DEPARTMENT OF ZOOLOGY

B.SC. ZOOLOGY
SYLLABUS

BATCH: 2023-2026

FACULTY MEMBERS

DR. S. SOMASUNDARAM M.SC.,B.ED.,PH.D.,P.G.MBT(HOD)
DR. M. DURAIRAJU, M. SC.,M.PHIL.,B.ED.,PGDGC.,PH.D,
DR. S. MARISELVI, M.SC.,M.PHIL.,PGDCA.,PH.D
MS. S. JAYALAKSHMI, M.SC.,M.PHIL., PH.D
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NALLAMUTHU GOUNDER MAHALINGAM COLLEGE
(AN AUTONOMOUS INSTITUTION AFFILIATED TO BHARATHIAR UNIVERSITY)
RE ACCREDITED BY NAAC
AN ISO 9001:2015 CERTIFIED INSTITUTION
POLLACHI – 642 001
COIMBATORE (DT.) TAMIL NADU

Department of Zoology

Vision

Enlightening the students with total dedication to bring out the hidden skills, creativity and human excellence with due emphasis on knowledge about recent development in the field of biology and mould them as responsible citizens.

Mission

Metamorphosing the students holistically through seminars, symposia, guest lectures, group discussions, shared class experiences, assignments, nature club, job opportunities, and healthy practices to express the excellence within.

Program Educational Objectives:

PEO1	**Enhanced the professional skills by means of continuous education and development.**
PEO2	**Express a mastery of discipline, precise information and exhibit analytical and practical skills. Exhibit professional interigrity and the capability for ethical decision making**
PEO3	**Graduate will recognize the need and apply their knowledge in general and various discipline areas.**
PEO4	**Pursue lifelong learning and continuous improvement of their knowledge and skills in the diverse field with the highest professional and ethical standards.**
PEO5	**Skill to function on multidiscipline environment to meet desired needs within realistic constraints such as environmental, social, ethical, health, safety, and sustainability**

Program Outcomes:

PO1	**Scientific Temper, Individual and Team Work Communication** Students gain information and skill in the fundamentals of animal sciences, understands the multifarious connections along with different living organisms.
PO2	**Inter-disciplinary Exposure** Students achieve knowledge of internal structure of cell, its functions in control of various metabolic functions of organisms. Correlates the physiological, Biochemical processes of animals and relationship of organ systems.
PO3	**Education and Society Environment and Sustainability** Understanding of environmental conservation processes, pollution control methods and its importance. Students also gain knowledge and awareness about biodiversity as well as the importance of protection of endangered species.
PO4	**Vocational and Industry Exposure** Understands about various concepts and importance of Biotechnology, Bioinformatics, Genetics, Genetic engineering in industry and day today human life.
PO5	**Problem Analysis** Students will be able to compare and distinguish the characteristics of animals that discriminate them from other forms of life.
PO6	**Innovation and Entrepreneurship** Achieve knowledge in applied fields like Sericulture, Aquaculture and Apiculture alongside Statistical and Laboratory techniques.
PO7	**Life-long Learning** Understanding of Zoology to one's own life and apply the knowledge judicially and remain constantly employable.

Program Specific Outcomes:

PSO – 01	To understand the life of organisms with their diversity, morphological, ecological, physiological and evolutionary significance at cellular and molecular level.
PSO – 02	To understand the principals and applications of zoology in daily life by equipping practical and field based study knowledge.

Mapping

PEOs / POs \ PSOs	PEO1	PEO2	PEO3	PEO4	PEO5
PO1	H	H	H	H	M
PO2	H	H	H	M	H
PO3	H	M	M	H	H
PO4	H	H	H	H	M
PO5	M	M	M	H	H
PO6	H	M	H	H	H
PO7	M	H	M	H	H
PSO1	H	M	H	M	H
PSO2	H	H	M	H	H

Nallamuthu Gounder Mahalingam College - Curriculum Development Cell
Scheme of Examination For 2023– 2024,
Choice Based Credit System & OBES

For Part I and Part II for Four Semesters

SEMESTER – I

Part	Subject Code	Title of the Paper	Hrs / Week		Hrs / Sem.	Exam Hrs.	Maximum Marks		Total Marks	Credits
			L	P	T		CIA	ESE		
I	23UTL101 / 23UHN101 / 23UFR101	Tamil Paper - I /	6	-	-	3	25	75	100	3
		Hindi Paper - I /		-	-					
		French Paper – I		-	-					
II	23UEN101	Communication Skills - I (Level I)	5	-	-	3	25	75	100	3
	23UEN102	Communication Skills - I (Level II)		-	-					
III	23UZY101	CCI : Nonchordata	6	-	-	3	25	75	100	5
		CC Lab -I : Nonchordata and Chordata (Non semester pattern)	-	3	-	-	-	-	-	-
	23UBY1A1	GE -I Allied: Botany Paper I Invertebrata and Vertebrata	6	-	-	3	25	75	100	4
		GE Allied Lab -I : Practical I (Paper I &II)	-	2	-	-	-	-	-	-
IV		AECC- I : Environmental Studies	1	-	-	-		-	-	-
	23HEC101	Human Excellence - Personal Values & SKY Yoga Practice – I	1	-	-	2	20	30	50	1
V		Extension Activities – Annexure I	-	-	-	-	-	-	-	-
EC	23CFE101	Fluency in English-I	-	-	-	-	-	-	-	-
		Online Course (Optional) (MOOC/NPTEL/SWAYAM)								Grade
Total									**450**	**16**

EC – Extra Credit Course / Certificate Course / Co-scholastic Course / Job Oriented Course

CC – Core Course; GE – Generic Elective; AECC - Ability Enhancement Compulsory Course

SEMESTER – II										
Part	**Subject Code**	**Title of the Paper**	**Hrs / Week**		**Hrs / Sem.**	**Exam Hrs.**	**Maximum Marks**		**Total Marks**	**Credits**
			L	**P**	**T**		**CIA**	**ESE**		
I	23UTL202 / 23UHN202 / 23UFR202	Tamil Paper - II /	6	-	-	3	25	75	100	3
		Hindi Paper - II /		-	-					
		French Paper – II		-	-					
II	23UEN202	Communication Skills - II (Level I)	5	-	-	3	25	75	100	3
	23UEN203	Communication Skills - II (Level II)		-	-					
III	23UZY202	CC II :Chordata	6	-	-	3	25	75	100	4
	23UZY203	CC Lab - I: Nonchordata & Chordata (Non-Semester Pattern)	-	2	-	3	30	45	75	3
	23UBY2A2	GE II- Allied :Botany paper II Economic Zoology	6	-	-	3	25	75	100	4
	23UBY2A3	GE- Allied Lab I : Paper I & II (Non-Semester Pattern)	-	2	-	3	40	60	100	2
IV	23EVS201	AECC I: Environmental Studies	1	-	-	2	-	50	50	2
	23UEL2S1	SEC I :Naan Muthalvan:Professional Skills (offered by Department of English)	1	-	-	2	-	50	50	2
	23HEC202	Human Excellence - Family Values & SKY Yoga Practice – II	1	-	-	2	20	30	50	1
V		Extension Activities - Annexure I	-	-	-	-	-	-	-	-
EC	23CFE202	Fluency in English-II	-	-	-	-	-	-	-	-
	23CMM201	Manaiyiyal Mahathuvam-I	-	-	15	2	-	50	50	Grade
	23CUB201	Uzhavu Bharatham-I	-	-	15	2	-	50	50	Grade
		Online Course (Optional) (MOOC/NPTEL/SWAYAM)								Grade
Total									**725**	**24**

EC – Extra Credit Course / Certificate Course / Co-scholastic Course / Job Oriented Course

CC – Core Course; GE – Generic Elective; AECC - Ability Enhancement Compulsory Course

SEMESTER – III										
Part	**Subject Code**	**Title of the Paper**	**Hrs / Week**		**Hrs / Sem.**	**Exam Hrs.**	**Maximum Marks**		**Total Marks**	**Credits**
			L	**P**	**T**		**CIA**	**ESE**		
I	23UTL303 / 23UHN303 / 23UFR303	Tamil Paper - III / Hindi Paper - III/ French Paper – III	5	-	-	3	25	75	100	3
II	23UEN303	Communication Skills - III (Level I)	6	-	-	3	25	75	100	3
	23UEN304	Communication Skills - III (Level II)		-	-					
III	23UZY304	CC III:Cell Biology	6	-	-	3	25	75	100	5
		CC Lab II: Cell biology & Genetics (Non-Semester Pattern)	-	3	-	-	-	-	-	-
	23UZY3A4	GE III- Allied Chemistry Paper I (offered by Department of Chemistry)	6	-	-	3	25	75	100	4
		GE Allied Lab - II : Chemistry(offered by Department of Chemistry)	-	2	-	-	-	-	-	-
IV	23UZY3N1 / 23UZY3N2	Non Major Elective - I : Public Health and Hygiene/ Non Major Elective - I : Practical skills in Human Health	1	-	-	2		50	50	2
	23HEC303	Human Excellence - Professional Values & Ethics – III	1	-	-	2	20	30	50	1
V		Extension Activities - Annexure I	-	-	-	-	-	-	-	-
EC	23CFE303	Fluency in English-III	-	-	-	-	-	-	-	-
	23CMM302	Manaiyiyal Mahathuvam-II	-	-	15	2	-	50	50	Grade
	23CUB302	Uzhavu Bharatham-II	-	-	15	2	-	50	50	Grade
	23UZY3VA	VAC I: Value Added Course - Biofarming		30						2*
Total									**500**	**18**

EC – Extra Credit Course / Certificate Course / Co-scholastic Course / Job Oriented Course

CC – Core Course; GE – Generic Elective; AECC - Ability Enhancement Compulsory Course;

SEC – Skill Enhancement Course

SEMESTER – IV										
Part	**Subject Code**	**Title of the Paper**	**Hrs / Week**		**Hrs / Sem.**	**Exam Hrs.**	**Maximum Marks**		**Total Marks**	**Credits**
			L	**P**	**T**		**CIA**	**ESE**		
I	23UTL404 / 23UHN404 / 23UFR404	Tamil Paper - IV / Hindi Paper - IV/ French Paper – IV	5	-	-	3	25	75	100	3
II	23UEN404	Communication Skills - IV (Level I)	6	-	-	3	25	75	100	3
	23UEN405	Communication Skills - IV (Level II)		-	-					
III	23UZY405	CC IV :Genetics	6	-	6	3	25	75	100	5
	23UZY406	CC Lab - II : Cell biology & Genetics (Non-Semester Pattern)	-	3	-	3	30	45	75	3
	23UZY4A5	GE IV: Allied chemistry Paper II(offered by Department of Chemistry)	6	-	-	3	25	75	100	4
	23UZY4A6	GE- Allied Lab-II:Chemistry (offered by Department of Chemistry)	-	2	-	3	40	60	100	2
IV	23UZY4N3/ 23UZY4N4	Non Major Elective - II :Food and Nutrition / Non Major Elective - I : Ornamental Fish Culture	1	-	-	2		50	50	2
	23UZY4S2/ 23UZY4S3	SEC II :Naan Muthalvan: Aptitude for placement / Ethology	1	-	-	2	-	50	50	2
	23HEC404	Human Excellence - Social Values & SKY Yoga Practice – IV	1	-	-	2	20	30	50	1
V		Extension Activities - Annexure I	-	-	-	-	-	50	50	1
EC	23CFE404	Fluency in English-IV	-	-	-	-	-	-	-	-
	23CMM403	Manaiyiyal Mahathuvam-III	-	-	15	2	-	50	50	Grade
	23CUB403	Uzhavu Bharatham-III	-	-	15	2	-	50	50	Grade
	23UZY4VA	VAC II: Value Added Course- Frontiers in nutrition		30						2*
Total									**775**	**26**

EC – Extra Credit Course / Certificate Course / Co-scholastic Course / Job Oriented Course

CC – Core Course; GE – Generic Elective; SEC – Skill Enhancement Course; VAC-Department Specific Value Added Course;

*Extra Credits;

SEMESTER – V										
Part	**Subject Code**	**Title of the Paper**	**Hrs / Week**		**Hrs /Sem.**	**Exam Hrs.**	**Maximum Marks**		**Total Marks**	**Credits**
			L	**P**	**T**		**CIA**	**ESE**		
III	23UZY507	CC - V: Developmental Biology	5	-	-	3	25	75	100	4
	23UZY508	CC - VI :Biotechnology	5	-	-	3	25	75	100	4
	23UZY509	CC - VII : Biostatistics & Biophysics	5	-	5	3	25	75	100	4
	23UZY510	CC- VIII : Biochemistry	5	-	-	3	25	75	100	4
	23UZY5E1 / 23UZY5E2 / 23UZY5E3	DSE - I : Medical Laboratory Techniques/ DSE - I : Poultry Science and Management technology / DSE - I : Haematology and Clinical Pathology	4	-	-	3	25	75	100	4
	23UZY614	CC Lab- III: Developmental Biology, Animal Physiology & Endocrinology, Biostatistics &Biophysics, Biochemistry, Polutry science managment , Haematology and Clinical pathology & MLT (Non-Semester Pattern)	-	2	10	-	-	-	-	-
	23UZY615	CC Lab- IV: Ecology, Evolution, Biotechnology, Microbiology , Sericulture,Insect Pest Management, Parasitology and Aquaculture,Dairy farming and Management	-	2	-	-	-	-	-	-

		Technology, Wildlife Conservation (Non-Semester Pattern)								
IV	23UZY5S4 / 23UZY5S5	SEC III: Apiculture/ SEC III: Biopharmaceuticals	1			2		50	50	2
	23HEC505	Human Excellence - National Values & SKY Yoga Practice – V	1	-	-	2	25	25	50	1
	23GKL501	General Awareness - Self Study	SS			2	-	50*	50*	Grade
V		Extension Activities - Annexure I	-	-	-	-	-	-	-	-
EC	23CFE505	Fluency in English-V	-	-	-	-	-	-	-	-
	23CSD501	SoftSkills Development -I	-	-	-	-	-	-	-	Grade
	23UZY5AL	ALC - I:Advanced Learner Course – I Bioinformatics (Optional) - Self Study					50*	50*	100*	5*
Total									**600+150***	**23+5***

EC – Extra Credit Course / Certificate Course / Co-scholastic Course / Job Oriented Course
CC – Core Course; DSE – Discipline-Specific Elective; SEC – Skill Enhancement Course
ALC-Advanced Learner Course (Optional)

*Extra Credits;**Credits – Based on course content maximum of 4 credits

SEMESTER – VI										
Part	**Subject Code**	**Title of the Paper**	**Hrs / Week**	**Hrs / Sem.**		**Exam Hrs.**	**Maximum Marks**		**Total Marks**	**Credits**
			L	**P**	**T**		**CIA**	**ESE**		
III	23UZY611	CC- IX :Animal Physiology and endocrinology	5	-	-	3	25	75	100	4
	23UZY612	CC- X :Ecology and Evolution	5	-	-	3	25	75	100	4
	23UZY613	CC - XI : Microbiology and Immunology	5	-	-	3	25	75	100	4
	23UZY6E4/ 23UZY6E5/ 23UZY6E6	DSE - II : Sericulture/ DSE - II :Insect Pest Management / DSE - II : Parasitology	4	-	-	3	25	75	100	4
	23UZY6E7 / 23UZY6E8 / 23UZY6E9	DSE - III :Aquaculture / DSE - III : Wild life Conservation/ DSE –III : Dairy farming and Management Technology	5	-	-	3	25	75	100	4
	23UZY614	CC Lab- III: Developmental Biology, Animal Physiology & Endocrinology, Biostatistics &Biophysics, Biochemistry, Polutry science managment , Heamatology and Clinical pathology & MLT (Non-Semester Pattern))	-	2	10	3	30	45	75	3
	23UZY615	CC Lab- IV: Ecology, Evolution, Biotechnology, Microbiology , Sericulture,Insect Pest Management, Parasitology and Aquaculture,Dairy farming and Management Technology, Wildlife Conservation (Non-Semester Pattern)	-	2	-	3	30	45	75	3

		Project/ Internship					25	75	100	4
IV	23UZY6S6/ 23UZY6S7	SEC IV : Naan Muthalvan : Zoology for Competitive Exams / Cyber security	1	-	-	2	-	50	50	2
	23HEC606	Human Excellence - Global Values & SKY Yoga Practice – VI	1	-	-	2	20	30	50	1
V		Extension Activities - Annexure I	-	-	-	-	-	-	-	-
EC	23CFE606	Fluency in English-VI	-	-	-	-	-	-	-	-
	23UZY6AL	ALC - II:Advanced Learner Course – I Immunotherpetuics (Optional) - Self Study					50	50	100*	5*
Total									**850+100***	**33+5***

EC – Extra Credit Course / Certificate Course / Co-scholastic Course / Job Oriented Course
CC – Core Course; DSE – Discipline-Specific Elective; SEC – Skill Enhancement Course
ALC-Advanced Learner Course (Optional)

*Extra Credits;**Credits – Based on course content maximum of 4 credits

List of Abbreviations:

CC – Core Course
GE – Generic Elective
AECC –Ability Enhancement Compulsory Course
SEC – Skill Enhancement Course
DSE – Discipline-Specific Elective
VAC –Value Added Course
ALC – Advanced Learner Course

Grand Total = 3900; Total Credits = 140

Question Paper Pattern
(Based on Bloom's Taxonomy)

K1-Remember; **K2**- Understanding; **K3**- Apply; **K4**-Analyze; **K5**- Evaluate

1. Theory Examinations: 75 Marks (Part I, II, & III)

(i) Test- I & II, ESE:

Knowledge Level	Section	Marks	Description	Total
K1 & K2 (Q1 - 10)	A (Q1 – 5 MCQ) (Q6 – 10 Define / Short Answer / MCQ)	10 * 1 = 10	MCQ / Define	**75**
K3 (Q11-15)	B (Either or pattern)	5 * 5 = 25	Short Answers	
K4 & K5 (Q16 – 20)	C (Either or pattern)	5 * 8 = 40	Descriptive/ Detailed	

2. Theory Examinations: 38 Marks (3 Hours Examination) (Part III: If applicable)

Knowledge Level	Section	Marks	Description	Total
K1 & K2 (Q1 - 10)	A (Q 1 – 10 MCQ)	10 * 1 = 10	MCQ	**50 (Reduced to 38)**
K3 (Q11 – 15)	B (Either or pattern)	5 * 3 = 15	Short Answers	
K4 & K5 (Q16-20)	C (Either or pattern)	5 * 5 = 25	Descriptive/ Detailed	

3. Theory Examinations: 38 Marks (2 Hours Examination) (Part IV: If applicable)

Knowledge Level	Section	Marks	Description	Total
K1 & K2 (Q1-10)	A (Q1 – 5 MCQ) (Q6–10 Define / Short Answer)	10 * 1 = 10	MCQ / Define	**50 (Reduced to 38)**
K3, K4 & K5 (Q11-15)	B (Either or pattern)	5 * 8 = 40	Descriptive/ Detailed	

4. Practical Examinations:

Paper	Maximum Marks	Marks for		Components for CIA		
		CIA	CEE	Tests	Observation Note	Record Note
Practical (Core / Elective)	50	20	30	10	05	05
Practical (Core / Elective)	75	30	45	20	05	05
Practical (Core / Elective)	100	40	60	30	05	05

5. Project:

Paper	Maximum Marks	Marks for		
		CIA	CEE	
			Evaluation	Viva-voce
Project	100	25	50	25
Project	150	40	75	35
Project	200	50	100	50

***** CIA – Continuous Internal Assessment & CEE – Comprehensive External Examinations

Components of Continuous Internal Assessment (CIA)

Theory

Maximum Marks: 100; CIA Mark: 25; CEE Mark: 75;

Components		Calculation	CIA Total
Test 1	75	(75+75+15+10)/7	25
Test 2 / Model	75		
Assignment / Digital Assignment	15		
Others*	10		

*Others may include the following: Seminar / Socratic Seminars,Group Discussion, Role Play, APS, Class participation, Case Studies Presentation, Field Work, Field Survey, Term Paper, Workshop / Conference Participation, Presentation of Papers in Conferences, Quiz, Report / Content Writing, etc.

Maximum Marks: 50; CIA Mark: 12; CEE Mark: 38; (Part III: If applicable)

Components		Calculation	CIA Total
Test 1	50	(50+50+10+10)/10	12
Test 2 / Model	50		
Assignment / Digital Assignment	10		
Seminar	10		

PROJECT

Maximum Marks: 100; CIA Mark: 25; CEE Mark: 75;

Components		Calculation	CIA Total
Review I	5	5+5+5+10	25
Review II	5		
Review III	5		
Report Submission	10		

Maximum Marks: 200; CIA Mark: 50; CEE Mark: 150;

Components		Calculation	CIA Total
Review I	10	10+ 10+10+20	50
Review II	10		
Review III	10		
Report Submission	20		

** Components for 'Review' may include the following:*

Originality of Idea, Relevance to Current Trend, Candidate Involvement, and Presentation of Report for Commerce, Management & Social Work.

Synopsis, System Planning, Design, Coding, Input form, Output format, Preparation of Report & Submission for Computer Science cluster.

Continuous Internal Assessment for Project

Maximum Marks: 100 Marks

Components for CIA: 25 Marks

S. No	Internal Components	Marks
1	Selection of the field of study, Topic & Literature Collection	5
2	Research Design and Data Collection	5
3	Analysis & Conclusion	5
4	Rough Draft Submission	10
Total		**25**

ComponentsforCEE: 75 Marks

S. No	External Components	Marks
	Mode of Evaluation	
	Project Report	
1	Relevance of the topic to academic / society Objectives	15
2	Experimental Design	15
3	Expression of Results and Discussion	20
	Viva Voce	
4	Presentation	15
5	Discussion	10
Total		**75**

STUDENT SEMINAR EVALUATION RUBRIC

Grading Scale:

A	B	C	D
8-10	5-7	3-4	0-2

CRITERIA	A - Excellent	B - Good	C - Average	D - Inadequate
Organization of presentation	Information presented as an interesting story in a logical, easy-to-follow sequence	Information presented in logical sequence; easy to follow	Most of the information is presented in sequence	Hard to follow; sequence of information jumpy
Knowledge of the subject & References	Demonstrated full knowledge; answered all questions with elaboration **&** Material sufficient for clear understanding **AND** exceptionally presented	At ease; answered all questions **but** failed to elaborate **&** Material sufficient for clear understanding **AND** effectively presented	At ease with information; answered most questions **&** Material sufficient for clear understanding **but** not clearly presented	Does not have a grasp of information; answered only rudimentary Questions **&** Material not clearly related to the topic **OR** background dominated seminar
Presentation Skills using ICT Tools	Uses graphics that explain and reinforce text and presentation	Uses graphics that explain the text and presentation	Uses graphics that relate to text and presentation	Uses graphics that rarely support text and presentation
Eye Contact	Refers to slides to make points; engaged with the audience	Refers to slides to make points; eye contact the majority of the time	Refers to slides to make points; occasional eye contact	Reads most slides; no or just occasional eye contact
Elocution – (Ability to speak English language)	Correct, precise pronunciation of all terms The voice is clear and steady; the audience can hear well at all times	Incorrectly pronounces a few terms Voice is clear with few fluctuations; the audience can hear well most of the time	Incorrectly pronounces some terms Voice fluctuates from low to clear; difficult to hear at times	Mumbles and/or Incorrectly pronounces some terms Voice is low; difficult to hear

WRITTEN ASSIGNMENT RUBRIC

Grading Scale:

A	B	C	D	F
13-15	10-12	7-9	4-6	0-3

CRITERION	A - Excellent	B - Good	C - Average	D - Below Average	F - Inadequate
Content & Focus	Hits on almost all content exceptionally clear	Hits on most key points and the writing is interesting	Hits in basic content and writing are understandable	Hits on a portion of content and/or digressions and errors	Completely off track or did not submit
Sentence Structure & Style	* Word choice is rich and varies * Writing style is consistently strong * Students own formal language	* Word choice is clear and reasonably precise * Writing language is appropriate to the topic * Words convey intended message	* Word choice is basic * Most writing language is appropriate to the topic * Informal language	* Word choice is vague * Writing language is not appropriate to the topic * Message is unclear	* Not Adequate
Sources	Sources are cited and are used critically	Sources are cited and some are used critically	Some sources are missing	Sources are not cited	Sources are not at all cited
Neatness	Typed; Clean; Neatly bound in a report cover; illustrations provided	Legible writing, well-formed characters; Clean and neatly bound in a report cover	Legible writing, some ill-formed letters, print too small or too large; papers stapled together	Illegible writing; loose pages	Same as below standard
Timeliness	Report on time	Report one class period late	Report two class periods late	Report more than one week late	Report more than 10 days late

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY101			**Title**	**Batch:**	2023 – 2026
				CC –I	**Semester:**	I
Lecture Hrs./Week	6	**Tutorial Hrs./Sem.**	--	Nonchordata	**Credits:**	5

Course Objective

To understand the nonchordates animal groups under different phyla in animal kingdom

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the outline classification of nonchordata	K1
CO2	Understand the structure and inter-relationship between nonchordate animals.	K2
CO3	Deploy the each phylum general characters with an example	K3
CO4	Discuss the general topics of each phylum	K4
CO5	Assess the internal structure of nonchordate organisms	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	L	L	-	H	-	H	H	M
CO2	H	H	L	-	H	-	M	H	L
CO3	M	M	M	-	H	-	L	H	M
CO4	H	L	M	-	H	-	L	H	M
CO5	M	H	H	-	H	-	H	H	L

Units	Content	Hrs
Unit I	• Outline Classification of Nonchordata up to class level • General characteristics of phylum Nonchordata • **Phylum Protozoa:** *Paramecium caudatum* – Structure- Feeding- Binary fission and Conjugation. o *Protozoa in Human Diseases* *	**18**
Unit II	• **Phylum Porifera** : *Leucosolenia* - Structure - Reproduction and Life cycle o Canal system in sponges. • **Phylum Coelenterata:** *Obelia geniculata* – Structure - Reproduction and Life cycle. o Coral reef types and Formation • **Phylum Platyhelminthes:** *Taenia solium* – Structure Reproductive system and Life cycle. o Parasitic adaptations in Helminth worm	**18**
Unit III	• **Phylum Aschelminthes:** *Ascaris lumbricoides* –Structure – Excretory system-Reproductive system and life cycle • **Phylum Annelida** : *Megascolex mauritti*– Structure - Digestive system - Excretory system and Reproductive system. o Metamerism in Annelids	**18**

Unit IV	• **Phylum Arthropoda**: *Periplanata americana*– Structure - Mouth parts – Digestive – Respiratory – Circulatory - Nervous and Reproductive systems. o Peripatus as a Connecting Link. • Arthropod Vectors and Human diseases.	**18**
Unit V	• **Phylum Mollusca**: *Pila globosa*– Structure Respiratory system and Reproductive Systems. • *Economic importance of Mollusca** • **Phylum Echinodermata** : *Asterial rubens* – Structure- Digestive system Water vascular system and Reproductive system. o Larval forms of Echinoderms and their significance.	**18**
	Total Contact Hrs	**90**

** denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Kotpal R.L. Modern Text Book of Zoology, Rastogi Publications.Meerut (2014)

Reference Books

1. Nair N.C., Leelavathy S., Soundarapandian N and Arumugam, N. A text book of Invertebrates– Saras Publication, Nagercoil. (2022)
2. Ekambaranatha Iyyer, A Manual of Zoology, Part I & II, Invertebrata, 5th edition Volume I and II. S. Viswanathan (Printers and Publishers) (2016)
3. Jordan E.L & Verma J. K Invertebrate Zoology, S. Chand & Company, New Delhi. (1995)
4. Dhami P.S & Dhami J.K Invertebrate Zoology, S. Chand & Company (1990)
5. Ganguly B.B Sinha.A & Adhikari.S Biology of Animals, Vol –I, Invertebrates, 3rdEdition, New Central Book Agencies. . (1977)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Ms.S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY203			**Title**	**Batch:**	2023 – 2026
				CC Lab –I Nonchordata & Chordata (Non semester Pattern)	**Semester:**	I & II
Practical Hrs./Week	3	**Tutorial Hrs./Sem.**	--		**Credits:**	3

Course Objective

To understand the nonchordate animal groups under different phyla in animal kingdom

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember external and internal features of organisms	K1
CO2	Understand the unity of life with the rich diversity of organisms and their ecological, and evolutionary significance	K2
CO3	Evaluate the conservation awareness of the biosphere by field visit	K3
CO4	Acquire knowledge about biological significance of organisms	K4
CO5	Analyse the reasons for classification of organisams	K4

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	M	-	H	-	H	H	M
CO2	H	H	L	-	H	-	M	H	M
CO3	H	H	M	-	H	-	L	H	M
CO4	M	H	L	-	H	-	L	H	L
CO5	H	H	M	-	H	-	L	H	M

CONTENT

1. Virtual/ Dissection practical

Identifying the virtual specimen exposed in monitor dissect the virtual specimen and dissect the Specimen label it and comment on it with suitable diagram

1. Nonchordata – Cockroach Dissection

- External Male
- External Female
- Digestive system
- Nervous system
- Male Reproductive system
- Female Reproductive system

2. Chordata – Frog and Fish

- Fish -Digestive system
- Fish - Placoid scale
- Frog - Digestive system
- Frog - Limbs
- Frog - Male Urino-genital system
- Frog - Female Urino-genital system

2. SPOTTERS

A. Classify giving reasons:

1) *Paramecium caudatum*
2) *Leucosolenia*
3) *ObeliaColony*
4) *Taenia solium*
5) *Ascaris lumbricoides*
6) *Megascolex mauritti*
7) *Scorpion*
8) *Pila globosa*
9) *Asterial rubens*
10) *Scoliodon sorrakowah*
11) *Calotes versicolor*
12) *Columba livia*
13) *Oryctolagus cuniculus*

B. Draw labeled sketch:

1) L.S.of *Leucosolenia*
2) *Obelia Medusa*
3) T.S of *Taenia solium*
4) T.S of Earthworm
5) Cockroach- Mouth parts
6) Frog – Pectoral girdle
7) Frog – pelvic girdle
8) Poison apparatus – snake
9) Pigeon – flight muscle
10) Rabbit Brain

C. Biological significance:

1) Sponge Gemmule
2) *Peripatus*
3) *Limulus*
4) Bipinnaria Larva
5) *Balanoglossus*
6) *Amphioxus*
7) Axolotl larva
8) Hyla
9) Chamaeleon
10) Bat

D. Write descriptive notes:

1) *Taenia solium* – Scolex
2) Earth worm - setae
3) Penaeus
4) Pila – Radula
5) Sea horse
6) Rhacophorous
7) Draco
8) Cobra
9) Monotremes - Echidna
10) Marsupials – Kangaroo

3. Field visit and report submission along with record Field Visit/Project (Select A or B option) The student has to maintain a log book showing the progress of the field/project work, duly signed by the supervising teacher and may be shown to the external examiner at the time of end of semester practical examination. **A. Individual activity** Identification of invertebrate and vertebrate species available in our area/field without disturbing the natural habitat Field/project/tour report and photographs to be submitted **B. Group Activity** A maximum of three students can choose any one group of activity any matter of zoological interest and submit the report for external practical examination. **Viva** Experiences of field visit and report preparation should be present.	
4. Record	
Total Contact Hrs	**90**

Pedagogy

Direct Instruction, Digital Presentation, Hands on Training

Assessment Methods:

Record, Practical Skills, Observation note

Mark Distribution:

Total Marks	Internal(CIA)	Marks	End of semester Practical Examination (ESE)	Marks
75	Practical Skill/observation note	5	Experiments Virtual dissection – Non Chordata Virtual Dissection - Chordata	15
			Spotters	20
	Model Practical Examination	20	Field Visit Report Submission- Campus Biodiversity	5
	Record work	5	Record	5
	Total Marks	**30**	**Total Marks**	**45**

Reference Books

1. Lal, S. S. A text book of Practical Zoology Invertebrate. Rastogi Publications, Shivaji Road, Meerut, India (2004)
2. Lal, S. S. (2004) A text book of Practical Zoology Vertebrate. Rastogi Publications, Shivaji Road, Meerut, India
3. www.froguts.com
4. www.sciencelass.com
5. www.ento.vt.edu.
6. www.petaindia.com
7. www. digi frog. Com

Course Designed by	Verified by HoD	Verified by CDC Coordinator	Verified by COE
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Ms.S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UBY1A1			**Title:**	**Batch:**	2023– 2026
				GE I : Allied Botany paper I Invertebrates and Vertebrates (For I B. Sc., Botany Program)	**Semester :**	I
Lecture Hrs /Week	6	**Tutorial Hrs/Sem.**	--		**Credits:**	4

Course Objective

The students are able to analyze the levels of organization and general characters of various invertebrate and vertebrate phyla.

Course Outcomes

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

CO **Number**	**CO Statement**	**Knowledge Level**
CO1	Keep in mind the outline classification of Invertebrates and Vertebrates	K1
CO2	Understand the structure and inter-relationship between Invertebrates and Vertebrate animals.	K2
CO3	Assess the each phylum general characters with an example	K3
CO4	Analyze the biodiversity of Invertebrates and Vertebrates	K4
CO5	Evoluate invertebrate and vertebratetheir affinities and adaptations to different modes of life.	K5

Mapping

PO /PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**
CO1	H	H	M	L	M	L	H	H	H
CO2	H	H	L	L	M	L	H	H	M
CO3	H	M	M	M	L	M	H	M	H
CO4	H	H	L	M	L	M	H	H	M
CO5	H	M	H	L	M	M	H	M	M

Units	**Content**	**Hrs**
Unit I	Outline classification of Phyla up to the class level • Phylum Protozoa: *Paramecium caudatum*– Structure- Feeding- Binary fission and Conjugation. • Phylum: Coelenterata: *Obelia geniculata* – Structure and Life cycle.	18
Unit II	• Phylum Platyhelminthes: *Taenia solium* – Structure - Reproduction and Life cycle. • Phylum Arthropoda: *Periplanata americana* – Structure- Mouthparts, Digestive system –Nervous system and Reproductive system.	18

Unit III	• Phylum Mollusca *:Pila globasa* – Structure – Digestive system- Respiratory system-Nervous system – Reproductive system. • Phylum Echinodermata: *Asterial rubens*– Structure and Water Vascular system.	18
Unit IV	• Phylum Chordata • Sub Phylum: Prochordata – General Characters of o *Branchiostoma lanceolatum*(Amphioxus) o *Balanoglossus glavigerous* o *Herdmania pallida* (Ascidian) • Sub Phylum Vertebrata Class : Pisces Shark - External structure* – Digestive & Urinogenital system • Class Amphibia: *Rana hexadactyla* – External structure – Respiratory system, Brain –Reproductive system.	18
Unit V	• Class Reptilia: *Calotes versicolar* –structure– Circulatory system – Reproductive system. • Class Aves: *Columba livia* –structure – Flight muscles – Digestive system - Respiratory system • Class Mammal: *Oryctolagus cuniculus* – structure* – Heart – Reproductive system	18
	Total contact hours	**90**

** denoted as self study topic*

Pedagogy

Direct Instruction, Google classroom, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Kotpal R.L. Modern Text Book of Zoology, 12th Edition Rastogi Publications.Meerut (2022)
2. Jordan E.L and Verma, P.S Invertebrate Zoology S. Chand S. Chand & Company LTD., Ram Nagar, New Delhi. 110055. (2021)
3. Jordan, E.L. and Verma, P.S. Chordate Zoology. S. Chand & Company LTD., Ram Nagar, New Delhi. 110055. (2021)

Reference Books

1. Arumugam N. Allied Zoology Part I & Part – II – Saras Publications, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari (2020)
2. Ekambaranatha Iyer, M..& Ananthakrishnan, T. N. Outlines of Zoology, 5 th edition volume I & II, Vishwanathan Printers and Publishers Private Limited, Chennai (2003)
3. Jordan E.L & Verma J.K. Invertebrate Zoology, S. Chand & Company Ltd, Ram Nagar, New Delhi (1997)
4. Dhami P.S & Dhami J.K. Invertebrate Zoology, S. Chand & Company (1995)
5. Nigam Shoban I Naginhand H.C. Biology of Non-Chordates, Shoban I Nagin hand & Co Educational & Publishers (1995)
6. Ganguly B.B. Sinha. A &Adhikari.S. 3rd Edition Biology of Animals, Vol. –I, Invertebrates, New Central Book Agencies (1977)

Course Designed by	Verified by HoD	Verified by CDC Coordinator	Verified by COE
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr.S.Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme code:	B. Sc.,			**Programme Title :**		Bachelor of Zoology	
Course Code:	23UBY2A3			**Title**		**Batch :**	2023 – 2026
				GE Allied Lab-I- Zoology Practical – (Paper I & II)For B. Sc., Botany Program		**Semester:**	I & II
Practical Hrs/ Week	**2**	**Tutorial Hours/ Sem**	**--**			**Credits:**	**2**

Course Objectives

To get the knowledge on biological systems through virtual dissection, analyzing the results and discussing the economic importance observation pertain to various animal specimen and develop skills in identifying fauna in campus

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember external and internal features of organisms	K1
CO2	Understand the unity of life with the rich diversity of organisms and their ecological, and evolutionary significance	K2
CO3	Evaluate the conservation awareness of the biosphere by field visit	K3
CO4	Acquire knowledge about biological significance of organisms	K4
CO5	Analyse the reasons for classification of organisams	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	M	-	M	M	H	H	M
CO2	H	H	M	-	M	L	H	H	M
CO3	H	M	M	-	L	L	H	H	H
CO4	H	H	L	-	L	M	H	M	M
CO5	H	M	H	-	M	M	H	H	L

CONTENT

1. Virtual/ Dissection

Identifying the virtual specimen exposed in monitor /dissect the virtual specimen and label it and comment on it with suitable diagram

1. **Nonchordata – Cockroach**
   - External structure Male and female Cockroach
   - Mouth Parts of cockroach
   - Digestive system
   - Nervous system
   - Reproductive system of Male
   - Reproductive system of female

2. **Chordata – Frog**
   Fish- Tilapia
   - External features
   - Digestive system
   - Heart, Brain and limbs
   - Male and female urinogenital system

2. SPOTTERS **A. Classify giving reasons:** 1) Paramecium 2) Obelia colony 3) Penaeus 4) Sea star 5) Amphioxus *6) Calotes versicolar* 7) Pigeon (*Columba livia*) 8) Rabbit *(Oryctolagus cuniculus*)	
B. Draw labeled sketch: 1) Leucosolenia 2) *Taenia solium* – Scolex 3) Octopus 4) Frog – Pectoral girdle 5) *Calotes versicolor* – Brain 6) Pigeon –Flight Muscle 7) Rabbit – Dentition 8) Human – Digestive system	
C. Biological significance: 1) Obelia Medusa 2) Earthworm 3) Honey bee 4) Mosquito 5) Silk worm 6) Balanoglossus Salamander 7) Salamander 8) Kangaroo	
D. Write descriptive notes: 1) Paramecium – conjugation 2) Silkworm's silkgland 3) Peripatus 4) Sea horse 5) Gold fish 6) Tortoise 7) Owl 8) Bat	
3. Identification of fauna and report submission	
4. Record	
Total Contact Hrs	**60**

Pedagogy

Direct Instruction, Digital Presentation, Hands on training

Assessment Methods:

Record , practical skills, observation note

Mark Distribution:

Total Marks	Internal(CIA)	Marks	End of semester Practical Examination (ESE)	Marks
100	Practical Skill/observation note	10	Experiments Virtual dissection – Non Chordata Virtual Dissection – Chordata	20
			Spotters	20
	Model Practical Examination	30	Field Visit Report Submission- Campus Biodiversity	10
	Record work	10	Record	10
	Total Marks	**40**	**Total Marks**	**60**

Reference Books

1. Arumugam . N. Practical Zoology Invertebrata Volume -I First edition. Saras publication, Nagarcoil, Kanyakunari (2020)
2. Arumugam .N. Practical Zoology Chordata Volume -II First edition. Saras publication, Nagarcoil, Kanyakunari (2018)
3. www.froguts.com
4. www.sciencelass.com
5. www.ento.vt.edu.
6. www.petaindia.com
7. www. digifrog. com

Course Designed by	Verified by HoD	Verified by CDC Coordinator	Verified by COE
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr.S.Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY202			**Title**	**Batch:**	2023 – 2026
				CC–II Chordata	**Semester:**	II
Lecture Hrs./Week	6	**Tutorial Hrs./Sem.**	--		**Credits:**	4

Course Objectives

To acquire a basic knowledge of chordates and biodiversity of Organisms

Course Outcome

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

CO Number	CO Statement	Knowledge Level
CO1	Keep in mind the outline Classification of Chordata	K1
CO2	Understand the morphology of Chordata	K2
CO3	Execute inter-relationship between each class	K3
CO4	Analyse the biodiversity of chordata	K4
CO5	Discuss the internal structure of chordate and its function	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	M	-	H	-	H	H	M
CO2	H	M	M	-	H	-	M	H	M
CO3	M	M	M	-	H	-	H	H	M
CO4	H	M	M	-	H	-	H	H	M
CO5	M	H	H	-	H	-	H	H	M

Unit	Content	Hrs
Unit I	**General characters and outline classification of Phylum Chordata up to class level with suitable examples.** General characters and affinities of o *Branchiostoma lanceolatum*(Amphioxus) o *Balanoglossus glavigerous* o *Herdmania pallida* (Ascidian) • **Class Pisces Type study – *Scoliodon*-** External- Placoid scale - Digestive system - Respiratory and - Excretory system - Reproductive system o ***Parental care in Fishes****	**18**
Unit II	• **Class Amphibia Type study – *Rana hexadactyla*-** External - Girdles and Limbs - Digestive system -Respiratory system – Heart- Brain – Excretory system- Reproductive system. • Origin of Amphibia.	**18**
Unit III	• **Class Reptilia Type study– *Calotes versicolar*-**Externals - Digestive system – Brain- Excretory system- Reproductive system	**18**

	○ Poisonous and Non-Poisonous Snakes. ○ Poison apparatus and biting mechanism in Snakes ***First –Aid for Snake Bite.****	
Unit IV	• **Class Aves Type study – *Columba livia*-** External – Synsacrum - Flight muscles - Digestive system - Respiratory system- Brain- Eye and Urino – genital system. ○ Flight adaptation ○ Migration in Birds	**18**
Unit V	• **Class Mammalia Type study – *Oryctolagus cuniculus* -** External– Heart – Brain – Digestive system - Excretory system – Reproductive system • **Salient features of** ○ Protheria ○ Metatheria ○ Eutheria	**18**
Total Contact Hrs		**90**

** denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. R.L.Kotpal Modern text book of Vertebrates, (3rd Edition), Rastogi Publications.Meerut (2012)
2. Jordan, E.L. and Verma, P.S. Chordate Zoology. S. Chand & Company LTD., Ram Nagar, New Delhi. 110055. (2006)

Reference Books

1. Thangamani, A., Prasanna kumar, S., Narayanan, L.M., and Arumugam, N. A text book of Chordata, Saras publications, (10th Edition)114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari(2022)
2. Ekambaranatha Iyer, Manual of Zoology, Vol.II (6h Edition). S.Viswanathan PVT Ltd., Parts I & II. Viswanathan & Co. (2008)
3. Jordan, E.L. and Verma, P.S. Chordate Zoology. S. Chand & Company LTD., Ram Nagar, New Delhi. 110055. (2006)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Ms. S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme code:	B. Sc.,			**Programme Title :**	Bachelor of Zoology
Course Code:	23UBY2A2			**Title**	**Batch :** 2023 – 2026
				GE-II -Allied : Botany Paper II Economic Zoology	**Semester:** II
Lecture Hrs/Week	6	**Tutorial Hours/ Sem**	---		**Credits:** 4

Course Objectives

To acquire the knowledge on application of zoology in the field of aquaculture, apiculture, dairy farming, sericulture, poultry keeping, and pest and pest management.

Course Outcomes

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

CO Number	CO Statement	Knowledge level
CO1	Remember the knowledge of applied aspects of biological sciences	K1
CO2	understand the rearing methods of beneficial organisms – an economic perspectives	K2
CO3	Apply the knowledge of Culture of oyster, Honey bee, Silkworm and poultry management in marketing field.	K3
CO4	Analyze the diseases and control measure of beneficial organism.	K4
CO5	Start their own agro based industries and business in applied biology	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	L	M	M	H	H	H	H
CO2	M	L	L	L	H	M	H	M	M
CO3	M	L	M	M	M	H	H	M	H
CO4	H	M	L	L	M	H	H	H	H
CO5	H	M	M	L	L	M	H	M	M

Units	Content	Hrs

Unit I	**AQUACULTURE**
	• Scope of Aquaculture
	  • Type of Fisheries - Inland fisheries and Marine fisheries
	  • Culturable organisms - Fin fishes
	  • Diseases of Fish
	  o Bacterial - Erythroderma , Bacterial Gill Rot
	  o Viral - EUS,IPN, VHS
	  o Fungal - Saprolegniasis
	  • Oyster culture - Edible oyster and Pearl oyster
		18

Unit II	**APICULTURE** • Scope of Apiculture • *Apis indica, Apis. mellifera and Apis dorsata* • Products of Bee Keeping - Royal jelly, Honey, Wax and Bee venom **DAIRY FARMING** • Scope of dairy farming • A typical dairy farm	**18**

	• Dairy animals: cow • Live stock diseases - Mastitis and Foot and Mouth disease(FMD) • *Nutritive value of milk** • Dairy By-products	
Unit III	**SERICULTURE** • Scope of sericulture • Optimum conditions for mulberry growth • Vegetative preparation – Stem cutting • Structure of silkworm • Structure of silk gland • Life cycle of *Bombyx mori* • Rearing appliances • Disinfection • Diseases of silkworm -Pebrine and Viral flacherie • Cocoon market	**18**
Unit IV	**POULTRY KEEPING** • Scope of poultry • Construction of poultry house • Rearing of Broilers and Layers • Diseases of poultry 1. Fowl pox 2. Coccidiosis 3. Ranikhet disease 4. Bird Flu • *Nutritive value of Egg**	**18**
Unit V	**PEST MANAGEMENT** • Scope of Pest management • Types of Pest • Pest of coconut, Sugarcane and Paddy • Vectors o *Culex quinquefasciatus*(Mosquito) o *Cimex lectularius* (Bedbugs) o *Pediculus capitis* (Head lice) • Methods of pest control - biological, chemical and cultural • Integrated pest Management	**18**
Total Contact Hrs		**90**

** denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Tarit Kumar Banerjee, Applied Zoology, New central book agency pvt. ltd. Kolkata (2017)
2. Shukla & Upadhya, Economic Zoology - Rastrogi Publication, Shivaji Road, Meerut (2001)

Reference Books

1. Arumugam, N. Applied Zoology, Saras Publication, 114/35 G ARP Camp Road, Periavilai, Nagercoil, (2020)
2. Arumugam, N Economic Zoology, Saras Publication, 114/35 G ARP Camp Road, Periavilai, Nagercoil, 1st edition, (2013)
3. Ezhili, N. & Thirumathal, K A hand book for sericulture, Shrishti Impression,Coimbatore . (2008)
4. Tripaty, S.N. Food biotechnology. Doarinant Publishing and distributions, New Delhi. (2004)
5. Ganga and Sulochana Chetty, An introduction to sericulture, 2nd Edition, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi (1999)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr.S.Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23EVS201			**Title**	**Batch:**	2023 – 2026
				AECC I- Environmental Studies (EVS)	**Semester:**	II
Lecture Hrs./Week	2	**Tutorial Hrs./Sem.**	12		**Credits:**	2

Course Objective

To know the basic concepts of Environment, environmental legislations and conservation of biodiversity

Course Outcomes

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

CO Number	CO Statement	Knowledge level
CO1	Create an awareness about the Environment	K1
CO2	Get the idea on Environment conservation and management.	K2
CO3	Execute the pollution free environment and value of natural resources	K3
CO4	Evaluate the value of environment and social issues	K4
CO5	Acquire knowledge about biodiversity, human population and environment	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	L	H	M	M	M	M	H	H
CO2	M	M	H	M	L	M	M	H	M
CO3	H	L	M	L	M	L	H	H	H
CO4	H	M	H	M	L	M	M	M	M
CO5	M	M	M	L	L	L	M	H	H

Units	Content	Hrs
Unit I	**The Multidisciplinary nature of Environmental Studies**: • Introduction • Scope of Environmental Studies • Need for Public Awareness **Natural Resources** : • Types of Natural Resources • Natural resources and associated problems a. Forest resources b. Water resources c. Mineral resources d. Food resources *e. Energy resources** • Role of an individual in conservation of natural resources case studies	**6**

Unit II	**Ecosystems:** • Concept of an ecosystem • Structure and function of an ecosystem • Energy flow in the ecosystem • Ecological succession • Structure and functions of a) Aquatic ecosystems b) Terrestrial ecosystems **Biodiversity and its conservation:** • Introduction • Genetic diversion • Species diversion • Value of Biodiversity • Hot – Spots of Biodiversity • Threats to biodiversity • Endangered and Endemic Species of India • Conservation of biodiversity	**6**
Unit III	**Environmental Pollution:** • Causes, effects and control measures of a. Air Pollution b. Water pollution c. Soil pollution *d. Noise pollution* * e. Thermal pollution f. Radioactive pollution • Pollution case studies **Solid waste management**: • Causes, effects and control measures • Role of individual in prevention of pollution	**6**
Unit IV	**Disaster management:** Floods, Earthquake, Cyclone and Landslides **Social issues and environment:** • Sustainable Development • Urban problems related to energy • *Rainwater harvesting* * • Environmental Ethics • Global warming	**6**
Unit V	**Environmental Legislations and Acts:** a. Environment (Protection) Act b. Air (prevention and control of pollution) Act c. Water (Prevention and control of pollution) Act d. Wildlife protection Act e. Forest conservation Act **Human Population and Environment:** • Population growth and explosion • Environment and Human health • Value education • Role of Information Technology in Environment and Human health	**6**
	Total Contact Hrs	**30**

** denoted as self study topics*

Pedagogy

Direct Instruction, Power point Presentation, subject videos, case studies

Assessment Methods:

Seminar, Assignments, Group Task.

Field work

- Visit to local area to document environmental assets river / forest / Grassland Mountain
- Visit to a local polluted site – urban / rural / industrial / agricultural

Text Book

1. N.Arumugam, M.Durairaju and V.Kumaresan – Environmental Studies – (2021 Reprint)

Reference Books

1. Odum E. P - Fundamentals of ecology - W. B. Saunders Company, London - 1st edition, (1971)
2. Verma and Agarwal.- Principles of Ecology - S. Chand & Company, Ltd. New Delhi, 110055 - 5th edition (2003).
3. Agarwal, K.C - Environmental Biology - Nidi Publ. Ltd. Bikaner (2001).
4. Bharucha Erach - The Biodiversity of India, Mapin Publishing Pvt. Ltd. , Ahmedabad -13, India, Email: mapin@icenet.net, ISBN-10: 1890206407 (2006).
5. Clark R.S - Text book in Marine Pollution, Clanderson Press Oxford (TB) - 5th Edition, (2001).
6. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T - Environmental Encyclopedia, Jaico Publ. House. Mumbai, 1196p (2001).

Course Designed by	Verified by HoD	Verified by CDC Coordinator	Verified by COE
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Dr. S. Mariselvi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY304			**Title**	**Batch:**	2023 – 2026
				CC III - Cell Biology	**Semester:**	III
Lecture Hrs./Week	6	**Tutorial Hrs./Sem.**	--		**Credits:**	5

Course Objectives

To study the basic concepts, principles, techniques and recent development of cell biology

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the structural and functional aspects of basic units of life	K1
CO2	Understand the overview of cells and organs that control biological system	K2
CO3	Apply the knowledge of origin, development and differentiation of different cells.	K3
CO4	Analyse the structure and functions of cell organelles.	K4
CO5	Evaluate the cell constituents and their biological activities.	K5

Mapping

PO /PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	H	L	M	H	M	H	H	H
CO2	M	H	M	L	M	L	H	M	H
CO3	M	M	M	M	H	M	M	H	M
CO4	M	H	M	M	H	M	H	M	H
CO5	H	M	M	L	M	H	M	M	M

Units	Content	Hrs

Unit I	• Scope of Cell Biology
	• **Cell Theory**: Salient features of cell theory
	  ○ Protoplasm theory
	  ○ Germplasm theory
	  ○ Organismal theory.
	• **Cytological techniques:** Fixation –Dehydration –Embedding - Sectioning - Staining and Mounting
	• Prokaryotic cell (*E.coli* bacterium)
	• *A typical animal cell*
		18

Unit II	• Corona virus –SARS-CoV-2 • **Organelles**: **Plasma membrane** Structure – Trilaminar model - Bimolecular leaflet model and Fluid mosaic model and functions of plasma membrane. • **Endoplasmic Reticulum**: Ultra Structure – Rough and Smooth types - Functions. • **Ribosomes**: Types – Chemical composition – Biogenesis of 70S – Biogenesis of 80S -Function	**18**
Unit III	• **Golgi complex**: Structure and Functions. • **Lysosomes**: Polymorphism and Functions • **Mitochondria**: Structure - Origin of mitochondria– General functions.	**18**

	• **Nucleus**: Ultra structure of interface nucleus and function. • **Nucleolus**: Ultra structure and function • **Centrosomes:** Structure and functions	
Unit IV	• **Chromosomes**: Structure **–** Types – Chemical composition of chromosomes. • **Nucleic acids** DNA Structure (Watson & Crick model) o Types and replication of DNA (Semi-conservative model) • **Protein synthesis -** o Central dogma and Central dogma reverse o Mechanism of protein synthesis • Transcription and Translation. • **Genetic Code** – Salient features	**18**
Unit V	• **Cell division** o Cell cycle o Amitosis, Mitosis and Meiosis • **Cell signaling:** o Characteristics and Cell transduction pathways • **Cancer cells** o Characteristics – Properties –Types - Diagnosis and Treatment o Oncogenes. • ***Cell aging*** *- Causes – Changes and Apoptosis**	**18**
	Total Contact Hrs	**90**

**denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Ajay Paul - A Text Book of Cell and Molecular Biology, Books and Allied Pvt.Ltd. Kolkata (2020)

Reference Books

1. Arumugam N. - Cell Biology — Saras Publication, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari – (2021)
2. Aminul Islam - Essentials of Cell biology. Books and Allied Pvt.Ltd. Kolkata - (Reprint 2019)-
3. C.P.Powar - Cell Biology – Himalaya Publishing House, Mumbai, (2018)
4. E.D.P. De Robertis and E.M.F. De Robertis Jr - Cell and Molecular Biology –, Lippincott Williams and Williams Publishers - 8th Edition, (2017)
5. Singh and Tomar - Cell Biology – Rastogi Publications, Shivaji Road, Meerut - 10th Rev.Edi (2012)
6. P.S. Verma and V.K Agarwal - Cell Biology, Genetics, Molecular biology, Evolution and Ecology – S.Chand & Company, New Delhi – (2012).
7. Singh & Tomar - Cell Biology –Rastogi Publications, Shivaji road, Meerut – 250 002, India - 9th revised edition –(2008)
8. Verma P.S.and.Agarwal V.K - Cell Biology , Genetics, Molecular Biology, Evolution and Ecology–S.Chand and Company LTD. Ram Nagar, New Delhi -110055 – (2006)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Mariselvi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY406			**Title**	**Batch:**	2023 – 2026
				CC Lab – II Cell Biology and Genetics (Non Semester Pattern)	**Semester:**	III & IV
Practical Hrs./Week	3	**Tutorial Hrs./ Sem.**	10		**Credits:**	3

Course Objectives

To be able to perform experiments using the common tools of cell biology and the basic concepts in genetics.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the concepts of genetics through experiments.	K1
CO2	Understand the practical experience in instrument handling	K2
CO3	Apply the laboratory test outcomes and determine the validity of the test results obtained.	K3
CO4	Analyse the different stages of cell divisions and genetic disorders in human	K4
CO5	Evaluate the role of chromosomes in sex determination and inheritance of X and Y linked genes	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	H	M	M	M	H	H	M	H
CO2	H	H	M	M	H	L	M	M	M
CO3	H	M	L	H	M	M	H	H	M
CO4	M	H	M	H	H	M	H	M	H
CO5	H	H	M	M	M	M	H	M	M

	Content	Hrs
	EXPERIMENTS • Measurements of cell using - Stage Micrometer and Ocular Micrometer • Squash preparation of Onion root tip • Identification of squamous epithelial cells in buccal smear. • Human Traits survey and gene frequency calculations. • ABO Blood grouping in man. • Probability Test – Two coin tossing experiment. • Law of Segregation – Using color beads. • Law of Independent Assortment – Using color beads. **SPOTTERS:** **CELL BIOLOGY** 1. *E. coli* Bacterium 2. Corona virus –SARS-CoV-2 3. A typical animal cell 4. Interface Nucleus 5. Lamp brush chromosome 6. Polytene Chromosome 7. Mitosis – stages 8. Meiosis - stages 9. DNA – Watson & Crick Model 10. Cancer cells	

	11. Structure of tRNA 12. Structure of haemoglobin **GENETICS** 1. Drosophilla – Male and Female 2. Gynandromorph 3. Hairy Pinna 4. Erythroblastosis foetalis 5. Kleinfelter's syndrome 6. Down syndrome 7. Turner's syndrome 8. Twins 9. Free – martin cattle 10. Sickle cell anemia 11. Atavism 12. Pedigree analysis	
	Record	
	Total Contact Hrs	**90**

Pedagogy

Direct Instruction, Digital Presentation, Hands on Tranining, Survey

Assessment Methods:

Record, Practical Skills, observation Note

Mark Distribution:

Total Marks	Internal(CIA)	Marks	End of semester Practical Examination (ESE)	Marks
75	Practical Skill/observation	5	Experiments ; Major practical	15
			Minor Practical	5
	Model Practical Examination	20	Spotters	20
	Record work	5	Record	5
	Total Marks	**30**	**Total marks**	**45**

Reference Books

1. Lal, S. S. - A text book of Practical Zoology. Rastogi Publications, Shivaji Road, Meerut , (2008)
2. Mohan.P.Arora - An Introduction to Genetics, Vol.I (Theory and Practical), Himalaya Publishing House, (2011)
3. J.Sinha, A.K. Chatterjee, P. Chattopadhyay - Advanced Practical Zoology, Books and Allied Company, Kolkata, (2011)
4. Jaysura and Arumugam. N - Practical Zoology Vol.3 Saras Publication, Nagarcoil, Tamil Nadu – (2013)
5. Jaysura and Arumugam. N - Practical Zoology Vol.3 Saras Publication, Nagarcoil, Tamil Nadu – (2017)

Course Designed by	Verified by HoD	Verified by CDC Coordinator	Verified by COE
Name and Signature	**Nameand Signature**	**Nameand Signature**	**Name and Signature**
Dr. S. Mariselvi Signature:	Dr.S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY 3N1			**Title**	**Batch:**	2023 – 2026
				Non major Elective –I Public Health and Hygiene	**Semester:**	III
Lecture Hrs./Week	1	**Tutorial Hrs./Sem.**	--		**Credits:**	2

Course Objectives

To study the importance of health and hygiene for the society and keep in mind the maintenance of our body

Course Outcomes

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

Number	CO Statement	Knowledge Level
CO1	Remember the Health awareness and Hygiene	K1
CO2	Understand the reasons for the diseases	K2
CO3	Implement the nutrient requirments for day today life	K3
CO4	Discuss the importance of nutrition and its classification	K4
CO5	Acquire the knowledge of deficiency diseases of protein , lipids and vitamins and Health programming	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	M	M	M	M	M	H	M	H
CO2	M	H	L	L	M	L	H	H	M
CO3	L	M	H	L	L	M	M	M	M
CO4	M	M	M	M	M	L	L	M	M
CO5	L	H	L	L	L	M	M	H	M

Units	Content	Hrs
Unit I	• Introduction to public health • **Health indicators** *Personal hygiene, Public health** • **Health** Dynamics of disease transmission eg. Malaria, – host, vectors and environment	**3**
Unit II	• Concepts of Health and diseases • **Nutrition and Health** Classification of food (Macro &Micro nutrients) • Balanced diet • Vitamins	**3**
Unit III	• Nutrition deficiency disease • Lipid deficiency diseases o Dermatitis o Fucosidosis • Protein deficiency diseases o Kwashiorkar o Marasmas • Vitamin deficiency disorders	**3**

Unit IV	• **Communicable diseases** o Viral Disease-Measles o Bacterial Disease- Cholera • **Non-Communicable Diseases** o Coronary heart Disease (CHD) o Diabetes	**3**
Unit V	• **Health Education**: o Health care services in India o Health Planning and Programmes in India o Role of World Health Organization (WHO) in health education • *First Aid and Nursing** o Methods, Dressing, Care & Duties.	**3**
Total Contact Hrs		**15**

** denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Nelson, D.L. & Cox, M.M. (2017) Lehninger Principles of Biochemistry (7th edition) Worth. (2017)
2. Park and Park, Text book of Preventive and Socio Medicine. M/S. Banarsidas Bhanot Publishers, Jabalpur(1995)

Reference Books

1. Srilakshmi, B. 5th edition. Food Science, New age International Publishers, New Delhi (2012)
2. Rastogi S. C. Biochemistry .Tata McGraw Hill Publishing Co. Ltd. (2003)
3. Verma S. Medical Zoology. Rastrogi Publications, New Delhi. (1998)
4. Jordon, E.L. and Verma. P.S. Invertebrate Zoology. 12th edn. Sultan Chand & Co(1995)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Ms.S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY3N2			**Title**	**Batch:**	2023 – 2026
				Non major Elective –I Practical skill in Human Health	**Semester:**	III
Lecture Hrs./Week	1	**Tutorial Hrs./Sem.**	--		**Credits:**	2

Course Objectives

To study the importance of health keep in mind the maintenance of our body

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the importance of laboratory test	K3
CO2	Understand the normal level of various human physiological parameters	K4
CO3	Apply the instruments used in biological experiment.	K5
CO4	Analyse the bleeding and clotting time of blood in invidiuals	K4
CO5	Evaluate the Knowledge of Blood grouping	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	L	L	L	H	M	H	H	H
CO2	H	M	M	L	M	H	H	H	M
CO3	M	M	M	M	H	M	H	M	H
CO4	M	M	M	H	H	H	H	H	H
CO5	M	M	M	M	H	M	H	H	H

Content

EXPERIMENTS

- Calculate the Body Mass Index
- Identify the Blood group of the individual
- Estimation of haemoglobin by using haemoglobinometer
- Preparation of Blood smear
- Bleeding time of blood
- clotting time of blood

Spotters

- Haemocytometer
- Albuminometer
- Automatic blood pressure monitor
- Urinometer
- Autoclave
- BP apparatus
- Stethoscope
- Glucometer

Total Contact Hrs **15 hours**

Text Book

1.Dutta, A. Experimental Biology A laboratory manual. Narosa Publishing House , New Delhi. (2009)
2.Ramnik Sood, Medical Laboratory Techniques, 5th edition. Jaypee Brothers Medical publishers (P) Ltd. Delhi, . (1999)

Reference Books

1. Vandana Puri, Praveen Kr Gupta. Complex review of Pathology and Haematalogy for NBE . 6th edition, CBS publishers, Delhi (2020).
2. Ajmani PS.Handbook of Clinical Laboratory Techniques . AITBS Publisher , India(2017)
3. Mukherjee. KL. Medical Laboratory Technology. Volume 1,2 and 3. Tata McGraw Hill education, India. (2010)
4. Talib VH, Khurana. Handbook of Medical Laboratory Technology , CBS publishers, Delhi(2009)
5. Varley H. Practical Clinical Biochemistry, CBS Publishers, Delhi (2008)

Course Designed by	Verified by HoD	Verified by CDC Coordinator	Verified by COE
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Ms.S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY3VA			**Title**	**Batch:**	2023 – 2026
				Value added Course I: Bio Farming	**Semester:**	III
Lecture Hrs./Week	1	**Tutorial Hrs./Sem.**	--		**Credits:**	2*

Course Objective

To understand the importance of vermiculture, external and internal structure of earthworm, nutrient value of vermicompost, preparation methods of vermibed and maketing of vermicompost

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the role of organisams in Modern Farming	K1
CO2	Construct the concepts and principles of biofarming	K2
CO3	Apply the knowledge of organisams in biofarming	K3
CO4	Analyze the potential of biocompost as an alternative to chemical fertilizers	K4
CO5	Evaluate the knowledge about various type of organisams in biofarming	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	M	H	M	M	H	H	M
CO2	H	H	M	H	M	L	M	M	M
CO3	H	L	L	H	M	L	M	M	H
CO4	M	M	L	H	H	H	H	M	H
CO5	H	M	M	M	L	M	M	M	M

Units	Content	Hrs
Unit I	**Soil as a natural medium** o Role of microorganisms in soil formation o Soil microorganisms o Symbiotic microbes and Crop production o Types of Soil	**3**
Unit II	**Types of Organisms in biofarming** o Azotobacter - Field applications and beneficial role of azotobater o Azospirillum- Field application o Blue green algae-Field application and crop response	**3**
Unit III	**Vermiculture** o *Economic importance of Vermiculture** o Collection of earth worms o Methods of vermicomposting o *Vermiwash*	**3**
Unit IV	o Indoor vermicomposting o Precautions need for vermicomposting o Biodegradable wastes used in vermiculture o Nutrient Content of vermicompost	**3**

Unit V	o Preparation of Vermibed o Maintenance of Vermibed o Collection of vermicompost o Marketing of vermicompost	**3**
Total Contact Hrs		**15**

**denoted as self study topics*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Seethlakshmi. M. and Santhi. R. Vermitechnology, Saras publication, Nagercoil, Tamilnadu. (2012)
2. Nair N.C., Leelavathy S., Soundarapandian N and Arumugam, N**.** A text book of Invertebrates – Saras Publication, Nagercoil, Tamilnadu(2018)

3. Mani. A., Selvaraj. A.M., Narayanan, L. M. and Arumugam, N. Microbiology. Saras publications, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari(2007)

Reference Books

1. Rana. S. V. S. Environmental biotechnology. Rastogi Publication. Meerut. India (2010)
2. Aravind Kumar. Verms and vermitechnology APH Publishing co-operation. (2005)
3. Gupta. P. K. Vemicomposting for sustainable agriculture. Agrobios. Jothpur. India (2005)
4. Ekambaranatha Iyyer, A Manual of Zoology, Part I & II, Invertebrata, Revised edition. S. Viswanathan(Printers and Publishers) (1990).
5. Odum, E. P Fundamentals of ecology W.B. Sanders Company, London(1971).

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Ms. S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY405			**Title**	**Batch:**	2023 – 2026
				CC – IV Genetics	**Semester:**	IV
Lecture Hrs./Week	6	**Tutorial Hrs./Sem.**	6		**Credits:**	5

Course Objectives

To Study the basic concepts of hereditary, genetic disorders, cancer and all applied aspects of genetics

Course Outcomes

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

CO Numbers	CO Statement	Knowledge level
CO1	Keep in mind the Mendals experiments and chromosomes	K1
CO2	Understand the chemical basis of heredity	K2
CO3	Deploy the heritable traits in families and populations	K3
CO4	Sort of genetic concepts including health and disorders of human	K4
CO5	Construct personal and family pedigrees and integrate genetic testing options in genetic counselling practices	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	H	M	M	M	M	H	H	H
CO2	M	H	M	M	M	L	M	M	M
CO3	H	M	L	M	M	M	H	M	H
CO4	H	H	M	H	H	L	M	H	M
CO5	H	H	L	H	H	M	H	M	M

Units	Content	Hrs
Unit I	• Mendel's Monohybrid and Dihybrid experiments • Mendel's Laws - Problems. • **Interaction of genes** Lethal genes and *Epistasis* • Polygenic inheritance: Skin colour in man 1:4:6:4:1 • **Multiple alleles** o Coat colour in rabbit o ABO blood groups in man o Rh factor	**18**
Unit II	• **Linkage** Complete and incomplete linkage • **Chromosome maps**: o Chromosome map in Drosophila (Three Point Cross) • **Sex determination**: o Homogametic and heterogametic o Hymenopteran type – Honey bee o Gynandromorph – *Drosophila melanogaster** o Hormonal control – Free Martin Cattle.	**18**
Unit III	• **Sex linked inheritance** o Haemophilia and colour blindness in man – problems o Hairy pinna in man. • Euploidy and Aneuploidy • Inbreeding and outbreeding • *Twins**	**18**

Unit IV	**Non-disjonction** o **Anomalies of Autosomes** – Down's syndrome and Patau's syndrome o **Anomalies of Allosomes**– Klienfelter's syndrome and Turner's syndrome • **Pedigree analysis** • **Inborn Errors of metabolism** o Phenylketoneuria, Alkaptonuria and Albinism • **Eugenics** • **Euphenics**	**18**
Unit V	• **Nucleic acids as genetic material:** - DNA as Genetic material: o Bacterial transformation o Bacterial conjugation o Bacteriophage infection o Transduction - RNA as Genetic material (TMV) • **Genetic counseling**	**18**
Total Contact Hrs		**90**

**- denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation, Problem solving.

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Veer Bala Rastogi - Genetics. Kendhranath, Meerut- 4th edition – 2020

Reference Books

1. Meyyan R. P. – Genetics – Saras Publications, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari - 15th Edition , (2021)
2. Ajay Paul – Text book of Genetics, Books and allied company, Kolkata – (2018)

3. Kottari, L., *et al*., - Essentials of Human Genetics. University Press Private Ltd. Hydrabad, 500029 - 5th edition – (2009).

4. Verma and Agarwal - Genetics. S. Chand & Company, Ltd. New Delhi, 110055 - 3rd edition – (2008).

5. Gupta, P. K - Genetics. Rastogi Publication, Meerut - 3rd edition – (2007).

6. Miglani G. S. - Advanced Genetics. Narosa Publishing House, New Delhi, 110002 - 1st edition – (2002).

7. Russell, J.- Essential Genetics. Black well Scientific Publication London - 2nd edition – (1987).

8. E.D. Garber - Cytogenetics – An Introduction. TATA McGRAW – Hill Publishing Company Ltd. New Delhi - (1979)

Course Designed by	Verified by HoD	Verified by CDC Coordinator	Verified by COE
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Mariselvi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23 UZY 4N3			**Title**	**Batch:**	2023 – 2026
				Non- Major Elective -II Food and Nutrition	**Semester:**	IV
Lecture Hrs./Week	1	**Tutorial Hrs./Sem.**	--		**Credits:**	2

Course Objective

To aquire knowledge on the nutritive values of various foods stuffs, importance of food chart, food borne diseases, adultarations and about food laws.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Recollect the concept of nutritive values of food.	K1
CO2	Understand the energy values of various food stuffs.	K2
CO3	Apply the importance of food chart.	K3
CO4	Analyze the food deficiency diseases	K4
CO5	Get the knowledge about importance of diet.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	L	M	--	--	M	M	M	M	H
CO2	--	--	--	L	L	L	M	H	M
CO3	--	--	--	L	--	M	M	M	L
CO4	L	L	M	M	--	M	L	M	M
CO5	--	--	--	L	--	L	M	H	M

Units	Content	Hrs
Unit I	• The scope of food and nutrition • Composition of food (Protein –Carbohydrate – Fat-Vitamins and Minerals) • Function and sources of food	**3**
Unit II	• Energy measurement - and energy values of various food • Nutritional requirements – children, adolescence, old age • Balanced diet and Glycemic index • *Digestion and absorption**	**3**
Unit III	• Nutrtiion and importance of o Hens Egg o Meat o Fish	
Unit IV	• Nutritional composition and importance of o Milk and Milk products o Vegetables o Fruits o Cereals and pulses	**3**

Unit V	• Food spoilage- Bacteria, Moulds, Yeasts • Food poisoning - Botulism, Staphylococcus • Adulteration of food • Food laws- Prevention of Food Adulteration Act, Essential Commodities Act	**3**
	Total Contact Hrs	**15**

**denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Anita Tull, 1st edition. Food and nutrition – Oxford University press. Cambridge (1987)
2. Srilakshmi, B. 5th edition. Food Science, New age International Publishers, New Delhi (2012)

Reference Books

1. Swaran Pasran Pasricvha, 1st edition. Count what you eat – NIN – Hyderabad (2000)
2. Tripathy, S. N. Food Biotechnology. 1st edition. Dominant Publishes and distributors, New Delhi. 110002 (2004)
3. Srilakshmi, B. Dietetics, 6th edition New age International Publishers, New Delhi (2012)

Course Designed by	Verified by HoD	Verified by CDC Coordinator	Verified by COE
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme code:	B. Sc			Programme Title :	Bachelor of Zoology	
Course Code:	23UZY4N4			Title	Batch :	2023 – 2026
				Non- Major Elective -I	Semester:	IV
Lecture Hrs/Week	1	Tutorial Hrs/ Sem	--	Ornamental Fish Culture	Credits:	2

Course Objectives

Student will learn the importance of ornamental fish culture, maintain an aquarium, know the common ornamental fishes and explore the self employment opportunities.

Course Outcomes

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

CO Numbers	CO Statement	Knowledge level
CO1	Remember the knowledge of Common ornamental fishes	K1
CO2	Demonstrate the aquarium construction, Nuitrional requirement of ornamental fish	K2
CO3	Apply the ornamental fish culture methods and breeding techniques of aquarium fishes	K3
CO4	Analyze the fish feed formulation , fish diseases and control measures of ornamental fishes	K4
CO5	Evaluate the transgenic technology in ornamental fishes	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	L	L	L	M	H	H	M
CO2	M	L	M	M	M	L	H	H	H
CO3	M	L	L	M	M	M	H	M	M
CO4	H	M	M	L	L	H	H	H	L
CO5	L	M	L	L	L	L	H	L	M

Units	Content	Hrs
Unit I	• **Scope of ornamental fish culture** o General characters of fish o Digestive system o Reproductive system	**3**
Unit II	• **Egg layer** o *Carassius auratus* o *Pterophyllum scalare* o *Beta splendens* • **Live bearers** o *Xiphophorus helleri* o *Xiphophorus maculatus* o *Poecilia reticulate.* • Breeding and spawning of live bearers and egg layers.	**3**
Unit III	• **Applications of transgenic technology in ornamental fish -** Zebrafish • **Aquarium** o Requirements for an aquarium o setting of an aquarium* o Maintenance of water quality	**3**

Unit IV	• **Ornamental fish feeds and nutritional requirement** • **Types of feeds** • **Live feed** o Artemia o Daphnia o Tubifex o Rotifers and Cyclops. • **Artificial feed** o Simple and compound o Composition of an idaeal fish feed o Preparation of artificial feed • Feeding methods and Problems in artificial feed*	**3**
Unit V	• **Diseases of Ornamental Fishes and their Control** • **Parasitic** o Argulus o Lernaeasis • **Protozoan** o Ichthyophthiriasis o Costiasis • **Bacterial**- Fin and Tail rot • **Fungal** - Saprolegniosis • Nutritional diseases, their diagnosis and Treatment	**3**
Total Contact Hrs		**15**

** denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Pandey and Shukla, Fish and fisheries. Rastogi publication (2018)
2. Jordan, E.L. and Verma, P.S. Chordate Zoology. S. Chand & Company LTD., Ram Nagar, New Delhi. 110055. (2006)

Reference Books

1. Arumugam, N. Aquaculture SARAS Publications, Nagercoil, Tamilnadu. (2020)
2. Biswas, K. P. A Text book of fish& Fisheries Technology - Calcutta(W.B) 2nd Edition, Published by Narendra Publishing house, Delhi (1996)
3. Agarwal, S.C A hand book of fish farming. B.H.Enterprises. New Delhi(1994)

4.Dhote. A.K Publication Department – NCERT — 55 Inland fishery – Instructional – cum – Practical -Manual Vol IV Aquaculture. (1989)

5.Jhingran, V. G. Fish and Fisheries of India - Hindustan Publishing Corporation (India) Delhi, Printed in India at Gopsons papers Pvt Ltd, Noida (1988)

Course Designed by	Verified by HoD	Verified by CDC Coordinator	Verified by COE
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr.S.Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY4S2			**Title**	**Batch:**	2023 – 2026
				SEC II: Nan Muthalvan : Aptitude for Placement	**Semester:**	IV
Lecture hrs./Week		**Tutorial Hrs./Sem.**	-		**Grade**	2

Course Objective

To enable the students to refine their mathematical, logical, and analytical skills.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	To have fundamental **knowledge** of Mathematics about problems of numbers using Mathematical formulae.	K1
CO2	To **understand** the concepts of profit & loss related processing, simplification, etc.,	K2
CO3	To **apply** the formulae to real time problems on probability, Areas of surfaces and **apply** data visualization tool for any data set.	K3
CO4	To **analyze** the problems solving related to Age, Time and Distance and Time and Work etc.	K4
CO5	Use their logical thinking and analytical abilities to **evaluate** puzzle and decision making related questions from company specific and other competitive tests / To critically **evaluate** numerous possibilities related to puzzles.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	M	M	L	H	M	M	M
CO2	H	L	H	M	M	M	L	M	M
CO3	H	H	M	M	L	H	H	H	L
CO4	H	M	H	H	H	M	H	H	H
CO5	M	M	L	H	M	H	M	M	M

Unit	Content	Hrs
Unit I	Numbers-HCF And LCM of Numbers-Decimal Fractions-Comparison of Fractions - Simplification- Square Root and Cube Roots – Average.	**6**
Unit II	Time and Work - Time and Distance – Mixtures or Allegations - Problems on Numbers - Problems on Ages –Percentage - Profits and Loss.	**6**
Unit III	Ratio and Proportion - Time and Work - Time and Distance - Simple Interest - Compound Interest - Area-Volume and Surface Area.	**6**

Unit IV	Permutation and Combination - Probability, Height and Distances - Boats and Streams - Odd Man Out &Series.	**6**
Unit V	Interpretation: Tabulation, Bar Graphs, Pie Chart, Line Charts.	**6**
	Total Contact Hrs	**30**

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. R.S. Aggarwal – Quantitative Aptitude for Competitive Examinations .Chand & Company Ltd., New Delhi.2018

Web References

1. https://www.javatpoint.com/aptitude/quantitative
2. https://www.toppr.com/guides/quantitative-aptitude/
3. https://www.tutorialspoint.com/quantitative_aptitude/index.htm
4. https://www.sscadda.com/quantitative-aptitude/
5. https://prepinsta.com/learn-aptitude/
6. https://www.indiabix.com/
7. https://www.icai.org/post.html?post_id=17790
8. https://tnpsc.news/tnpsc-study-materials
9. http://www.kalvisolai.com/p/kalvisolai-tnpsc-study-materials.html
10. https://byjus.com/free-ias-prep/tnpsc-study-material/

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY4S3			**Title**	**Batch:**	2023 – 2026
				SEC II: Nan Muthalvan Ethology	**Semester:**	IV
Lecture hrs./Week		**Tutorial Hrs./Sem.**	-		**Grade**	2

Course Objective

To understand the importance of animal behaviour

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the behaviours of animals	K1
CO2	Understand the ability to communicate with animals	K2
CO3	Apply the knowledge of key concepts in animal behavior	K3
CO4	Analyse the individual, social and reproductive behaviour of animals	K4
CO5	Evaluate the behaviour patterns of animals	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	M	M	M	H	H	M	M
CO2	H	H	L	L	M	H	H	M	M
CO3	H	M	L	M	L	M	H	M	H
CO4	H	L	M	L	M	H	H	L	H
CO5	H	M	L	L	L	M	H	M	M

Unit	Content	Hrs
Unit I	**Introduction** • Scope of Ethology • Types of Behaviour • Behaviour Patterns- Stereotype & behaviour	**6**
Unit II	**Ecological aspect of Behaviour** • Food selection – Anti predator behaviour • Genetic basis of behaviour • Evolution of behaviour	**6**
Unit III	**Social Behaviour** • Individual behaviour : Conflict- Aggression Communication- Biological rhythms • Social behaviour Social organization in insects, mammals	**6**
Unit IV	**Reproductive Behaviour Patterns** • Courtship Mating – Parental care • Migration behaviour: Pattern of migration- causes of migration •	**6**
Unit V	**Biological rhythms and learning Behaviour** • Biological clock characterestics, range types, Mechanism and	**6**

	Controlling centers • Orientation, kinesis taxis , Ecolocation and navigation • Migration in insects • Migration in mammals with special refrence to flying and aquatic mammals • Learning behaviour in Vertebrates	
	Total Contact Hrs	**30**

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Agrawal V. K. –Animal Behaviour (Ethology) S. Chand Publishing 2009
2. Shukla J. P – Fundamentals of Animal Behaviour Atlantic Publishers & Distributors (p) Ltd.,2012

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. M. Durairaju Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.	**Programme**	Bachelor of Zoology

				Title:		
Course Code:	21UZY 4VA			**Title**	**Batch:**	2023 -2026
				Value Added Course II: Frontiers in nutrition	**Semester**	IV
Lecture hrs./Week		**Tutorial Hrs./Sem.**	-		**Grade**	2*

Course Objective

To understand the importance of nutrition, food safety and health.

Course Outcomes

On the successful completion of the course, students will be able to maintain hygiene and know about the requirements of nutrition in various age groups.

CO Number	CO Statement	Knowledge Level
CO1	Remember the Health awareness and Hygiene	K1
CO2	Understand the importance of food safety	K2
CO3	Deploy the nutrient requirements for day today life	K3
CO4	Analyze the potential of food laws	K4
CO5	Acquire the knowledge about various health education	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	M	H	M	M	H	H	M
CO2	H	H	H	H	H	L	M	M	M
CO3	H	L	L	H	L	L	M	M	H
CO4	M	M	L	H	H	H	H	M	H
CO5	H	L	L	M	L	M	M	M	M

Unit	Content	Hrs
Unit I	• Composition of food - Protein –Carbohydrate – Fat-Vitamins and Minerals • Functions and sources of food • objectives of cooking • Nutritional requirements – children - adolescence - old age	**6**
Unit II	• Nutrtiion and importance of - Egg, meat and fish - Vegetables and fruits • Role of milk and milk products in cookery • Food spoilage- Bacteria, Moulds, Yeasts • Food poisoning - Botulism, Staphylococcus • Adulteration of food	**6**
Unit III	• Food technology: - Organic foods - Packaging of foods - Nutrition labelling • Food laws: - Prevention of Food Adulteration Act - Essential Common dietics Act	**6**
Unit IV	• **Health indicators** *Personal hygiene, Public health*	**6**

	• **Nutrition and Health** Classification of food (Macro &Micro nutrients) • Balanced diet • Nutrition disorders	
Unit V	• **Health Education**: o Health care services in India o Health Planning and Programmes in India o Role of World Health Organization (WHO) in health education • *First Aid and Nursing**	**6**
Total Contact Hrs		**30**

**denoted as self study topics*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Srilakshmi, B. 5th edition. Food Science, New age International Publishers, New Delhi (2012)

Reference Books

1. Verma S. Medical Zoology. Rastrogi Publications, New Delhi. (1998)
2. Jordon, E.L. and Verma. P.S. Invertebrate Zoology. 12th edn. Sultan Chand & Co(1995)
3. Rastogi S. C. Biochemistry .Tata McGraw Hill Publishing Co. Ltd. (2003)
4. Tripathy, S. N. Food Biotechnology. 1st edition. Dominant Publishes and distributors, New Delhi. 110002 (2004)
5. Srilakshmi, B. Dietetics, 6th edition New age International Publishers, New Delhi (2012)
6. Anita Tull, 1st edition. Food and nutrition – Oxford University press. Cambridge (1987)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Name: Dr.S.Mariselvi Signature:	Name: Dr. S. Somasundaram Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY507			**Title**	**Batch:**	2023 – 2026
				CC– V Developmental Biology	**Semester:**	V
Lecture Hrs./Week	5	**Tutorial Hrs./Sem.**	--		**Credits:**	4

Course Objectives

To understand the basic concepts, landmark events, applications and advances in modern developmental biology.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the steps and advancements in the developmental biology	K1
CO2	Comprehend embryonic formation and developmental stages with suitable example	K2
CO3	Apply functional knowledge on developmental biology into the frontier sciences	K3
CO4	Sort of embryonic development and its functional applications	K4
CO5	Study about the organogenesis	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	M	L	M	M	M	H	M
CO2	M	H	M	M	M	M	M	M	L
CO3	H	M	M	M	H	M	H	H	H
CO4	M	H	L	L	M	L	H	M	M
CO5	H	M	M	M	M	M	M	H	H

Units	Content	Hrs
Unit I	• **Scope of developmental biology** • **Programmes of Developmental Biology** • **Theories** o Pre-formation - Spemann's experiments on Organizer • **Gametogenesis** o Spermatogenesis and Oogenesis • **Fertilization** - Mechanism of fertilization • **Parthenogenesis** o Types of Parthenogenesis -Natural and Artificial o Significance of Parthenogenesis.	**15**
Unit II	• **Cleavage in Frog** o Planes ofclevage -Meridional, Vertical , Equatorial and Latitudinal o Patterns of cleavage -Holoblastic and Meroblastic • **Gastrulation in Frog** o Morphogenic movements- Epiboly& Emboly - Mechanism of morphogenetic movement • Exo gastrulation • Fate map	**15**

Unit III	• **Cell lineage** • **Organogenesis in Frog** o Ectodermal -Brain o Mesodermal -Heart o Endodermal- Alimentary canal • **Development of Chick** o Hours of incubation - 24,48 &72 • Development and significance of fetal membranes in chick.	**15**
Unit IV	• **Placentation in mammals** o Classification based on Fetal membranes o Distribution of villi o Histology and Functions of placenta • **Neoteny** o Types o Factors affecting neoteny o Evolutionary significance • **Organizer** o Structure, properties and theories of organizer o Types of induction– embryonic induction o Mechanism of induction • **Metamorphosis** o Aspects of metamorphosis in insects and amphibians, o Changes and hormonal control. • **Regeneration** o Types of regeneration – amphibian limb regeneration o Role of hormones in regeneration.	**15**
Unit V	• Stem cells • *Embryonic stem cell culture and applications** • In-vitro Fertilization(IVF) • Multiple ovulation and embryo transfer technology (MOET). • Embryonic sexing • Diagnosis Genetic disorder -ICSI, GIFT • Cloning of animals - Nuclear transfer method.	**15**
Total Contact Hrs		**75**

**- denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Assignments, Group Task.

Text Book

1. Veer Bal Rastogi - Chordate embryology Kedar nath ram nath, 132. R.G. College road, Meerut- 250 001 – (2017).

Reference Books

1. Arumugam .N. - Developmental Zoology - Saras Publication,114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamilnadu, India, (2021)
2. Chattopadhyay.S. An Introduction to Developmental Biology. Books and Allied Pvt. Ltd., Kolkata – (2019)
3. Verma P S & Agarwal V K -Chordate embryology-S Chand & Company Ltd. (2020)
4. Balinsky - Embryology - Philadelphia, Saunders College Publishing - 5th Edition, (2012).
5. Berrill, W. J. and Graw M. C. - Developmental biology - Hill Book Co, New York – (2010).
6. Subramaniam - Developmental Biology. Narosa Publishing House, New Delhi – (2002)
7. Twyman. R.M. - Developmental Biology. Viva Books Private limited, New Delhi – (2001).
8. Wesley - An Outline of animal development – Davenport, Addison –publishers, University of Michigan – (1979).

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Mariselvi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme code:	B. Sc.,		Programme Title :	Bachelor of Zoology	
Course Code:	23UZY508		Title:	Batch :	2023 – 2026
			CC – VI Biotechnology	Semester	V
Lecture Hrs/Week	5	Tutorial Hrs/Sem --		Credits:	4

Course objectives

Recognize the foundation, techniques, applications of Biotechnology

Course Outcomes

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

CO Number	CO Statement	Knowledge level
CO1	Impart the knowledge of principles and practices in biotechnology.	K1
CO2	Understanding the various tools and technique used in biotechnology	K2
CO3	Apply the various technologies on genetically modified organisms .	K3
CO4	Assorted the different culture method and instrument used in biotechnology	K4
CO5	Evaluate the clonal propagation of animal in commercial scale	K5

Mapping

PO /PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	H	M	H	H	L	H	H	H
CO2	L	H	M	H	M	L	H	M	M
CO3	L	H	L	H	H	M	H	H	H
CO4	M	M	M	H	M	L	H	M	H
CO5	L	H	L	H	L	M	H	H	M

Units	Content	Hrs
Unit I	• Scope and importance of Biotechnology • Plasmids pBR 322 • Cosmids • Transposons • Construction of recombinant DNA • Recombinant Vaccines	**15**
Unit II	• **Principle and applications of blotting Techniques** o Southern Blotting o Northern Blotting o Western Blotting • Polymerase Chain Reaction (PCR) • DNA Finger printing • *Genomic library**	**15**
Unit III	• **Principle and applications of** • *Biolistics* • Hybridoma technology • Transgenic Mice o Microinjection method • Applications of transgenic animals • Genetically modified organisms - Mice and Sheep • Primary and secondary cell lines	**15**

Unit IV	• Tissue culture
	  ○ Culture media
	  ○ Culture of animal tissues
	• Bioreactors
	  ○ Selection and modification of animal(Pig)
	  ○ Applications of bioreactor
	• Scope and application of nano- biotechnology
		15

Unit V	• Biosafety
	• Bioethics
	  ○ Monitoring the welfare of transgenic animals
	  ○ Keeping of transgenic animals
	• Patenting
	  ○ IPR- Intellectual Property Rights
	  ○ TRIPS- Trade Related Aspects of Intellectual Property Rights
		15

Total Contact Hrs		**75**

- *denoted as self study topic

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1.Sathyanarayana U Biotechnology, 12th Printing Arunabha sen Books and Allied (P)Ltd 8/1 chintamoni Das lane, KolKata 70009 (India) (2020)

2.Dubey, P.C Text Book of Biotechnology Revised 5th Ed, Chand and Co., New Delhi . (2014).

Reference Books

1. Kumaresan V. and Arumugam N., Animal Biotechnology –Saras publications, 114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamilnadu, India (2021)

2. Kumaresan V., Biotechnology –Saras publications, 114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamilnadu, India (2014)

3. Sayyed and Patil Biotechnology-emerging trends Scientific publishers India (2009)

4. Jayanto Achrekar Fermentation biotechnology. Dominant Publishers. New Delhi (2007)

5. Balasubramaniam. D. C.F. A. Bryce, Dharmalingam. K. J. Green, Kunthala Jayaraman Concepts in Biotechnology, University Press (India) Pvt. Ltd. Hydrabed (2005)

6. Gupta. P.K., Elements of biotechnology – Rastogi publications, Meerut (2004)

7. Dubey, R. C., A text book of Biotechnology, Cambridge University Press (1996)

8. Ignacimuthu, S., Basic Biotechnology, Tata McGraw Hill Publishing Company Ltd, New Delhi (1995)

9. Molecular Biology and Biotechnology S.Chand & Company Ltd, NewDelhi (1993)

10.John.E.Smith, Biotechnology, Vikas Publishing House Pvt. Ltd, New Delhi(1993)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr.S.Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			Programme Title:	Bachelor of Zoology	
Course Code:	23UZY509			Title	Batch:	2023 – 2026
				CC - VII Biostatistics and Biophysics	Semester:	V
Lecture Hrs./Week	5	Tutorial Hrs./Sem.	5		Credits:	4

Course Objective

The basic knowledge about Biostatistics, Biophysics and basic principles of instruments

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the concepts of biostatistics and biophysics	K1
CO2	Understand the formula and principles used in biology	K2
CO3	Apply the knowledge of Biostat and Biophysics	K3
CO4	Analyze the importance about instruments in biological laboratory	K4
CO5	Evaluate the different data used in biological samples	K5

Mapping

PO /PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	H	M	M	H	L	H	M	M
CO2	L	M	H	L	M	H	H	M	H
CO3	M	M	M	M	M	M	M	H	M
CO4	M	H	H	M	H	M	H	M	H
CO5	M	M	M	M	M	M	H	M	M

Units	Content	Hrs
Unit I	• **Types and Collection of data** o Methods of collection – Random and Non-random sampling o Primary and Secondary data • **Tabulation** o Parts and types of table • **Diagrammatic presentation** o Line diagram, Bar diagram and *Pie diagram* • **Measures of central tendency** o Arithmetic mean o Individual - Discrete and Continuous series o Median o Mode	**15**
Unit II	**Measures of dispersion** • **Standard deviation** o Individual - Discrete and Continues series • **Correlation** o Types of correlation o Karl Pearson's coefficient of correlation • **Regression analysis –** Linear regression	**15**

Unit III	• **Chi-square Test** o Degrees of freedom • **Student - t test** • **Analysis of Variance (ANOVA)** - One-Way Analysis • **Statistical Inference** – Procedure of testing a hypothesis	**15**
Unit IV	• **Scope of biophysics** • **Thermodynamics principles** o First and second law • **Bioluminescence** o Types and significance	**15**
Unit V	• **Instrumentation** o *Compound microscope** o Electron microscope- Transmission Electron Microscope (TEM) and Scanning Electron Microscope (SEM) o Chromatography - Thin layer chromatography (TLC) o Electrophoresis – Polyacrylamide Gel Electrophoresis (PAGE) o Real Time Polymerase Chain Reaction (RTPCR)	**15**
	Total Contact Hrs	75

** denoted as self study topic*

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Arumugam N. and Kumaresan V. Biophysics and Bioinstrumentation -, Saras publication, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari-(2016)
2. Veer Bala Rastogi - Fundamentals of biostatistics. Ane Books, Pvt. Ltd. New Delhi -2nd edition,(2009)

Reference Book

1. Arumugam N. - Basic concepts of Biostatistics - Saras publication 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari - (2021)
2. Satguru Prasad– Biostatistics - Rastogi Publication, Meerut, (3rd Rev.Edi 2012)
3. Rana, S. V. S. Biotechniques – Theory and Practice. Rastogi Publication, Meerut2nd edition,(2009).
4. P. K. Srivastava. Elementary Biophysics – Narosa Publishing House, New Delhi, 110 002, 1st edition, (2005).
5. Subramanian, M. A. (2005) 1st edition. Biophysics – Principles and Techniques- MJP Publishers, Chennai, 600 005, 1st edition, (2005).

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. M. Durairaju Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY510			**Title**	**Batch:**	2023 – 2026
				CC - VIII Biochemistry	**Semester:**	V
Lecture Hrs./Week	5	**Tutorial Hrs./Sem.**	--		**Credits:**	4

Course Objective

To understand the structure of biomolecules with emphasis on the techniques used for structure determination and aims to enlighten the students how structural information can be utilized for better understanding of biological processes and adaptation of animals physiologically to environmental challenges

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember basic principles of biochemistry, structure of chemical bonds and their significance in biological system	K1
CO2	Understand the structure and function of carbohydrates, their metabolism and regulatory mechanisms.	K2
CO3	Analyse the role of lipids and fatty acids in various regulatory mechanisms and their metabolism and regulation.	K3
CO4	Apply the knowledge how proteins, enzymes and vitamins influence the biological processes and their architecture.	K4
CO5	Integrate the knowledge of vitamins and enzymes in various industries and interpret the mechanism of action of various drugs and their catalytic properties.	K5

Mapping

PO /PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	H	--	M	L		M	M	M
CO2	--	M	--	M	--	--	L	M	M
CO3	--	M	--	M	--	--	L	M	M
CO4	L	H	M	H	L	--	M	H	M
CO5	--	M	--	M	--	--	H	M	H

Units	Content	Hrs
Unit I	**Biochemistry** • **Scope of Biochemistry** o Atoms, molecules, water o Functional groups • **Chemical bonds of Biomolecules** • **Classification of Carbohydrates:** o Monosaccharides - Pentoses	15

	○ Disaccharides ○ Polysaccharides- Homopolysaccharide and Heteropolysaccharide	
Unit II	• **Classification of Lipids:** ○ Simple Lipids - Fats ○ Compound lipids -Phospholipids ○ Derived lipids -Glycerol ○ *Lipids associated Obesity disorders.**	15
Unit III	• **Classification of Proteins:** ○ Structure: Simple – Conjugated and Derived proteins. ○ Solubility: Globular and Fibrous proteins ○ Biosynthesis of glutamic acid, phenyl alanine, methionine,histidine	15
Unit IV	• **Metabolism** ○ Carbohydrates: Glycolysis-Glycogenesis- Kreb's cycle & Glycogenolysis ○ lipids :β-oxidation of fatty acids ○ Proteins: Transamination, Deamination, decarboxylation, ornithine cycle.	15
Unit V	• **Classification of Enzymes, Co-Enzymes and Vitamins** ○ Nomenclature and properties. ○ Factors influencing enzyme action. ○ Enzyme inhibition. ○ Salient features of co enzymes ○ Types and *Properties of vitamins*.	15
	Total Contact Hrs	**75**

*- *denoted as self study topics*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1.Satyanarayana U. Biochemistry , Book Syndicate Pvt. Ltd. 2008

Reference Books

1. Nelson, D.L. & Cox, M.M. Lehninger Principles of Biochemistry (7th edition) Worth. 2017
2. Thulsi Fatima. Biochemistry - Saras Publication,114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamil nadu, India. 2016
3. Sathyanarayana U.& Chakrapani, U. 2nd Edition, Essential of Biochemistry - Books & Allied pvt.ltd 83/1, Beliaghata main road, Kolkata 700010, India. 2009.
4. Rastogi S. C. Biochemistry .Tata McGraw Hill Publishing Co. Ltd. 2003
5. Lehninger A., Nelson D. L. and Cox M. M. Principles of Biochemistry. CBC Publishers.1993.

Course Designed by	Verified by HoD	Verified by CDC Coordinator	Verified by COE
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY5E1			**Title**	**Batch:**	2023 – 2026
				DSE - I Medical Laboratory Techniques	**Semester:**	V
Lecture Hrs./Week	4	**Tutorial Hrs./Sem.**	--		**Credits:**	4

Course Objective

To understand the basic principles and applications of MLT.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the structure and function of medical laboratory instruments and sample diagnostic mehtods	K1
CO2	Understand the methods used in medical laboratory	K2
CO3	Apply the knowledge about laboratory diagnosis and reasons for the diseases	K3
CO4	Analyze and estimation of CSF, urine, faeces, sputum and semen	K4
CO5	Acquire the knowledge about laboratory techniques	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	L	L	H	H	M	M	H
CO2	M	M	L	L	M	H	M	M	H
CO3	H	M	M	M	M	H	H	M	H
CO4	M	M	M	M	M	M	M	M	H
CO5	H	M	M	M	M	M	H	M	H

Units	Content	Hrs

Unit I	• **Introduction**
	  o Code of conduct for laboratory personnel
	  o Structure of a laboratory
	• **Laboratory instruments**
	  o Centrifuge
	  o Autoclave
	  o ECG
	  o B. P. apparatus and stethoscope
	  o Urinometer
	  o Albumino meter
	  o General procedure – Cleaning -Sterilization and disposal of infected materials
	  o *Safety measures and first aid**
		12

Unit II	• **Cerebro Spinal Fluid Analysis** o Physiology of CSF o Routine examination of CSF collection of the Specimen o Physical examination o Cytologic examination o Chemical examination o Bacteriological examination o Serologic examination	**12**
Unit III	• **Urine Analysis** o Collection & preservation of urine o Physical examination o Chemical examination o Microscopic analysis • **Faeces Analysis** o Collection & preservation o Physical examination o Microscopic examination-Various ova seen o Occult blood test	**12**
Unit IV	• **Sputum Analysis** o Collection & preservation o Physical examination o Microscopic examination o Chemical examination • **Semen Analysis** o Collection of semen o Physical examination o Microscopic analysis o Preparation of smear and staining	**12**
Unit V	• **Pregnancy test** o Immunolological methods- LAI, HAI o Pregnancy card* • **Sexual Diseases** • Laboratory diagnosisof syphilis o Serology of syphilis o The V. D. R. L Flocculation Test • **Cryopreservation and its application** o Gamete Bank	**12**
Total Contact Hrs		**60**

** denoted as self study topics*

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Dutta, A. Experimental Biology A laboratory manual. Narosa Publishing House , New Delhi. (2009)
2. Ramnik Sood, Medical Laboratory Techniques, 5th edition. Jaypee Brothers Medical publishers (P) Ltd. Delhi, . (1999)
3. Sachdev, K. N. Clinical pathology and bacteriology. Jaypee brothers- medical publishers, New Delhi(1999)

Reference Books

1. Vandana Puri, Praveen Kr Gupta. Complex review of Pathology and Haematalogy for NBE . 6th edition, CBS publishers, Delhi (2020).
2. Ajmani PS.Handbook of Clinical Laboratory Techniques . AITBS Publisher , India(2017)
3. Mukherjee. KL. Medical Laboratory Technology. Volume 1,2 and 3. Tata McGraw Hill education, India. (2010)
4. Talib VH, Khurana. Handbook of Medical Laboratory Technology , CBS publishers, Delhi(2009)
5. Varley H. Practical Clinical Biochemistry, CBS Publishers, Delhi (2008)
6. John Macleod and John Munro, Clinical Examination. ELBS publishers (1988)
7. Samuel, K. M. Notes on Clinical Lab Techniques. K. Gopalan publishers, Madras(1982)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Ms.S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY5E2			**Title**	**Batch:**	2023 – 2026
				DSE- I Poultry Science and Management Technology	**Semester:**	V
Lecture Hrs./Week	4	**Tutorial Hrs./Sem.**	--		**Credits:**	4

Course Objective

To gain the Knowledge about the basic concept of poultry science, construction of poultry farm, knowledge about different breeders,the diseases of poultry birds, the nutritive value of egg

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Keep in mind the role of poultry science	K1
CO2	Understand the concepts of poultry house and management.	K2
CO3	Execute knowledge of poultry science and management	K3
CO4	Evaluate the nutritive value of poultry meat and egg.	K4
CO5	Analyze the appropriate of livestock transport and marketing.	K4

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	M	L	H	H	M	H	M
CO2	M	M	M	L	M	H	M	H	M
CO3	H	H	H	M	M	H	H	H	H
CO4	M	M	M	M	M	M	M	M	M
CO5	H	H	H	M	M	M	H	M	H

Units	Content	Hrs
Unit I	• Importance and role of the poultry in rural development and employment potential. • Anatomy and physiology of poultry birds (hen) with reference to digestive and reproductive systems.	**12**
Unit II	• Poultry house and equipment • Space requirements • Types of houses • *Summer management - Winter management** • Sterilization of room	**12**
Unit III	• Classification of feed stuffs • Availability of raw materials and their cost • Feed formulation and Feeding programme • Equipment for feeding and drinking.	**12**
Unit IV	• Management of Broilers • Management of layers • Management of Breeders • Common diseases – Bird flu disease • Antibiotics - Vaccination and deworming • Insecticide treatment and Bio-remedies	**12**

Unit V	• *Nutritive value of poultry meat and egg** • Grading and Preservation of eggs • Packing and Transport and Marketing • Different uses of eggs • Poultry manure**.**	**12**
Total Contact Hrs		**60**

**denoted as self study topics*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Shukla. Upadhyay Economic Zoology –Rastogi Publications, Shivaji Road, Meerut- India (2003).

Reference Books

1. Rice . E.J and Botosford . H. E. Practical poultry management . John Wiley, Hansen Inc. N.Y.
2. Gnanmani. J . Profitable poultry product ; Pyton publ. Co. Madurai, Tamilnadu
3. Siddiqui. H.M Manual of poultry production Practicals: College of Veterinary Science, Andrapradesh.
4. Arumugam, N. Applied Zoology, Saras Publication, 114/35 G ARP Camp Road, Periavilai, Nagercoil, Kanyakumari – 629 002 (2018)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Ms.S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY5E3			**Title**	**Batch:**	2023 – 2026
				DSE– I Haematology and Clinical pathology	**Semester:**	V
Lecture Hrs./Week	4	**Tutorial Hrs./Sem.**	--		**Credits:**	4

Course Objective

To understand the methods of blood analysis and laboratory diagnostics in clinical pathology.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the methods of blood analysis and disease diagnostics	K1
CO2	Understand the methods used in blood cells count and blood chemistry	K2
CO3	Apply knowledge about laboratory diagnosis	K3
CO4	Analyze and blood samples and organs diagnostics methods	K4
CO5	Acquire the knowledge about laboratory techniques	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	M	L	H	H	M	M	H
CO2	M	M	M	L	M	H	M	M	H
CO3	H	H	H	M	M	H	H	M	H
CO4	M	M	M	M	M	M	M	M	H
CO5	H	H	H	M	M	M	H	M	H

Units	Content	Hrs
Unit I	• **Haematology** o Blood Collection o Capillary Blood collection o Venous Blood collection o Anticoagulant- Ammonium &potassium Oxalate mixture • **Clinical examination of blood** o Blood smear Preparation o Staining of a thin blood film o Examination of stained film o Parasites seen in the blood o Bleeding time of blood o Clotting time of blood	**12**

Unit II	• **Blood analysis** • **Estimation of Haemoglobin** o Cyan methaemoglobin Photometric method o Haemoglobin estimation by sahli method o Haemoglobin estimation of the sample blood • **Blood cell total count** o Neubauer Counting chamber o Total RBC Count o Total WBC Count • **Erythrocyte Sedimentation Rate (ESR)** o Westergren's method o Windrobe method o Precautions o Interpretation	**12**
Unit III	• **Blood Chemistry** o *Blood samples for different Analysis** • **Blood Sugar** o Methods for estimation of glucose o Glucose tolerance test o Two hour post prandial blood glucose o Oral Glucose tolerance test o Intra venous tolerance test • **Cholesterol** • **Urea** • **Non protein Nitrogen in Blood**	**12**
Unit IV	• **Clinical Pathology** **Laboratory diagnosis of Various types of anaemia** o Iron deficiency anaemia o Vitamin B12 deficiency anaemia • **Liver Function tests** o Normal functions of the Liver o Indications for Liver function tests o bilirubin metabolism o Estiamtion of Urine bilirubin o Estimation of Urine Urobilinogen	**12**
Unit V	• **Laboratory diagnosis of jaundice** o Bilirubin metabolism o Classification of Jaundice • **Laboratory diagnosis of AIDS** o Aetiology o Epidemology o Pathogenesis o Transmission o Clinical diagnosis of AIDS o *Prevention of HIV transmission in health care settings**	**12**
	• **Total contact Hours**	**60**

**- denoted as self study topics*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Dutta, A. Experimental Biology A laboratory manual. Narosa Publishing House , New Delhi. (2009)
2. Ramnik Sood, Medical Laboratory Techniques, 5th edition. Jaypee Brothers Medical publishers (P) Ltd. Delhi, . (1999)
3. Sachdev, K. N. Clinical pathology and bacteriology. Jaypee brothers- medical publishers, New Delhi(1999)

Reference Books

1.Vandana Puri, Praveen Kr Gupta. Complex review of Pathology and Haematalogy for NBE . 6th edition, CBS publishers, Delhi (2020).
2. Ajmani PS.Handbook of Clinical Laboratory Techniques . AITBS Publisher , India(2017)
3. Mukherjee. KL. Medical Laboratory Technology. Volume 1,2 and 3. Tata McGraw Hill education, India. (2010)
4. Talib VH, Khurana. Handbook of Medical Laboratory Technology , CBS publishers, Delhi(2009)
5. Varley H. Practical Clinical Biochemistry, CBS Publishers, Delhi (2008)
6. John Macleod and John Munro, Clinical Examination. ELBS publishers (1988)
7. Samuel, K. M. Notes on Clinical Lab Techniques. K. Gopalan publishers, Madras(1982)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Ms.S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY614			**Title**	**Batch:**	2023 – 2026
				CC Lab- III: Developmental Biology, Animal Physiology & Endocrinology, Biostatistics &Biophysics, Biochemistry, Polutry science managment , Haematology and Clinical pathology & MLT (Non-Semester Pattern)	**Semester:**	V & VI
Practical Hrs./Week	2	**Tutorial Hrs./Sem.**	10		**Credits:**	3

Course Objective

To gain the practical knowledge on Zoology, importance of blood cell count, estimate the glucose and haemoglobin in blood samples and structure of embryo of various animals.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Recollect the importance of laboratory test	K3
CO2	Understand the normal level of various human physiological parameters	K4
CO3	Apply the instruments used in biological experiment.	K5
CO4	Understand the structure and functions of endocrine glands.	K4
CO5	Know about the importance of blood cell count.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	L	L	L	H	M	H	H	H
CO2	H	M	M	L	M	H	H	H	M
CO3	M	M	M	M	H	M	H	M	H
CO4	M	M	M	H	H	H	H	H	H
CO5	M	M	M	M	H	M	H	H	H

Content

EXPERIMENTS

- Analysis of excretory products
- Total count of RBC
- Total count of WBC
- Estimation of haemoglobin by using haemoglobinometer
- Preparation of Blood smear
- Bleeding and clotting time
- Estimation of Erythrocyte Sedimentation(ESR) in human
- Find the mean and Standard deviation of the given samples
- Estimation of glucose by using digital method

SPOTTERS

Developmental Biology

- Egg of frog
- Cleavage of frog
- Blastula of frog
- Chick embryo - 24 hours

- Chick embryo - 72 hours
- Chick embryo - 96 hours
- Placenta of sheep
- Human foetus

Biostatistics and Biophysics

- Multiple bar diagram
- Pie diagram
- Frequency polygon
- Compound microscope
- Transmision Electron microscope (TEM)
- Thin Layer Chromatography (TLC)
- Electrophoresis – PAGE

Animal Physiology & Endocrinology

- T. S. of thyroid gland
- T. S. of ovary
- T. S. of testis
- Mammalian Eye
- Mammalian Ear
- Mammalian Kidney

Medical Laboratory Technique (MLT)

- Haemocytometer
- Albuminometer
- Automatic blood pressure monitor
- Urinometer
- Autoclave
- UV Spectrophotometer

Biochemistry - Structures

- Sucrose
- Cholesterol
- Purine
- α-tocopherol
- Chymotrypsin

	Total Contact Hrs	**60**

Mark Distribution:

Total Marks	**Internal(CIA)**	**Marks**	**End of semester Practical Examination (ESE)**	**Marks**
75	Practical Skill/observation note	5	Experiments Major Practical	15
			Minor Practical	5
	Model Practical Examination	20	Spotters	20
	Record work	5	Record	5
	Total Marks	**30**	**Total Marks**	**45**

Pedagogy

Direct Instruction, Hands on training, Digital Presentation

Assessment Methods:

Record, practical skills, observation note.

Reference Books

1. Arumugam .N. (2017) Developmental Zoology - Saras Publication,114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamilnadu, India.
2. H. R. Singh and Neerajkumar, (2014). Animal Physiology and biochemistry, Vishal Publishing Co. Jalandhar, Delhi
3. Mariakuttikan , A and Arumugam, N. (2014). Animal P|hysiology . Saras publication. Nagarcoil, Kanyakumari Dist. Tamil Nadu.
4. Ramnik Sood, Medical Laboratory Techniques (MLT). (1999) 5th edn. Jaypee Brothers Medical publishers (P) Ltd. Delhi

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. M. Durairaju Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			Programme Title:	Bachelor of Zoology	
Course Code:	23UZY615			Title	Batch:	2023 – 2026
				CC Lab- IV: Ecology, Evolution, Biotechnology, Microbiology , Sericulture,Insect Pest Management, Parasitology and Aquaculture,Dairy farming and Management Technology, Wildlife Conservation (Non-Semester Pattern)	Semester:	V &VI
Practical Hrs./Week	2	Tutorial Hrs./Sem.	--		Credits:	3

Course Objective

To obtain practical knowledge in ecology, evolution, biotechnology, microbiology by doing experiments on physico-chemical characters of environment and also uptaining the real time visualsing the appliances used in sericulture and aquaculture

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Apply the knowledge on Ecology, Evolution concepts in real time experiments	K3
CO2	Analyse the different water quality parameters, microbial culture and morphometric measurement of fish.	K4
CO3	Understand the techniques and the same in Biotechnology and Microbiology experiments	K5
CO4	Analyse the real time problems in Sericulture and Aquaculture	K4
CO5	Understand the environment quality and critically evaluvate and solve	K6

Mapping

PO /PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	--	H	H	L	M	H	H	M
CO2	--	--	M	M	--	M	H	M	M
CO3	L	L	M	H	--	M	M	M	L
CO4	L	--	M	--	--	H	M	M	M
CO5	--	--	M	M	--	H	H	H	M

Content
EXPERIMENTS • Estimation of dissolved oxygen in water samples. • Estimation of carbondioxide • Determination of primary productivity • Estimation of salinity in water samples • Determination of pH in water samples • Culture medium preparation (Demonstration only) • Milk Methylene Blue Test • Hanging drop preparation • Morphology and morphometric measurements of fish by using model. • Water quality analyzer (Demonstration only)

SPOTTERS

Ecology and Evolution

- Albunea
- Hippa
- Anguilla
- Fossil
- Vermiform appendix
- Giraffe
- Lung fish

Biotechnology and Microbiology

- E-Coli
- Plasmids
- Biodiesel Plant – Jatropha
- PCR
- Colony counter
- Magnetic stirrer
- Laminar Air FlowChamber
- Gel Electrophoresis

Sericulture

- Silkworm
- Silkgland
- Cocoon
- Mulberry shoot
- Mulberry leaf
- Netrika/chandrika
- Leaf Mosaic disease
- Leaf Blight disease
- Pebrine

Aquaculture

- Common Carp
- Sucker fish
- Live feed - Daphnia
- Purse seines net
- Hook
- Fish parasite – Argulus
- Chinese dip net
- Edible Oyster
- Pearl oyster – *Pinctada vulgaris*
- Lerniasis

Total Contact Hrs	**60**

Pedagogy

Direct Instruction, Hands on Training, Digital Presentation

Assessment Methods:

Record, practical skills, observation note.

Mark Distribution:

Total Marks	Internal(CIA)	Marks	End of semester Practical Examination (ESE)	Marks
75	Practical Skill/observation note	5	Experiments-major practical	15
			Experiments-minor practical	5
	Model Practical Examination	20	Spotters	20
	Record work	5	Record	5
	Total Marks	**30**	**Total Marks**	**45**

Reference Books

1. Jayasurya,. Economic Zoology. Saras publication. Nagarcoil, Kanyakumari Dist. Tamil Nadu (2018)
2. Kumaresan. V Biotechnology. Saras publication. Nagarcoil, Kanyakumari Dist. Tamil Nadu(2018)
3. Arumugam, N. Aquaculture SARAS Publications, Nagercoil, Tamilnadu. (2020)
4. Sinha.J., Chatterjee.A.K. and Chattopadhyay. P. Advanced practical Zoology. Books and Allied pvt. Limited , Kolkata. (2011)
5. ICAR Publication 1st edition. Hand book of fisheries and aquaculture, Directorate of information and publicatios of agriculture. Indian Council of Agricultural Research, New Delhi (2006)
6. Ganga, G and Sulochana chetty. An introduction to sericulture. Oxford and IBH Publishing company Pvt. Ltd. New Delhi (1999)
7. Odum, E. P Fundamentals of ecology W.B. Sanders Company, London (1971)

Course Designed by	Verified by HoD	Verified by CDC Coordinator	Verified by COE
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme code:	B. Sc.,			**Programme Title :**	Bachelor of Zoology	
Course Code:	23UZY5S4			**Title**	**Batch :**	2023 – 2026
				SEC III:	**Semester**	V
Lecture Hrs/Week	1	Tutorial hours/Sem	--	Apiculture	**Credits:**	2

Course Objectives

Understanding the biology, rearing and management of honeybees and study the interaction of bees with plants.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the steps involved in modern bee keeping techniques and its practical Difficulties	K1
CO2	Comprehend methodologies involved in bee keeping	K2
CO3	Apply modern tools in bee keeping and value added product preparation	K3
CO4	Validate different bee keeping techniques	K4
CO5	Acquire the knowledge about byproducts of honey bee	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	M	M	M	H	H	M	H
CO2	H	H	L	L	M	H	H	M	M
CO3	H	M	L	M	L	M	H	M	H
CO4	H	L	M	L	M	H	H	L	H
CO5	H	M	L	L	L	M	H	M	H

Units	Content	Hrs
Unit I	• Scope of Apiculture • Classification of Honey bee • Types of honey bee o *Apis dorsata* o *Apis indica* o *Apis florae* • Biology of honey bee – External Structure of worker bee Life cycle of honey bee	**3**
Unit II	• *Social organization of honey bee colony -Queen - Drones and Worker** • Structure of Beehive • Food of Honeybees • Relationship between plants and bee- plant as habitat- symbiosis- pollination	**3**

Unit III	• Modern bee hive o Langstroth hive o Newton's hive Bee keeping equipments • Extraction of honey • Honey – Properties • Chemical composition of Honey o *Value of honey (Nutritional, Medicinal values)*	**3**
Unit IV	• Royal jelly – Composition and functions • Bee wax – Production • Characteristics and uses of bee wax • Bee venom – Characteristics and uses	**3**
Unit V	• Rearing of Honey bees o Mehods : Hopkins , Miller, and Doolittle • Diseases of honey bee o Bacterial disease o Viral disease o Fungal disease	**3**
Total Contact Hrs		**15**

** denoted as self study topic*

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Rajendra Singh & Sachan G.C. 1st edition.Elements of Entomology, Rastogi Publications, Meerut, (2010)
2. Shukla. Upadhyay Economic Zoology –. Rastogi Publications, Shivaji Road, Meerut-250002. India (2003).

Reference Books

1. Arumugam N Applied Zoology, Saras Publication, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari (2020)

2. Dharm Singh & Sevender Pratap Singh, edition. A handbook of Bee Keeping –Agrobios (India), Jodhpur, (2006)

3. Bhamrah Kavita Juneja H.S.. An Introduction to Arthropoda-, Anmol Publications Pvt. Ltd., New Delhi, 2nd edition (2001)

4. Bee keeping basics. MAAREC: Delavane, Maryland, NewJersey, Pennsylvania, West Virginia the USDA Co-operating PENNSTATE 1855- E-book

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr.S.Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			Programme Title:	Bachelor of Zoology	
Course Code:	23UZY5S5			Title	Batch:	2023 – 2026
				SEC III : Biopharmaceuticals	Semester:	V
Lecture Hrs./Week or Practical Hrs./Week	1	Tutorial Hrs./Sem.	- -		Credits:	2

Course Objective

To study the biological systems to understand the actual path of metabolism of drugs and the method of drug discovery, Quality assurance and control such as DNA technology and probiotics.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Keep in mind the Routes of administration in biological systems and models	K1
CO2	Understand the drug metabolism	K2
CO3	Implement the microbial products in pharmaceutical industry	K3
CO4	Discuss the DNA technology in Pharmaceutical products	K4
CO5	Acquire the knowledge abouta uses of probiotics	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	M	--	H	--	M	H	H	M
CO2	--	M	--	H	--	--	M	L	M
CO3	--	--	--	H	--	--	M	M	H
CO4	--	--	--	H	--	H	H	M	H
CO5	--	--	--	M	--	M	M	L	M

Units	Content	Hrs
Unit I	• **Biological systems and models**: o Routes of administration o Adsorption enhancement o Bioavailability o Site specific delivery; • Pharmacodynamics of protein therapeutics- Inter species scaling	3
Unit II	• **Drug metabolism:** o Oxidation o Reduction o Hydrolysis o Conjugation. o Need for developing new Drugs: Procedure followed in drug design; Prodrug and soft drugs; Drug toxicity.	3

Unit III	• **Drug discovery & cardiovascular drugs:** o Substances derived from bacteria o Plants- insects- and animals o Sources of active principles o D*rugs used in atherosclerosis**	3
Unit IV	• **Pharmaceutical products:** o Microbial products o Antibiotics (penicillin- streptomycin) o *P*robiotics o Animal vaccines- Anti platelets drugs.	3
Unit V	• **Quality assurance and quality control** o Fundamental of quality assurance, o Benefits, o Documentation, o Quality assurance in manufacturing.	3
	Total Contact Hrs	**15**

**- denoted as self study topics*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Lachman L Lieberman, HA, and Kanig, J, Theory and practice of industrial pharmacy, 3rd edition, Varghese publishing & Co, New Delhi, (1986)

Reference Books

1. Jay P Rho and Stan G Louie, Hand book of Pharmaceutical Biotechnology,Pharmaceutical products press, New york, (2003)
2. Heinrich Klefenz, Industrial Pharmaceutical Biotechnology, WILEY-VCH Publication, Germany, (2002)
3. Daan Crommelin and Robert D Sindelar, Pharmaceutical Biotechnology, Tailor and Francis Publications, New york, (2002)
4. Remington's Pharamaceutial sciences, 18th edtion, Mack publishing & Co., Easton, PA(2000)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			Programme Title:	Bachelor of Zoology	
Course Code:	23UZY5AL			Title	Batch:	2023 – 2026
Lecture Hrs./Week	--	Tutorial Hrs./Sem.	--	Advanced Learner Course -I Bioinformatics	Semester:	V
					Credits:	5*

Course Objective

To study about the basic bioinformatics and its tools

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Keep in mind the basic bioinformatic tools	K1
CO2	Comprehend the genomic study and sequence analysis	K2
CO3	Apply the basic knowledge of drug designing	K3
CO4	Sort the core principles of Bioinformatics	K4
CO5	Acquire knowledge about the phylogenetic analysis	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	M	H	H	M	M	M	H
CO2	H	M	L	M	M	L	H	H	M
CO3	M	H	M	H	H	M	H	M	H
CO4	H	M	L	M	M	L	M	H	M
CO5	M	H	L	H	H	M	H	M	H

Units	Content	Hrs
Unit I	• Scope of Bioinformatics • Databases o Biological databases o Specialized databases • Protein sequence database – SWISS-PROT	
Unit II	• Symbols used in databases - Single letter code for nucleotides - Single letter code for aminoacids • Standard genetic codes used in Bioinformatics • PubMed – Hard link database connection • GenBank (Genetic sequence database)	
Unit III	• **Genomics** o Classification and applications • **Proteomics** o Classification and applications • Human genome project o Goals and techniques o Potential benefits	
Unit IV	• Bioinformatics tools • Significance of bioinformatic tools • Similarity tool : BLAST and FASTA • Visualizing tool : RasMol and Chime • Miscellaneous tool : Webcutter	
Unit V	• Virtual Library • Drug designing • Phylogenetic analysis	

	• Construction of phylogenetic tree – PHYLIP (free online sofrware) • Applications of phylogenetic analysis	
Total Contact Hrs		

Pedagogy and Assessment Methods: self study

Text Book

1. Sundaralingam R.& Kumaresan V - Bioinformatics , Saras Publication, 114/35G . A.R.P Camp road, Periavillai, Kottar PO, Nagercoil, Kanyakumari - 2nd edition – (2012)

Reference Books

1. Ron Mansfield - Working in Microsoft office- McGraw-Hill Book Co, New York – (2009).
2. Rajaraman, V - Fundamentals of computer –Prentice Hall of India Pvt.Ltd, New Delhi -110001 – (1986).
3. Simminder Kaur Thukral -Bioinformatics-Orpita Bosu, Oxford University Press, New Delhi – (2007).
4. Attwood T.K. and Parrysmith D.J - Introduction to Bioinformatics - Addison Wesley Longman, Harlow. (1999).
5. Fuelker , M.H. -Bioinformatics – Applications in Life and Environmental Sciences Capital Publishing Company, New Delhi –(2009).
6. Ignacimuthu, S. -Basic Bioinformatics –Narosa Publishing House, New Delhi – (2005).
7. Sharma, Munjal & Shankar - A text book of Bioinformatics – Rastogi Publications, Meerut, India- (2008)
8. Jin Xiong - Essential Bioinformatics - Cambridge University Press - (2006).
9. Subramanian C. - Genomic Bioinformatics- Dominent Publisher, New Delhi – (2010).

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Name: Dr. S. Mariselvi Signature:	Name: Dr. S. Somasundaram Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY611			**Title**	**Batch:**	2023 – 2026
				CC–IX Animal Physiology & Endocrinology	**Semester:**	VI
Lecture Hrs./Week or Practical Hrs./Week	5	**Tutorial Hrs./Sem.**	--		**Credits:**	4

Course Objective

To the complete understanding of all the animals physiological and chemical process associated with living cell in the animal kingdom

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the physical, physiological structure and bio chemical activities at cellular Level	K1
CO2	Understand the comprehend physiological activity of organ system and bio chemical activity of cells	K2
CO3	Apply the functional knowledge on various organs and endocrine glands	K3
CO4	Correlate the physiological activities with the anatomical structure and apply the recent techniques to study the same	K4
CO5	Evaluate the role of physiology and endocrinology in environmental knowledge	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	H	-	-	M	--	M	M	H
CO2	H	H				M	L	H	M
CO3	--	M	--	--	L	M	--	M	M
CO4	--	M	--	--	L	--	L	H	M
CO5	--	L	M	--	--	--	M	M	M

Units	Content	Hrs
Unit I	• **Digestion** o Functional anatomy of digestive system o Digestion and absorption. o Neuroendocrine regulation of gastro – intestinal movements and secretions. • **Respiration:** o Aerobic & Anaerobic respiration o Respiratory pigments in animals o Transport of gases - O_2 and CO_2	15
Unit II	• **Circulation:** o Myogenic & Neurogenic heart o Pacemaker and electrical activity of heart in man o Composition and functions of blood • *Composition and functions of Lymph** • **Water Balance:** o Osmatic and Ionic regulations in aquatic animal (Fish) • **Receptors:** o Chemoreceptors - Gustatoreceptors & o Olfactoreceptors	15

	○ Photoreceptor (Eye) ○ Phonoreceptor (Ear)	
Unit III	• **Effectors:** ○ Types of muscles : Striped- unstriped and cardiac muscles ○ Structure and properties of striped muscle • Mechanism of muscular contraction- sliding filament theory. **Nervous system:** ○ Structure of vertebrate neuron ○ Conduction of nerve impulse through : Non-myelinated neuron Synapse ○ Neuromuscular junction ○ Reflex action and reflex arc • **Excretion**: ○ *Structure of mammalian kidney** ○ Structure of Nephron ○ Synthesis of ammonia - urea and uric acid ○ Formation of urine in Human • **Reproductive system:** ○ Male and female reproductive system structure	15
Unit IV	• **Scope of Endocrinology** • **Endocrine glands** (Structure & Functions) ○ Pituitary ○ Thyroid ○ Parathyroid ○ Pancreas ○ Testes & ovary • Hormonal interactions- Feedback control mechanisms.	15
Unit V	• **Mechanism of hormone action:** peptide, steroid & thyroid. • **Hormonal disorders:** ○ Pancreas (Diabetes mellitus) ○ Thyroid (Goiter) ○ Pituitary (Gigantism - Dwarfism) ○ Sex hormones (Infertility).	15
	Total Contact Hrs	**75**

**- denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Rastogi S.C. Essentials of Animal Physiology, 4th Edition . New age international publishers. (2008)

Reference Books

1. Arumugam N. Animal physiology- Saras Publication, 114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamil nadu, India (2018)
2. Suresh.R. Essentials of Human Physiology. Books and Allied Pvt. Limited. Kolkata (2012)
3. Arora. M.P.. Animal Physiology, Himalaya Publishing house, Mumbai (2015)
4. S. Sree Kumar, Basic Physiology –PHI Learning Pvt. Ltd, New Delhi, 110001, Edition. (2010)
5. Berry, A.K. A text book of Animal Physiology –EMKAY Publication, New Delhi-110051 (2010)
6. Sreekumar S. Edition. Basic Physiology –, PHI Learning Pvt. Ltd, New Delhi. (2010)
7. Sastry, K.V. Endocrinology & Reproductive Biology –Rastogi Publications, Shivaji road, Meerut-250002, India. (2009-2010)
8. Prakash S. Lohar. Endocrinology. MJP Publishers, Chennai. (2005)
9. Verma, P. S ., Tyagi and Agarwal. Animal physiology - Chand& company ltd (1997)
10. Parameswaran, Ananthakrishnan& Ananthasubramaniam, Outline of animal physiology - S. Viswanathan printers & Publishers Pvt. Ltd. (1991)

Course Designed by	Verified by HoD	Verified by CDC Coordinator	Verified by COE
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature :

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY612			**Title**	**Batch:**	2023 – 2026
				CC–X Ecology and Evolution	**Semester:**	VI
Lecture Hrs./Week or Practical Hrs./Week	5	**Tutorial Hrs./Sem.**	- -		**Credits:**	4

Course Objective

To know about the basic concepts of Ecology, origin of life, animal population animal relationships and Evolution.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Recollect the importance of abiotic factors and origin of life	K1
CO2	Understand the basic concepts of animal relationship and fossils	K2
CO3	Apply knowledge about animal ethics and evidences of evolution	K3
CO4	Analyze the animal population and organic evolution of man	K4
CO5	Gain the knowledge about biogeochemical cycles.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	H	H	M	H	L	M	H	H
CO2	M	H	H	M	M	H	L	M	H
CO3	M	H	H	L	M	H	H	M	H
CO4	H	H	H	L	M	H	M	H	H
CO5	M	H	H	H	M	M	L	H	H

Units	Content	Hrs
Unit I	• **Scope of ecology** • **Abiotic factors** o Soil: Pedogenesis - texture- profile – fauna and soil erosion. o *Water: Properties** o Water problems in aquatic habitat – Fresh water, Sea water and Esturay water o Temperature: Range - Thermal stratification- biological effects of temperature o Light: biological effects of light	**15**
Unit II	• **Biogeochemical cycle** o Gaseous cycle : Carbon- Nitrogen o Sedimentary cycle: Sulphur- Phosphorus • **Animal relationship** o Commensalism o Mutualism o Parasitism • **Animal population** o Characteristics of population - Natality- mortality- growth- density • **Human Ecology**	**15**

	○ Population growth (Explosion), Population control • **Space Ecology** ○ Physiological changes during space travel.	
Unit III	• Theories of origin of life • Biochemical origin of life • *Urey and Miller's experiment** • **Evidences of evolution** ○ Morphological: Homologous structures – vestigial organs – connecting links ○ Embryological: Recapitulation theory • Palaeontological : Missing links	**15**
Unit IV	• Darwinism • Neo Darwinism • Lamarckism • Neo Lamarckism	**15**
Unit V	• Mutation theory of DeVries • Geological time scale • Fossils: Types • Dating of fossils • Evolution of man – Cultural and Biological	**15**
	Total Contact Hrs	75

**denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Verma and Agarwal. Principles of Ecology. S. Chand & Company, Ltd. New Delhi, 1100555th edition(2003).
2. Saha, T. K. Life: Origin, evolution and adaptation. Books and allied (P) Ltd. Kolkata – 700 010, 1st edition(2002)

Reference Books

1. Arumugam N. Concepts of ecology. Saras publication 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari (2021).
2. N.Arumugam- Ecology, Toxicology and Evolution, Saras Publications, Kanyakumari(2015)
3.Arumugam N. Organic Evolution–- Saras publication 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari(2015)
4. Tomar and Singh, Evolutionary Biology – Rastogi Publication, Meerut. 250 0028th edition(2010).
5. Odum E. P. Fundamentals of ecology . W. B. Saunders Company, London. 1st edition. (1971).

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. M. Durairaju Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY613			**Title**	**Batch:**	2023 – 2026
				CC XI - Microbiology and Immunology	**Semester:**	VI
Lecture Hrs./Week	5	**Tutorial Hrs./Sem.**	--		**Credits:**	4

Course Objective

To acquire a basic knowledge of microbiology and immunology, working mechanism of immunity, basic methods in microbiology, classification of microganisms and Immunity and applications of microbiology and immunology

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Keep in mind the scope of microbiology and immunology	K1
CO2	Understand the classification of microorganisms and immunity	K2
CO3	Apply the knowledge about applied microbiology and Immunology	K3
CO4	Analyse the types of Immunity involved in our body against pathogen	K4
CO5	Acquire the knowledge of microorganisms and immunity	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	H	M	H	H	M	H	H	H	H
CO2	H	M	H	H	M	H	H	H	M
CO3	M	H	H	H	M	H	H	H	H
CO4	M	H	H	H	M	H	H	M	H
CO5	H	M	H	H	M	H	H	M	H

Units	Content	Hrs

Unit I	• Introduction and scope of microbiology
	• Classification of Bacteria, virus, Fungi
	• **Basic methods in Microbiology**
	  o Pure culture - purification techniques
	  o Types of culture media
	  o Preparation of Culture media
	  o Culture techniques of microorganisms
	  o Bacterial growth and Growth curve
	• **Staining procedure and types of staining**
	• **Sterilization, Isolation and Maintenance of Microbes**
		15

Unit II	• **Bacteria**:
	  o Major features and structure of bacteria
	  o Economic importance of bacteria
	• **Viruses**:
	  o Characteristic and structure of viruses
	  o Structure of Bacteriophage
	• **Applied microbiology**
	  ▪ **Agricultural microbiology**:
	  ▪ Role of microorganism in soil fertility
	  ▪ Biofertilizers-Rhizobium
	  ▪ Role of microorganism in agriculture
		15

Unit III	• **Food microbiology**: ▪ Food spoilage ▪ Food borne diseases, ▪ Food borne infections ▪ Food borne intoxicans ▪ *Food preservation** • **Medical microbiology** ▪ Bacterial Diseases -TB, Cholera ▪ Viral Diseases – Measles, Covid19 ▪ Fungal Diseases- Cutaneous and systemic mycoses • **Industrial Microbiology** ▪ Fermentor design ▪ Microbial Selection,ethanol and penicillin Production	**15**
Unit IV	• **Immunology** o Introduction and scope of immunology • **Classification of Immunity** o Innate Immunity o Acquired Immunity • **Immune Response** o Mechanism of Humoral immune response o Mechanism of Cell mediated immune response • **Lymphoid Organs** o Primary lymphoid organs o Secondary lymphoid organs	**15**
Unit V	• **Cells of the immune system** o Lymphoid lineage o Myeloid lineage • **Immunoglobulins** o Structure of immunoglobulin o Classes and properties of immunoglobulin • **Major Histocompatibility complex-Classification of MHC** • **Tumor immunology** o Types of tumor o *Properties and causes of tumor cells** o Causes of tumour o Factors involved in tumor immunity o Immune diagnosis and immunotherapy of tumor	**15**
	• **Total contact Hrs**	**75**

** denoted as self study topics*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Dubey R. C. and Maheswari, D.K. A Text book of Microbiology, S. Chand Publishers, (2013)
2. Shyamasree ghosh, Immunology and Immunotechnology –Books and allied (P) Ltd. (2017)

Reference Books

1. Dulsy Fatima and N. Arumugam. Immunology, Saras Publications, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari(2020)
2. Ryan KJ. Ray CG, Editors. Sherris Medical Microbiology 7th Edition, MCGraw Hill Education Singapore(2018)
3. Mani. A., Selvaraj. A.M., Narayanan, L. M. and Arumugam, N. Microbiology. Saras publications, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari(2017)
4. Willey JM, Sherwod L, Woolverton CJ Prescotts Microbiology, MCGraw Hill Education Singapore(2017)
5. Atlas RM. Principles of Microbiology, Ist Edition, Mosby- Yearbook, Inc Missouri(1995)
6. John.E.Smith, Biotechnology – Vikas Publishing House Pvt. Ltd, New Delhi(1993)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Ms.S.Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY6E4			**Title**	**Batch:**	2023 – 2026
				DSE - II Sericulture	**Semester:**	VI
Lecture Hrs./Week	4	**Tutorial Hrs./Sem.**	--		**Credits:**	4

Course Objectives

To acquire knowledge in CSB, moriculture, silkworm rearing and reeling techniques.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the historical background and importance of Sericulture	K1
CO2	Get the idea for increasing cocoon productivity and to prevent silkworm diseases	K2
CO3	Execute the construction of rearing house and self employment in silkworm rearing	K3
CO4	Analyze this course for employment and job opportunities in the public, private and Govt.sectors	K4
CO5	To Assess the Knowledge of moriculture and sericulture.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	L	M	M	M	M	H	M	M
CO2	H	H	L	M	M	H	M	M	M
CO3	M	L	M	L	H	M	H	H	H
CO4	M	M	L	M	M	H	H	M	H
CO5	M	L	L	L	M	H	M	L	L

Unit	Content	Hrs
Unit I	• Definition and History of Sericulture • Economic importance of sericulture • Varieties of silkworms: Mulberry silk worm: Bombyx mori Non- Mulberry silk worm: Tasar- Muga and Eri silk worms • Moriculture: Optimum conditions for mulberry growth • Planting direction and season • Planting systems	**12**
Unit II	• Methods of vegetative Propagation o Cutting o Layering o Grafting • Pruning: Low cut–High cut and Rejuvenation pruning • Methods of Leaf harvesting • *Preservation of leaves** • Diseases of Mulberry: Fusarium Root Rot – Powdery Mildew – Leaf Blight	**12**

Unit III	• Life cycle of Bombyx mori • Structure of silk worm • Structure of Silk gland • Grainages • Incubation and its methods • Bed cleaning and its methods • Silkworm rearing appliances	**12**
Unit IV	• Disinfection • Rearing of silkworm : • Chawki, Shelf- Floor and shoot rearing • Mounting: Methods and precaution during mounting • Diseases of silk worms: o Pebrine, o Viral Flacherie (IFV) o Grasserie :Nuclear Polyhedrosis (NPV)	**12**
Unit V	• Pest of silk worm-Indian Uzi fly • Physical characteristics of cocoons • *Defective cocoons** • Reeling appliance – Country Charkha • Cocoon Markets • Raw silk testing	**12**
Total Contact Hrs		**60**

* *denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Ganga G. and Sulochana Chetty. J. – An Introduction to sericulture – Oxford and IBH Publishing Co. PVT. LTD – 2nd Edition, (2020).

Reference Books

1. Ezhili N. & Thirumathal K. – A hand book for sericulture –Shrishti Impression, Coimbatore – (2008)

2. Ullal and Narasimhanna. M.N. – Hand Book of practical sericulture –SBS Publishers, Bangalore – 2nd Edition – (1981)

3. Manual on sericulture – FAO – Central Silk Board Bangalore – (1977).

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Mariselvi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY6E5			**Title**	**Batch:**	2023 – 2026
				DSE- II Insect Pest Management	**Semester:**	VI
Lecture Hrs./Week	4	**Tutorial Hrs./Sem.**	--		**Credits:**	4

Course Objectives

To study the agricultural insects, pesticides, pest control management and Integrated Pest Management

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember agricultural pest and their management	K1
CO2	Understand the control of pest management	K2
CO3	Apply modern methods in agricultural field	K3
CO4	Interpret application of pesticide	K4
CO5	Acquire the knowledge about different types of pests	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	L	M	L	M	H	H	M	M
CO2	H	L	H	M	M	H	M	M	M
CO3	M	M	L	L	H	M	H	H	H
CO4	H	L	M	M	M	H	H	M	H
CO5	M	M	L	L	M	H	M	M	L

Units	Content	Hrs

Unit I	• Pest – Definition and Classification
	• Reasons for insect assuming pest status
	• Insect pest out break
	  o Economic injury level
	  o Economic threshold level
	• Injuries and Damage caused by insect pests
		12

Unit II	• Assessment of insect pest population methods
	  o Sample count and total count
	• Assessment of insect pest damage-methods
	  o Leaf damage and root damage
	• Pest surveillance and forecasting pest outbreak
	• *Need for insect pest management**
		12

Unit III	• Pest control • Climatic factors • Natural enemies • Physical, Mechanical, Chemical, Cultural, B*iological and legal control**	**12**
Unit IV	• Insecticide- Formulation of insecticides • Classification based on mode of entry and mode of action • Attractants- Antifeedants and Chemosterilants • *Integrated Pest Management**	**12**

Unit V	Biology, life cycle, damage and management of Agriculture pest • Cotton – The cotton Boll worm – *Helicoverpa armigera* • Coconut – The Rhinoceros beetle – *Oryctes rhinoceros* • Groundnut – The Red hairy caterpillar – *Amsacta albistriga* • Sugarcane – The sugarcane stem bore- *Chilo infuscatellus*	**12**
Total Contact Hrs		**60**

**denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Chapman, R.F - The insects: Structure and Function, Hodder and Bhoughton Ltd., Kent, U.S.A.,(2015)

Reference Books

1. Nalina Sundari, M.S., and R. Santhi - Entomology, MJP Publishers, Chennai –(2006).
2. Shukla & Upadhyay - Economic Zoology –. Rastogi Publications, Shivaji Road, Meerut-250002. India – (2003).
3. Vasantharaj David, B., - Elements of Economic Entomology, Popular Book Depot., Chennai, (2001)
4. Nayar, K.K.., Ananthakrishnan,T.N., and David., M., - General and Applied Entomology, Tata McGraw Hill Pub. Co., Ltd., New York – (1995)
5. Rathinaswamy,T.K., - Medical Entomology, S. Viswanathan and Co., Madras – (1986).
6. Snodgrass, R.E., - Principles of Insect Morphology, McGraw Hill and Co., New York – (1985).
7. Nayar, K.K. - Economic Entomology and Applied Entomology - Oxford and IBH Publishing Co., New Delhi – (1983).
8. Mani, M.S., - General Entomology, Oxford and IBH publishing Co., New Delhi – (1982).

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Mariselvi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY6E6			**Title**	**Batch:**	2023 – 2026
				DSE - II Parasitology	**Semester:**	VI
Lecture Hrs./Week	4	**Tutorial Hrs./Sem**	-		**Credits:**	4

Course Objectives

To study about the different parasites and diseases in human.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the diversity of parasites	K1
CO2	Comprehend the parasite-host relationship	K2
CO3	Apply Medical Importance of parasites	K3
CO4	Analyse the Life cycle of parasites	K4
CO5	Recollect the knowledge on parasitic diseases in human	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	L	L	L	M	L	M	H	L	H
CO2	L	M	L	L	M	L	M	M	H
CO3	M	M	M	M	M	M	H	L	M
CO4	L	M	L	L	M	L	M	M	H
CO5	M	L	M	M	L	M	H	L	M

Units	Content	Hrs
Unit I	• Scope of parasitology • Host parasitic relationship –Commensalism, Phoresis, Parasitism, Mutualism • Ecological aspects of parasitism • Minor Medical Importance of parasites	**9**
Unit II	• **Effect of parasites on hosts** Tissue damage – Hyperplasia, Hypertrophy, Metaplasia, Neoplasia. • Opportunistic parasites –*Toxoplasma gondii, Cryptosporidium parvum, Enterocytozoon bieneusi*	**9**
Unit III	• *Locomotory organs of parasites** • Encystation in parasites • Reproduction in parasites • Pathogenecity in human – *Naegleria fowleri*, Acanthamoeba	**9**

Unit IV	• **pathogenecity**
	  o Ciliates – *Balantidium coli*
	  o Flagellates – *Geordia lamblia*
	• Blood and Tissue Protistans - *Leishmania* and *Trypanasoma*
		9

Unit V	• Nematode infection of human - *Enterobius vermicularis* and *Trichuris trichiura*. • Hookworm – *Ancylostoma duodenale* and *Trichinella spiralis* • Vector borne nematode - *Wuchereria bancrofti* • *Filarial nematode – Loa loa**	**9**
	Total Contact Hrs	**45**

** denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Human parasitology-Burton J Bogtish – Academic Press, An Imprint of Elsevier – 5th Edition, (2019)

Reference Books

1. Loker, Eric S. and Bruce V.Hofkin - Parasitology: A Conceptual Approach, Garland Science, Taylor & Francis Group, New York and London.ISBN978-0-8153-4473-5 – (2015)
2. Zimmer, C. Parasite Rex: Inside the Bizarre World of Nature's Most Dangerous Creatures, The Free Press, New York.ISBN 978-0-7432-0011-(2000)
3. Desowitz, R.S. New Guinea Tapeworms and Jewish Grandmothers: Tales of Parasites and People, W.W. Norton and Company, New York.ISBN 978-0-393-30426-8 (1987)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Mariselvi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme code:	B.Sc		**Programme Title :**	Bachelor of Zoology	
Course Code:	23UZY6E7		**Title:**	**Batch :**	2023 – 2026
			DSE–III Aquaculture	**Semester:**	VI
Lecture Hrs/Week:	5 Tutorial hours	---		**Credits:**	4

Course Objectives

The student learns the methods of culturing economically viable fish, prawn, oyster and clam farming. Best practices adopted in aquaculture, fish diseases and methods of their control.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Keep in mind the environmental assessment strategies and management system in aquaculture.	K1
CO2	To Acquire the knowledge on culture of aquatic animals.	K2
CO3	To Apply the knowledge in different fishing strategies of aquaculture	K3
CO4	To Analyze the enrichment of live food and nutritional requirements of aquatic organisms	K4
CO5	To Evaluate the various technique involved in aquaculture	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	H	M	L	M	M	H	M	H
CO2	M	H	L	M	M	H	H	M	H
CO3	M	M	H	L	M	M	H	M	M
CO4	H	H	M	M	L	M	H	L	H
CO5	M	H	M	L	M	L	H	M	H

Units	Content	Hrs
Unit I	• Scope of Aquaculture in India • Desirable character of fishes o Teleost – *Labeo rohita* o Morphology and anatomy ▪ Digestive system ▪ Reproductive system • Economic importance of fish • Nutritive value of fish	**15**
Unit II	**Culture of Fishes** • Types of fish Pond o Nursery pond, o Rearing pond o Culture pond, • Preparation of pond for fish culture. **Culture methods** o Mono culture , o Poly culture o Integrated culture, o Fresh water culture, o Marine culture ▪ Hypophysation ▪ Age and growth study	**15**

	Fish Feed and nutrional requirement • **Live feed** o Artemia culture, o Daphnia,Spiruliana o Tubifex, Cyclops and chlorella • **Artificial feed** o Classification of feed o Composition of an ideal feed o Preparation of artificial feed o Feeding methods and Problems in artificial feed.	
Unit III	**Biofloc technology: Application and animal food industires** • **Fresh water fishes -** Indian major carps o *Catla catla* o *Cyrhinus mrigala* o *Labeo rohita*(Rohu) • **Exotic fishes**- *Cyprinus carpio* and *Oreochromis mossambicus* o **Marine fisheries** - *Sardinella longiceps* • **Prawn culture**- Methods- Seed collection, hatchery, hormonal control- paddy and pokkali fields • **Oyster culture**- Edible oyster and pearl oyster culture	**15**
Unit IV	**Fishing Crafts and Gears** • *Fish crafts – different types of fishing boats**. • Gears o Hooks o Simple dipnets o Chinese dipnets o Gill nets o Purse seine o Trawl nets **Preservation of fishes** o Identification of good and spoiled fish o Refrigeration o Freeze drying o Fumigation o Canning o Salting	**15**
Unit V	• **Ornamental fish culture** o Requirements and setting of an aquarium • **Aquarium fishes**- • **Egg layer** *Carassius auratus, Pterophyllum scalare, Betta splendens, Colisa* o **Live bearer :** *Poecilia, Puntius tetrazona, Xiphophorus helleri, Poecilia reticulata* • **Fish pathology and major diseases** o Bacterial diseases- Dropsy, Gill Rot o Viral diseases - Ebizootic ulcerative syndrome, Haemorrhagic septicaemia o Fungal diseases - Gill Rot, Saprolegniasis o Fish parasites - Argulosis • Principles of harvesting- transport and marketing • By-products of fishes • *Role of fishes in mosquito control** • Transgenic fishes	**15**
Total Contact Hrs		**75**

**denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. Pandey and Shukla, Fish and fisheries. Rastogi publication (2018)
2. Jordan E. L. and Verma. P. S.,Chordate Zoology. S. Chand and company LTD, New Delhi(2006).
3. Shanmugham, K. Fishery biology and aquaculture, LEO Pathippagam, Madras (1992)

Reference Books

1. Arumugam, N Aquaculture SARAS Publications, Nagercoil, Tamilnadu (2020).
2. ICAR Publication 1st edition. Hand book of fisheries and aquaculture, Directorate of information and publicatios of agriculture. Indian Council of Agricultural Research, New Delhi (2006)
3. Charls L Cutting, Fish processing and preservation. Agrobotanical publishers India (1999)
4. Vadapalli and Satyanarayanan, Fish culture. Narendra publishing house, Delhi (1996) .
5. Agarwal. S. C., A hand book on fish farming. Narendra publishing house. Delhi (1994)
6. Datta Munshi and Srivastava, Natural history of fishes and systematic of Fresh-water fishes of India. Narendra Publishing House, New Delhi (1988).
7. Jhingran, V.G., Fish and Fisheries of India – Hindustan Publishing Corporation India Delhi. Printed in India at Gopsons paper Pvt. Ltd. Noida1988.

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY6E8			**Title:**	**Batch:**	2023 – 2026
				DSE– III Wildlife Conservation	**Semester:**	VI
Lecture Hrs./Week	5	**Tutorial Hrs./Sem.**	--		**Credits:**	4

Course Objective

To acquire knowledge on forest types, biodiversity, wild life conservation and techniques deployed for conservation.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the importance of forest, wildlife conservation and its management techniques	K1
CO2	Understand the methods used in wildlife census	K2
CO3	Apply knowledge about conservation on Indian wildlife	K3
CO4	Analyze and estimate different animal population	K4
CO5	Acquire the knowledge about priorities in wildlife conservation	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	L	H	L	M	--	M	H	M
CO2	L	--	H	--	M	L	M	M	M
CO3	--	--	H	--	L	--	H	H	M
CO4	--	--	H	--	M	L	M	M	L
CO5	--	--	H	--	L	L	M	H	M

Units	Content	Hrs
Unit I	• **Scope and importance of Wildlife** o Causes of wildlife depletion o *Economic importance of wildlife** o Need for wildlife conservation o Rare, endangered,threatened endemic species	15
Unit II	• **Forestry** o Types in India- identification, dendrology; • **Deforestation & Impacts** o Impact and removal of invasive alien species o Remote sensing in Forestry management.	15
Unit III	• **Wildlife Management Techniques** o Vegetative analyses – Point Centered Quadrat, Quadrat, Strip transect o GIS and Remote sensing in wildlife habitat surveys- • **Wildlife Photography** o Types of cameras, camera traps o Field equipments-altimeter, pedometer, field compass, binoculars; radio collaring; GPS	15

Unit IV	• **Wildlife Census Techniques** o Total counts -Sample counts o Direct count -block count, transect methods, Point counts, visual encounter survey, waterhole survey o Indirect count -Call count, track and signs, pellet count, pugmark, camera trap,Capture-recapture techniques	15
Unit V	• **Conservation of Wildlife**: in-situ and ex-situ conservation: o *Wildlife Sanctuaries,and Parks*,* o Tiger Reserves and Biosphere reserves: o Project: Tiger; Elephant o Role of Government and Non-Governmental organizations in conservation.	15
	Total contact hours	**75**

** denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

1. K.V. Krishnamurthy An advanced text book on Biodiversity, principles, and practice, Oxford IBH Publishing company private limited, New Delhi. (2017).
2. Anne E Magurran. Ecological diversity and its measurement. Springer Netherlands. (1988)

Reference Books

1. P.K. Maiti and P.Maiti. Biodiversity perception, Peril, and Preservation. PHL Learning private Ltd., New Delhi. (2011)
2. D. Kar. Biodiversity Conservation prioritization. Swastik publications, New Delhi. (2010)
3. Prithipalsingh. An introduction to biodiversity . ANE Books India , New Delhi(2007)
4. Asish Ghosh. Natural resource conservation and environment management. APH Publishing Corporation, New Delhi(2003)
5. B.S. Badan and Harish Bhatt. Ecotourism. Commonwealth Publishers, New Delhi(2007)
6. K.P.Singh and J.S.Singh (EDS).. Tropical ecosystem, ecology and management. Willey eastern limited, New Delhi. (1991)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S.Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme code:	B. Sc.,	Programme Title :	Bachelor of Zoology	
Course Code:	23UZY 6E9	Title:	Batch :	2023 – 2026
		DSE–III Dairy Farming and Management Technology	Semester:	VI
Hrs/Week:	5		Credits:	4

Course Objectives

To provide recent knowledge of dairy farming, animal management and production

Course Outcomes

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

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CO Number	CO Statement	Knowledge Level
CO1	Remember knowledge of dairy farming and milk product	K1
CO2	Deduce the Breeding practices in dairy farm	K2
CO3	Apply the knowledge in Production of condensed and dried milks	K3
CO4	Sort of the Food safety and quality assurance.	K4
CO5	To Assess the knowledge of diry Product	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	M	M	L	M	M	H	H	H
CO2	M	L	L	L	L	H	H	M	M
CO3	H	M	M	M	M	M	H	H	H
CO4	M	L	L	L	H	L	H	M	H
CO5	M	M	L	M	M	M	H	M	M

Units	Content	Hrs
Unit I	• Scope of dairy farming • Dairy progress in India • Milk production in India and Tamil Nadu • Nutritive value of milk * • By products of milk	**15**
Unit II	**ANALYTICAL TECHNIQUES IN MILK AND MILK PRODUCTS** • Detection of Hypochlorites • Estimation of Chloramines • Test for presence of skimmed milk powder in Natural milk (Cow, buffalo, goat, sheep). • Alkaline phosphatase Test - Pasteurisation in Liquid Milk	**15**
Unit III	**DAIRY HUSBANDRY** • Dairy Cattle Breeds • Indigenous Breeds o Gir o RedSindhi o Sahiwal and Deoni • Exotic Breeds ▪ Jersey ▪ Holstein ▪ Brown Swiss • Nutritive requirements of dairy cows • Maintanannce of Health and Hygiene *	**15**

Unit IV	**DAIRY CHEMISTRY**
	• Physical and chemical properties of milk
	• Structural elements of milk
	  o Fat Globules
	  o Casein Micelles
	  o Globular Proteins
	• Environmental factors influencing the composition of milk
	DAIRY MICROBIOLOGY
	• Common microorganisms in milk
	• Spoilage of milk
	• Fermentation of milk
	• Milk borne diseases
		15

Unit V	**DAIRY PROCESSING AND TECHNOLOGY:** • Dairy processing • Standardization • Pasteurization • Homogenization • Indigenous milk products	**15**
Total Contact Hrs		**75**

**- denoted as self study topic*

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Books

1. Banarjee G.C A Text book of Animal Husbandry S.CHAND Publications, Oxford & ibh Publishing Pvt. Ltd (1998).

Reference Books

1. Eiri Board Handbook of Dairy Farming: To Produce Milk with Packaging Engineers India Research Institute (2008).
2. Gupta P.R. Dairy India Year Book – (2007 b)
3. Lampert., Modern Dairy Products Chemical Publishing Co Inc.,U.S.; 3 edition (1998)
4. Varnam, A., Sutherland, Jane P., Milk and Milk Products Technology, chemistry and microbiology publishers, Springer, U.S (1994).
5. John L. Curtis Cattle Embryo Transfer Procedure Academic Press Inc (1992).
6. Schmidt G. H., Van vleck L. D. and Hutjens M. F. Principles of Dairy Science Subsequent edition (1988)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme code:	B. Sc.,	**Programme Title :**	Bachelor of Zoology	
Course Code:	23UZY 616	**Title:**	**Batch :**	2023– 2026
		Project	**Semester:**	VI
Hrs/Week:			**Credits:**	4

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Project and Viva Voce

Each faculty will be allotted 5 students. A specific problem will be assigned to the students. The topic/area of work will be finalized at the end of IV semester, allowing scope for the students to gather relevant literature during the vacation. The research work will be carried out based on the objective of the project and viva voce/presentation will be conducted by a panel comprising of HOD, internal examiners. A power point presentation by the student group will be evaluated on the basis of students' response to the questions.

Area of Work

Limnology, Pollution studies, Clinical studies, Molecular Biology, Fish Toxicology, Microbiology, Entomology, Environmental Science, Biotechnology, Bioinformatics, Cancer Biology.

Methodology

Each project should contain the following details:

- Brief introduction on the topic
- Review of Literature
- Materials and Methods
- Results and Discussions – evidences in the form of figures, tables and photographs
- Conclusion / Summary
- Bibliography

The above contents should not exceed 50 pages

Internal Assesment

S. No	Internal Components	Marks
1	Selection of the field of study, Topic & Literature Collection	5
2	Research Design and Data Collection	5
3	Analysis & Conclusion	5
4	Rough Draft Submission	10
Total		**25**

External Assesment

S. No	External Components	Marks
	Mode of Evaluation	
	Project Report	
1	Relevance of the topic to academic / society Objectives	15
2	Experimental Design	15
3	Expression of Results and Discussion	20
	Viva Voce	
4	Presentation	15
5	Discussion	10
Total		**75**

Course Designed by	Verified by HoD	Verified by CDC Coordinator	Verified by COE
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY6S6			**Title:**	**Batch:**	2023 – 2026
				SEC IV: Naan Muthalvan- Zoology for Competitive Exams	**Semester:**	VI
Lecture Hrs./Week	-	**Tutorial Hrs./Sem.**	--		**Credits:**	2

Course Objective

To acquire the comprehensive knowledge of zoology to achive the competitive examinations.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the basic concepts of emerging fileds of zoology	K1
CO2	Understand the Knowledge about different fields of zoology	K2
CO3	Analyse the principles and concepts of zoology	K3
CO4	Deploy the zoology knowledge to competitive examinations	K4
CO5	Assess the various methods and tools to remember the zoology topics	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	L	M	L	H	H	M	M	H
CO2	M	M	L	L	M	H	M	M	H
CO3	L	M	M	M	M	H	H	M	H
CO4	M	M	M	M	M	M	M	M	H
CO5	M	M	M	M	M	M	H	M	H

Units	Content	Hrs
Unit I	**GENETICS** Mendelian principles - Concept of gene : Allele, multiple alleles, pseudoallele, complementation tests -linkage and crossing over, sex linkage, sex limited and sex influenced characters. -Extra chromosomal inheritance - Human genetics : Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders. Mutation : Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis.	
Unit II	**DEVELOPMENTAL BIOLOGY** Basic concepts of development – Gametogenesis -fertilization and early development: zygote formation, cleavage, blastula formation- Morphogenesis and organogenesis in animals	
Unit III	**ANIMAL PHYSIOLOGY** Blood and circulation - Cardiovascular System: - Respiratory system - Nervous system - Sense organs - Excretory system - Digestive system - Reproductive system - Endocrine glands.	
Unit IV	**ECOLOGY** The Environment - Population Ecology- Species Interactions- Community Ecology- Ecological Succession-Ecosystem structure- Biogeography- Applied Ecology- Environmental pollution; -Conservation Biology	

Unit V	**EVOLUTION AND BEHAVIOUR** Emergence of evolutionary thoughts Lamarck; Darwin–concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; Spontaneity of mutations-Evolutionary synthesis- Origin of cells and unicellular evolution-Experiement of Miller (1953-Paleontology and Evolutionary History-Molecular Evolution: Concepts of neutral evolution; Molecular tools in phylogeny, classification and identification; Protein and nucleotide sequence analysis; origin of new genes and proteins; Gene duplication and divergence-Mechanisms: Population genetics.	
	Total Contact Hrs	

**denoted as self study topics*

Pedagogy and Assessment Methods: Self Study

Text Book

1. Mani. A., Selvaraj. A.M., Narayanan, L. M. and Arumugam, N. Microbiology. Saras publications, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari(2007)
3. Verma and Agarwal. Principles of Ecology. S. Chand & Company, Ltd. New Delhi, 1100555th edition(2003).
4. Saha, T. K. Life: Origin, evolution and adaptation. Books and allied (P) Ltd. Kolkata – 700 010, 1st edition(2002)

Reference Books

1.CSIR-UGC National Eligibility Test (NET) for Junior Research Fellowship and Lecturer-ship (2022)

2. Balinsky - Embryology - Philadelphia, Saunders College Publishing - 5th Edition, (2012).

3.Tomar and Singh, Evolutionary Biology – Rastogi Publication, Meerut. 250 0028th edition(2010).

4. Berrill, W. J. and Graw M. C. - Developmental biology - Hill Book Co, New York – (2010).

5. Kottari, L., *et al*., - Essentials of Human Genetics. University Press Private Ltd. Hydrabad, 500029 - 5th edition – (2009).

6. Verma and Agarwal - Genetics. S. Chand & Company, Ltd. New Delhi, 110055 - 3rd edition –(2008).

7. Miglani G. S. - Advanced Genetics. Narosa Publishing House, New Delhi, 110002 - 1st edition –(2002).

8. Subramaniam - Developmental Biology. Narosa Publishing House, New Delhi – (2002)

9. Russell, J.- Essential Genetics. Black well Scientific Publication London - 2nd edition – (1987).

10. E.D. Garber - Cytogenetics – An Introduction. TATA McGRAW – Hill Publishing Company Ltd. New Delhi - (1979)

11.Wesley - An Outline of animal development – Davenport, Addison –publishers, University of Michigan – (1979).

12.Odum E. P. Fundamentals of ecology . W. B. Saunders Company, London. 1st edition. (1971).

Course Designed by	Verified by HoD	Verified by CDC Coordinator	Verified by COE
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R. Manickachezhian Signature:

Programme Code:	B.Sc.,			**Programme Title:**	Bachelor of Zoology	
Course Code:	23UZY6AL			**Title**	**Batch:**	2023 – 2026
				Advanced Learner Course- II Immuno therapeutics	**Semester:**	VI
Lecture Hrs./Week	-	**Tutorial Hrs./Sem.**	--		**Credits:**	5*

Course Objective

To acquire the Knowledge of diseases and working mechanisms and test against infectious diseases.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Remember the concepts of infections	K1
CO2	Understand the Knowledge about immunotechniques	K2
CO3	Analyse the diseases by diagnostic methods	K3
CO4	Deploy the biosyntheisis of antibodies	K4
CO5	Assess the various tests used to detect the diseases	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	M	L	M	L	H	H	M	M	H
CO2	M	M	L	L	M	H	M	M	H
CO3	L	M	M	M	M	H	H	M	H
CO4	M	M	M	M	M	M	M	M	H
CO5	M	M	M	M	M	M	H	M	H

Units	Content	Hrs
Unit I	**Introduction** o Infectious Disease Causing organisms o Types of Infection o Pathogen Escape Mechanisms o Immune response to Malaria o Plasmodium Escape Mechanism	
Unit II	**Biosynthesis of Antibody** • Site and Genetic control of Antibody • Mechanisam of Biosynthesis of Antibody • Theories on Antibody Synthesis	
Unit III	**Monoclonal AntibodiesMCAs** • Production of Monoclonal antibodies • Applications of Monoclonal antibodies* **Transplantation Immunology** • Types of Graft • Graft rejection • Mechanism of Allograft rejection	

Unit IV	**Auto Immune Diseases** • Characteristics of autoimmune diseases • Causes of autoimmune diseases • Pathogenesis of autoimmune disease • Diagnosis of autoimmune diseases • Treatment of autoimmune diseases	
Unit V	**Immunotechniques** • Double immunodiffusion • Radial immunodiffusion • Enzyme Linked Immuno sorbent Assay • VDRL Test for Syphilis • Widal Test • Well Felix Test	
	Total Contact Hrs	

**denoted as self study topics*

Pedagogy and Assessment Methods: Self Study

Text Book

1. Mani. A., Selvaraj. A.M., Narayanan, L. M. and Arumugam, N. Microbiology. Saras publications, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari(2007)
2. Dulsy Fatima and N. Arumugam. Immunology, Saras Publications, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari(2013)

Reference Books

1. Dubey R. C. and Maheswari, D.K. A Text book of Microbiology, Cambridge University Press,(2013)
2. Gupta. P. K. Elements of biotechnology –Rastogi Publications, Meerut (2004)
3. Shyamasree ghosh, Immunology and Immunotechnology –Books and allied (P) Ltd. (2017)

Course Designed by	**Verified by HoD**	**Verified by CDC Coordinator**	**Verified by COE**
Name and Signature	**Name and Signature**	**Name and Signature**	**Name and Signature**
Name: Ms. S. Jayalakshmi Signature:	Name: Dr. S. Somasundaram Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R. Manickachezhian Signature: