY AS23E03 (73 Hrs)

UNIT I

(15 Hrs)

Introduction: Economics of different fish farming systems. Current status, problems and future prospective for aquaculture and fish farming in the world and India. Aquaculture systems: Extensive, semi-intensive and intensive culture of fish, Pen and cage culture in lentic and lotic water bodies. Fish farming-Water quality management in the farming of major and minor (carps), magur, singh, murrels, tilapia, pangasius, freshwater turtle, etc. Introduction to commercial Pisciculture practices in inland water.

UNIT II

(15 Hrs)

Aquaculture and ecosystem relationship: Ecosystems and productivity, biotic interaction within ecosystems and ecological homeostasis. Impact of environment on aquaculture: physical and chemical characteristics, contaminants and pollutants (algae, pathogens, heavy metals, pesticides) and their effect on productivity. Environmental variables related to fish health with special reference to Microplastics. Sanitation in aquaculture systems.

UNIT III

(15 Hrs)

Fish nutrition-feed and feeding: Principles of fish nutrition and terminologies, nutritional requirements of cultivable finfish: larvae, juveniles and adults. Live fish feed: phytoplankton- Spirulina culture techniques and zooplankton –Daphnia culture techniques, Artemia, Rotifer and Copepod culture techniques, and their role in larval nutrition.

UNIT IV

(14 Hrs)

Nutritional biochemistry of fish: Classification, nutrient quality and evaluation of proteins, lipids and carbohydrates. Role of nutrients: amino acids, fatty acids, proteins, lipids, carbohydrates, vitamins and minerals. Types of by-products and Value-Added Products. Introduction: Scope of biotechnology in fisheries and aquaculture research. Transgenics: Principles of transgenic technology and its application in fisheries. Feed biotechnology: Probiotics, single cell proteins, Nutraceuticals. Application of nanotechnology in aquaculture. Recent Technological Innovations in Aquaculture - Aquaponics and Biotechnology.

UNIT V**(14 Hrs)**

General characteristics, life cycle, diagnosis, prevention and treatment of parasitic, bacterial, fungal and viral diseases of fish. Health management strategies in Aquaculture: Vaccines, Immuno-stimulants, Probiotics, Good and Best management practices.

Text Books

S. No.	Authors	Title of the Book	Publishers	Year and Edition
1	Jhingran V. G	Fish and Fisheries of India	Hindustan Publishing Corporation, New Delhi.	1997 and 3 rd Edn.
2	Bandyopadhyay, B.K.	Fundamentals of Freshwater Fish and Fisheries of India	Narendra Publishing House	2023 and 2 nd Edn.
3	T.P. Trivedi	Handbook of Fisheries and Aquaculture	Indian Council of Agricultural Research	2011 and 2 nd Edn.

Reference Books:

S. No.	Authors	Title of the Book	Publishers	Year and Edition
1	Gayathri Shankarrao Madakai	Fish Biology	Bhumi Publishing	2022 and 2 nd Edn.
2	Hart, Paul & Reynolds, John.	Handbook of Fish Biology and Fisheries	Volume 1: Fish Biology.	2002 and 1 st Edn.
3	Reynolds, John & Dulvy, Nicholas & Roberts, Callum.	Handbook of Fish Biology and Fisheries	Volume 2: Fisheries.	2002 and 2 nd Edn.

Pedagogy

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

Course Designers:

Dr. G.Sasikala

Course content and Lecture Schedule

Module No.	Topic	CLOs	No. of periods	Content delivery methods	Learning Methods
UNIT – I (15 Hrs)					
1	Economics of different fish farming systems, Introduction: Current status, problems and future prospective for aquaculture and fish farming in the world and India, Aquaculture systems: Extensive, semi-intensive and intensive culture of Fish	CLO1 CLO2 CLO3	3	Lecture – Chalk and Talk /Group reading	Participatory Learning, problem based learning
2	Pen and cage culture in lentic and lotic water bodies, polyculture, composite fish culture, Fish farming: Nursery and grow-out, pond preparation, stocking, feeding, Water quality management in the farming of major and minor carps	CLO1 CLO2 CLO3	4	PPT/OER, Lecture – Chalk and Talk /Group reading, Observations, display, Demonstration, practical experiments	Blended learning problem based learning
3	Magur, Singh, Murrels, Tilapia, Pangasius, freshwater turtle, etc.	CLO1 CLO2 CLO3	6	Lecture – Chalk and Talk /Group reading, PPT, OER, Virtual lab, Demonstration	Participatory Learning
4	Introduction to commercial Pisciculture practices in inland water	CLO2 CLO3 CLO4	2	Lecture, Chalk and Talk /Group reading	Participatory Learning
UNIT – II (15 Hrs)					
1	Aquaculture and ecosystem relationship, Ecosystems and productivity	CLO1 CLO2 CLO3	4	OER /PPT, Lecture	Blended learning
2	Biotic interaction within ecosystems and ecological homeostasis, Impact of environment on aquaculture, physical and chemical characteristics, contaminants	CLO1 CLO2 CLO3	5	Video/ Observation/Chalk and talk lecture, Lecture, PPT	Experiential Learning

3	Pollutants (algae, pathogens) and their effect on productivity, Pollutants (heavy metals, pesticides) and their effect on productivity, Environmental variables related to fish health with special reference to Microplastics	CLO1 CLO2 CLO3	3	Lecture, PPT, Seminar, Practical	Participatory Learning, Experiential Learning
4	Water quality and sediment characteristics, Biological indicators and indices of water quality, Sanitation in aquaculture systems	CLO1 CLO2 CLO3	3	Video / Observation, Seminar/PPT, Lecture	Participatory Learning, Experiential Learning
UNIT – III (15 Hrs)					
1	Fish nutrition-feed and feeding, Principles of fish nutrition and terminologies	CLO1 CLO2 CLO3	4	Lecture PPT	Blended learning
2	Nutritional requirements of cultivable finfish: larvae, Nutritional requirements of cultivable finfish: juveniles and adults	CLO1 CLO2 CLO3	3	PPT / OER, Video / Observation	Experiential Learning
3	Live fish feed, Phytoplankton-Spirulina culture techniques, Zooplankton–Daphnia culture techniques	CLO1 CLO2 CLO3	4	Lecture, PPT, Seminar, OER	Experiential Learning, Participatory Learning
4	Artemia and Rotifer culture techniques, and their role in larval Nutrition	CLO1 CLO2 CLO3 CLO4	4	Lecture PPT	Participatory Learning
UNIT – IV (14 Hrs)					
1	Nutritional biochemistry of fish: Classification, nutrient quality and evaluation of proteins, lipids and carbohydrates, Role of nutrients: amino acids, fatty acids, proteins, lipids, carbohydrates, vitamins and minerals	CLO1 CLO2 CLO3	4	Lecture, Research article reading	Blended learning
2	Types of by-products and Value-Added Products, Introduction: Scope of biotechnology in fisheries and aquaculture research	CLO1 CLO2 CLO3	4	PPT	Participatory Learning
4	Transgenics: Principles of transgenic technology and its application in fisheries	CLO2 CLO3	2	PPT	Participatory Learning

5	Feed biotechnology: Probiotics, single cell proteins, Nutraceuticals. Application of nanotechnology in aquaculture, Recent Technological Innovations in Aquaculture- Aquaponics technology, Recent Technological Innovations in Aquaculture- Biofloc technology	CLO1 CLO2 CLO3	4	Research article reading, PPT, Brainstorming	Blended learning
UNIT – V (14 Hrs)					
1	General characteristics, life cycle, diagnosis, prevention and treatment of parasitic diseases of fish,	CLO1 CLO2 CLO3	2	Practical Demonstration	Participatory Learning
2	General characteristics, life cycle, diagnosis, prevention and treatment of bacterial, fungal, viral disease of fish	CLO1 CLO2 CLO3	6	Practical Demonstration, Video / Observation	Participatory Learning
4	Health management strategies in Aquaculture, Vaccines, Immuno-stimulants,	CLO1 CLO2 CLO3	4	Lecture PPT, Seminar	Blended learning
5	Probiotics, Good and Best management practices	CLO1 CLO2 CLO3	2	Practical Demonstration	Participatory Learning, experiential Learning

Learning Methodology

S.No	Learning Methodology	Percentage (%)
1	Participatory Learning	30
2	Experiential Learning	30
3	Problem-based Learning	30
4	Blended learning	10

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
AS23E04	DAIRY SCIENCE	THEROY	73	2	-	4

Preamble

To train and impart practical knowledge in clean milk production, processing of milk and preparation of milk products. To provide knowledge to give them an opportunity to get employment in Cooperative Milk Producers Union Limited, and in private dairy product factories

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the different breeds of dairy cattle, physiological status, housing and nutritional requirements of dairy cattle	K1
CLO2	Understand the principles and practices essential in dairy farming	K2
CLO3	Apply the principles of Biotechnology in Dairy Industry	K3
CLO4	Analyse the network between the Dairy Co-operatives, the Dairy Development Department and other stakeholders for efficient and effective management of Dairy farming	K4

Mapping with Programme Learning Outcomes

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

S- Strong; M-Medium

DAIRY SCIENCE AS23E04 (73 hrs)

Unit I (15 hrs)

Dairy Farming –Definition and scope of dairy farming. Importance of dairy industry in Indian economy and employment generation. Global and national status of milk production. Dairy Breeds of India and Classification, Indigenous cow breeds, Exotic cow breeds, Crossbreeding programmes; Buffalo Breeds – Murrah, Surti– their characters and milk yield potential. Goat Breeds – Jamunapari, Malapuri – importance and milk composition. Livestock Identification and Record Keeping – tagging, branding, microchipping, pedigree and production records.

Unit II (15 hrs)

Common Cattle Feed and Fodder – types, composition and nutritive values; green fodder, dry fodder, concentrates, silage and hay. Rations – definition, computation, qualities and examples of balanced rations for different categories of cattle. Digestive System of Ruminants – structure and function of rumen, reticulum, omasum and abomasum; microbial fermentation and VFA production; Anatomy and Physiology of Mammary Glands, Milk Secretion and Colostrum.

Unit III (15 hrs)

Milk Composition and Nutritive Value – physical and chemical properties; factors affecting composition; Milk Collection and Quality Testing – hygienic milking, use of lactometer, fat and SNF testing, milk grading; Pasteurization and Preservation of Milk – methods, packaging, storage and transportation; Spoilage of Milk – microbial, enzymatic and physical spoilage; preventive measures; Milk Products – preparation and processing of butter, cream, curd, cheese, paneer, khoa, ghee, and value- added products; Adulteration of Milk, FSSAI standards and food safety measures.

Unit IV (14 hrs)

Viral Diseases – Cowpox, Foot and Mouth Disease, Rinderpest – symptoms, prevention and control; Bacterial Diseases – Anthrax, Mastitis, Tuberculosis, Hemorrhagic Septicemia – causes, symptoms, and management; Parasitic and Non-contagious Diseases – internal and external parasites; milk fever, ketosis, bloat – causes and control; Vaccination and Biosecurity – vaccination schedule, quarantine, disinfection and herd health management; First Aid and Veterinary Assistance – basic treatment, deworming, and disease prevention measures.

Unit V (14 hrs)

Role of Co-operative Societies in Milk Production and Marketing – Amul model, Operation Flood, NDDB, and milk co-operative structures; Techniques in Cattle Breeding – Inbreeding, Outbreeding, Crossbreeding and Artificial Insemination – merits and demerits; advanced techniques like embryo transfer and cloning; Dairy Farm Management – housing, ventilation, sanitation, waste disposal, herd management, and record keeping; Entrepreneurship in Dairy Farming – small-scale dairy unit setup, self-help groups, women empowerment and sustainable dairy practices.

Reference Books:

S. No.	Authors	Title of the Book	Publishers	Year and Edition
1	Banerjee, G. C.	A Textbook of Animal Husbandry	Oxford & IBH Publishing, New Delhi	2011 and 8 th Edn.
2	Sukumar De	Outlines of Dairy Technology	Oxford University Press, New Delhi	2015 and 2 nd Edn
3	Ranjhan, S. K.	Animal Nutrition and Feeding Practices in India	Vikas Publishing House, New Delhi	2007 and 2 nd Edn.

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
AS21AC3	INDUSTRIAL BIOTECHNOLOGY	SELF STUDY				5**

UNIT I

Fermentation Technology – Fermenter design and types - Culture of microorganisms: Solid, Semisolid, Batch culture, Continuous culture, Fed-batch culture – Metabolic pathways in microorganisms – microbial products: Primary metabolites - Amylases, Proteases, Ethanol, Citric acid and Lipases, Secondary metabolites - penicillin, Tetracycline, streptomycin, vitamin B12, Biogas production.

UNIT II

Source and production of commercially important enzymes – Cellulase, Amylase, Pectinase. Proteinases. Immobilization of enzymes and its applications – Biofertilizers – Mass cultivation of *Rhizobium*, *Azotobacter*, *Azolla*, *Azospirillum* - Biopesticides- Biological control of plant pathogens, insects pests and weeds. Genetic engineering of biocontrol agents. Benefits from Biofertilizers.

UNIT III

Application of enzymes in commercial Industries – Food Industries – Detergent Industries – Leather Industries

– Pharmaceutical Industries – Enzymes in clinical diagnostics - Enzymes as therapeutic agents. Genomes and its applications to health

UNIT IV

Production of Single Cell Protein (SCP) - Advantages of producing microbial protein – Microorganisms used as SCP – Substrates used for the production of Bacterial, Algal. Fungal and Yeast biomass - Nutritional value of SCP - Genetic improvements of microbial cells. *Mushroom culture

UNIT V

Bioremediation – *In-situ* and *Ex-situ* bioremediation – Factors affecting bioremediation – Use of genetically engineered bacterial strains – VAM fungi – Bioremediation of heavy metals, Xenobiotics, dyes - Microbial leaching: copper leaching - Biosafety – IPR – Patenting. Biowar, Bioprivacy, Plant Breeder right (PBR), Bacteriology of water and sewage.

Reference Books:

S. No.	Authors	Title of the Book	Publishers	Year and Edition
2	Dubey R.C.	A textbook of Biotechnology	S. Chand & Co., Ltd., New Delhi	2005 and 3 rd Edition
3	Kumaresan, V.	Biotechnology	Saras Publications, Nagercoil	2004 and 2 nd Edition
5	Prakash, M.	Textbook of Biotechnology	Sonali Publication	2009 and 5 th Edition

Pedagogy

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

Course designer

Dr. M.Sheeba

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
AS21AC4	APPLIED ZOOLOGY	SELF STUDY				5**

UNIT I

Parasites in Man: Protozoan Parasites – *Entamoeba histolytica*, *Giardia lamblia*, *Plasmodium*, *Trypanosoma gambiense*; Helminth Parasite – *Ancylostoma duodenale*, *Ascaris lumbricoides*, *Enterobius vermicularis*, *Wuchereria bancrofti*, *Taenia solium*; Host Parasite Relationship.

UNIT II

Beneficial Insects – Apiculture – Different Species; Social Organization; Equipment connected with bee keeping; Newton hive; Bee products: Honey extraction – Beeswax and their uses; Diseases and enemies of bees. Sericulture: Different types of silkworms used in sericulture; Life history of *Bombyx mori*; Rearing; Silk extraction and reeling; Diseases of silkworm; Economic importance. Lac insect – biology and life cycle

UNIT III

Insect Pests – Salient features, Nature of destruction and control measures of the following - Pests of rice: Rice stem borer, Green rice leafhopper. Pests of Cotton: Cotton leaf hopper, Pink bollworms. Pests of coconut: Rhinoceros beetle, Black headed caterpillar. Pests of Sugarcane - Indian sugarcane leaf hopper, Sugarcane root borer, Sugarcane top shoot borer.

UNIT IV

Aquaculture: Kinds of aquaculture – Mono, Poly-extensive, Semi intensive, Intensive; Monosex sewage integrated fish farming (brief account). Culture of selected species – Major carps, oysters. Recent developments in aquaculture: Application of hormones – Spawning-Eyestalk ablation. Preservation and processing of fish, prawns, Chilling, Freezing, Freeze drying, Salting, Smoking, Canning (Briefly). Fish parasites and diseases (any3). Ornamental Fish Culture

UNIT V

Economic importance of birds and mammals. Different breeds of fowls – Selective breeding; Housing and rearing; Role of nutrition in egg laying; Common diseases. Indirect and direct value of mammals - Dairy, Sheep, and piggery farming; Novel methods of breeding livestock.

Reference Books

S. No.	Authors	Title of the Book	Publishers	Year and Edition
1	Ahsan, J. and Sinha, S.P.	Handbook of Economic Zoology	S. Chand & Co., New Delhi	1985 and 1 st Edn.
2	Ayyar, T.V.T.M	Handbook of Economic Entomology for South India	Govt. Press. Madras	1963 and 1 st Edn.
3	Banerjee, G.C.	Poultry	Oxford and IBH Publishing Co., Pvt Ltd.	1992 and 1 st Edn.
4	Bardach, John E., Ryther, John, H. and McLamey William, O.	Aqua culture	John Wiley and Sons Inc., New Delhi	1972 and 1 st Edn.
5	Crofton, H.D.	Nematodes	Hutchinson University Library, London	1966 and 1 st Edn.
6	Chaterjee, K.D	Parasitology	Chaterjee Medical Publishers Calcutta	1982 and 1 st Edn.

Pedagogy

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

Course designer

Dr. M.Sheeba

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	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	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	Apply knowledge towards handling of important instruments, conduct basic clinical lab experiments, apply statistical analysis for problem solving future course of their career development in higher education and research	K3
CLO4	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

60hrs

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 and Edition
1	Sinha J, Chatterjee A K, Chattopadhyay P	Advanced Zoology Practical	Arunabha Sen Books and Allied (P) Ltd	2011, 1 st Edn.
2	Gupta S P	Statistical Methods	S. Chand & Sons	2008, 1 st Edn.
3	Pranab Kumar Banerjee	Introduction to Biostatistics	S. Chand Publishers	2011, 3 rd Edn.
4	Kanai, L Mukherjee	Medical Laboratory Technology	Tata McGraw Hill Publishing Company Ltd., New Delhi	2017, 3 rd Edn.
5	Ramnick Sood, M. D	Medical Laboratory Technology	Medical Publishers(P)Ltd	2009, 6 th Edn.
6	Sathish Gupte	Short Textbook of Medical Laboratory for Technicians	Jaypee Brothers, Medical Publishers	2021, 3 rd Edn.
7	Jhingran V.G	Fish and fisheries of India	Hindustan Publishing Corporation, New Delhi	1991, 3 rd Edn.

Course designer

- Dr. P. Susheela
- Dr. G. Sasikala

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
AS23SB03	ADVANCE TECHNIQUES IN SCIENCE VIDEO CONTENT CREATION THROUGH MULTIMEDIA INTEGRATION	PRACTICAL	-	2	43	3

Preamble

To introduce the role of artificial Intelligence in animation of science video content and enhance the creativity, efficiency, and ethical practices in media creation.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the key applications and ethical considerations of AI in graphic design and video production.	K1
CLO2	Understand the various aspects of animation software to develop storyboards and 2-dimensional animation motion graphics	K2
CLO3	Apply the knowledge of storytelling, animation and other areas of traditional animation to design and develop 2D animations, visual effects for the creative media	K3
CLO4	Develop a complete AI-integrated design and video project applying professional workflows, ethical practices, and creative problem-solving.	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	M	S	S	S	S

S- Strong; M- Medium

ADVANCE TECHNIQUES IN SCIENCE VIDEO CONTENT CREATION THROUGH MULTIMEDIA INTEGRATION AS23SB03 (43 Hrs)

UNIT I: Overview of AI applications in graphic design and video production. (8 Hrs)

Introduction to key AI-powered creative tools and their role in modern workflows. Understanding AI-generated art and videos. Ethical use of AI in media creation: copyright, originality, and authenticity. Exploring how AI transforms professional design, storytelling, and editing practices.

UNIT II: AI Tools and Practical Applications in Creative Design (8 Hrs)

Hands-on experience with AI-powered image and video tools. Integrating AI tools in design workflows and efficiency. Creating simple AI-generated posters and visuals. Combining human creativity with AI automation to enhance design execution. Basics of branding and customization using AI outputs.

UNIT III: Video Editing and AI-Enhanced Production Workflow (9 Hrs)

Introduction to DaVinci Resolve: workspace overview, panels, navigation, and customization. Importing and organizing media: file formats, bins, metadata, labeling, sorting. Basic editing techniques: timeline management, trimming, ripple edits, and sequence settings. Transitions and effects: applying video/audio transitions, keyframing, and creative visual effects. Titles and graphics: adding motion titles, lower thirds, and integrating AI-generated visuals. Colour correction and lighting basics: exposure, contrast, temperature, tone adjustments. Workflow efficiency with shortcuts, automation, and proxy editing. Exporting and rendering: settings for web and broadcast formats, quality optimization.

UNIT IV: Advanced AI Integration in Video and Audio Editing (9 Hrs)

AI-driven video tools: automated scene detection, motion tracking, and visual effects. AI-assisted techniques for color correction, enhancement, and style transfer. Audio enhancement using AI: noise reduction, equalization, compression, and effects. Practical exercise: editing and enhancing video/audio clips with AI. Advanced editing workflows: intelligent transitions, summarization, and storytelling optimization. Combining AI-generated outputs with traditional methods for professional quality.

UNIT V: Project and Best Practices

(9 Hrs)

AI Design and Video Project: Creating a complete campaign or educational video using integrated AI workflows. Applying concepts from graphic, video, and audio AI tools. Discussion on ethical and professional best practices in AI-assisted media production. Peer review and project showcase collaborative feedback. Workflow optimization strategies for future projects.

Reference books

S. No	Author	Title of book	Publisher	Year and Edition
1	Nick Hodges	AI for Creative Professionals: A Practical Guide to AI-Powered Design, Video, and Audio Production	Routledge	2023, 1 st Edn.
2	Sam Carter	Artificial Intelligence for Artists: Tools and Techniques for Creative Workflows	Apress	2022, 1 st Edn.
3	Stuart Russell, Peter Norvig	Artificial Intelligence: A Modern Approach	Pearson	2021, 1 st Edn.

E-links

Adobe Firefly & Generative AI Learning Hub

<https://helpx.adobe.com/firefly/learn.html>

DaVinci Resolve Official Training Resources

<https://www.blackmagicdesign.com/products/davinciresolve/training>

Google AI Experiments (Creative Tools)

<https://experiments.withgoogle.com/collection/ai>

Runway ML Tutorials:

<https://runwayml.com/>

