

DEPARTMENT OF ZOOLOGY

B.SC. ZOOLOGY SYLLABUS

BATCH: 2021-2024

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

DR. S. CHRISTOBHER, M.SC., B.ED., PH.D.,



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 interegrity 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	Students gain information and skill in the fundamentals of animal sciences, understands the multifarious connections along with different living organisms.
PO2	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	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	Understands about various concepts and importance of Biotechnology, Bioinformatics, Genetics, Genetic engineering in industry and day today human life.
PO5	Students will be able to compare and distinguish the characteristics of animals that discriminate them from other forms of life.
PO6	Achieve knowledge in applied fields like Sericulture, Aquaculture and Apiculture alongside Statistical and Laboratory techniques.
PO7	Understanding of Zoology to one's own life and apply the knowledge judiciously 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.

Nallamuthu Gounder Mahalingam College - Curriculum Development Cell
Scheme of Examination For 2021 – 2022,
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		Internal	External		
I	21UTL101 / 21UHN101 / 21UFR101	Tamil Paper - I /	6	-	-	3	50	50	100	3
		Hindi Paper - I /		-	-					
		French Paper – I		-	-					
II	21UEN101	Communication Skills - I (Level I)	5	-	-	3	50	50	100	3
	21UEN102	Communication Skills - I (Level II)		-	-					
III	21UZY101	Core - I :Nonchordata	6	-	-	3	50	50	100	5
		Core Lab -I : Nonchordata and Chordata (Non semester pattern)	-	3	-	-	-	-	-	-
	21UZY1A1	Allied - I :Allied Botany Paper I	6	-	-	3	50	50	100	4
		Allied Lab -I : Practical I (Paper I &II)	-	2	-	-	-	-	-	-
IV	21UHR101	Human Rights	1	-	-	2		50	50	2
	21HEC101	Human Excellence - Personal Values & SKY Yoga Practice – I	1	-	-	2	25	25	50	1
V		Extension Activities – Annexure I	-	-	-	-	-	-	-	-
CC	21 CFE101	Fluency in English-I	-	-	-	-	-	-	-	-
		Online Course (Optional) (MOOC/NPTEL/SWAYAM)								Grade
Total									500	18

SEMESTER – II

Part	Subject Code	Title of the Paper	Hrs / Week		Hrs / Sem.	Exam Hrs.	Maximum Marks		Total Marks	Credits
			L	P	T		Internal	External		
I	21UTL202 / 21UHN202 / 21UFR202	Tamil Paper - II /	6	-	-	3	50	50	100	3
		Hindi Paper - II /		-	-					
		French Paper – II		-	-					
II	21UEN202	Communication Skills - II (Level I)	5	-	-	3	50	50	100	3
	21UEN203	Communication Skills - II (Level II)		-	-					
III	21UZY202	Core - II :Chordata	6	-	-	3	50	50	100	4
	21UZY203	Core Lab - I: Nonchordata & Chordata (Non-Semester Pattern)	-	2	-	3	50	50	100	4
	21UBY2A2	Allied - II :Economic Zoology	6	-	-	3	50	50	100	4
	21UBY2A3	Allied Lab : Paper I & II (Non-Semester Pattern)	-	2	-	3	50	50	100	2
IV	21EVS201	Environmental Studies	2	-	-	2		50	50	2
	21HEC202	Human Excellence - Family Values & SKY Yoga Practice – II	1	-	-	2	25	25	50	1
V		Extension Activities - Annexure I	-	-	-	-	-	-	-	-
CC	21CFE202	Fluency in English-II	-	-	-	-	-	-	-	-
	21CMM201	Manaiyiyal Mahathuvam-I	1	-	-	2	-	50	50	Grade
	21 CUB201	Uzhavu Bharatham-I	1	-	-	2	-	50	50	Grade
		Online Course (Optional) (MOOC/NPTEL/SWAYAM)								Grade
Total									700	23

SEMESTER – III

Part	Subject Code	Title of the Paper	Hrs / Week		Hrs / Sem.	Exam Hrs.	Maximum Marks		Total Marks	Credits
			L	P	T		Internal	External		
I	21UTL303 / 21UHN303 / 21UFR303	Tamil Paper - III /	5	-	-	3	50	50	100	3
		Hindi Paper - III/								
		French Paper – III								
II	21UEN303	Communication Skills - III (Level I)	6	-	-	3	50	50	100	3
	21UEN304	Communication Skills - III (Level II)		-	-					
III	21UZY304	Core - III:Cell Biology	6	-	-	3	50	50	100	5
		Core –Lab II: Cell biology & Genetics (Non-Semester Pattern)	-	3	-	-	-	-	-	-
	21UZY3A4	Allied - III :Ancillary Chemistry (offered by Department of Chemistry)	6	-	-	3	50	50	100	4
		Allied Lab - II : Chemistry(offered by Department of Chemistry)	-	2	-	-	-	-	-	-
IV	21UZY3N1 / 21UZY3N2	Non Major Elective - I : Public Health and Hygiene/ Non Major Elective - I : Ornamental Fish Culture	1	-	-	2		50	50	2
	21HEC303	Human Excellence - Professional Values & Ethics – III	1	-	-	2	25	25	50	1
V		Extension Activities - Annexure I	-	-	-	-	-	-	-	-
CC	21CFE303	Fluency in English-III	-	-	-	-	-	-	-	-
	21CMM302	Manaiyiyal Mahathuvam-II	1	-	-	2	-	50	50	Grade
	21 CUB302	Uzhavu Bharatham-II	1	-	-	2	-	50	50	Grade
Total									500	18

SEMESTER – IV

Part	Subject Code	Title of the Paper	Hrs / Week		Hrs / Sem.	Exam Hrs.	Maximum Marks		Total Marks	Credits
			L	P	T		Internal	External		
I	21UTL404 /	Tamil Paper - IV /	5	-	-	3	50	50	100	3
	21UHN404 /	Hindi Paper - IV/								
	21UFR404	French Paper – IV								
II	21UEN403	Communication Skills - IV (Level I)	6	-	-	3	50	50	100	3
	21UEN404	Communication Skills - IV (Level II)								
III	21UZY405	Core - IV :Genetics	6	-	6	3	50	50	100	5
	21UZY406	Core Lab - II : Cell biology & Genetics (Non-Semester Pattern)	-	3	-	3	50	50	100	4
	21UZY4A5	Allied - IV :Ancillary chemistry Paper II(offered by Department of Chemistry)	6	-	-	3	50	50	100	4
	21UZY4A6	Allied Lab-II:Chemistry (offered by Department of Chemistry)	-	2	-	3	50	50	100	2
IV	21UZY4N3/ 21UZY4N4	Non Major Elective - II :Food and Nutrition / Non Major Elective - II : Apiculture	1	-	-	2	-	50	50	2
	21HEC404	Human Excellence - Social Values & SKY Yoga Practice – IV	1	-	-	2	25	25	50	1
V		Extension Activities - Annexure I	-	-	-	-	-	50	50	1
CC	21CFE 404	Fluency in English-IV	-	-	-	-	-	-	-	-
	21CMM403	Manaiyiyal Mahathuvam-III	1	-	-	2	-	50	50	Grade
	21 CUB403	Uzhavu Bharatham-III	1	-	-	2	-	50	50	Grade
Total									750	25

SEMESTER – V

Part	Subject Code	Title of the Paper	Hrs / Week		Hrs /Sem.	Exam Hrs.	Maximum Marks		Total Marks	Credits
			L	P	T		Internal	External		
III	21UZY507	Core - V: Developmental Biology	5	-	-	3	50	50	100	4
	21UZY508	Core - VI :Biotechnology Skill Enhanced Course	5	-	-	3	50	50	100	4
	21UZY509	Core - VII : Biostatistics & Biophysics	5	-	5	3	50	50	100	4
	21UZY510	Core - VIII : Biochemistry	5	-	-	3	50	50	100	4
	21UZY5E1 / 21UZY5E2 / 21UZY5E3	Core Elective - I : Medical Laboratory Techniques/ Core Elective - I : Poultry Science and Management Core Elective - I : Haematology and Clinical Pathology	4	-	-	3	50	50	100	4
	21UZY614	Core Lab- III: Developmental Biology, Animal Physiology & Endocrinolog y, Biostatistics & Biophysics, biochemistry & MLT (Non- Semester Pattern)	-	2	10	-	-	-	-	-
	21 UZY615	Core Lab- IV: Ecology, Evolution, Biotechnology, Microbiology , Sericulture and Aquaculture (Non- Semester Pattern)	-	2	-	-	-	-	-	-
	21UZY5AL	Advanced Learner Course – I Bioinformatics (Optional) - Self Study					50	50	100*	5*
	21UZ 5VA	Value Added Course - Food safety and Hygiene(Optional)	30					50	50*	2*

IV	21UZY5S1 / 21UZY5S2	Skill Based Elective - I : Network and Information Security (Online) / Skill Based Elective - I : Cyber security – Ethical Hacking (Online)	1			2		50	50	2
	21HEC505	Human Excellence - National Values & SKY Yoga Practice – V	1	-	-	2	25	25	50	1
	21GKL501	General Awareness - Self Study	SS			2	-	50	50	2
V		Extension Activities - Annexure I	-	-	-	-	-	-	-	-
CC	21CFE505	Fluency in English-V	-	-	-	-	-	-	-	-
	21CSD501	SoftSkills Development -I	-	-	-	-	-	-	-	Grade
Total									650+150*	25+7*

AL - Advanced Learner Course (Optional); VA-Department Specific Value Added Course

*Extra Credits,Extra Hour Course

SEMESTER – VI

Part	Subject Code	Title of the Paper	Hrs / We ek	Hrs / Sem.			Exa m Hrs.	Maximum Marks		Total Marks	Credits
			L	P	T	Internal		External			
III	21UZY611	Core - IX :Animal Physiology and endocrinology	5	-	-	3	50	50	100	4	
	21UZY612	Core - X :Ecology and Evolution	5	-	-	3	50	50	100	4	
	21UZY613	Core - XI : Microbiology and Immunology -Skill Enhanced Course	5	-	-	3	50	50	100	4	
	21UZY6E4/ 21UZY6E5/ 21UZY6E6	Core Elective - II : Sericulture/ Core Elective - II :Insect Pest Management / Core Elective - II : Parasitology	4	-	-	3	50	50	100	4	
	21UZY6E7 / 21UZY6E8 / 21UZY6E9	Core Elective - III :Aquaculture / Core Elective - III : Wild life Conservation/ Core Elective –III Dairy farming and Management Technology	5	-	-	3	50	50	100	4	

	21UZY614	Core Lab- III : Developmental Biology, Animal Physiology & Endocrinology, Biostatistics &Biophysics, Bioinformatics &Biochemistry & MLT (Non-Semester Pattern)	-	2	10	3	50	50	100	4
	21 UZY615	Core Lab- IV: (Non- Semester Pattern) Ecology, Evolution, Biotechnology, Microbiology , Sericulture and Aquaculture	-	2	-	3	50	50	100	4
	21UZY6AL	Advanced Learner Course - II Immunotherapeutics (Optional) - Self Study					50	50	100*	5*
	21UZY6VA	Value Added Course- Personality Development (Optional)	30	-	-	-	-	50	50*	2*
IV	21UZY6S3/ 21UZY6S4	Skill Based Elective - II : Vermiculture / Skill Based Elective - II : Biopharmaceuticals	1			2		50	50	2
	21HEC606	Human Excellence - Global Values & SKY Yoga Practice – VI	1	-	-	2	25	25	50	1
V		Extension Activities - Annexure I	-	-	-	-	-	-	-	-
CC	21CFE606	Fluency in English-VI	-	-	-	-	-	-	-	-
	21CSD602	Soft Skills Development -II	-	-	-	-	-	-	-	Grade
Total									800+150*	31+7*

AL - Advanced Learner Course (Optional)

VA-Department Specific Value Added Course

CC – Certificate Course / Co-scholastic Course

***Extra Credits, Extra Hour 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: 70 Marks (Part I, II, & III)

(i) Test- I & II, ESE:

Knowledge Level	Section	Marks	Description	Total
K1 & K2 (Q 1 -10)	A (Q 1 – 5 MCQ) (Q 6–10 Define/Short Answer)	10 x 1 = 10	MCQ Define	70 (Reduced to 50 for ESE)
K3 (Q 11-15)	B (Either or pattern)	5 x 4 = 20	Short Answers	
K4 & K5 (Q 16 – 21)	C (Q -16 is Compulsory and Q 17 – 21 answer any 3)	4 x 10 = 40	Descriptive/ Detailed	

2. Theory Examinations: 50 Marks (Part IV)

Knowledge Level	Section	Marks	Description	Total
K1 & K2 (Q 1 -10)	A (Q 1 – 5 MCQ) (Q 6–10 Define / Short Answer)	10 x 1 = 10	MCQ Define	50 (Reduced to 25 for ESE)
K3, K4 & K5 (Q 11-18)	B (Answer 5 out of 8)	5 x 8 = 40	Short Answers	

3. Practical Examinations: 100/50 Marks

Knowledge Level	Criterion	External/Internal Marks	Total
K3	Record work & Practical	50/50	100
K4			
K5		25/25	50

*** In theory ESE, Students will write Examination Maximum Marks as 70 and it will be reduced to 50 for Total mark calculation.**

Components of Continuous Assessment

THEORY

Maximum Marks: 100; CIA Mark: 50

Components		Calculation	CIA Total
Test 1	$(70 / 4.67) = 15$	15+15+10+05+05	50
Test 2 / Model	$(70 / 4.67) = 15$		
Assignment / Digital Assignment	10		
Seminar / Socratic Seminar	05		
Group Task : GD, Role Play, APS	05		

Maximum Marks: 50; CIA Mark: 25

Components		Calculation	CIA Total
Test / Model	10	10+5+5+5	25
Assignment / Digital Assignment	5		
Seminar / Socratic Seminar	5		
Group Task : GD, Role Play, APS	5		

PRACTICAL

Maximum Marks: 100; CIA Mark: 50

Components		Calculation	CIA Total
Test / Model	30	30+10+10	50
Observation / Practical Skills	10		
Record	10		

PROJECT

Maximum Marks: 50; CIA Mark: 25

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

** 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.

Problem Analysis, Data Collection and Data Analysis for Science stream.

STUDENT SEMINAR EVALUATION RUBRIC

Grading Scale:

D	C	B	A
01 – 05	06 - 10	11 - 15	16 - 20

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

WRITTEN ASSIGNMENT GRADING RUBRIC

Grading Scale:

F	D	C	B	A
01 – 04	05 - 08	09 - 12	13 - 16	17 - 20

CRITERION	A – Excellent	B – Good	C - OK	D - Below Standard	F – Missing
Content & Focus	Hits on almost all content exceptionally clear	Hits on most key points and writing is interesting	Hits in basic content and writing is understandable	Hits on a portion of content and/or digressions and errors	Completely off track or did not submit
Sentence Structure & Style	<ul style="list-style-type: none"> * Word choice is rich and varies * Writing style is consistently strong * Students own formal language 	<ul style="list-style-type: none"> * Word choice is clear and reasonably precise * Writing language is appropriate to topic * Words convey intended message 	<ul style="list-style-type: none"> * Word choice is basic * Most writing language is appropriate to topic * Informal language 	<ul style="list-style-type: none"> * Word choice is vague * Writing language is not appropriate to topic * Message is unclear 	* Did not include
Sources	Sources are cited and are used critically	Sources are cited and some are used critically	Some sources are missing	Sources are not cited	Did not include
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	Did not include

Continuous Internal Assessment for Project / Internship

The Final year students should undergo a project work during (V/VI) semester

- The period of study is for 4 weeks.
- Project / Internship work has to be done in an industrial organization (or) work on any industrial problem outside the organization is allowed.
- Students are divided into groups and each group is guided by a Mentor.
- The group should not exceed four students, also interested student can undergo individually.
- A problem is chosen, objectives are framed, and data is collected, analyzed and documented in the form of a report / Project.
- Viva – Voce is conducted at the end of this semester, by an External Examiner and concerned Mentor (Internal Examiner).
- Project work constitutes 100 marks, out of which 50 is Internal and 50 is External Marks.

Mark Split UP

Internal	External	Total
25	25	50

S. No	Internal Components	Marks
1	Review - I	5
2	Review - II	5
3	Review - III	5
4	Rough Draft Submission	10
Total		25

Review I:

- * Problem Analysis

Review II:

- * Data collection

Review III:

- * Data Analysis

Programme Code:	B.Sc.,			Programme Title:	Bachelor of Zoology	
Course Code:	21UZY101			Title	Batch:	2021 – 2024
Lecture Hrs./Week	6	Tutorial Hrs./Sem.	--	Core –I	Semester:	I
				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 with an example	K3
CO4	Discuss the general topics of each phylum	K4
CO5	Acquire the knowledge about internal structure of nonchordate organisms	K5

Mapping

PO /PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO									
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	<ul style="list-style-type: none"> Outline Classification of Nonchordata up to class level General characteristics of phylum Nonchordata Phylum Protozoa: <i>Paramecium caudatum</i> – Structure- Feeding- Binary fission and Conjugation. <ul style="list-style-type: none"> <i>Protozoa in Human Diseases</i> * 	18
Unit II	<ul style="list-style-type: none"> Phylum Porifera : <i>Leucosolenia</i> - Structure - Reproduction and Life cycle <ul style="list-style-type: none"> Canal system in sponges. Phylum Coelenterata: <i>Obelia geniculata</i> – Structure - Reproduction and Life cycle. <ul style="list-style-type: none"> Coral reef types and Formation Phylum Platyhelminthes: <i>Taenia solium</i> – Structure Reproductive system and Life cycle. <ul style="list-style-type: none"> Parasitic adaptations in Helminth worm 	18
Unit III	<ul style="list-style-type: none"> Phylum Aschelminthes: <i>Ascaris lumbricoides</i> –Structure – Excretory system-Reproductive system and life cycle Phylum Annelida : <i>Megascolex mauritti</i>– Structure - Digestive system - Excretory system and Reproductive system. <ul style="list-style-type: none"> Metamerism in Annelids 	18

Unit IV	<ul style="list-style-type: none"> • Phylum Arthropoda: <i>Periplanata americana</i>– Structure - Mouth parts – Digestive – Respiratory – Circulatory - Nervous and Reproductive systems. ○ Peripatus as a Connecting Link. • Arthropod Vectors and Human diseases. 	18
Unit V	<ul style="list-style-type: none"> • Phylum Mollusca: <i>Pila globosa</i>– Structure Respiratory system and Reproductive Systems. <ul style="list-style-type: none"> • <i>Economic importance of Mollusca*</i> • Phylum Echinodermata : <i>Asterial rubens</i> – Structure- Digestive system Water vascular system and Reproductive system. <ul style="list-style-type: none"> ○ 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. Ekambaranatha Iyyer, A Manual of Zoology, Part I & II, Invertebrata, 5th edition Volume I and II. S. Viswanathan (Printers and Publishers) (2016)
2. Nair N.C., Leelavathy S., Soundarapandian N and Arumugam, N. A text book of Invertebrates– Saras Publication, Nagercoil. (2021)
3. Jordan E.L & Verma J. K Invertebrate Zoology, S. Chand & Company, New Delhi. (1995)
4. Ganguly B.B Sinha.A & Adhikari.S Biology of Animals, Vol –I, Invertebrates, 3rdEdition, New Central Book Agencies. . (1977)
5. Dhami P.S & Dhami J.K Invertebrate Zoology, S. Chand & Company (1990)

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	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY203		Title	Batch:	2021 – 2024
Practical Hrs./Week	3	Tutorial Hrs./Sem.	Core Lab –I Nonchordata & Chordata (Non semester Pattern)	Semester:	I & II
				Credits:	4

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 organisms	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 practical

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

2. Chordata – Frog

- External
- Digestive system
- Heart
- Brain
- Limbs
- Male Urino-genital system
- Female Urino-genital system

2. SPOTTERS

A. Classify giving reasons:

- 1) Paramecium
- 2) Leucosolenia
- 3) Obelia
- 4) *Taenia solium*
- 5) *Ascaris lumbricoides*
- 6) Earthworm
- 7) Scorpion
- 8) Pila
- 9) Sea star
- 10) Shark
- 11) Calotes
- 12) Pigeon
- 13) Rabbit

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) Placoid scale
- 7) Frog – Pectoral girdle
- 8) Frog – pelvic girdle
- 9) Poison apparatus – snake
- 10) Pigeon – Symsacrum
- 11) Pigeon – flight muscle
- 12) Rabbit Brain

C. Biological significance:

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

D. Write descriptive notes:

- 1) *Taenia solium* – Scolex
- 2) Earth worm - setae
- 3) Penaeus
- 4) Pila – Radula
- 5) Sea horse
- 6) Sepia
- 7) Rhacophorous
- 8) Draco
- 9) Cobra
- 10) Platypus
- 11) Monotremes - Echidna
- 12) 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
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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	10	Experiments Virtual dissection – Non Chordata Virtual Dissection -Chordata Spotters	20
	Model Practical Examination	30	Field Visit Report Submission- Campus Biodiversity	10
	Record work	10	Record	10
	Total Marks	50	Total Marks	60 (Converted into 50)

Reference Books

- Lal, S. S. A text book of Practical Zoology Invertebrate. Rastogi Publications, Shivaji Road, Meerut, India (2004)
- Lal, S. S. (2004) A text book of Practical Zoology Vertebrate. Rastogi Publications, Shivaji Road, Meerut, India
- www.froguts.com
- www.sciencelass.com
- www.ento.vt.edu.
- www.petaindia.com
- 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
Name: Ms.S. Jayalakshmi	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,			Programme Title:	Bachelor of Zoology	
Course Code:	21UBY1A1			Title	Batch:	2021 – 2024
Lecture Hrs /Week	6	Tutorial Hrs/Sem.	--	Allied –I Invertebrates and Vertebrates (For I B. Sc., Botany Program)	Semester :	I
					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	Remember different levels of organization with respect to its distinguish characters and Specific examples	K1
CO2	Comprehend animal systems and its peculiar characters	K2
CO3	Understand the structure and physiology of the types included with special emphasis on the adaptations to their modes of life and environment.	K3
CO4	Analyze of characteristic features of prochordates with example	K4
CO5	Imparts conceptual knowledge of vertebrates, their adaptations and association in relations to their environment	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 <ul style="list-style-type: none"> Phylum Protozoa: <i>Paramecium caudatum</i>– Structure- Feeding- Binary fission and Conjugation. Phylum: Coelenterata: <i>Obelia geniculata</i> – Structure and Life cycle. 	18
Unit II	<ul style="list-style-type: none"> Phylum Platyhelminthes: <i>Taenia solium</i> – Structure - Reproduction and Life cycle. Phylum Arthropoda: <i>Periplanata americana</i> – Structure- Mouthparts, Digestive system –Nervous system and Reproductive system. 	18

Unit III	<ul style="list-style-type: none"> • Phylum Mollusca : <i>Lamellidens marginalis</i> – Structure – Digestive system- Respiratory system – Reproductive system. • Phylum Echinodermata: <i>Asterial rubens</i>– Structure and Water Vascular system. 	18
Unit IV	<ul style="list-style-type: none"> • Phylum Chordata • Sub Phylum: Prochordata – General Characters of <ul style="list-style-type: none"> ○ <i>Branchiostoma lanceolatum</i>(Amphioxus) ○ <i>Balanoglossus glavigerous</i> ○ <i>Herdmania pallida</i> (Ascidian) • Sub Phylum Vertebrata Class : Pisces Shark - External structure* – Digestive & Urinogenital system • Class Amphibia: <i>Rana hexadactyla</i> – External structure – Respiratory system, Brain –Reproductive system. 	18
Unit V	<ul style="list-style-type: none"> • Class Reptilia: <i>Calotes versicolor</i> –structure– Circulatory system – Reproductive system. • Class Aves: <i>Columba livia</i> –structure – Flight muscles – Digestive system - Respiratory system • Class Mammal: <i>Oryctolagus cuniculus</i> – 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, Rastogi Publications.Meerut (2014)
2. Jordan, E.L. and Verma, P.S. Chordate Zoology. S. Chand & Company LTD., Ram Nagar, New Delhi. 110055. (2006)

Reference Books

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

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.Christobher	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezian
Signature:	Signature:	Signature:	Signature:

Programme code:	B. Sc.,	Programme Title :		Bachelor of Zoology	
Course Code:	21UBY2A3	Title		Batch :	2021-2024
		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 the anatomical and morphological structure of animals and micro organisms	K1
CO2	Understand the ecological and biological importance of vertebrates and invertebrates	K2
CO3	Validate the practical efficiency in the animal kingdom structure and function	K3
CO4	Acquire knowledge about biological significance of organisms	K4
CO5	Know about the reasons for classifications	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. 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
- Male and female reproductive system

2. Chordata – Frog

- 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)	<i>Calotes versicolor</i>
7)	Pigeon (<i>Columba livia</i>)
8)	Rabbit (<i>Oryctolagus cuniculus</i>)
B. Draw labeled sketch:	
1)	Leucosolenia
2)	<i>Taenia solium</i> – Scolex
3)	Octopus
4)	Frog – Pectoral girdle
5)	<i>Calotes versicolor</i> – Brain
6)	Pigeon –Flight Muscle
7)	Rabbit – Dentition
8)	Human – Digestive system
C. Biological significance:	
1)	Obelia Medusa
2)	Silkworm
3)	Honey bee
4)	Mosquito
5)	Earthworm
6)	Salamander
7)	Balanoglossus
8)	Kangaroo
D. Write descriptive notes:	
1)	Paramecium – conjugation
2)	Silkworm's silk gland
3)	Peripatus
4)	Gold fish
5)	Sea horse
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	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	50	Total Marks	60 (Converted into 50)

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
Name: Dr.S.Christobher	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY202		Title	Batch:	2021 – 2024
Lecture Hrs./Week	6	Tutorial Hrs./Sem.	--	Core-II Chordata	Semester: II
				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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO									
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	<p>General characters and outline classification of Phylum Chordata up to class level with suitable examples.</p> <p>General characters and affinities of</p> <ul style="list-style-type: none"> ○ <i>Branchiostoma lanceolatum</i>(Amphioxus) ○ <i>Balanoglossus glavigerous</i> ○ <i>Herdmania pallida</i> (Ascidian) <ul style="list-style-type: none"> ● Class Pisces Type study – <i>Scoliodon</i>- External- Placoid scale - Digestive system - Respiratory and - Excretory system - Reproductive system <ul style="list-style-type: none"> ○ <i>Parental care in Fishes*</i> 	18
Unit II	<ul style="list-style-type: none"> ● Class Amphibia Type study – <i>Rana hexadactyla</i>- External - Girdles and Limbs - Digestive system -Respiratory system – Heart- Brain – Excretory system- Reproductive system. ● Origin of Amphibia. 	18
Unit III	<ul style="list-style-type: none"> ● Class Reptilia Type study– <i>Calotes versicolor</i>-Externals - Digestive system – Brain- Excretory system- Reproductive system 	18

	<ul style="list-style-type: none"> ○ Poisonous and Non-Poisonous Snakes. ○ Poison apparatus and biting mechanism in Snakes <i>First –Aid for Snake Bite.*</i> 	
Unit IV	<ul style="list-style-type: none"> ● Class Aves Type study – <i>Columba livia</i>- External – Synsacrum - Flight muscles - Digestive system - Respiratory system- Brain- Eye and Urino – genital system. ○ Flight adaptation ○ Migration in Birds 	18
Unit V	<ul style="list-style-type: none"> ● Class Mammalia Type study – <i>Oryctolagus cuniculus</i> - External– Heart – Brain – Digestive system - Excretory system – Reproductive system ● Salient features of <ul style="list-style-type: none"> ○ 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 Invertebrates, (3rd Edition), Rastogi Publications.Meerut (2012)

Reference Books

1. Ekambaranatha Iyer, Manual of Zoology, Vol.II (6^h Edition). S.Viswanathan PVT Ltd., Parts I & II. Viswanathan & Co. (2008)
2. Jordan, E.L. and Verma, P.S. Chordate Zoology. S. Chand & Company LTD., Ram Nagar, New Delhi. 110055. (2006)
3. 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(2019)

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	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme code:	B. Sc.,			Programme Title :	Bachelor of Zoology	
Course Code:	21UBY2A2			Title	Batch :	2021-2024
				Allied Paper – II Economic Zoology		
Lecture Hrs/Week	6	Tutorial Hours/ Sem	---	Semester	II	
				Credits:	4	

Course Objectives

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 knowledge of applied biological sciences such as aquaculture , apiculture, sericulture	K1
CO2	Elucidate rearing methods of beneficial organisms – an economic perspectives	K2
CO3	Apply the knowledge of rearing of silk and lucrative sale in cocoon market	K3
CO4	Analysis method of poultry farming, identify the poultry disease and control measure	K4
CO5	Discuss the importance of agricultural pests and methods of their control.	K5

Mapping

PO /PSO	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 <ul style="list-style-type: none"> • Scope of Aquaculture <ul style="list-style-type: none"> • Type of Fisheries - Inland fisheries and Marine fisheries • Culturable organisms - Fin fishes • Diseases of Fish <ul style="list-style-type: none"> ○ Bacterial - Erythroderma , Bacterial Gill Rot ○ Viral - EUS,IPN, VHS ○ Fungal - Saprolegniasis • Oyster culture - Edible oyster and Pearl oyster 	18
Unit II	APICULTURE <ul style="list-style-type: none"> • Scope of Apiculture • <i>Apis indica, Apis. mellifera and Apis dorsata</i> • Products of Bee Keeping - Royal jelly, Honey, Wax and Bee venom DAIRY FARMING <ul style="list-style-type: none"> • Scope of dairy farming • A typical dairy farm • Dairy animals: cow • Live stock diseases - Mastitis and Foot and 	18

	Mouth disease(FMD) <ul style="list-style-type: none"> • <i>Nutritive value of milk*</i> • Dairy By-products 	
Unit III	SERICULTURE <ul style="list-style-type: none"> • Scope of sericulture • Optimum conditions for mulberry growth • Vegetative preparation – Stem cutting • Structure of silkworm • Structure of silk gland • Life cycle of <i>Bombyx mori</i> • Rearing appliances • Disinfection • Diseases of silkworm -Pebrine and Viral flacherie • Cocoon market 	18
Unit IV	POULTRY KEEPING <ul style="list-style-type: none"> • Scope of poultry • Construction of poultry house • Rearing of Broilers and Layers • Diseases of poultry <ol style="list-style-type: none"> 1. Fowl pox 2. Coccidiosis 3. Ranikhet disease 4. Bird Flu • <i>Nutritive value of Egg*</i> 	18
Unit V	PEST MANAGEMENT <ul style="list-style-type: none"> • Scope of Pest management • Types of Pest • Pest of coconut, Sugarcane and Paddy • Vectors <ul style="list-style-type: none"> ○ <i>Culex quinquefasciatus</i>(Mosquito) ○ <i>Cimex lectularius</i> (Bedbugs) ○ <i>Pediculus capitis</i> (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 & Upadhyaya, Economic Zoology - Rastroggi Publication, Shivaji Road, Meerut (2001)

Reference Books

1. Ganga and Sulochana Chetty, An introduction to sericulture, 2nd Edition, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi (1999)
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. Arumugam, N. Applied Zoology, Saras Publication, 114/35 G ARP Camp Road, Periavilai, Nagercoil, (2020)

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.Christobher	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,			Programme Title:	Bachelor of Zoology	
Course Code:	21EVS201			Title	Batch:	2021 – 2024
Lecture Hrs./Week	2	Tutorial Hrs./Sem.	12	Environmental Studies (EVS)	Semester:	II
					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 in future perspectives.	K3
CO4	Evaluate the value of Natural Resources	K4
CO5	Acquire knowledge about genetic diversion	K5

Mapping

PO / PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO									
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	<p>The Multidisciplinary nature of Environmental Studies:</p> <ul style="list-style-type: none"> • Introduction • Scope of Environmental Studies • Need for Public Awareness <p>Natural Resources :</p> <ul style="list-style-type: none"> • Types of Natural Resources • Natural resources and associated problems <ul style="list-style-type: none"> a. Forest resources b. Water resources c. Mineral resources d. Food resources e. <i>Energy resources*</i> • Role of an individual in conservation of natural resources case studies 	6

Unit II	<p>Ecosystems:</p> <ul style="list-style-type: none"> • 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 <p>Biodiversity and its conservation:</p> <ul style="list-style-type: none"> • 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	<p>Environmental Pollution:</p> <ul style="list-style-type: none"> • Causes, effects and control measures of <ul style="list-style-type: none"> a. Air Pollution b. Water pollution c. Soil pollution d. Noise pollution * e. Thermal pollution f. Radioactive pollution • Pollution case studies <p>Solid waste management:</p> <ul style="list-style-type: none"> • Causes, effects and control measures • Role of individual in prevention of pollution 	6
Unit IV	<p>Disaster management: Floods, Earthquake, Cyclone and Landslides</p> <p>Social issues and environment:</p> <ul style="list-style-type: none"> • Sustainable Development • Urban problems related to energy • <i>Rainwater harvesting</i> * • Environmental Ethics • Global warming 	6
Unit V	<p>Environmental Legislations and Acts:</p> <ol style="list-style-type: none"> 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 <p>Human Population and Environment:</p> <ul style="list-style-type: none"> • 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, Digital Presentation

Assessment Methods:

Seminar, Quiz, 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
Name: Dr. S. Mariselvi	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,	Programme Title:	Bachelor of Zoology	
Course Code:	21UZY304	Title	Batch:	2021 – 2024
		Core 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	Structural and functional aspects of basic units of life - ie cell concept	K1
CO2	Remember the overview of cells and their origin and evolution.	K2
CO3	Get the fundamental ideas of prokaryotic and eukaryotic cell.	K3
CO4	Deploy the structure and functions of cell organelles.	K4
CO5	Sort of 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	<ul style="list-style-type: none"> Scope of Cell Biology Cell Theory: Salient features of cell theory <ul style="list-style-type: none"> Protoplasm theory Germplasm theory Organismal theory. Cytological techniques: Fixation –Dehydration –Embedding - Sectioning - Staining and Mounting Prokaryotic cell (<i>E.coli</i> bacterium) Corona virus –SARS-CoV-2 	18
Unit II	<ul style="list-style-type: none"> 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 – Function Golgi complex: Structure and Functions. 	18
Unit III	<ul style="list-style-type: none"> Lysosomes: Polymorphism and Functions Mitochondria: Structure - Origin of mitochondria– General functions. Nucleus: Ultra structure of interface nucleus and function. Nucleolus: Ultra structure and function 	18
Unit IV	<ul style="list-style-type: none"> Centrosomes: Structure and functions Chromosomes: Structure – Types - <i>Giant chromosomes*</i> – Polytene and Lamp brush. 	

	<ul style="list-style-type: none"> • Nucleic acids DNA Structure (Watson & Crick model) <ul style="list-style-type: none"> o Types and replication of DNA (Semi-conservative model) • Protein synthesis - <ul style="list-style-type: none"> o Central dogma and Central dogma reverse o Mechanism of protein synthesis • Transcription and Translation. 	18
Unit V	<ul style="list-style-type: none"> • Genetic Code – Salient features • Cell division <ul style="list-style-type: none"> o Cell cycle o Amitosis, Mitosis and Meiosis • Cell signaling: <ul style="list-style-type: none"> o Characteristics and Cell transduction pathways • Cancer cells <ul style="list-style-type: none"> o Characteristics – Properties –Types - Diagnosis and Treatment o Oncogenes. • <i>Cell aging - Causes – Changes and Apoptosis*</i> 	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. P.S. Verma and V.K Agarwal - Cell Biology, Genetics, Molecular biology, Evolution and Ecology – S.Chand & Company, New Delhi – (2012).
3. 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)
4. Singh & Tomar - Cell Biology –Rastogi Publications, Shivaji road, Meerut – 250 002, India - 9th revised edition –(2008)
5. E.D.P. De Robertis and E.M.F. De Robertis Jr - Cell and Molecular Biology –, Lippincott Williams and Williams Publishers - 8th Edition, (2017)
6. Aminul Islam - Essentials of Cell biology. Books and Allied Pvt.Ltd. Kolkata - (Reprint 2019)-
7. Singh and Tomar - Cell Biology – Rastogi Publications, Shivaji Road, Meerut - 10th Rev.Edi (2012)
8. C.P.Powar - Cell Biology – Himalaya Publishing House, Mumbai, (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
Name: Dr. S. Mariselvi	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY406		Title	Batch:	2021 – 2024
Practical Hrs./Week	3	Tutorial Hrs./Sem.	10	Core Lab – II	Semester:
				Cell Biology and Genetics (Non Semester Pattern)	III & IV
				Credits:	4

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	Keep in mind for identify the different stages of mitosis.	K1
CO2	Understand the concepts of genetics through experiments.	K2
CO3	Access the practical experience in instrument handling.	K3
CO4	Evaluate laboratory test outcomes and determine the validity of the test results obtained	K4
CO5	Assess the role of chromosomes in sex determination and inheritance of X and Y linked genes	K5

Mapping

PO /PSO	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
	<p>EXPERIMENTS</p> <ul style="list-style-type: none"> • 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. <p>SPOTTERS:</p> <p>CELL BIOLOGY</p> <ol style="list-style-type: none"> 1. <i>E. coli</i> 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. Klinefelter’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 Training, Survey

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	10	Experiments ; Major practical	20
			Minor Practical	10
	Model Practical Examination	30	Spotters	20
	Record work	10	Record	10
	Total Marks	50	Total marks	60 (converted into 50)

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, Nagarcovil, Tamil Nadu – (2013)
5. Jaysura and Arumugam. N - Practical Zoology Vol.3 Saras Publication, Nagarcovil, Tamil Nadu – (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: Dr. S. Mariselvi	Name: Dr.S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY 3N1		Title	Batch:	2021 – 2024
Lecture Hrs./Week	1	Tutorial Hrs./Sem.	--	Non major Elective –I Public Health and Hygiene	Semester: III 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 communicable and non-communicable diseases	K2
CO3	Implement the nutrient requirements 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	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	<ul style="list-style-type: none"> Introduction to public health Health indicators <i>Personal hygiene, Public health*</i> Health Dynamics of disease transmission eg. Malaria, – host, vectors and environment 	3
Unit II	<ul style="list-style-type: none"> Concepts of Health and diseases Nutrition and Health Classification of food (Macro &Micro nutrients) Balanced diet Vitamins 	3
Unit III	<ul style="list-style-type: none"> Nutrition deficiency disease Lipid deficiency diseases <ul style="list-style-type: none"> ○ Dermatitis ○ Fucosidosis Protein deficiency diseases <ul style="list-style-type: none"> ○ Kwashiorkar ○ Marasmas Vitamin deficiency disorders 	3

Unit IV	<ul style="list-style-type: none"> • Communicable diseases <ul style="list-style-type: none"> ○ Viral Disease-Measles ○ Bacterial Disease- Cholera • Non-Communicable Diseases <ul style="list-style-type: none"> ○ Coronary heart Disease (CHD) ○ Diabetes 	3
Unit V	<ul style="list-style-type: none"> • Health Education: <ul style="list-style-type: none"> ○ Health care services in India ○ Health Planning and Programmes in India ○ Role of World Health Organization (WHO) in health education • <i>First Aid and Nursing*</i> <ul style="list-style-type: none"> ○ 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. Verma S. Medical Zoology. Rastogi Publications, New Delhi. (1998)
2. Jordon, E.L. and Verma. P.S. Invertebrate Zoology. 12th edn. Sultan Chand & Co(1995)
3. Srilakshmi, B. 5th edition. Food Science, New age International Publishers, New Delhi (2012)
4. Rastogi S. C. Biochemistry .Tata McGraw Hill Publishing Co. Ltd. (2003)

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	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezian
Signature:	Signature:	Signature:	Signature:

Programme code:	B. Sc		Programme Title :	Bachelor of Zoology	
Course Code:	21UZY3N2		Title	Batch :	2021-2024
Lecture Hrs/Week	1	Tutorial Hrs/ Sem --	Non- Major Elective -I Ornamental Fish Culture	Semester	III
				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 knowledge of general ornamental fishes	K1
CO2	Demonstrate the construction of home aquarium	K2
CO3	Apply the ornamental fish culture methods for aquarium maintenance	K3
CO4	Compare the various types of fish feed and feed formulation	K4
CO5	Determine the various fish diseases, diagnosis and treatment	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	<ul style="list-style-type: none"> • Scope of ornamental fish culture <ul style="list-style-type: none"> ○ General characters of fish ○ Digestive system ○ Reproductive system 	3
Unit II	<ul style="list-style-type: none"> • Egg layer <ul style="list-style-type: none"> ○ <i>Carassius auratus</i> ○ <i>Pterophyllum scalare</i> ○ <i>Beta splendens</i> • Live bearers <ul style="list-style-type: none"> ○ <i>Xiphophorus helleri</i> ○ <i>Xiphophorus maculatus</i> ○ <i>Poecilia reticulata</i>. • Breeding and spawning of live bearers and egg layers. 	3
Unit III	<ul style="list-style-type: none"> • Applications of transgenic technology in ornamental fish - Zebrafish • Aquarium <ul style="list-style-type: none"> ○ Requirements for an aquarium ○ setting of an aquarium* ○ Maintenance of water quality 	3

Unit IV	<ul style="list-style-type: none"> • Ornamental fish feeds and nutritional requirement • Types of feeds <ul style="list-style-type: none"> • Live feed <ul style="list-style-type: none"> ○ Artemia ○ Daphnia ○ Tubifex ○ Rotifers and Cyclops. • Artificial feed <ul style="list-style-type: none"> ○ Simple and compound ○ Composition of an ideal fish feed ○ Preparation of artificial feed • Feeding methods and Problems in artificial feed* 	3
Unit V	<ul style="list-style-type: none"> • Diseases of Ornamental Fishes and their Control • Parasitic <ul style="list-style-type: none"> ○ Argulus ○ Lernaeasis • Protozoan <ul style="list-style-type: none"> ○ Ichthyophthiriasis ○ 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. Dhote. A.K Publication Department – NCERT — 55 Inland fishery – Instructional – cum – Practical -Manual Vol IV Aquaculture. (1989)
2. Agarwal, S.C A hand book of fish farming. B.H.Enterprises. New Delhi(1994)
3. Biswas, K. P. A Text book of fish& Fisheries Technology - Calcutta(W.B) 2nd Edition, Published by Narendra Publishing house, Delhi (1996)
4. Jhingran, V. G. Fish and Fisheries of India - Hindustan Publishing Corporation (India) Delhi, Printed in India at Gopsons papers Pvt Ltd, Noida (1988)
5. Arumugam, N. Aquaculture SARAS Publications, Nagercoil, Tamilnadu. (2020)

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.Christobher	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY405		Title	Batch:	2021 – 2024
Lecture Hrs./Week	6	Tutorial Hrs./Sem.	6	Core – IV Genetics	Semester: IV 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 genetic disorders in man	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 diseases	K4
CO5	Construct personal and family pedigrees and integrate genetic testing options in genetic counselling practices	K5

Mapping

PO /PSO	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	<ul style="list-style-type: none"> Mendel's Monohybrid and Dihybrid experiments Mendel's Laws - Problems. Interaction of genes Lethal genes and its types <i>Epistasis</i> Polygenic inheritance: Skin colour in man 1:4:6:4:1 Multiple alleles (problems) <ul style="list-style-type: none"> Coat colour in rabbit ABO blood groups in man Rh factor 	18
Unit II	<ul style="list-style-type: none"> Linkage Complete and incomplete linkage Chromosome maps: <ul style="list-style-type: none"> Chromosome map in <i>Drosophila</i> (Three Point Cross) Sex determination: <ul style="list-style-type: none"> Homogametic and heterogametic Hymenopteran type – Honey bee Gynandromorph – <i>Drosophila melanogaster</i>* Hormonal control – Free Martin Cattle. 	18
Unit III	<ul style="list-style-type: none"> Sex linked inheritance <ul style="list-style-type: none"> Haemophilia and colour blindness in man – problems Hairy pinna in man. Euploidy and Aneuploidy Inbreeding and outbreeding <i>Twins</i>* 	18

Unit IV	Non-disjunction <ul style="list-style-type: none"> ○ Anomalies of Autosomes – Down’s syndrome and Patau’s syndrome ○ Anomalies of Allosomes– Klienfelter’s syndrome and Turner’s syndrome • Pedigree analysis • Inborn Errors of metabolism <ul style="list-style-type: none"> ○ Phenylketoneuria, Alkaptonuria and Albinism • Eugenics and Euphenics 	18
Unit V	<ul style="list-style-type: none"> • Nucleic acids as genetic material: <ul style="list-style-type: none"> - DNA as Genetic material: <ul style="list-style-type: none"> ○ Bacterial transformation ○ Bacterial conjugation ○ Bacteriophage infection ○ 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. Miglani G. S. - Advanced Genetics. Narosa Publishing House, New Delhi, 110002 - 1st edition – (2002).
3. Russell, J.- Essential Genetics. Black well Scientific Publication London - 2nd edition – (1987).
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. Kottari, L., *et al.*, - Essentials of Human Genetics. University Press Private Ltd. Hydrabad, 500029 - 5th edition – (2009).
7. E.D. Garber - Cytogenetics – An Introduction. TATA McGRAW – Hill Publishing Company Ltd. New Delhi - (1979)
8. Ajay Paul – Text book of Genetics, Books and allied company, Kolkata – (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
Name: Dr. S. Mariselvi	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,			Programme Title:	Bachelor of Zoology	
Course Code:	21 UZY 4N3			Title	Batch:	2021 – 2024
Lecture Hrs./Week	1	Tutorial Hrs./Sem.	--	Non- Major Elective -II Food and Nutrition	Semester:	IV
					Credits:	2

Course Objective

To acquire knowledge on the nutritive values of various foods stuffs, importance of food chart, food borne diseases, adulterations 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	<ul style="list-style-type: none"> The scope of food and nutrition Composition of food (Protein –Carbohydrate – Fat-Vitamins and Minerals) Function and sources of food 	3
Unit II	<ul style="list-style-type: none"> Energy measurement - and energy values of various food Nutritional requirements – children, adolescence, old age Balanced diet and Glycemic index <i>Digestion and absorption*</i> 	3
Unit III	<ul style="list-style-type: none"> Nutrition and importance of <ul style="list-style-type: none"> Hens Egg Meat Fish 	
Unit IV	<ul style="list-style-type: none"> Nutritional composition and importance of <ul style="list-style-type: none"> Milk and Milk products Vegetables Fruits Cereals and pulses 	3

Unit V	<ul style="list-style-type: none"> • 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
Name: Dr. S. Somasundaram	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme code:	B. Sc.,		Programme Title :	Zoology	
Course Code:	21UZY4N4		Title	Batch :	2021-2024
			Non- Major Elective -II	Semester	IV
Lecture Hrs/Week	1	Tutorial hours/Sem	--	Credits:	2
			Apiculture (NME)		

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	<ul style="list-style-type: none"> • Scope of Apiculture • Classification of Honey bee • Types of honey bee <ul style="list-style-type: none"> ○ <i>Apis dorsata</i> ○ <i>Apis indica</i> ○ <i>Apis florea</i> • Biology of honey bee – External Structure of worker bee Life cycle of honey bee 	3
Unit II	<ul style="list-style-type: none"> • <i>Social organization of honey bee colony -Queen - Drones and Worker*</i> • Structure of Beehive • Food of Honeybees • Relationship between plants and bee- plant as habitat- symbiosis- pollination 	3
Unit III	<ul style="list-style-type: none"> • Modern bee hive <ul style="list-style-type: none"> ○ Langstroth hive ○ Newton's hive Bee keeping equipments • Extraction of honey • Honey – Properties • Chemical composition of Honey <ul style="list-style-type: none"> ○ <i>Value of honey (Nutritional, Medicinal values)</i> 	3

Unit IV	<ul style="list-style-type: none"> • Royal jelly – Composition and functions • Bee wax – Production • Characteristics and uses of bee wax • Bee venom – Characteristics and uses 	3
Unit V	<ul style="list-style-type: none"> • Rearing of Honey bees <ul style="list-style-type: none"> ○ Mehods : Hopkins , Miller, and Doolittle • Diseases of honey bee <ul style="list-style-type: none"> ○ Bacterial disease ○ Viral disease ○ 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. Bhamrah Kavita Juneja H.S..An Introduction to Arthropoda-, Anmol Publications Pvt. Ltd., New Delhi, 2nd edition (2001)
2. Dharm Singh & Sevender Pratap Singh, edition. A handbook of Bee Keeping –Agrobios (India), Jodhpur, (2006)
- 3.Arumugam N Applied Zoology, Saras Publication, 114/35 G, A.R.P Camp Road, Periaivillai, Kottar PO, Nagercoil -629 002, Kanyakumari (2020)
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
Name: Dr.S.Christobher	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,			Programme Title:	Bachelor of Zoology	
Course Code:	21UZY507			Title	Batch:	2021 – 2024
Lecture Hrs./Week	5	Tutorial Hrs./Sem.	--	Core– V Developmental Biology	Semester:	V
					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	<ul style="list-style-type: none"> • Scope of developmental biology • Programmes of Developmental Biology • Theories <ul style="list-style-type: none"> ○ Pre-formation - Spemann's experiments on Organizer • Gametogenesis <ul style="list-style-type: none"> ○ Spermatogenesis and Oogenesis • Fertilization - Mechanism of fertilization • Parthenogenesis <ul style="list-style-type: none"> ○ Types of Parthenogenesis -Natural and Artificial ○ Significance of Parthenogenesis. 	15
Unit II	<ul style="list-style-type: none"> • Cleavage in Frog <ul style="list-style-type: none"> ○ Planes of cleavage -Meridional, Vertical , Equatorial and Latitudinal ○ Patterns of cleavage -Holoblastic and Meroblastic • Gastrulation in Frog <ul style="list-style-type: none"> ○ Morphogenic movements- Epiboly& Emboly • Exo gastrulation • Fate map • Mechanism of morphogenetic movement 	15

Unit III	<ul style="list-style-type: none"> • Cell lineage • Organogenesis in Frog <ul style="list-style-type: none"> ○ Ectodermal -Brain ○ Mesodermal -Heart ○ Endodermal- Alimentary canal • Development of Chick <ul style="list-style-type: none"> ○ Hours of incubation - 24,48 &72 • Development and significance of fetal membranes in chick. 	15
Unit IV	<ul style="list-style-type: none"> • Placentation in mammals <ul style="list-style-type: none"> ○ Classification based on Fetal membranes ○ Distribution of villi ○ Histology and Functions of placenta • Neoteny <ul style="list-style-type: none"> ○ Types ○ Factors affecting neoteny ○ Evolutionary significance • Organizer <ul style="list-style-type: none"> ○ Structure, properties and theories of organizer ○ Types of induction– embryonic induction ○ Mechanism of induction • Metamorphosis <ul style="list-style-type: none"> ○ Aspects of metamorphosis in insects and amphibians, ○ Changes and hormonal control. • Regeneration <ul style="list-style-type: none"> ○ Types of regeneration – amphibian limb regeneration ○ Role of hormones in regeneration. 	15
Unit V	<ul style="list-style-type: none"> • Stem cells • <i>Embryonic stem cell culture and applications*</i> • 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, Quiz, Assignments, Group Task.

Text Book

1. Verma P S & Agarwal V K -Chordate embryology-S Chand & Company Ltd. (2020)

Reference Books

1. Arumugam .N. - Developmental Zoology - Saras Publication,114/35G, A.R.P Camp Road, Periaivilai, Kottar Post, Nagercoil - 629002 , Tamilnadu, India, (2021)
2. Veer Bal Rastogi - Chordate embryology Kedar nath ram nath , 132. R.G. College road, Meerut- 250 001 – (2017).
3. Berrill, W. J. and Graw M. C. - Developmental biology - Hill Book Co, New York – (2010).
4. Wesley - An Outline of animal development – Davenport, Addison –publishers, University of Michigan – (1979).
5. Balinsky - Embryology - Philadelphia, Saunders College Publishing - 5th Edition, (2012).
6. Subramaniam - Developmental Biology. Narosa Publishing House, New Delhi – (2002)
7. Twyman. R.M. - Developmental Biology. Viva Books Private limited, New Delhi – (2001).
8. Chattopadhyay.S. - An Introduction to Developmental Biology. Books and Allied Pvt. Ltd., Kolkata – (2019)

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:	21UZY508		Title:	Batch :	2021-2024
			Core – VI Biotechnology (skill enhanced course)	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 comprehensive understanding of the principles and practices of biotechnology.	K1
CO2	Understand the different blotting techniques, PCR and DNA Fingerprinting	K2
CO3	Apply various aspects of animal biotechnology including media preparations of cell culture and Transgenic animals	K3
CO4	Analyze animal tissue culture and demonstrate the components and design of a bioreactor	K4
CO5	Evaluate the bio-safety, bioethics and intellectual property rights.	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	<ul style="list-style-type: none"> • Scope and importance of Biotechnology • Plasmids pBR 322 • Cosmids • Transposons • Construction of recombinant DNA • Recombinant Vaccines 	15
Unit II	<ul style="list-style-type: none"> • Principle and applications of blotting Techniques <ul style="list-style-type: none"> ○ Southern Blotting ○ Northern Blotting ○ Western Blotting • Polymerase Chain Reaction (PCR) • DNA Finger printing • <i>Genomic library*</i> 	15
Unit III	<ul style="list-style-type: none"> • Principle and applications of • <i>Biolistics</i> • Hybridoma technology • Transgenic Mice <ul style="list-style-type: none"> ○ Microinjection method • Applications of transgenic animals • Genetically modified organisms - Mice and Sheep • Primary and secondary cell lines 	15

Unit IV	<ul style="list-style-type: none"> • Tissue culture <ul style="list-style-type: none"> ○ Culture media ○ Culture of animal tissues • Bioreactors <ul style="list-style-type: none"> ○ Selection and modification of animal(Pig) ○ Applications of bioreactor • Scope and application of nano- biotechnology 	15
Unit V	<ul style="list-style-type: none"> • Biosafety • Bioethics <ul style="list-style-type: none"> ○ Monitoring the welfare of transgenic animals ○ Keeping of transgenic animals • Patenting <ul style="list-style-type: none"> ○ 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) (2017)
- 2.Dubey, P.C Text Book of Biotechnology Revised 5th Ed, Chand and Co., New Delhi . (2014).

Reference Books

1. Ignacimuthu, S., Basic Biotechnology, Tata McGraw Hill Publishing Company Ltd, New Delhi (1995)
2. Dubey, R. C., A text book of Biotechnology, Cambridge University Press (1996)
3. Molecular Biology and Biotechnology S.Chand & Company Ltd, NewDelhi (1993)
4. John.E.Smith, Biotechnology, Vikas Publishing House Pvt. Ltd, New Delhi(1993)
5. Gupta. P.K., Elements of biotechnology – Rastogi publications, Meerut (2004)
6. Balasubramaniam. D. C.F. A. Bryce, Dharmalingam. K. J. Green, Kunthala Jayaraman Concepts in Biotechnology, University Press (India) Pvt. Ltd. Hydrabed (2005)
7. Jayanto Achrekar Fermentation biotechnology. Dominant Publishers. New Delhi (2007)
8. Sayyed and Patil Biotechnology-emerging trends Scientific publishers India (2009)
9. Kumaresan V., Biotechnology –Saras publications, 114/35G, A.R.P Camp Road, Periaivilai, Kottar Post, Nagercoil - 629002 , Tamilnadu, India (2014)
10. Kumaresan V. and Arumugam N., Animal Biotechnology –Saras publications, 114/35G, A.R.P Camp Road, Periaivilai, Kottar Post, Nagercoil - 629002 , Tamilnadu, India (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: Dr.S.Christobher	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY509		Title	Batch:	2021 – 2024
			Core - 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	Recollect the concepts of biostatistics and biophysics	K1
CO2	Understand the formula and principles used in biology	K2
CO3	Understand the principle of TEM and SEM	K3
CO4	Analyze the importance about instruments in biological laboratory	K4
CO5	Apply different data used in biological samples	K5

Mapping

PO / PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO									
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	<ul style="list-style-type: none"> • Types and Collection of data <ul style="list-style-type: none"> ○ Methods of collection – Random and Non-random sampling ○ Primary and Secondary data • Tabulation <ul style="list-style-type: none"> ○ Parts and types of table • Diagrammatic presentation <ul style="list-style-type: none"> ○ Line diagram, Bar diagram and <i>Pie diagram</i> • Measures of central tendency <ul style="list-style-type: none"> ○ Arithmetic mean ○ Individual - Discrete and Continuous series ○ Median ○ Mode 	15
Unit II	<p>Measures of dispersion</p> <ul style="list-style-type: none"> • Standard deviation • Mean deviation <ul style="list-style-type: none"> ○ Individual - Discrete and Continues series • Correlation <ul style="list-style-type: none"> ○ Types of correlation ○ Karl Pearson's coefficient of correlation • Regression analysis – Linear regression 	15

Unit III	<ul style="list-style-type: none"> • Chi-square Test <ul style="list-style-type: none"> ○ Degrees of freedom • Student - t test • Analysis of Variance (ANOVA) - One-Way Analysis • Statistical Inference – Procedure of testing a hypothesis 	15
Unit IV	<ul style="list-style-type: none"> • Scope of biophysics • Thermodynamics principles <ul style="list-style-type: none"> ○ First and second law • Bioluminescence <ul style="list-style-type: none"> ○ Types and significance 	15
Unit V	<ul style="list-style-type: none"> • Instrumentation <ul style="list-style-type: none"> ○ <i>Compound microscope*</i> ○ Electron microscope- Transmission Electron Microscope (TEM) and Scanning Electron Microscope (SEM) ○ Chromatography - Thin layer chromatography (TLC) ○ Electrophoresis – Polyacrylamide Gel Electrophoresis (PAGE) ○ 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. Veer Bala Rastogi - Fundamentals of biostatistics. Ane Books, Pvt. Ltd. New Delhi -2nd edition,(2009)
2. Arumugam N. and Kumaresan V. Biophysics and Bioinstrumentation -, Saras publication, 114/35 G, A.R.P Camp Road, Periyavillai, Kottar PO, Nagercoil -629 002, Kanyakumari-(2016)

Reference Book

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

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. M. Durairaju	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhan
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY510		Title	Batch:	2021 – 2024
Lecture Hrs./Week	5	Tutorial Hrs./Sem.	--	Semester:	V
				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 <ul style="list-style-type: none"> • Scope of Biochemistry <ul style="list-style-type: none"> ○ Atoms, molecules, water ○ Functional groups • Chemical bonds of Biomolecules • Classification of Carbohydrates: <ul style="list-style-type: none"> ○ Monosaccharides - Pentoses ○ Disaccharides ○ Polysaccharides- Homopolysaccharide and Heteropolysaccharide 	15

Unit II	<ul style="list-style-type: none"> • Classification of Lipids: <ul style="list-style-type: none"> ○ Simple Lipids - Fats ○ Compound lipids -Phospholipids ○ Derived lipids -Glycerol ○ <i>Lipids associated Obesity disorders.*</i> 	15
Unit III	<ul style="list-style-type: none"> • Classification of Proteins: <ul style="list-style-type: none"> ○ Structure: Simple – Conjugated and Derived proteins. ○ Solubility: Globular and Fibrous proteins ○ Biosynthesis of glutamic acid, phenyl alanine, methionine,histidine 	15
Unit IV	<ul style="list-style-type: none"> • Metabolism <ul style="list-style-type: none"> ○ Carbohydrates: Glycolysis-Glycogenesis- Kreb’s cycle & Glycogenolysis ○ lipids :β-oxidation of fatty acids ○ Proteins: Transamination, Deamination, decarboxylation, ornithine cycle. 	15
Unit V	<ul style="list-style-type: none"> • Classification of Enzymes, Co-Enzymes and Vitamins <ul style="list-style-type: none"> ○ Nomenclature and properties. ○ Factors influencing enzyme action. ○ Enzyme inhibition. ○ Salient features of co enzymes ○ Types and <i>Properties of vitamins.</i> 	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. Rastogi S. C. Biochemistry .Tata McGraw Hill Publishing Co. Ltd. 2003
3. Thulsi Fatima. Biochemistry - Saras Publication,114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamil nadu, India. 2016
4. Sathyanarayana U.& Chakrapani, U. 2nd Edition, Essential of Biochemistry - Books & Allied pvt.ltd 83/1, Beliaghata main road, Kolkata 700010, India. 2009.
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
Name: Dr. S. Somasundaram	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,			Programme Title:	Bachelor of Zoology	
Course Code:	21UZY5E1			Title	Batch:	2021 – 2024
Lecture Hrs./Week	4	Tutorial Hrs./Sem.	--	Core Elective Paper - I Medical Laboratory Techniques	Semester:	V
					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	K1
CO2	Understand the methods used in medical laboratory	K2
CO3	Apply knowledge about laboratory diagnosis	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	<ul style="list-style-type: none"> • Introduction <ul style="list-style-type: none"> ○ Code of conduct for laboratory personnel ○ Structure of a laboratory • Laboratory instruments <ul style="list-style-type: none"> ○ Centrifuge ○ Autoclave ○ ECG ○ B. P. apparatus and stethoscope ○ Urinometer ○ Albumino meter ○ General procedure – Cleaning -Sterilization and disposal of infected materials ○ <i>Safety measures and first aid*</i> 	12

Unit II	<ul style="list-style-type: none"> • Cerebro Spinal Fluid Analysis <ul style="list-style-type: none"> ○ Physiology of CSF ○ Routine examination of CSF collection of the Specimen ○ Physical examination ○ Cytologic examination ○ Chemical examination ○ Bacteriological examination ○ Serologic examination 	12
Unit III	<ul style="list-style-type: none"> • Urine Analysis <ul style="list-style-type: none"> ○ Collection & preservation of urine ○ Physical examination ○ Chemical examination ○ Microscopic analysis • Faeces Analysis <ul style="list-style-type: none"> ○ Collection & preservation ○ Physical examination ○ Microscopic examination-Variou ova seen ○ Occult blood test 	12
Unit IV	<ul style="list-style-type: none"> • Sputum Analysis <ul style="list-style-type: none"> ○ Collection & preservation ○ Physical examination ○ Microscopic examination ○ Chemical examination • Semen Analysis <ul style="list-style-type: none"> ○ Collection of semen ○ Physical examination ○ Microscopic analysis ○ Preparation of smear and staining 	12
Unit V	<ul style="list-style-type: none"> • Pregnancy test <ul style="list-style-type: none"> ○ Immunological methods- LAI, HAI ○ Pregnancy card* • Sexual Diseases • Laboratory diagnosis of syphilis <ul style="list-style-type: none"> ○ Serology of syphilis ○ The V. D. R. L Flocculation Test • Cryopreservation and its application <ul style="list-style-type: none"> ○ 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
Name: Ms.S. Jayalakshmi	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.			Programme Title:	Bachelor of Zoology	
Course Code:	21UZY5E2			Title	Batch:	2021 – 2024
Lecture Hrs./Week	4	Tutorial Hrs./Sem.	--	Core Elective Paper - I Poultry Science and Management Technology	Semester:	V
					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	Get the idea on poultry house and management.	K2
CO3	Execute feed formulation for broiler, layer and breeders.	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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Poultry house and equipment Space requirements Types of houses <i>Summer management - Winter management*</i> Sterilization of room 	12
Unit III	<ul style="list-style-type: none"> Classification of feed stuffs Availability of raw materials and their cost Feed formulation and Feeding programme Equipment for feeding and drinking. 	12

Unit IV	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • <i>Nutritive value of poultry meat and egg*</i> • 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
Name: Ms.S. Jayalakshmi	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,			Programme Title:	Bachelor of Zoology	
Course Code:	21UZY5E3			Title	Batch:	2021 – 2024
Lecture Hrs./Week	4	Tutorial Hrs./Sem.	--	Core Elective Paper – I Haematology and Clinical pathology	Semester:	V
					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	<ul style="list-style-type: none"> • Haematology <ul style="list-style-type: none"> ○ Blood Collection ○ Capillary Blood collection ○ Venous Blood collection ○ Anticoagulant- Ammonium & potassium Oxalate mixture • Clinical examination of blood <ul style="list-style-type: none"> ○ Blood smear Preparation ○ Staining of a thin blood film ○ Examination of stained film ○ Parasites seen in the blood ○ Bleeding time ○ Clotting time 	12

Unit II	<ul style="list-style-type: none"> • Blood analysis • Estimation of Haemoglobin <ul style="list-style-type: none"> ○ Cyan methaemoglobin Photometric method ○ Haemoglobin estimation by sahli method ○ Haemoglobin estimation of the sample blood • Blood cell total count <ul style="list-style-type: none"> ○ Neubauer Counting chamber ○ Total RBC Count ○ Total WBC Count • Erythrocyte Sedimentation Rate (ESR) <ul style="list-style-type: none"> ○ Westergren's method ○ Windrobe method ○ Precautions ○ Interpretation 	12
Unit III	<ul style="list-style-type: none"> • Blood Chemistry <ul style="list-style-type: none"> ○ <i>Blood samples for different Analysis*</i> • Blood Sugar <ul style="list-style-type: none"> ○ Methods for estimation of glucose ○ Glucose tolerance test ○ Two hour post prandial blood glucose ○ Oral Glucose tolerance test ○ Intra venous tolerance test • Cholesterol • Urea • Non protein Nitrogen in Blood 	12
Unit IV	<ul style="list-style-type: none"> • Clinical Pathology • Laboratory diagnosis of Various types of anaemias <ul style="list-style-type: none"> ○ Iron deficiency anaemia ○ Vitamin B12 deficiency anaemia • Liver Function tests <ul style="list-style-type: none"> ○ Normal functions of the Liver ○ Indications for Liver function tests ○ bilirubin metabolism ○ Estiamtion of Urine bilirubin ○ Estimation of Urine Urobilinogen 	12
Unit V	<ul style="list-style-type: none"> • Laboratory diagnosis of jaundice <ul style="list-style-type: none"> ○ Bilirubin metabolism ○ Classification of Jaundice • Laboratory diagnosis of AIDS <ul style="list-style-type: none"> ○ Aetiology ○ Epidemology ○ Pathogenesis ○ Transmission ○ Clinical diagnosis of AIDS ○ Prevention of HIV transmission in health care settings 	12
	<ul style="list-style-type: none"> • 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 Haematology for NBE . 6th edition, CBS publishers, Delhi (2020).
1. Ajmani PS. Handbook of Clinical Laboratory Techniques . AITBS Publisher , India(2017)
2. Mukherjee. KL. Medical Laboratory Technology. Volume 1,2 and 3. Tata McGraw Hill education, India. (2010)
3. Talib VH, Khurana. Handbook of Medical Laboratory Technology , CBS publishers, Delhi(2009)
4. Varley H. Practical Clinical Biochemistry, CBS Publishers, Delhi (2008)
5. John Macleod and John Munro, Clinical Examination. ELBS publishers (1988)
6. 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
Name: Ms.S. Jayalakshmi	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY614		Title	Batch:	2021 – 2024
Practical Hrs./Week	2	Tutorial Hrs./Sem.	10	Core Lab- III:	Semester:
				Developmental Biology, Animal Physiology & Endocrinology, Biostatistics & Biophysics, Biochemistry, Polutry science managment , Heamatology and Clinical pathology & MLT (Non-Semester Pattern)	V & VI
				Credits:	4

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	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
- Transmission 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
100	Practical Skill/observation	10	Experiments	20
			Major Practical	
			Minor Practical	10
	Model Practical Examination	30	Spotters	20
	Record work	10	Record	10
	Total Marks	50	Total Marks	60(conv erted into 50)

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, Periyavilai, Kottar Post, Nagercoil - 629002 , Tamilnadu, India.
2. H. R. Singh and Neerajkumar, (2014). Animal Physiology and biochemistry, Vishal Publishing Co. Jalandhar, Delhi
3. Ramnik Sood, Medical Laboratory Techniques (MLT). (1999) 5th edn. Jaypee Brothers Medical publishers (P) Ltd. Delhi
4. Mariakuttikan , A and Arumugam, N. (2014). Animal P[hysiology . Saras publication. Nagercoil, Kanyakumari Dist. Tamil Nadu.

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. M. Durairaju	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY615		Title	Batch:	2021 – 2024
Practical Hrs./Week	2	Tutorial Hrs./Sem.	Core 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
		--		Credits:	4

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 visualising 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 evaluate 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 Flow Chamber
- Gel Electrophoresis

Sericulture

- Silkworm
- Silk gland
- 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
100	Practical Skill/observation	10	Experiments-major practical	20
			Mini Project	10
	Model Practical Examination	30	Spotters	20
	Record work	10	Record	10
	Total Marks	50	Total Marks	60 (converted into 50)

Reference Books

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

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. Somasundaram	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY5AL		Title	Batch:	2021 – 2024
Lecture Hrs./Week	--	Tutorial Hrs./Sem.	--	Advanced Learner Course -1 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	<ul style="list-style-type: none"> • Scope of Bioinformatics • Databases <ul style="list-style-type: none"> ○ Biological databases ○ Specialized databases • Protein sequence database – SWISS-PROT 	
Unit II	<ul style="list-style-type: none"> • Symbols used in databases <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> • Genomics <ul style="list-style-type: none"> ○ Classification and applications • Proteomics <ul style="list-style-type: none"> ○ Classification and applications • Human genome project <ul style="list-style-type: none"> ○ Goals and techniques ○ Potential benefits 	
Unit IV	<ul style="list-style-type: none"> • Bioinformatics tools • Significance of bioinformatic tools • Similarity tool : BLAST and FASTA • Visualizing tool : RasMol and Chime • Miscellaneous tool : Webcutter 	

Unit V	<ul style="list-style-type: none"> • Virtual Library • Drug designing • Phylogenetic analysis • Construction of phylogenetic tree – PHYLIP (free online software) • 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, Periyavillai, 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- Dominant 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	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY 5VA		Title	Batch:	2021 -2024
Lecture hrs./Week		Tutorial Hrs./Sem.	-	Value Added Course: Food safety and Hygiene	Semester V 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	<ul style="list-style-type: none"> Composition of food - Protein –Carbohydrate – Fat-Vitamins and Minerals Functions and sources of food objectives of cooking Nutritional requirements <ul style="list-style-type: none"> - children - adolescence - old age 	6
Unit II	<ul style="list-style-type: none"> Nutrition and importance of <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> Food technology: <ul style="list-style-type: none"> - Organic foods - Packaging of foods - Nutrition labelling Food laws: <ul style="list-style-type: none"> - Prevention of Food Adulteration Act - Essential Common dietics Act 	6

Unit IV	<ul style="list-style-type: none"> • Health indicators <i>Personal hygiene, Public health</i> • Nutrition and Health Classification of food (Macro & Micro nutrients) • Balanced diet • Nutrition disorders 	6
Unit V	<ul style="list-style-type: none"> • Health Education: <ul style="list-style-type: none"> ○ Health care services in India ○ Health Planning and Programmes in India ○ Role of World Health Organization (WHO) in health education • <i>First Aid and Nursing*</i> 	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. Rastogi 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	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY5S1		Title	Batch:	2021 – 2024
Lecture Hrs./Week	1	Tutorial Hrs./Sem.	--	Skill Based Elective- I	Semester:
				Network and Information Security (SBE-Online)	Credits:
					2

Course Objective

To acquire knowledge on Network security, network monitoring, password management, Wi-Fi security and hackers.

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 network	K1
CO2	Understand the network hacking techniques	K2
CO3	Deploy information and network security	K3
CO4	Interpret the common threats today in computer network	K4
CO5	Importance of right password usage	K5

Mapping

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

Units	Content	Hrs
Unit I	<ul style="list-style-type: none"> Basics of Network Network Media Various Operating Systems Basics of Firewalls on all Platforms including Windows MacOS and Linux. 	3
Unit II	<ul style="list-style-type: none"> Security Vulnerabilities across an entire network Network Hacking techniques and Vulnerability scanning. 	3
Unit III	<ul style="list-style-type: none"> Configure and architect a small network for physical and wireless security Firewalls configuration on Windows platform and Linux platform Network privacy issues 	3
Unit IV	<ul style="list-style-type: none"> Network monitoring to discover and identify potential hackers and malware using tools like WIRESHARK and SYSLOG . Online tracking by hackers 	3

Unit V	<ul style="list-style-type: none"> • Best methods of authentication including passwords, multifactor authentication including soft tokens and hard tokens. • Best password managers to use – how passwords are cracked – how to mitigate the password attacks. 	3
Total Contact Hrs		15

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book:

Reference Books

Course Materials will be made online through NGM Open source learning platforms

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. Somasundaram	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY5S2		Title	Batch:	2021 – 2024
Lecture Hrs./Week or Practical Hrs./Week	1	Tutorial Hrs./Sem.	Skill based Elective –I Cyber Security- Ethical Hacking (SBE online)	Semester:	V
				Credits:	2

Course Objective

To acquire knowledge about the basics of cyber security, ethical hacking in the Cyber space and protect them from security experts and use of hacking tools.

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 cyber security	K1
CO2	Understand the knowledge about ethical hacking	K2
CO3	Deploy the use of hacking tools	K3
CO4	Analyze the details about internet connection	K4
CO5	Create awareness about cyber security	K5

Mapping

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

Units	Content	Hrs
Unit I	<ul style="list-style-type: none"> To Understand how websites work, how to discover and exploit web application vulnerabilities and to gain full control over websites . Secure systems from all the known attacks . Secret tracking and hacking infrastructure. 	3
Unit II	<ul style="list-style-type: none"> Ethical hacking in Cyber space - its fields and the different types of hackers Hack & secure both Wi-Fi & wired networks 	3
Unit III	<ul style="list-style-type: none"> Discover vulnerabilities & exploitation of hacking in cyber network servers How secure systems are hacked using client-side and social engineering attacks . Use of hacking tools such as Metasploit, Aircrack- ng, SQLmap. etc. 	3

Unit IV	<ul style="list-style-type: none"> • Network basics & how devices interact inside a network - Network Penetration. Control connections of clients in network by password cracking. • Fake Wi-Fi network creation with internet connection and spy on clients. • To Gather detailed information about clients and networks like their OS, opened ports etc. 	3
Unit V	<ul style="list-style-type: none"> • Explore the threat landscape - Darknets, dark markets, zero day vulnerabilities, exploit kits, malware, phishing and much more. • Master defenses against phishing, SMSing, vishing, identity theft, scam, cons and other social engineering threats. 	3
	Total Contact Hrs	15

Pedagogy

Direct Instruction, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

Course Materials will be made online through NGM Open source learning platforms

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. Somasundaram	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY611		Title	Batch:	2021 – 2024
Lecture Hrs./Week or Practical Hrs./Week	5	Tutorial Hrs./Sem.	Core-IX Animal Physiology & Endocrinology	Semester:	VI
				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	<ul style="list-style-type: none"> • Digestion <ul style="list-style-type: none"> ○ Functional anatomy of digestive system ○ Digestion and absorption. ○ Neuroendocrine regulation of gastro – intestinal movements and secretions. • Respiration: <ul style="list-style-type: none"> ○ Aerobic & Anaerobic respiration ○ Respiratory pigments in animals ○ Transport of gases - O₂ and CO₂ 	15
Unit II	<ul style="list-style-type: none"> • Circulation: <ul style="list-style-type: none"> ○ Myogenic & Neurogenic heart ○ Pacemaker and electrical activity of heart in man ○ Composition and functions of blood • <i>Composition and functions of Lymph*</i> • Water Balance: <ul style="list-style-type: none"> ○ Osmatic and Ionic regulations in aquatic animal (Fish) • Receptors: <ul style="list-style-type: none"> ○ Chemoreceptors - Gustatoreceptors & ○ Olfactoreceptors ○ Photoreceptor (Eye) ○ Phonoreceptor (Ear) 	15

Unit III	<ul style="list-style-type: none"> • Effectors: <ul style="list-style-type: none"> ○ Types of muscles : Striped- unstriped and cardiac muscles ○ Structure and properties of striped muscle • Mechanism of muscular contraction- sliding filament theory. • Nervous system: <ul style="list-style-type: none"> ○ Structure of vertebrate neuron ○ Conduction of nerve impulse through : Non-myelinated neuron Synapse ○ Neuromuscular junction ○ Reflex action and reflex arc • Excretion: <ul style="list-style-type: none"> ○ <i>Structure of mammalian kidney*</i> ○ Structure of Nephron ○ Synthesis of ammonia - urea and uric acid ○ Formation of urine in Human • Reproductive system: <ul style="list-style-type: none"> ○ Male and female reproductive system structure 	15
Unit IV	<ul style="list-style-type: none"> • Scope of Endocrinology • Endocrine glands (Structure & Functions) <ul style="list-style-type: none"> ○ Pituitary ○ Thyroid ○ Parathyroid ○ Pancreas ○ Testes & ovary • Hormonal interactions- Feedback control mechanisms. 	15
Unit V	<ul style="list-style-type: none"> • Mechanism of hormone action: peptide, steroid & thyroid. • Hormonal disorders: <ul style="list-style-type: none"> ○ 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. Parameswaran, Ananthakrishnan& Ananthasubramaniam, Outline of animal physiology - S. Viswanathan printers & Publishers Pvt. Ltd. (1991)
2. Verma, P. S ., Tyagi and Agarwal. Animal physiology - Chand& company ltd (1997)
3. S. Sree Kumar, Basic Physiology –PHI Learning Pvt. Ltd, New Delhi, 110001, Edition. (2010)
4. Berry, A.K. A text book of Animal Physiology –EMKAY Publication, New Delhi-110051 (2010)
5. Sreekumar S. Edition. Basic Physiology –, PHI Learning Pvt. Ltd, New Delhi. (2010)
6. Sastry, K.V. Endocrinology & Reproductive Biology –Rastogi Publications, Shivaji road, Meerut-250002, India. (2009-2010)
7. Prakash S. Lohar. Endocrinology. MJP Publishers, Chennai. (2005)
8. Suresh.R. Essentials of Human Physiology. Books and Allied Pvt. Limited. Kolkata (2012)
9. Arora. M.P.. Animal Physiology, Himalaya Publishing house, Mumbai (2015)
10. Arumugam N. Animal physiology- Saras Publication, 114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamil nadu, India (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
Name: Dr. S. Somasundaram	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature :

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology		
Course Code:	21UZY612		Title	Batch:	2021 – 2024	
Lecture Hrs./Week or Practical Hrs./Week	5	Tutorial Hrs./Sem.	- -	Core–X Ecology and Evolution	Semester:	VI
					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	<ul style="list-style-type: none"> • Scope of ecology • Abiotic factors <ul style="list-style-type: none"> ○ Soil: Pedogenesis - texture- profile – fauna and soil erosion. ○ <i>Water: Properties*</i> ○ Water problems in aquatic habitat – Fresh water, Sea water and Esturay water ○ Temperature: Range - Thermal stratification- biological effects of temperature ○ Light: biological effects of light 	15
Unit II	<ul style="list-style-type: none"> • Biogeochemical cycle <ul style="list-style-type: none"> ○ Gaseous cycle : Carbon- Nitrogen ○ Sedimentary cycle: Sulphur- Phosphorus • Animal relationship <ul style="list-style-type: none"> ○ Commensalism ○ Mutualism ○ Parasitism • Animal population <ul style="list-style-type: none"> ○ Characteristics of population - Natality- mortality- growth- density 	15

	<ul style="list-style-type: none"> • Human Ecology <ul style="list-style-type: none"> ○ Population growth (Explosion), Population control • Space Ecology <ul style="list-style-type: none"> ○ Physiological changes during space travel. 	
Unit III	<ul style="list-style-type: none"> • Theories of origin of life • Biochemical origin of life • <i>Urey and Miller's experiment*</i> • Evidences of evolution <ul style="list-style-type: none"> ○ Morphological: Homologous structures – vestigial organs – connecting links ○ Embryological: Recapitulation theory • Palaeontological : Missing links 	15
Unit IV	<ul style="list-style-type: none"> • Darwinism • Neo Darwinism • Lamarckism • Neo Lamarckism 	15
Unit V	<ul style="list-style-type: none"> • 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. Odum E. P. Fundamentals of ecology . W. B. Saunders Company, London. 1st edition. (1971).
2. N.Arumugam- Ecology, Toxicology and Evolution, Saras Publications, Kanyakumari(2015)
3. Tomar and Singh, Evolutionary Biology – Rastogi Publication, Meerut. 250 0028th edition(2010).
4. Arumugam N. Concepts of ecology. Saras publication 114/35 G, A.R.P Camp Road, Periyavillai, Kottar PO, Nagercoil -629 002, Kanyakumari (2021).
5. Arumugam N. Organic Evolution— Saras publication 114/35 G, A.R.P Camp Road, Periyavillai, Kottar PO, Nagercoil -629 002, Kanyakumari(2015)

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. M. Durairaju	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhan
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY613		Title	Batch:	2021 – 2024
Lecture Hrs./Week	5	Tutorial Hrs./Sem.	Core XI - Microbiology and Immunology- Skill enhancement course	Semester:	VI
		--		Credits:	4

Course Objective

To acquire a basic knowledge of microbiology and immunology, working mechanism of immunity, basic methods in microbiology, classification of microorganisms 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	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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO									
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	<ul style="list-style-type: none"> • Introduction and scope of microbiology • Classification of Bacteria, virus, Fungi • Basic methods in Microbiology <ul style="list-style-type: none"> ○ Pure culture - purification techniques ○ Types of culture media ○ Preparation of Culture media ○ Culture techniques of microorganisms ○ Bacterial growth and Growth curve • Staining procedure and types of staining • Sterilization, Isolation and Maintenance of Microbes 	15
Unit II	<ul style="list-style-type: none"> • Bacteria: <ul style="list-style-type: none"> ○ Major features and structure of bacteria ○ Economic importance of bacteria • Viruses: <ul style="list-style-type: none"> ○ Characteristic and structure of viruses ○ Structure of Bacteriophage • Applied microbiology <ul style="list-style-type: none"> ▪ Agricultural microbiology: <ul style="list-style-type: none"> ▪ Role of microorganism in soil fertility 	15

	<ul style="list-style-type: none"> ▪ Biofertilizers-Rhizobium ▪ Role of microorganism in agriculture 	
Unit III	<ul style="list-style-type: none"> • Food microbiology: <ul style="list-style-type: none"> ▪ Food spoilage ▪ Food borne diseases, ▪ Food borne infections ▪ Food borne intoxicans ▪ <i>Food preservation*</i> • Medical microbiology <ul style="list-style-type: none"> ▪ Bacterial Diseases -TB, Cholera ▪ Viral Diseases – Measles, Covid19 ▪ Fungal Diseases- Cutaneous and systemic mycoses • Industrial Microbiology <ul style="list-style-type: none"> ▪ Fermentor design ▪ Microbial Selection, ethanol and penicillin <p>Production</p>	15
Unit IV	<ul style="list-style-type: none"> • Immunology <ul style="list-style-type: none"> ○ Introduction and scope of immunology • Classification of Immunity <ul style="list-style-type: none"> ○ Innate Immunity ○ Acquired Immunity • Immune Response <ul style="list-style-type: none"> ○ Mechanism of Humoral immune response ○ Mechanism of Cell mediated immune response • Lymphoid Organs <ul style="list-style-type: none"> ○ Primary lymphoid organs ○ Secondary lymphoid organs 	15
Unit V	<ul style="list-style-type: none"> • Cells of the immune system <ul style="list-style-type: none"> ○ Lymphoid lineage ○ Myeloid lineage • Immunoglobulins <ul style="list-style-type: none"> ○ Structure of immunoglobulin ○ Classes and properties of immunoglobulin • Major Histocompatibility complex-Classification of MHC • Tumor immunology <ul style="list-style-type: none"> ○ Types of tumor ○ <i>Properties and causes of tumor cells*</i> ○ Causes of tumour ○ Factors involved in tumor immunity ○ Immune diagnosis and immunotherapy of tumor 	15
	<ul style="list-style-type: none"> • 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. Ryan KJ, Ray CG, Editors. Sherris Medical Microbiology 7th Edition, MCGraw Hill Education Singapore(2018)
2. Willey JM, Sherwod L, Woolverton CJ Prescotts Microbiology, MCGraw Hill Education Singapore(2017)
3. Atlas RM. Principles of Microbiology, Ist Edition, Mosby- Yearbook, Inc Missouri(1995)
4. John.E.Smith, Biotechnology – Vikas Publishing House Pvt. Ltd, New Delhi(1993)
5. Mani. A., Selvaraj. A.M., Narayanan, L. M. and Arumugam, N. Microbiology. Saras publications, 114/35 G, A.R.P Camp Road, Perivillai, Kottar PO, Nagercoil -629 002, Kanyakumari(2017)
6. Dulsy Fatima and N. Arumugam. Immunology, Saras Publications, 114/35 G, A.R.P Camp Road, Perivillai, Kottar PO, Nagercoil -629 002, Kanyakumari(2020)

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	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,			Programme Title:	Bachelor of Zoology	
Course Code:	21UZY6E4			Title	Batch:	2021 – 2024
				Core Elective Paper - 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 of Sericulture and importance of agricultural production.	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	Assess the Knowledge of Central Silk Board and its functions.	K5

Mapping

PO /PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO									
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	<ul style="list-style-type: none"> • Definition and History of Sericulture • Economic importance of sericulture • Varieties of silkworms: <ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> • Methods of vegetative Propagation <ul style="list-style-type: none"> ○ Cutting ○ Layering ○ Grafting • Pruning: Low cut–High cut and Rejuvenation pruning • Methods of Leaf harvesting • <i>Preservation of leaves*</i> • Diseases of Mulberry: Fusarium Root Rot – Powdery Mildew – Leaf Blight 	12

Unit III	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Disinfection • Rearing of silkworm : • Chawki, Shelf- Floor and shoot rearing • Mounting: Methods and precaution during mounting • Diseases of silk worms: <ul style="list-style-type: none"> ○ Pebrine, ○ Viral Flacherie (IFV) ○ Grasserie :Nuclear Polyhedrosis (NPV) 	12
Unit V	<ul style="list-style-type: none"> • Pest of silk worm-Indian Uzi fly • Physical characteristics of cocoons • <i>Defective cocoons*</i> • 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. Ullal and Narasimhanna. M.N. – Hand Book of practical sericulture –SBS Publishers, Bangalore – 2nd Edition – (1981)
2. Manual on sericulture – FAO – Central Silk Board Bangalore – (1977).
3. Ezhili N. & Thirumathal K. – A hand book for sericulture –Shrishti Impression, Coimbatore – (2008)
- 4.

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	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY6E5		Title	Batch:	2021 – 2024
			Core Elective Paper- II	Semester:	VI
Lecture Hrs./Week	4	Tutorial Hrs./Sem.	--	Insect Pest Management	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	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	<ul style="list-style-type: none"> Pest – Definition and Classification Reasons for insect assuming pest status Insect pest outbreak <ul style="list-style-type: none"> Economic injury level Economic threshold level Injuries and Damage caused by insect pests 	12
Unit II	<ul style="list-style-type: none"> Assessment of insect pest population methods <ul style="list-style-type: none"> Sample count and total count Assessment of insect pest damage-methods <ul style="list-style-type: none"> Leaf damage and root damage Pest surveillance and forecasting pest outbreak <i>Need for insect pest management*</i> 	12
Unit III	<ul style="list-style-type: none"> Pest control Climatic factors Natural enemies Physical, Mechanical, Chemical, Cultural, <i>Biological and legal control*</i> 	12
Unit IV	<ul style="list-style-type: none"> Insecticide- Formulation of insecticides Classification based on mode of entry and mode of action Attractants- Antifeedants and Chemosterilants <i>Integrated Pest Management*</i> 	12

Unit V	Biology, life cycle, damage and management of Agriculture pest <ul style="list-style-type: none"> • Cotton – The cotton Boll worm – <i>Helicoverpa armigera</i> • Coconut – The Rhinoceros beetle – <i>Oryctes rhinoceros</i> • Groundnut – The Red hairy caterpillar – <i>Amsacta albistriga</i> • Sugarcane – The sugarcane stem bore- <i>Chilo infuscatellus</i> 	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 Broughton Ltd., Kent, U.S.A.,(2015)

Reference Books

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

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	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,			Programme Title:	Bachelor of Zoology	
Course Code:	21UZY6E6			Title	Batch:	2021 – 2024
				Core Elective - II	Semester:	VI
Lecture Hrs./Week	4	Tutorial Hrs./Sem	-	Parasitology	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	<ul style="list-style-type: none"> Scope of parasitology Host parasitic relationship –Commensalism, Phoresis, Parasitism, Mutualism Ecological aspects of parasitism Minor Medical Importance of parasites 	9
Unit II	<ul style="list-style-type: none"> Effect of parasites on hosts Tissue damage – Hyperplasia, Hypertrophy, Metaplasia, Neoplasia. Opportunistic parasites –<i>Toxoplasma gondii</i>, <i>Cryptosporidium parvum</i>, <i>Enterocytozoon bieneusi</i> 	9
Unit III	<ul style="list-style-type: none"> <i>Locomotory organs of parasites*</i> Encystation in parasites Reproduction in parasites Pathogenicity in human – <i>Naegleria fowleri</i>, <i>Acanthamoeba</i> 	9

Unit IV	<ul style="list-style-type: none"> • pathogenecity <ul style="list-style-type: none"> ○ Ciliates – <i>Balantidium coli</i> ○ Flagellates – <i>Geardia lamblia</i> • Blood and Tissue Protistans - <i>Leishmania</i> and <i>Trypanasoma</i> 	9
Unit V	<ul style="list-style-type: none"> • Nematode infection of human - <i>Enterobius vermicularis</i> and <i>Trichuris trichiura</i>. • Hookworm – <i>Ancylostoma duodenale</i> and <i>Trichinella spiralis</i> • Vector borne nematode - <i>Wuchereria bancrofti</i> • <i>Filarial nematode</i> – <i>Loa loa</i>* 	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. 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)
3. 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)
- 4.

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	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme code:	B.Sc			Programme Title :	Zoology	
Course Code:	21UZY6E7			Title	Batch :	2021-2024
				Core Elective Paper–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 systems.	K1
CO2	Evaluate the freshwater and brackish water resources for aquaculture	K2
CO3	Apply the knowledge in food sectors, hatchery and nursery operations	K3
CO4	Analyze and apply the knowledge of aquaculture in composite fish farming	K4
CO5	Identify fish diseases and explain induced breeding techniques	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	<ul style="list-style-type: none"> • Scope of Aquaculture in India • Desirable character of fishes <ul style="list-style-type: none"> ○ Teleost – <i>Labeo rohita</i> ○ Morphology and anatomy <ul style="list-style-type: none"> ▪ Digestive system ▪ Reproductive system • Economic importance of fish • Nutritive value of fish 	15
Unit II	<p>Culture of Fishes</p> <ul style="list-style-type: none"> • Types of fish Pond <ul style="list-style-type: none"> ○ Nursery pond, ○ Rearing pond ○ Culture pond, • Preparation of pond for fish culture. <p>Culture methods</p> <ul style="list-style-type: none"> ○ Mono culture , ○ Poly culture ○ Integrated culture, ○ Fresh water culture, 	15

	<ul style="list-style-type: none"> ○ Marine culture ▪ Hypophysation ▪ Age and growth study <p>Fish Feed and nutritional requirement</p> <ul style="list-style-type: none"> • Live feed <ul style="list-style-type: none"> ○ Artemia culture, ○ Daphnia, Spirulina ○ Tubifex, Cyclops and chlorella • Artificial feed <ul style="list-style-type: none"> ○ Classification of feed ○ Composition of an ideal feed ○ Preparation of artificial feed ○ Feeding methods and Problems in artificial feed. 	
Unit III	<p>Bionomics of some important aquatic animals</p> <ul style="list-style-type: none"> • Fresh water fishes - Indian major carps <ul style="list-style-type: none"> ○ <i>Catla catla</i> ○ <i>Cyrhinus mrigala</i> ○ <i>Labeo rohita</i> (Rohu) • Exotic fishes- <i>Cyprinus carpio</i> and <i>Oreochromis mossambicus</i> ○ Marine fisheries - <i>Sardinella longiceps</i> • Prawn culture- Methods- Seed collection, hatchery, hormonal control-paddy and pokkali fields • Oyster culture- Edible oyster and pearl oyster culture 	15
Unit IV	<p>Fishing Crafts and Gears</p> <ul style="list-style-type: none"> • <i>Fish crafts – different types of fishing boats*</i>. • Gears <ul style="list-style-type: none"> ○ Hooks ○ Simple dipnets ○ Chinese dipnets ○ Gill nets ○ Purse seine ○ Trawl nets <p>Preservation of fishes</p> <ul style="list-style-type: none"> ○ Identification of good and spoiled fish ○ Refrigeration ○ Freeze drying ○ Fumigation ○ Canning ○ Salting 	15
Unit V	<ul style="list-style-type: none"> • Ornamental fish culture <ul style="list-style-type: none"> ○ Requirements and setting of an aquarium • Aquarium fishes- <ul style="list-style-type: none"> • Egg layer <i>Carassius auratus</i>, <i>Pterophyllum scalare</i>, <i>Betta splendens</i>, <i>Colisa</i> ○ Live bearer : <i>Poecilia</i>, <i>Puntius tetrazona</i>, <i>Xiphophorus helleri</i>, <i>Poecilia reticulata</i> • Fish pathology and major diseases <ul style="list-style-type: none"> ○ Bacterial diseases- Dropsy, Gill Rot ○ Viral diseases - Ebizootic ulcerative syndrome, Haemorrhagic septicaemia ○ Fungal diseases - Gill Rot, Saprolegniasis ○ Fish parasites - Argulosis • Principles of harvesting- transport and marketing • By-products of fishes • <i>Role of fishes in mosquito control*</i> • 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. Vadapalli and Satyanarayanan, Fish culture. Narendra publishing house, Delhi (1996) .
2. Datta Munshi and Srivastava, Natural history of fishes and systematic of Fresh-water fishes of India. Narendra Publishing House, New Delhi (1988).
3. Agarwal. S. C., A hand book on fish farming. Narendra publishing house. Delhi (1994)
4. Charls L Cutting, Fish processing and preservation. Agrobotanical publishers India (1999)
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. Jhingran, V.G., Fish and Fisheries of India – Hindustan Publishing Corporation India Delhi. Printed in India at Gopsons paper Pvt. Ltd. Noida1988.
7. Arumugam, N Aquaculture SARAS Publications, Nagercoil, Tamilnadu (2020).

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. Christobher	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY6E8		Title	Batch:	2021 – 2024
Lecture Hrs./Week	5	Tutorial Hrs./Sem.	--	Core Elective Paper – III Wildlife Conservation	Semester: VI
				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	<ul style="list-style-type: none"> • Scope and importance of Wildlife <ul style="list-style-type: none"> ○ Causes of wildlife depletion ○ <i>Economic importance of wildlife*</i> ○ Need for wildlife conservation ○ Rare, endangered, threatened endemic species 	15
Unit II	<ul style="list-style-type: none"> • Forestry <ul style="list-style-type: none"> ○ Types in India- identification, dendrology; • Deforestation & Impacts <ul style="list-style-type: none"> ○ Impact and removal of invasive alien species ○ Remote sensing in Forestry management. 	15
Unit III	<ul style="list-style-type: none"> • Wildlife Management Techniques <ul style="list-style-type: none"> ○ Vegetative analyses – Point Centered Quadrat, Quadrat, Strip transect ○ GIS and Remote sensing in wildlife habitat surveys- • Wildlife Photography <ul style="list-style-type: none"> ○ Types of cameras, camera traps ○ Field equipments-altimeter, pedometer, field compass, binoculars; radio collaring; GPS 	15

Unit IV	<ul style="list-style-type: none"> • Wildlife Census Techniques <ul style="list-style-type: none"> ○ Total counts -Sample counts ○ Direct count -block count, transect methods, Point counts, visual encounter survey, waterhole survey ○ Indirect count -Call count, track and signs, pellet count, pugmark, camera trap, Capture-recapture techniques 	15
Unit V	<ul style="list-style-type: none"> • Conservation of Wildlife: in-situ and ex-situ conservation: <ul style="list-style-type: none"> ○ <i>Wildlife Sanctuaries, and Parks*</i>, ○ Tiger Reserves and Biosphere reserves: ○ Project: Tiger; Elephant ○ 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
Name: Dr. S.Somasundaram	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme code:	B. Sc.,	Programme Title :	Zoology	
Course Code:	21UZY 6E9	Title	Batch :	2021-2024
		Core Elective Paper–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

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	Assess the knowledge nutritive value of milk.	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	<ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Dairy Cattle Breeds • Indigenous Breeds <ul style="list-style-type: none"> ○ Gir ○ RedSindhi ○ Sahiwal and Deoni • Exotic Breeds <ul style="list-style-type: none"> ▪ Jersey ▪ Holstein ▪ Brown Swiss • Nutritive requirements of dairy cows • Maintanance of Health and Hygiene * 	15

Unit IV	DAIRY CHEMISTRY <ul style="list-style-type: none"> • Physical and chemical properties of milk • Structural elements of milk <ul style="list-style-type: none"> ○ Fat Globules ○ Casein Micelles ○ Globular Proteins • Environmental factors influencing the composition of milk DAIRY MICROBIOLOGY <ul style="list-style-type: none"> • Common microorganisms in milk • Spoilage of milk • Fermentation of milk • Milk borne diseases 	15
Unit V	DAIRY PROCESSING AND TECHNOLOGY: <ul style="list-style-type: none"> • 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. Varnam, A., Sutherland, Jane P., Milk and Milk Products Technology, chemistry and microbiology publishers, Springer, U.S (1994).
2. Lampert., Modern Dairy Products Chemical Publishing Co Inc.,U.S.; 3 edition (1998)
3. Gupta P.R. Dairy India Year Book – (2007 b)
4. Schmidt G. H., Van vleck L. D. and Hutjens M. F. Principles of Dairy Science Subsequent edition (1988)
5. Eiri Board Handbook of Dairy Farming: To Produce Milk with Packaging Engineers India Research Institute (2008).
6. John L. Curtis Cattle Embryo Transfer Procedure Academic Press Inc (1992).

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. Christobher	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY6AL		Title	Batch:	2021 – 2024
Lecture Hrs./Week	-	Tutorial Hrs./Sem.	Advanced Learner Course- Immuno therapeutics	Semester:	VI
				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 biosynthesis 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 <ul style="list-style-type: none"> ○ Infectious Disease Causing organisms ○ Types of Infection ○ Pathogen Escape Mechanisms ○ Immune response to Malaria ○ Plasmodium Escape Mechanism 	
Unit II	Biosynthesis of Antibody <ul style="list-style-type: none"> • Site and Genetic control of Antibody • Mechanism of Biosynthesis of Antibody • Theories on Antibody Synthesis 	
Unit III	Monoclonal AntibodiesMCAs <ul style="list-style-type: none"> • Production of Monoclonal antibodies • Applications of Monoclonal antibodies* Transplantation Immunology <ul style="list-style-type: none"> • Types of Graft • Graft rejection • Mechanism of Allograft rejection 	

Unit IV	Auto Immune Diseases <ul style="list-style-type: none"> • Characteristics of autoimmune diseases • Causes of autoimmune diseases • Pathogenesis of autoimmune disease • Diagnosis of autoimmune diseases • Treatment of autoimmune diseases 	
Unit V	Immunotechniques <ul style="list-style-type: none"> • 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, Periaivillai, Kottar PO, Nagercoil -629 002, Kanyakumari(2007)
2. Dulsy Fatima and N. Arumugam. Immunology, Saras Publications, 114/35 G, A.R.P Camp Road, Periaivillai, 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	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R. Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.			Programme Title:	Bachelor of Zoology	
Course Code:	21UZY 6VA			Title	Batch:	2021 -2024
Lecture hrs./Week	/	Tutorial Hrs./Sem.	-	Value Added Course: Personality Development	Semester	VI
					Grade	

Course Objective

To understand the importance of personality development

Course Outcomes

On the successful completion of the course, students will be able to maintain some characteristics of personality and know about the social behaviour.

CO Number	CO Statement	Knowledge Level
CO1	Remember the role of personality	K1
CO2	Understand the human stages of lifecycle	K2
CO3	Deploy the role of Family, culture, society and situation	K3
CO4	Analyze the potential of nature of personality	K4
CO5	Acquire the knowledge about various types of personalities	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	<ul style="list-style-type: none"> • Evolution • Life cycle <ul style="list-style-type: none"> - Infancy - Childhood - Adolescence - Adulthood - Old age 	6
Unit II	<ul style="list-style-type: none"> • Definition and concept of personality • Need for understanding personality • Nature of personality • Formation of personality. 	6
Unit III	<ul style="list-style-type: none"> • Personality some characteristics <ul style="list-style-type: none"> - image- achievements, affiliation, extension, power, self-meaning, self-concept, self-esteem, perception and attitude and self development 	6
Unit IV	<ul style="list-style-type: none"> • Theories of personality • Hereditary theory • Environmental theory • Family, culture, society and situation • Psychoanalytic theory. 	6

Unit V	<ul style="list-style-type: none"> Types of personalities, Type A, Type B, Introvert, Exovert, Locus of control. Styles- authoritarian, democratic, problem solving skills, communication skills, Etiquette, Presentation skills, Interpersonal skills, Leadership skills 	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. Personality Development – Kv Jayashree, V Sreedevi, Cs Thara Devi, Saras Publication, Kanyakumari

Reference Books

1. Personality Development – Dr.K.K.Ramachandran and Dr.K.K. Karthick, Macmillan Publishers, New Delhi – 2015
2. Personality Development – S.Chandran, Vikas Publishing House Pvt.Ltd, 2008
3. Personality – Dr. Robyeung , Ashford colour press Ltd, Gosport, Honts – 2009.
4. Developmental psychology – Elizebeth B. Hurlock – Tata McGraw – Hill Publishing Company Ltd. New Delhi – 2007.
5. Industrial psychology – H.L. Kaila – Aitbs Publishers, India – 2011.

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.M.Durairaju	Name: Dr. S. Somasundaram	Name: Mr. K. Srinivasan	Name: Dr.R.Manickachezhian
Signature:	Signature:	Signature:	Signature:

Programme Code:	B.Sc.,			Programme Title:	Bachelor of Zoology	
Course Code:	21UZY6S3			Title	Batch:	2021 – 2024
Lecture Hrs./Week or Practical Hrs./Week	1	Tutorial Hrs./Sem.	--	Skill Based Elective - II Vermiculture	Semester:	VI
					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 making 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 worm farming in Modern Farming	K1
CO2	Understand Economic importance of vermiculture	K2
CO3	Deploy role of Vermiculture in protecting the environment and managing the waste	K3
CO4	Analyze the potential of vermicompost as an alternative to chemical fertilizers	K4
CO5	Acquire the knowledge about various type of earthworm	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	<ul style="list-style-type: none"> ○ Systematic position of Earthworm ○ Classification of earthworm based on Habitat ○ Commercial varieties of Earthworm for Vermicomposting. ○ <i>Economic importance of Vermitechnology*</i> 	3
Unit II	<ul style="list-style-type: none"> ○ Type study: Earthworm: Megascoclex sp., ○ External Structure ○ Digestive system ○ Respiratory system ○ Excretory system ○ Reproductive system ○ Life cycle of Earthworm 	3

Unit III	<ul style="list-style-type: none"> ○ Collection of earth worms ○ Vermicompost ○ Methods of vermicomposting ○ Types of soil ○ <i>Vermiwash</i> 	3
Unit IV	<ul style="list-style-type: none"> ○ Indoor vermicomposting ○ Precautions need for vermicomposting ○ Biodegradable wastes used in vermiculture ○ Nutrient Content of vermicompost 	3
Unit V	<ul style="list-style-type: none"> ○ Preparation of Vermibed ○ Maintenance of Vermibed ○ Collection of vermicompost ○ 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)

Reference Books

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

Programme Code:	B.Sc.,		Programme Title:	Bachelor of Zoology	
Course Code:	21UZY6S4		Title	Batch:	2021 – 2024
Lecture Hrs./Week or Practical Hrs./Week	1	Tutorial Hrs./Sem.	Skill Based Elective - II Biopharmaceuticals (SBE)	Semester:	VI
		--		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	<ul style="list-style-type: none"> • Biological systems and models: <ul style="list-style-type: none"> ○ Routes of administration ○ Adsorption enhancement ○ Bioavailability ○ Site specific delivery; • Pharmacodynamics of protein therapeutics- Inter species scaling 	3
Unit II	<ul style="list-style-type: none"> • Drug metabolism: <ul style="list-style-type: none"> ○ Oxidation ○ Reduction ○ Hydrolysis ○ Conjugation. ○ Need for developing new Drugs: Procedure followed in drug design; Prodrug and soft drugs; Drug toxicity. 	3

Unit III	<ul style="list-style-type: none"> • Drug discovery & cardiovascular drugs: <ul style="list-style-type: none"> ○ Substances derived from bacteria ○ Plants- insects- and animals ○ Sources of active principles ○ <i>Drugs used in atherosclerosis*</i> 	3
Unit IV	<ul style="list-style-type: none"> • Pharmaceutical products: <ul style="list-style-type: none"> ○ Microbial products ○ Antibiotics (penicillin- streptomycin) ○ Probiotics ○ Animal vaccines- Anti platelets drugs. 	3
Unit V	<ul style="list-style-type: none"> • Quality assurance and quality control <ul style="list-style-type: none"> ○ Fundamental of quality assurance, ○ Benefits, ○ Documentation, ○ 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. Heinrich Klefenz, Industrial Pharmaceutical Biotechnology, WILEY-VCH Publication, Germany, (2002)
2. Daan Crommelin and Robert D Sindelar, Pharmaceutical Biotechnology, Taylor and Francis Publications, New york, (2002)
3. Jay P Rho and Stan G Louie, (2003) Hand book of Pharmaceutical Biotechnology, Pharmaceutical products press, New york, (2002)
4. Remington's Pharamaceutial sciences, 18th edtion, Mack publishing & Co., Easton, PA(2000)

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Signature:	Signature:	Signature:	Signature: