DEPARTMENT OF ZOOLOGY

B.SC. ZOOLOGY
SYLLABUS

BATCH: 2020-2023

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

NALLAMUTHU GOUNDER MAHALINGAM COLLEGE, POLLACHI

VISION

Our dream is to make the college an institution of excellence at the national level by imparting quality education of global standards to make students academically superior, socially committed, ethically strong, spiritually evolved and culturally rich citizens to contribute to the holistic development of the self and society.

MISSION

Training students to become role models in academic arena by strengthening infrastructure, upgrading curriculum, developing faculty, augmenting extension services and imparting quality education through an enlightened management and committed faculty who ensure knowledge transfer, instill research aptitude and infuse ethical and cultural values to transform students into disciplined citizens in order to improve quality of life.

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.

Scheme of Examination

Part No	Course Code	Course title	Lecture+ Practical Hours/ week	Duration of Exam Hrs	Max. Marks			Credit Point
					Internal	End-of-Semester	Total	
	Semester I							
I	20UTL101	Tamil/Hindi Paper – I	6	3	30	70	100	3
II	20UEN101	English Paper – I	5	3	30	70	100	3
III	20UZY101	**Core Paper –I** Nonchordata	7	3	30	70	100	4
		Major Practical – I (Non-Semester Pattern) Nonchordata & Chordata	2	-	-	-	-	-
	20UBY1A1	**Ancillary Zoology Paper–I** Nonchordata & Chordata	6	3	30	70	100	4
		Ancillary Zoology Practical (Paper–I &II)	2	-	-	-	-	-
IV	20UHR101	Human Rights	1	2	-	50	50	2
	20HEC101	HE – (Personal values & SKY Yoga practice -I)	1	2	25	25	50	1
V		Extension activities (See Annexure –I)						
							500	**17**
	Semester II							
I	20UTL202	Tamil/ Hindi Paper – II	6	3	30	70	100	3
II	20UEN202	English Paper – II	5	3	30	70	100	3
III	20UZY202	**Core Paper –II** Chordata	6	3	30	70	100	4
	20UZY203	**Major Practical – I** (Non-Semester Pattern) Nonchordata & Chordata	2	3	40	60	100	4
	20UBY2A2	**Ancillary Zoology Paper –II** Economic Zoology	6	3	30	70	100	4
	20UBY2A3	**Ancillary Zoology Practical** (Non-Semester Pattern) Paper I & II	2	3	40	60	100	2
IV	20EVS201	Environmental Studies (EVS)	2	2	-	50	50	2
	20HEC202	HE – Family values SKY Yoga practice –II	1	2	25	25	50	1
V		Extension activities (See Annexure –I)						
							700	**23**

	Semester III							
I	20UTL303	Tamil/ Hindi Paper – III	5	3	30	70	100	3
II	20UEN303	English Paper – III	6	3	30	70	100	3
III	20UZY304	**Core Paper –IV** Cell Biology	7	3	30	70	100	4
		Major Practical – II (Non-Semester Pattern) Cell biology & Genetics	2	3	-	-	-	-
	20UZY3A4	Ancillary Chemistry Paper – I	6	3	30	70	100	4
		Ancillary Chemistry Practical	2	-	-	-	-	-
IV	20UZY3N1/ 20UZY3N2	**Non-Major Elective (NME)** Public health and hygiene/ Ornamental fish culture/ Basic Tamil paper/ AD Tamil paper	1	2	-	50	50	2
	20HEC303	HE – (Professional values & SKY Yoga practice -III)	1	2	25	25	50	1
V		Extension activities (See Annexure –I)						
							500	**17**
	Semester IV							
I	20UTL404	Tamil/ Hindi Paper – IV	5	3	30	70	100	3
II	20UEN404	English Paper – IV	6	3	30	70	100	3
III	20UZY405	**Core Paper –V** Genetics	7	3	30	70	100	4
	20UZY406	**Major Practical – II** (Non-Semester Pattern) Cell biology & Genetics	2	3	40	60	100	4
	20UZY4A5	Ancillary Chemistry Paper – II	6	3	30	70	100	4
	20UZY4A6	Ancillary Chemistry Practical	2	3	40	60	100	2
IV	20UZY4N3 /20UZY4N 4	**Non-Major Elective (NME)** Food and nutrition/ Apiculture / Basic Tamil paper/AD Tamil paper	1	2	-	50	50	2
	20HEC404	HE – (Social values & SKY Yoga practice -IV)	1	2	25	25	50	1
V		Extension activities (See Annexure –I)				50	50	1
							750	**24**
	Semester V							
III	20UZY507	**Core Paper – VII** Developmental Biology	5	3	30	70	100	4
	20UZY508	**Core Paper – VIII** Biotechnology	5	3	30	70	100	4
	20UZY509	**Core Paper – IX** Biostatistics& Biophysics	5	3	30	70	100	4
	20UZY510	**Core Paper – X** Biochemistry and Bioinformatics	5	3	30	70	100	5
	20UZY5E1/ 20UZY5E2	**Core Elective Paper – I & II** Medical Laboratory Technique / Poultry Science And Management Technology	4	3	30	70	100	5

		Major Practical – III (Non-Semester Pattern) Developmental Biology, Animal Physiology & Endocrinology, Biostatistics &Biophysics, Bioinformatics &Biochemistry and MLT	2	-	-	-	-	-
		Major Practical – IV (Non-Semester Pattern) Ecology, Evolution, Biotechnology, Microbiology, Sericulture and Aquaculture	2	-	-	-	-	-
IV	20UZY5S1/ 20UZY5S2	**Skill Based Elective (SBE)–Online** Network and Information Security Cyber security – Ethical Hacking	1	2	-	50	50	2
	20GKL501	**Skill Based Elective (SBE)–Online** General Knowledge & General Awareness	SS	2	-	50	50	2
	20HEC505	HE – (National values & SKY Yoga practice -V)	1	2	25	25	50	1
							650	**25**
	Semester VI							
III	20UZY611	**Core Paper –XI** Animal Physiology & Endocrinology	5	3	30	70	100	5
	20UZY612	**Core Paper – XII** Ecology & Evolution	5	3	30	70	100	4
	20UZY613	**Core Paper – XIII** Microbiology & Immunology	5	3	30	70	100	4
	20UZY6E3/ 20UZY6E4	**Core Elective Paper-III & IV** Sericulture/ Insect Pest Management	4	3	30	70	100	3
	20UZY6E5/ 20UZY6E6/ 20UZY6E7	**Core Elective Paper –V&VI** Aquaculture/ Wildlife Conservation/ Dairy farming and management Technology	5	3	30	70	100	5
	20UZY614	**Major Practical – III** (Non-Semester Pattern) Developmental Biology, Animal Physiology & Endocrinology, Biostatistics &Biophysics, Bioinformatics &Biochemistry & MLT	2	3	40	60	100	4
	20 UZY615	**Major Practical – IV** (Non-Semester Pattern) Ecology, Evolution, Biotechnology, Microbiology , Sericulture and Aquaculture	2	3	40	60	100	4
IV	20UZY6S3	**Skill Based Elective (SBE)** Vermiculture	1	2	-	50	50	2
	20UZY6S4	**Skill Based Elective (SBE)** Biopharmaceuticals						
	20HEC606	HE – (Global values & SKY Yoga practice -VI)	1	3	25	25	50	1
							800	**34**
		****Grand total**					**3900**	**140**

Annexure – I: List of Part – V Subjects

S.No	Subject Code	Subjects
1.	20 UNC 401	NCC
2.	20 UNS 402	NSS
3.	20 USG 403	Sports and Games
4.	20 URO 404	Rotract Club
5.	20 URR 405	Red Ribbon Club
6.	20 UYR 406	Youth Red Cross
7.	20 UCA 407	Consumer Awareness Club
8.	20 UED 408	Entrepreneurship Development Cell
9.	20 UCR 409	Center for Rural Development
10.	20 USS 410	Student Guild of Service
11.	20 UGS 411	Green Society
12.	20 UEO 412	Equal Opportunity Cell
13.	20 UFA 413	Fine Arts Club
14.	20 UAM 414	Arulchelvar Students Thinkers Forum
15.	20 USV 415	Swami Vivekanandhar Students Thinkers Forum

List of Part III Subjects (Core Elective Papers)

S.No	Subject Code	Subjects
1.	20UZY5E1	Medical Laboratory Technique
2.	20UZY5E2	Poultry Science And Management
3.	20UZY6E3	Sericulture
4.	20UZY6E4	Insect Pest Management
5.	20UZY6E5	Aquaculture
6.	20UZY6E6	Wildlife Conservation
7.	20UZY6E7	Dairy farming and Management

General Question Pattern
PART I,II & III

Max. Marks: 100	**Internal: 30**	**External : 70**	
Section	Pattern	Mark	Total
Part A	1-5 Multiple choice with 4 options (One question from each unit)	10×1	10
	6-10 Short answers (One question from each unit)		
Part B	11-15 Either /Or type (One question from each unit)	5×4	20
Part C	16-21 Four out of six (Question no. 16 is compulsory)	4×10	40
		Total :	70

CIA : Test – I : 2.5 Units
Test – II : Remaining 2.5 Units

Question Pattern for PART -IV

Max. Marks: 100	**External : 50**		
Section	Pattern	Mark	Total
Part A	1-5 Multiple choice with 4 options	5×1	5
	6-10 Short answers (One question from each unit)	5×1	5
Part B	Answer any questions five out of eight (11-18)	5×8	40
		Total : 50	

Bloom's Taxonomy Based Assessment Pattern

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

1. Theory: 70 Marks

(i) TEST- I & II and ESE:

Knowledge Level	Section	Marks	Description	Total
K1 & K2	A(Answer all)	10x1=10	MCQ/Define	70
K3	B (Either or pattern)	5x4=20	Short Answers	
K4	C(Answer 4 out of 6)	4x10=40	Descriptive/ Detailed	

2. Theory: 50 Marks

Knowledge Level	Section	Marks	Description	Total
K1	A(Answer all)	10x1=10	MCQ/Define	50
K2 & k3	B (Either or pattern)	5 x 8=40	Detailed Answers	

3. Practical Examinations:

Knowledge Level	Section	Marks	Total
K3	Practical & Record work	60	100
K4		40	
K5			

Components of Continuous Assessment

Components		Calculation	CIA Total
Test 1	70	$\frac{210}{7}$	30
Test 2	70		
Assignment	20		
Seminar/ Tutorial	20		
Knowledge Enhancement	20		
Information acquisition	10		

Programme Outcomes

PO1. To obtain knowledge in taxonomic position of animals and know the morphology and anatomy of Non-Chordates and Chordates.

PO2. The graduates can acquire knowledge along with the hands on experience in the life or job oriented subjects like apiculture, medical laboratory techniques, microbiology, animal tissue culture, bioinformatics etc.

PO3. Gain knowledge of agro based small scale industries like sericulture, fish farming, butterfly farming and vermicompost preparation.

PO4. Apply the knowledge and understanding of zoology to once own life as well as their jobs.

PO5. Develops empathy and love towards the animals.

Programme Specific Outcomes

PSO1	Impart awareness of the conservation of the biosphere.
PSO2	Understand the unity of life with the rich diversity of organisms and their ecological and evolutionary significance
PSO3	To acquire knowledge in the ecological, economical and biological significance of the animals
PSO4	To develop the awareness of health and hygiene for the society
PSO5	To know the communicable, non-communicable, hereditary and major killer diseases **.**

Verified by **HOD**	Checked by	Approved by
Name and Signature	**CDC**	**COE**
Dr. S. Somasundaram Signature:	Mr.K.Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology		
Course Code:	20UZY101	**Title**	**Batch :**	2020-2023	
		Core Paper – I Nonchordata	**Semester**	I	
Hrs/Week:	7		**Credits:**	4	

Course Objectives

- To understand the different animal groups under different phyla
- To know the Economic importance of Nonchordata
- To keep in mind the internal structure of Nonchordate organisms
- To study about the general topics of each phylum
- To understand the structure and inter-relationship between organisms.

Course Outcomes (CO)

K1	CO1	To remember the outline Classification of Nonchordata
K2	CO2	To understand the structure and inter-relationship between nonchordate animals.
K3	CO3	To deploy the each phylum with an example
K4	CO4	To discuss the general topics of each phylum
K5	CO5	To acquire knowledge about internal structure of Nonchordate organisms

Unit	Content	Hrs
Unit I	• General characteristics of phylum Nonchordata • Outline Classification of Nonchordata up to class level • **Phylum Protozoa:** *Paramecium* – Structure- Feeding- Binary fission and Conjugation. • Protozoa in Human Diseases	**19Hrs**
Unit II	• **Phylum Porifera** : *Leucosolenia* - Structure - Reproduction and Life cycle, Canal system in sponges. • **Phylum Coelenterata:** *Obelia colony*– Structure - Reproduction and Life cycle. o Polymorphism in coelenterates • **Phylum Platyhelminthes:** *Taenia solium* – Structure Reproductive system and Life cycle. Parasitic adaptations in Helminth worm	**18Hrs**
Unit III	• **Phylum Aschelminthes:** *Ascaris lumbricoides* –Structure – Excretory system-Reproductive system and life cycle • **Phylum Annelida** : Neries – Structure - Digestive system - Excretory system and Reproductive system. • Metamerism in Annelids	**18Hrs**
Unit IV	• **Phylum Arthropoda**: Cockroach – Structure - Mouth parts – Digestive – Respiratory – Circulatory - Nervous and Reproductive systems. o Peripatus as a Connecting Link. o Arthropod Vectors and Human diseases.	**18Hrs**
Unit V	• **Phylum Mollusca**: Pila – Structure Respiratory system and Reproductive Systems. o *Economic importance of Mollusca* • **Phylum Echinodermata** : Sea star – Structure- Digestive system Water vascular system and Reproductive system. o Larval forms of Echinoderms and their significance.	**18Hrs**
Total Contact Hrs		**91Hrs**

- *Italics denoted as self study topics*

Assignment, Seminar, Power point presentation, Google class room

Book for Study:

1. Nair N.C., Leelavathy S., Soundarapandian N and Arumugam, N**.** (2019) A text book of Invertebrates – Saras Publication, Nagercoil.

Reference:

1. Ekambaranatha Iyyer, (2016) A Manual of Zoology, Part I & II, Invertebrata, 5th edition Volume I and II. S. Viswanathan(Printers and Publishers)
2. Kotpal R. Agarwal S.K& Khetarpal R.P. (2010) 10th Edition Modern Text Book of Zoology, Invertebrata, , Rastogi Publications.
3. Jordan E.L & Verma J. K (1995) Invertebrate Zoology, S. Chand & Company, New Delhi.
4. Ganguly B.B Sinha.A & Adhikari.S. (1977) 3rdEdition Biology of Animals, Vol –I, Invertebrates New Central Book Agencies.
5. Dhami P.S & Dhami J.K (1990) Invertebrate Zoology, S. Chand & Company

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	M	H
CO2	H	M	H	H	H
CO3	M	M	H	M	M
CO4	H	H	M	H	M

H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Ms. S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology		
Course Code:	20UZY203	**Title**	**Batch :**	2020-2023	
		Major Practical -I Nonchordata and Chordata	**Semester**	I & II	
Hrs/Week:	2		**Credits:**	4	

Course Objectives

- To study the morphology of invertebrates and vertebrates
- To identify the organisms in the field
- To create awareness on biodiversity conservation
- To study about the anatomy of animals
- To know about the biological significance

Course Outcomes (CO)

K1	CO1	To remember external and internal features of organisms
K2	CO2	To understand the unity of life with the rich diversity of organisms and their ecological and evolutionary significance
K3	CO3	To evaluate the conservation awareness of the biosphere by field visit
K4	CO4	To acquire knowledge about biological significance of organisms
K5	CO5	To know about the reasons for classifications

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) Plasmodium
2) Leucosolenia
3) Obelia
4) *Taenia solium*
5) *Ascaris lumbricoides*
6) Neries
7) Pila
8) Sea star
9) Shark
10) Calotes
11) Pigeon
12) 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 – Synsacrum
11) Pigeon – flight muscle
12) Rabbit Brain

C. Biological significance:

1) Corals
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	**52**

Experience: Discussion, activity, Field visit, Report Preparation, Hands on experience in practicals

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	20	Field Visit Report Submission- Fauna in our area	10
	Record work	10	Record	10
	Total Marks	**40**	**Total Marks**	**60**

Reference:

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

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	M	H
CO2	H	M	M	H	M
CO3	M	M	M	H	M

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Ms. S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UBY1A1	**Title**	**Batch :**	2020-2023
		Ancillary Zoology Paper – I Nonchordata and Chordata	**Semester**	I
Hrs/Week:	6		**Credits:**	4

Course Objectives

- To study the structure and classification of different phylum.
- To understand the general characters of both non-chordate and chordate phyla
- To know about the different biological systems
- To gain the knowledge in prochordata and vertebrata
- To keep in mind the structure of creeping and flying vertebrates

Course Outcomes (CO)

K1	CO1	To remember the general taxonomic rules on animal classification
K2	CO2	To comprehend animal systems and its peculiar characters
K3	CO3	To execute the animal morphology and anatomy of Mollusca and Echinodermata
K4	CO4	To sort of complex vertebrate interaction.
K5	CO5	Imparts conceptual knowledge of vertebrates, their adaptations and association in relations to their environment.

Unit	Content	Hrs
Unit- I	**Outline classification of Phyla up to the class level** • **Phylum Protozoa**: *Paramecium caudatum*– Structure- Feeding- Binary fission and Conjugation. • **Phylum: Coelenterata:** *Obelia geniculata* **–** Structure and Life cycle.	**16Hrs**
Unit- II	• **Phylum Platyhelminthes : *Taenia solium* –** Structure - Reproduction and Life cycle. • **Phylum Arthropoda**: *Periplanata americana* – Structure- Mouthparts, Digestive system –Nervous system and Reproductive system.	**16Hrs**
Unit- III	• **Phylum Mollusca** *: Lamellidens marginalis* **–** Structure – Digestive system- Respiratory system – Reproductive system. • **Phylum Echinodermata:** *Asterial rubens***–** Structure and Water Vascular system.	**16Hrs**
Unit -IV	• **Phylum Chordata** • **Sub Phylum: Prochordata –** General Characters of o *Branchiostoma lanceolatum*(Amphioxus) o *Balanoglossus glavigerous* o *Herdmania pallida* (Ascidian) • **Sub Phylum Vertebrata Class : Pisces** Shark **-** External structure – Digestive & Urinogenital systems • **Class Amphibia:** *Ranahexa dactyla* – External structure – Respiratory system –Reproductive system.	**15Hrs**
Unit -V	• **Class Reptilia:** *Calotes versicalar –structure–* Circulatory system –Reproductive system. • **Class Aves:** *Columba livia* –structure – Flight muscles – Digestive system , Respiratory system • **Class Mammal:** *Oryctolagus cuniculus* **-** structure – Heart – Reproductive system	**15Hrs**
Total Contact Hrs		**78**

- *Italics denoted as self study topics*

Power point Presentations, Group discussions, Seminar , Assignment, Discussion, Google class room

Book for Study:

1. Arumugam N. (2019) Allied Zoology Part I & Part – II – Saras Publications, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari
2. R.L.Kotpal (10^{th} Edi, 2012), Modern text book of Invertebrates, Rastogi Publications.Meerut

Reference:

1. Ekambaranatha Iyyer (1995) A Manual of Zoology Vol. I & II, Ananda Book Depot, "Acton Lodge",Mc Nichols Road, Chetput, Madras – 600 031
2. Jordan E.L & Verma J.K. (1997) Invertebrate Zoology, S. Chand & Company Ltd, Ram Nagar, New Delhi 110055
3. Dhami P.S & Dhami J.K. (1995) Invertebrate Zoology, S. Chand & Company
4. Ganguly B.B. Sinha. A &Adhikari.S. (1977) 3^{rd} Edition Biology of Animals, Vol. –I, Invertebrates, New Central Book Agencies.
5. Kotpal R.L. (1983) Modern Text Book of Zoology, Rastogi Publications.Meerut
6. Nigam Shoban I Naginhand H.C. (1995) Biology of Non-Chordates, Shoban I Nagin hand & Co Educational & Publishers.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	L	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UBY2A3	**Title**	**Batch :**	2020-2023
		Ancillary Zoology Practical – (Paper I & II)	**Semester**	I& II
Hrs/Week:	**2**		**Credits:**	**2**

Course Objectives

- To study the morphology and anatomy of invertebrate and vertebrate
- To study the ecological and biological significance of the animals
- To get the knowledge on biological systems through virtual dissection
- To identify museum specimen
- To develop skills in identifying fauna in campus

Course Outcomes (CO)

K1	CO1	To remember the anatomical and morphological structure of animals and micro organisms
K2	CO2	To understand the ecological and biological importance of vertebrates and invertebrates
K3	CO3	To validate the practical efficiency in the animal kingdom structure and function
K4	CO4	To acquire knowledge about biological significance of organisms
K5	CO5	To know about the reasons for classifications

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 Male and female
   - 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) *Calotes versicolar*
7) Pigeon (*Columba livia*)
8) Rabbit *(Oryctolagus cuniculus*)

B. Draw labeled sketch:

1) Leucosolenia
2) *Taenia solium* – Scolex
3) Octopus
4) Frog – Pectoral girdle
5) *Calotes versicolor* – Brain
6) Pigeon –Flight Muscle
7) Rabbit – Dentition
8) Human – Digestive system

C. Biological significance:

1) Obelia Medusa
2) Balanoglossus

3) Honey bee 4) Mosquito 5) Earthworm 6) Salamander 7) Silkworm 8) Kangaroo
D. Write descriptive notes: 1) Paramecium - conjugation 2) Gold fish 3) Sea horse 4) Tortoise 5) Owl 6) Bat 7) Peripatus 8) Silkworm's silkgland
3. Identification of fauna and report submission
4. Record
Total Contact Hrs 52

Experience Discussion, Activity, Case study, Hands on experience in practicals

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	20	Field Visit Report Submission- Campus Biodiversity	10
	Record work	10	Record	10
	Total Marks	**40**	**Total Marks**	**60**

Reference:

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

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology		
Course Code:	20UZY202	**Title**	**Batch :**	2020-2023	
		Core Paper – II Chordata	**Semester**	II	
Hrs/Week:	6		**Credits:**	4	

Course Objectives

- To acquire a basic knowledge of Chordates
- To know the knowledge of classification of organisms
- To understand the biodiversity of organisms
- To study the inter –relationship of organisms
- To understand the animal behaviours

Course Outcomes (CO)

K1	CO1	To keep in mind the outline Classification of Chordata
K2	CO2	To understand the morphology and anatomy of Chordata
K3	CO3	To execute inter-relationship between Each class
K4	CO4	To discuss the biodiversity of chordates
K5	CO5	To acquire the knowledge of organisms

Unit	Content	Hrs
Unit I	**General characters and outline classification of Phylum Chordata up to class level with suitable examples.** General characters and affinities of a) Amphioxus b) Balanoglossus c) Ascidian • **Class Pisces Type study – Shark-** External- Placoid scale - Digestive system - Respiratory and - Excretory system - Reproductive system o ***Parental care in Fishes***	**16Hrs**
Unit II	• **Class Amphibia Type study – Frog-** External - Girdles and Limbs - Respiratory system – Heart- Brain - Urino-genital system. o Origin of Amphibia Parental care in frog .	**16Hrs**
Unit III	• **Class Reptilia Type study– Calotes**-Externals - Digestive system – Brain- Excretory system- Reproductive system o Poisonous and Non-Poisonous Snakes. o Poison apparatus and biting mechanism in Snakes - ***First –Aid for Snake Bite.***	**16Hrs**
Unit IV	• **Class Aves Type study - Pigeon-** External – Synsacrum - Flight muscles - Digestive system - Respiratory system- Brain- Eye and Urino – genital system. o Flight adaptation o Migration in Birds	**15Hrs**
Unit V	• **Class Mammalia Type study – Rabbit-** External– Heart – Brain – Digestive system - Excretory system – Reproductive system o **Salient features of** Protheria - Metatheria - Eutheria	**15Hrs**
Total Contact Hrs		**78 Hrs**

- *Italics denoted as self study topics*

Power point Presentations, Group discussions, Seminar , Assignment, Google class room

Book for Study:

1. Thangamani, A., Prasanna kumar, S., Narayanan, L.M., and Arumugam, N. (2019) (10th Edition)A text book of Chordata, Saras publications, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari
2. R.L.Kotpal (3rd Edi, 2012), Modern text book of Invertebrates, Rastogi Publications.Meerut

Reference:

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

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	M	M	H	H	M
CO3	H	H	H	M	M
CO4	M	M	H	M	M

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Ms. S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UBY2A2	**Title**	**Batch :**	2020-2023
		Ancillary Zoology Paper – II Economic Zoology	**Semester**	II
Hrs/Week:	6		**Credits:**	4

Course Objectives

- To understand the applications of zoology
- To explore entrepreneurship in zoology
- To study the importance of organic farming
- To gain knowledge in technical and ecological aspects of zoology
- To understand the economical value of farm animals.

Course Outcomes (CO)

K1	CO1	To remember aquaculture application in day to day life
K2	CO2	To get the idea of economical application of apiculture and dairy
K3	CO3	To acquire knowledge about the silkworm rearing
K4	CO4	To apply knowledge in self employment of poultry management
K5	CO5	To understand the knowledge in vermicompost preparation

Unit	Content	Hrs
Unit- I	**AQUACULTURE** • Scope of Aquaculture • Type of Fisheries - Inland fisheries and Marine fisheries 1. Culturable organisms - Fin fishes 2. Fishes diseases o Bacteria - Erythroderma , Bacterial Gill Rot o Virus - EUS,IPN, VHS o Fungal - Saprolegniasis 3. Oyster culture - Edible oyster and Pearl oyster	**16Hrs**
Unit -II	**APICULTURE** • Scope of Apiculture • Races of *A. indica, A. mellifera and A. dorsata* • Products of Bee Keeping - Royal jelly, Honey, Wax and Bee venom **DAIRY FARMING** • Scope of dairy farming • A typical dairy farm • Dairy animals: cow • Live stock diseases - Mastitis and Foot and Mouth disease(FMD) • *Nutritive value of milk* • Dairy By-products	**16Hrs**
Unit -III	**SERICULTURE** • Scope of sericulture • Optimum conditions for mulberry growth • Vegetative preparation – Stem cutting • Structure of silkworm and silk gland • Life cycle of *Bombyx mori* • Rearing appliances	**16Hrs**

	• Disinfection • Diseases of silkworm -Pebrine and Viral flacherie • Cocoon market	
Unit- IV	**POULTRY KEEPING** • Scope of poultry • Construction of poultry house • Rearing of Broilers and Layers • Diseases of poultry 1. Fowl pox 2. Coccidiosis 3. Ranikhet disease 4. Bird Flu • *Nutritive value of Egg*	**15Hrs**
Unit -V	**VERMICULTURE** • Scope of Vermiculture • Classification of earthworm - based on habitat • Collections of earthworm • Preparation of vermibed • Procedure and maintenance of indoor vemicompost • Vermiwash • Packaging of vermicompost and its marketing	**15Hrs**
Total Contact Hrs		**78**

- *Italics denoted as self study topics*

Power point Presentations, Seminar , Assignment, Discussion, Case study, Google class room

Book for Study:

1. Arumugam, N. (2018) Applied Zoology, Saras Publication, 114/35 G ARP Camp Road, Periavilai, Nagercoil, Kanyakumari – 629 002

Books for Reference:

1. Ganga and Sulochana Chetty, (1999) An introduction to sericulture, 2nd Edition, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi
2. Arumugam, N.(2013) Economic Zoology, 1st edition, Saras Publication, 114/35 G ARP Camp Road, Periavilai, Nagercoil, Kanyakumari – 629 002
3. Shukla & Upadhya,(2001) Economic Zoology - Rastrogi Publication, Shivaji Road, Meerut 250 002
4. Arumugam, N. (2012) Aquaculture -, 1st edition, Saras Publication, 114/35 G ARP Camp Road, Periavilai, Nagercoil, Kanyakumari – 629 002
5. Ezhili, N. & Thirumathal, K. (2008) A hand book for sericulture, Shrishti Impression, Coimbatore
6. Tripaty, S.N. (2004) Food biotechnology. Doarinant Publishing and distributions, New Delhi. 110 002.
7. Tarid Kumar Banerjee (2017), Applied Zoology, New central book agency pvt. ltd. Kolkata

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	L	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Dr. S. Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20EVS201	**Title**	**Batch :**	2020-2023
		Environmental Studies (EVS)	**Semester**	II
Hrs/Week:	2		**Credits:**	2

Course Objectives

- To know the basic concepts of Environment
- To get the knowledge about the maintenance of pollution free ecosystem.
- To acquire knowledge about the environmental legislations
- To understand the importance of biodiversity conservation
- To study the natural resources

Course Outcomes (CO)

K1	CO1	To create an awareness about the Environment
K2	CO2	To get the idea on Environment conservation and management.
K3	CO3	To execute the pollution free environment in future perspectives.
K4	CO4	To evaluate the value of Natural Resources
K5	CO5	To acquire knowledge about genetic diversion

Unit	Content	Hrs
Unit I	1. **The Multidisciplinary nature of Environmental Studies**: • Introduction • Scope of Environmental Studies • Need for Public Awareness 2. **Natural Resources** : • Types of Natural Resources • Natural resources and associated problems a. Forest resources b. Water resources c. Mineral resources d. Food resources *e. Energy resources** • Role of an individual in conservation of natural resources • case studies	**5Hrs**
Unit II	3. **Ecosystems:** • Concept of an ecosystem • Structure and function of an ecosystem • Energy flow in the ecosystem • Ecological succession • Structure and functions of a) Aquatic ecosystems b) Terrestrial ecosystems **4. Biodiversity and its conservation:** • Introduction • Genetic diversion • Species diversion • Value of Biodiversity • Hot – Spots of Biodiversity • Threats to biodiversity • Endangered and Endemic Species of India • Conservation of biodiversity	**5Hrs**
Unit III	**5. Environmental Pollution:** • Causes, effects and control measures of a. Air Pollution b. Water pollution c. Soil pollution d. *Noise pollution* *	**6Hrs**

	e. Thermal pollution f. Radioactive pollution • Pollution case studies 6. **Solid waste management**: • Causes, effects and control measures • Role of individual in prevention of pollution	
Unit IV	7. **Disaster management:** Floods, Earthquake, Cyclone and Landslides 8. **Social issues and environment:** • Sustainable Development • Urban problems related to energy • *Rainwater harvesting ** • Environmental Ethics • Global warming	**5Hrs**
Unit V	**9. Environmental Legislations and Acts:** a. Environment (Protection) Act b. Air (prevention and control of pollution) Act c. Water (Prevention and control of pollution) Act d. Wildlife protection Act e. Forest conservation Act **10. Human Population and Environment:** • Population growth and explosion • Environment and Human health • Value education • Role of Information Technology in Environment and Human health	**5Hrs**
Total Contact Hrs		**26**

- *Italics denoted as self study topics*

Power point Presentations, Seminar, Assignment, Group discussions, Case study

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 – (2018 Reprint) – Environmental Studies

Books for Reference:

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

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	H	H

H-High; M-Medium; L-Low

.

Course Teacher	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Mariselvi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY304	**Title**	**Batch :**	2020-2023
		Core Paper – IV Cell Biology	**Semester**	III
Hrs/Week:	7		**Credits:**	4

Course Objectives

- To study the basic concepts of cell biology
- To understand the principles of membrane transport
- To learn various cytological techniques to understand structure and functions of cellular organelles
- To acquire the basic knowledge about recent development in cell biology
- To understand the techniques in cytology.

Course Outcomes (CO)

K1	CO1	Structural and functional aspects of basic units of life - ie cell concept
K2	CO2	To remember the overview of cells and their origin and evolution.
K3	CO3	To get the fundamental ideas of prokaryotic and eukaryotic cell.
K4	CO4	To deploy the structure and functions of cell organelles.
K5	CO5	To sort of cell constituents and their biological activities.

Unit	Content	Hrs
Unit I	• Scope of Cell Biology • **Cell Theory**: Salient features of cell theory o Protoplasm theory o Germplasm theory o Organismal theory. • **Cytological techniques:** Fixation, Dehydration, Embedding, Sectioning,Staining and Mounting • Prokaryote (*E.coli* bacterium) and Eukaryotic Cell (Typical animal cell)	**19Hrs**
Unit II	• **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.	**18Hrs**
Unit III	• **Lysosomes**: Polymorphism and Functions • **Mitochondria**: Structure - Origin of mitochondria– General functions. • **Nucleus**: Ultra structure of interface nucleus and function. • **Nucleolus**: Ultra structure and function	**18Hrs**
Unit IV	• **Centrosomes: Structure and functions** • **Chromosomes**: Structure **– Types** - Giant chromosomes – Polytene and Lamp brush. • **Nucleic acids** DNA Structure (Watson & Crick model) o Types and replication of DNA (Semi-conservative model)	**18Hrs**
	• **Protein synthesis** - o Central dogma and Central dogma reverse o Mechanism of protein synthesis • Transcription and Translation.	
Unit V	• **Genetic Code** – Salient features • **Cell division** o Cell cycle o Amitosis, Mitosis and Meiosis • **Cell signaling:** o Characteristics and cell transduction pathways	**18Hrs**

	• **Cancer cells**
	  o Characteristics – Properties –Types - Diagnosis and Treatment
	  o Oncogenes.
	• *Cell aging - Causes – Changes and Apoptosis*	

Total Contact Hrs		**91**

- *Italics denoted as self study topics*

Power point Presentations, Seminar, Assignment,

Book for Study:

1. Arumugam N. (2018) Cell Biology — Saras Publication, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari
2. Verma P.S.and.Agarwal V.K (2006) Cell Biology , Genetics, Molecular Biology, Evolution and Ecology–S.Chand and Company LTD. Ram Nagar, New Delhi -110055

Books for Reference:

1. Verma P.S. and Agarwal V.K. (1993) Cytology–.S.Chand & Company LTD. Ram Nagar, New Delhi - 110055
2. Singh & Tomar, (2008). 9th revised edition Cell Biology –Rastogi Publications, Shivaji road, Meerut – 250 002, India.
3. E.D.P. De Robertis and E.M.F. De Robertis Jr - Cell and Molecular Biology – 8th Edition, Lippincott Williams and Williams Publishers.
4. **Aminul Islam (Reprint 2019)- Essentials of Cell biology. Books and Allied Pvt.Ltd. Kolkata**
5. **Singh and Tomar 10th Rev.Edi (2012) Cell Biology – Rastogi Publications, Shivaji Road, Meerut**
6. **C.P.Powar (2018) Cell Biology – Himalaya Publishing House, Mumbai**
7. **Ajay Paul (2018) A Text Book of Cell and Molecular Biology, Books and Allied Pvt.Ltd. Kolkata**

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	M
CO2	H	M	H	M	H
CO3	M	H	H	M	M
CO4	M	H	H	M	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Mariselvi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY406	**Title**	**Batch :**	2020-2023
		Major Practical – II Cell Biology and Genetics	**Semester**	III & IV
Hrs/Week:	2		**Credits:**	4

Course Objectives

- To know the measurements of microscopic objects.
- To be able to perform experiments using the common tools of cell biology, including light microscopy.
- To list the fundamental features of prokaryotic and eukaryotic cells and methods used to examine
- To acquire the knowledge in blood grouping.
- To understand the basic concepts in genetics through experiments.

Course Outcomes (CO)

K1	CO1	To keep in mind for identify the different stages of mitosis.
K2	CO2	To understand the concepts of genetics through experiments.
K3	CO3	To access the practical experience in instrument handling.
K4	CO4	Evaluate laboratory test outcomes and determine the validity of the test results obtained
K5	CO5	Assess the role of chromosomes in sex determination and inheritance of X and Y linked genes

Content	Hrs
EXPERIMENTS • Measurements of cell using - Stage Micrometer and Ocular Micrometer • Squash preparation of Onion root tip • Identification of squamous epithelial cells in buccal smear. • Human Traits survey and gene frequency calculations. • ABO Blood grouping in man. • Probability Test – Two coin tossing experiment. • Law of Segregation – Using color beads. • Law of Independent Assortment – Using color beads. **SPOTTERS:** **CELL BIOLOGY** 1. Human Immuno Deficiency Virus. 2. *E. coli* Bacterium 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. Structure of tRNA 11. Structure of haemoglobin **GENETICS** 1. Drosophilla – Male and Female 2. Gynandromorph 3. Hairy Pinna 4. Erythroblastosis foetalis 5. Kleinfelter's syndrome 6. Down syndrome 7. Turner's syndrome 8. Twins 9. Free – martin cattle 10. Sickle cell anemia 11. Atavism	
Record	
Total Contact Hrs	**52**

Practical Experience, Activity ,

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	20	Spotters	20
	Record work	10	Record	10
	Total Marks	**40**	**Total Marks**	**60**

Books for Reference

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

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	H	H
CO2	H	M	H	M	H
CO3	M	M	M	M	M

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Mariselvi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R.Muthukumaran Signature:

Programme	B. Sc	**Programme Title :**	Zoology

code: **Course Code:**	20UZY3N1	**Title** Public Health and Hygiene Non- Major Elective (NME)	**Batch :** **Semester**	2020-2023 III
Hrs/Week:	1		**Credits:**	2

Course Objectives

- To study the importance of health and hygiene for the society
- To know about prevent from diseases
- To keep in mind the maintenance of our body
- To understand the reasons for diseases
- To study the health programmes in India

Course Outcomes (CO)

K1	CO1	To remember the Health awareness
K2	CO2	To understand the communicable and non-communicable diseases
K3	CO3	To implement the Pollution free environment
K4	CO4	To discuss the importance of nutrition
K5	CO5	To acquire the knowledge of deficiency diseases

Unit	Content	Hrs
Unit I	• Introduction to public health • **Health indicators** *Personal hygiene, Public health* • **Health** Dynamics of disease transmission eg. Malaria, – host, vectors and environment	**3Hrs**
Unit II	• Concepts of Health and diseases • **Nutrition and Health** Classification of food (Macro &Micro nutrients) • **Nutritional deficiencies** Vitamin and Mineral deficiencies • Balanced diet	**3Hrs**
Unit III	• Blood borne diseases – Hepatitis B and Hepatitis C • Kidney stone • Lipid deficiency diseases • Protein deficiency diseases	**2Hrs**
Unit IV	• **Communicable diseases** Measles, Cholera, Amoebiasis, Influenza , Chicken pox - AIDS • **Non-Communicable Diseases** Coronary heart Disease, Diabetes, Obesity, Stroke and Cancer	**2Hrs**
Unit V	• **Health Education**: Health care services in India Health Planning and Programmes in India Role of World Health Organization (WHO) in health education • *First Aid and Nursing* Methods, Dressing, Care & Duties.	**3Hrs**
Total Contact Hrs		**13**

- *Italics denoted as self study topics*

Assignment, Seminar, power point

Book for study

1) Park and Park (1995) Text book of Preventive and Socio Medicine. M/S. Banarsidas Bhanot Publishers, Jabalpur

Reference:

1) Verma S. (1998) Medical Zoology. Rastrogi Publications, New Delhi
2) Jordon, E.L. and Verma. P.S. (1995) Invertebrate Zoology. 12th edn. Sultan Chand & Co

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	M	M	H	H	M
CO3	H	H	H	M	M
CO4	H	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Ms. S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY3N2	**Title**	**Batch :**	2020-2023
		Ornamental Fish Culture Non- Major Elective (NME)	**Semester**	III
Hrs/Week:	1		**Credits:**	2

Course Objectives

- To understand the scope of fish culture
- To study the various ornamental fishes and its culture
- To understand the morphology and physiology of different fishes.
- To know about the aquarium construction
- To study the ornamental fish culture methods for aquarium maintenance

Course Outcomes (CO)

K1	CO1	To recollect the general ornamental fishes
K2	CO2	To understand the scope of fish culture
K3	CO3	To apply the ornamental fish culture methods for aquarium maintenance
K4	CO4	To review the different types of cultural methods
K5	CO5	To understand the morphology and physiology of different fishes.

Unit	Content	Hrs

Unit I	• Scope of ornamental fish culture
	• General characteristic of fish
	• General structure of fish
	  o Digestive system
	  o Reproductive system
		3Hrs

Unit II	• Materials, equipment required for aquarium • *Construction of home aquarium* • Structure and location of home aquarium	**3Hrs**
Unit III	• Selection of fish for home aquarium • *Common aquarium fishes*	**2Hrs**

Unit IV	• Fish feed
	  ▪ Natural fish feed
	  ▪ Artificial fish feed
	• Maintenance of home aquarium
		2Hrs

Unit V	• Common disease of ornamental fishes • Fish parasites and control • Bioremedies for fish disease • Ornamental fish breeding- cum rearing unit for entrepreneurs	**3Hrs**
Total Contact Hrs		**13**

- *Italics denoted as self study topics*

Power point Presentations, Seminar ,Assignment, Google class room

Book for Study:

1. Arumugam, N. (2018) Aquaculture SARAS Publications, Nagercoil, Tamilnadu.

Books for Reference:

1. Dhote. A.K, (1989) Publication Department – NCERT — 55 Inland fishery – Instructional – cum – Practical -Manual Vol IV Aquaculture.
2. Agarwal, S.C (1994) A hand book of fish farming . B.H.Enterprises. New Delhi.

3. Biswas, K. P. (1996) A Text book of fish& Fisheries Technology - Calcutta(W.B) 2nd Edition, Published by Narendra Publishing house, Delhi
4. Jhingran, V. G. (1988) Fish and Fisheries of India - Hindustan Publishing Corporation (India) Delhi, Printed in India at Gopsons papers Pvt Ltd, Noida

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	M	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Dr. S. Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY405	**Title**	**Batch :**	2020-2023
		Core Paper – V Genetics	**Semester**	IV
Hrs/Week:	7		**Credits:**	4

Course Objectives

- To Study the basic concepts of hereditary and variations.
- To understand the basic Mendel's Laws.
- To understand the inheritance of genetic disorders in man.
- To acquire knowledge of Cancer cells and treatment.
- To know about the applied aspects of genetics

Course Outcomes (CO)

K1	CO1	To keep in mind the genetic disorders in man.
K2	CO2	To understand the chemical basis of heredity.
K3	CO3	To deploy the heritable traits in families and populations.
K4	CO4	To sort of genetic concepts including health and diseases
K5	CO5	Construct personal and family pedigrees and integrate genetic testing options in genetic counselling practices

Existing Syllabus

Unit	Content	Hrs
Unit I	• Mendel's Monohybrid and Dihybrid experiments • Mendel's Laws - Problems. • **Interaction of genes** Lethal genes and its types *Epistasis* • Polygenic inheritance: Skin colour in man 1:4:6:4:1 • **Multiple alleles** (problems) o Coat colour in rabbit o ABO blood groups in man o Rh factor	**19Hrs**
Unit II	• **Linkage** Complete and incomplete linkage • **Chromosome maps**: o Chromosome map in Drosophila (Three Point Cross) • **Sex determination**: o Homogametic and heterogametic o Hymenopteran type – Honey bee o Gynandromorph – *Drosophila melanogaster* o Hormonal control – Free Martin Cattle.	**18Hrs**
Unit III	• **Sex linked inheritance** o Haemophilia and colour blindness in man – problems o Hairy pinna in man. • Euploidy and Aneuploidy • Inbreeding and outbreeding • Twins	**18Hrs**
Unit IV	**Non-disjonction** o Anomalies of Autosomes – Down's syndrome and Patau's syndrome . o Anomalies of Allosomes– Klienfelter's syndrome and Turner's syndrome • Pedigree analysis • **Inborn Errors of metabolism** o Phenylketoneuria, Alcaptonuria and Albinism • Eugenics and Euphenics	**18Hrs**

Unit V	• **Nucleic acids as genetic material:** - DNA as Genetic material: ✓ Bacterial transformation ✓ Bacterial conjugation ✓ Transduction - Indirect evidences of DNA as genetic material - RNA as Genetic material (TMV) • **Genetic counseling**	**18Hrs**
Total Contact Hrs		**91**

➢ *Italics denoted as self study topics*

Power point Presentations, Seminar, Assignments, Google classroom

Books for Study:

1. Veer Bala Rastogi (2018) 4th edition. Genetics. Kendhranath, Meerut.
2. Meyyan R. P. (2018) 12th Edition, Genetics– Saras Publications, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari

Books for Reference:

1. Miglani G. S. (2002) 1st edition. Advanced Genetics. Narosa Publishing House, New Delhi, 110002.
2. Russell, J. (1987) 2nd edition. Essential Genetics. Black well Scientific Publication London
3. Verma and Agarwal (2008) 3rd edition. Genetics. S. Chand & Company, Ltd. New Delhi, 110055
4. Gupta, P. K. (2007) 3rd edition .Genetics. Rastogi Publication, Meerut.
5. Kottari, L., *et al*., (2009) 5th edition Essentials of Human Genetics. University Press Private Ltd. Hydrabad, 500029.
6. E.D. Garber (1979) Reprint, Cytogenetics – An Introduction. TATA McGRAW – Hill Publishing Company Ltd. New Delhi
7. **Ajay Paul (2018) – Text book of genetics , Books and allied company, Kolkata**
8. **P.S. Verma and V.K Agarwal (2012) Cell Biology, Genetics, Molecular biology, Evolution and Ecology – S.Chand & Company, New Delhi**

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	H	H
CO2	H	M	H	M	H
CO3	M	M	M	M	M
CO4	M	H	H	M	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Mariselvi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20 UZY 4N3	**Title** Food and Nutrition Non- Major Elective (NME)	**Batch :** **Semester**	2020-2023 IV
Hrs/Week:	1		**Credits:**	2

Course Objectives

- To understand the nutritive values of various foods
- To know about the food borne diseases
- To acquire knowledge about food laws.
- To study the importance of food chart.
- To know about the functions of food.

Course Outcomes (CO)

K1	CO1	To recollect the concept of nutritive foods.
K2	CO2	To understand the energy values of various foods.
K3	CO3	To apply the importance of food chart.
K4	CO4	To analyze the food deficiency diseases
K5	CO5	To get the knowledge about importance of diet.

Unit	Content	Hrs
Unit I	• The scope of food and nutrition • Composition of food (Protein –Carbohydrate – Fat-Vitamins and Minerals) • Function and sources of food	**3Hrs**
Unit II	• Measurement of energy and energy values of various food • Nutritional requirements – children, adolescence, old age • Balances diet • *Digestion and absorption*	**3Hrs**
Unit III	• Milk – Types – importance in the diet • Eggs – Structures and composition – importance in the diet • Meat – Types – importance in the diet	**3Hrs**
Unit IV	• Fish – Types - importance in the diet • Vegetables – Types - importance in the diet • Fruits – Types - importance in the diet • Cereals and pulses – Types- importance in the diet	**2Hrs**
Unit V	• Food spoilage • Food poisoning- food borne diseases • Food adulteration • *Methods of purification of potable water* • Food laws	**2Hrs**
Total Contact Hrs		**13**

- *Italics denoted as self study topics*

- Assignment ,Seminar

Books for Study:

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

Books for Reference:

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

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	M	H
CO2	H	M	H	M	H
CO3	H	H	H	H	H
CO4	M	H	M	H	M

H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY4N4	**Title**	**Batch :**	2020-2023
		Apiculture (NME)	**Semester**	IV
Hrs/Week:	1		**Credits:**	2

Course Objectives

- To examine the scope of beekeeping in India and other countries
- To identify major bee keeping challenges and opportunities.
- Purchase of honey, wax and byproducts from bee keeping industry
- To study the techniques of bee keeping
- To understand the chemical composition of honey.

Course Outcomes (CO)

K1	CO1	To remember the steps involved in modern bee keeping techniques and its practical difficulties
K2	CO2	To comprehend methodologies involved in bee keeping
K3	CO3	To apply modern tools in bee keeping and value added product preparation
K4	CO4	To validate different bee keeping techniques
K5	CO5	To acquire the knowledge about byproducts of honey bee

Unit	Content	Hrs
Unit- I	Scope of Apiculture Classification of honey bee Types of honey bee o *Apis dorsata* o *Apis indica* o *Apis florae* Biology of honey bee – External Structure of worker bee Life cycle of honey bee	**3Hrs**
Unit -II	*Social organization of honey bee colony -Queen - Drones and Worker* Structure of Beehive Food of Honeybees Relationship between plants and bee- Plant as habitat- symbiosis-pollination	**3Hrs**
Unit- III	Modern bee hive o Langstroth hive Newton's hive Bee keeping equipments Extraction of honey Honey – Properties Chemical composition of Honey *Value of honey (Nutritional, Medicinal values)*	**2Hrs**
Unit- IV	Royal jelly – Composition and functions Bee wax – Production Characteristics and uses of bee wax Bee venom – Characteristics and uses	**2Hrs**
Unit -V	Diseases of honey bee o Bacterial disease o Viral disease o Acarine disease Queen rearing o Procedure o Hopkins method o Miller method and Doolittle method.	**3Hrs**
Total Contact Hrs		**13**

- *Italics denoted as self study topics*

Power point Presentations, Seminar , Assignment, Discussion

Book for Study:

1. Arumugam N. (2017) Applied Zoology, Saras Publication, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari

Books for Reference:

1. Bhamrah Kavita Juneja H.S. (2001) 2nd edition.An Introduction to Arthropoda-, Anmol Publications Pvt. Ltd., New Delhi,
2. Shukla. Upadhyay (2003). Economic Zoology –. Rastogi Publications, Shivaji Road, Meerut-250002. India.
3. Dharm Singh & Sevender Pratap Singh, (2006) edition. A handbook of Bee Keeping –Agrobios (India), Jodhpur,
4. Rajendra Singh & Sachan G.C. (2010) 1st edition.Elements of Entomology, , Rastogi Publications, Meerut,
5. Bee keeping basics. MAAREC: Delavane, Maryland, NewJersey, Pennsylvania, West Virginia & the USDA Co-operating PENNSTATE 1855- E-book

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	L	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20 UZY 507	**Title**	**Batch :**	2020-2023
		Core Paper – VII Developmental Biology	**Semester**	V
Hrs/Week:	5		**Credits:**	4

Course Objectives

- To understand the basic concepts and definitions of modern developmental biology
- Identify and define the landmark events and advances in developmental biology.
- To know about the applications and recent advances in developmental biology.
- To study the embryonic development and its functional applications
- To gain knowledge about fertilization.

Course Outcomes (CO)

K1	CO1	To remember the steps and advancements in the developmental biology
K2	CO2	To comprehend embryonic formation and developmental stages with suitable example
K3	CO3	To apply functional knowledge on developmental biology into the frontier sciences
K4	CO4	To sort of embryonic development and its functional applications
K5	CO5	To study about the organogenesis

Unit	Content	Hrs
Unit -I	• Introduction to developmental biology • Programme of Developmental Biology • **Theories** Pre formation Spemann's experiments on Organizer • **Gametogenesis** Spermatogenesis Oogenesis • **Fertilization** Mechanism *InVitro Fertilization(IVF)* **Parthenogenesis**- Natural and Artificial Significance of Parthenogenesis.	**13Hrs**
Unit -II	• **Cleavage in Frog** Planes (Meridional, Vertical , Equatorial and Latitudinal) Patterns of cleavage (Holoblastic and Meroblastic) Example: Cleavage in frog • **Gastrulation in Frog** Types of morphogenic movements (Epiboly& Emboly). Example: Gastrulation in frog • Exo gastrulation • **Fate map** • Mechanism of morphogenetic movements • **Cell lineage**	**13Hrs**
Unit -III	• **Organogenesis in Frog** -Ectodermal (Brain) -Mesodermal (Heart) -Endodermal (Alimentary canal) • **Development of Chick** - Development of chick based on hours of incubation • Development and significance of fetal membranes in chick.	**13Hrs**
Unit- IV	• **Placentation in mammals** Classification based on -Fetal membranes -Distribution of villi -Histology-Functions of placenta	**13Hrs**

	• **Neoteny** types-factors affecting neoteny- Evolutionary significance • **Organizer** structure-properties- types of induction– embryonic induction - mechanism of induction • **Metamorphosis** Aspects of metamorphosis in insects and amphibians, events and hormonal control. • **Regeneration** Types of regeneration – amphibian limb regeneration – stimulus and suppression of regeneration.	
Unit -V	• **Stem cells:** embryonic &adult *Embryonic stem cell culture and applications*. • Multiple ovulation and embryo transfer technology (MOET). Embryonic sexing, cloning, screening for genetic disorder diagnosis (ICSI, GIFT etc.) • Cloning of animals by nuclear transfer.	**13Hrs**
Total Contact Hrs		**65**

➢ *Italics denoted as self study topics*

Power point Presentations, Seminar , Assignment, Discussion, Activity

Books for Study:

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

2. Arumugam .N. (2018) Developmental Zoology - Saras Publication,114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamilnadu, India, 2011

Books for Reference:

1. Berrill, W. J. and Graw M. C. (2010) Developmental biology - Hill Book Co, New York.
2. Wesley, (1979) An Outline of animal development – Davenport, Addison –publishers, University of Michigan.
3. Balinsky, 5th Edition, Embryology - Philadelphia, Saunders College Publishing.
4. Verma P S & Agarwal V K (2012) Chordate embryology-S Chand & Company Ltd
5. Subramoniam (2002) Developmental Biology. Narosa Publishing House, New Delhi
6. Twyman. R.M. (2001) Developmental Biology. Viva Books Private limited, New Delhi.
7. Chattopadhyay.S. (2019). An Introduction to Developmental Biology. Books and Allied Pvt. Ltd., Kolkata.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	L	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY508	**Title:**	**Batch :**	2020-2023
		Core Paper – VIII Biotechnology	**Semester**	V
Hrs/Week:	5		**Credits:**	4

Course Objectives

- To study the basics and applied aspects of biotechnology
- To learn the application of r-DNA technology
- To understand the different applications of biotechnology
- To acquire the knowledge on bioethics and patenting in biotechnology.
- To learn the various techniques employed.

Course Outcomes (CO)

K1	CO1	To keep in mind about the basic technologies applied in Biotechnology
K2	CO2	To understand the different blotting techniques, PCR and DNA Fingerprinting
K3	CO3	To apply the cell culture techniques and Patenting- Biotechnology inventions
K4	CO4	To demonstrate the components and design of a bioreactor
K5	CO5	To analyze the application of biotechnology and make interest in Bio safety Measure.

Unit	Content	Hrs
Unit I	• Scope and importance of Biotechnology • Plasmids pBR 322 • Cosmids • Transposons • Construction of recombinant DNA • Vaccines	**13Hrs**
Unit II	• **Blotting Techniques:** ➢ Southern Blotting ➢ Northern Blotting ➢ Western Blotting • Polymerase Chain Reaction (PCR) and its applications • DNA Finger printing • *Genomic library*	**13Hrs**
Unit III	• Cell lines – Primary and secondary • *Biolistics (Self Study)* • Hybridoma technology • Transgenic animals – Mice Microinjection method • Applications of transgenic animals	**13Hrs**
Unit IV	• Animal tissue culture o Explants o Culture media o Culture of animal tissues • Animal bioreactors o Selection and modification of micro-organisms o Preparation of animal o Product harvest • Scope and application of Nano- biotechnology	**13Hrs**
Unit V	• *Bacillus thuringensis* as a pesticide • Biofertilizer • Biosafety • Bioethics o Monitoring the welfare of transgenic animals o Keeping of transgenic animals Patenting	**13Hrs**

	▪ IPR ▪ TRIPS	
Total Contact Hrs		**65**

➢ *Italics denoted as self study topics*

Power point Presentations, Seminar, Assignment, Google class room

Books for Study:

1. Sathyanarayana U (2017) Biotechnology, 12th Printing Arunabha sen Books and Allied (P)Ltd 8/1 chintamoni Das lane, KolKata 70009 (India)

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

Books for Reference:

1. Ignacimuthu, S. (1995), Basic Biotechnology, Tata McGraw Hill Publishing Company Ltd, New Delhi.
2. Dubey, R. C. (1996) A text book of Biotechnology, Cambridge University Press
3. Molecular Biology and Biotechnology (1993) S.Chand & Company Ltd, NewDelhi
4. John.E.Smith, (1993) Biotechnology, Vikas Publishing House Pvt. Ltd, New Delhi
5. Balasubramaniam. D. C.F. A. Bryce, Dharmalingam. K. J. Green, Kunthala Jayaraman (2005) Concepts in Biotechnology, University Press (India) Pvt. Ltd. Hydrabed
6. Jayanto Achrekar (2007) Fermentation biotechnology. Dominant Publishers. New Delhi
7. Sayyed and Patil (2009)Biotechnology-emerging trends Scientific publishers India
8. Kumaresan V. (2014) Biotechnology –Saras publications, 114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamilnadu, India
9. Kumaresan V. and Arumugam N (2017) Animal Biotechnology –Saras publications, 114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamilnadu, India

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY509	**Title**	**Batch :**	2020-2023
		Core Paper –IX Biostatistics and Biophysics	**Semester**	V
Hrs/Week:	5		**Credits:**	4

Course Objectives

- The basic knowledge about Biostatistics for testing hypothesis and Biophysics.
- To understand the basic principles of instruments
- To acquire knowledge about the basic formula used in biology.
- To know about the bioluminiscence
- To communicate the results of statistical analysis accurately and effectively.

Course Outcomes (CO)

K1	CO1	To recollect the concepts of biostatistics and biophysics
K2	CO2	To understand the formula and principles used in biology.
K3	CO3	To apply different data used in biological samples.
K4	CO4	To analyze the importance about instruments in biological laboratory.
K5	CO5	To understand the principle of TEM and SEM

Unit	Content	Hrs
Unit I	• **Collection of data** o Methods of collection – Random and Non-random sampling o Primary and Secondary data • **Tabulation** o Parts and types of table • **Diagrammatic presentation** o Line diagram, Bar diagram and *Pie diagram* • **Measures of central tendency** o Arithmetic mean o Individual - Discrete and Continuous series o Median o Mode	**13Hrs**
Unit II	• **Standard deviation** • Mean deviation o Individual - Discrete and Continues series o Measures of dispersion, • **Correlation** o Karl Pearson's coefficient of correlation • Types of correlation • **Regression analysis** o Types and Methods	**13Hrs**
Unit III	• **Chi-square Test** o Degrees of freedom • Student - t test • **Analysis of Variance (ANOVA)** - One-Way Analysis	**13Hrs**
Unit IV	• **Scope of biophysics** • **Thermodynamics principles** o First and second law • **Bioluminescence** o Types and significance	**13Hrs**
Unit V	• **Instrumentation** o *Compound microscope* o Electron microscope - Transmission Electron Microscope (TEM) and Scanning Electron Microscope (SEM)	**13Hrs**

	○ Chromatography - Thin layer chromatography (TLC) ○ Electrophoresis – Polyacrylamide Gel Electrophoresis (PAGE)	
Total Contact Hrs		**65**

- *Italics denoted as self study topic*

Assignment , PPT, Seminar, group discussions

Books for Study:

1. Arumugam N. (2019), Basic concepts of Biostatistics - Saras publication 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari
2. Arumugam N. and Kumaresan V. (2016) Biophysics and Bioinstrumentation -, Saras publication, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari

Books for Reference:

1. Veer Bala Rastogi,(2009) 2nd edition. Fundamentals of biostatistics. Ane Books, Pvt. Ltd. New Delhi.
2. Rana, S. V. S. (2009) 2nd edition. Biotechniques – Theory and Practice. Rastogi Publication, Meerut.
3. P. K. Srivastava,(2005) 1st edition. Elementary Biophysics – Narosa Publishing House, New Delhi, 110 002.
4. Subramanian, M. A. (2005) 1st edition. Biophysics – Principles and Techniques- MJP Publishers, Chennai, 600 005.
5. Satguru Prasad (3rd Rev.Edi 2012) – Biostatistics - Rastogi Publication, Meerut

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	M	H	H	H
CO2	H	M	H	H	M
CO3	M	H	M	M	M
CO4	M	H	M	M	M

H-High; M-Medium; L-Low

Course Designed by	**Verified by HOD**	**Checked by**	**Approved by**
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. M. Durairaju Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY614	**Title**	**Batch :**	2020-2023
		MAJOR PRACTICAL-III (Developmental biology, Biostatistics& Biophysics, Animal Physiology and Endocrinology, Bioinformatics and Biochemistry and Medical Laboratory Technique)	**Semester**	V & VI
Hrs/Week:	2		**Credits:**	4

Course Objectives

- To gain the practical knowledge on Zoology
- To know about the structure and functions of various biomolecules
- To attain knowledge on blood cell count and its importance
- Learn the structure of embryo of various animals
- Learn the methods to estimate the glucose and haemoglobin in blood samples

Course Outcomes (CO)(for Practicals Only)

K1	CO1	To recollect the importance of laboratory test
K2	CO2	To understand the normal level of human samples
K3	CO3	To apply the instruments used in biological experiment.
K4	CO4	To understand the structure and functions of endocrineglands.
K5	CO5	To know about the bioinformatic tools.

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 (structure/developments)

- 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 (Statistical importance)

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

Animal physiology & Endocrinology (structure and function)

- T. S. of thyroid gland

• T. S. of ovary • T. S. of testis • Mammalian Eye • Mammalian Ear • Mammalian Kidney **Medical Laboratory Technique (MLT) – (structure, principle and uses)** • Haemocyto meter • Albuminometer • Automatic blood pressure monitor • Urinometer • Autoclave • UV Spectrophotometer **Bioinformatics and Biochemistry (Structure and uses)** • Phylogenetic tree (Rooted tree) • RasMol (Visualization tool) • BLAST • Structure of pentose • Structure of cholesterol
Content
Total Contact Hrs **52**

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	20	Spotters	20
	Record work	10	Record	10
	Total Marks	**40**	**Total Marks**	**60**

Hands on experience in practicals, Activity,

Books for Reference:

1. Arumugam .N. (2017) Developmental Zoology - Saras Publication,114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamilnadu, India.
2. H. R. Singh and Neerajkumar, (2014). Animal Physiology and biochemistry, Vishal Publishing Co. Jalandhar, Delhi
3. 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. Nagarcoil, Kanyakumari Dist. Tamil Nadu.

Mapping

PSO CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	H	H	H
CO2	M	H	M	H	M
CO3	H	H	H	M	M

H-High; M-Medium; L-Low

Course Designed by **Name and Signature**	**Verified by HOD** **Name and Signature**	**Checked by** **CDC**	**Approved by** **COE**
Dr. M. Durairaju Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY615	**Title**	**Batch :**	2020-2023
		MAJOR ZOOLOGY PRACTICAL - IV (Ecology, Evolution, Biotechnology, Microbiology, Sericulture and Aquaculture)	**Semester**	V & VI
Hrs/Week:	2		**Credits:**	4

Course Objectives

- To obtain practical knowledge in ecology, evolution, biotechnology, microbiology
- To study the physico-chemical nature of environment**.**
- To understand the different water quality analysis
- To get the knowledge about silkworm rearing appliances
- To acquire knowledge of sericulture and aquaculture

Course Outcomes (CO)

K1	CO1	To recollect the knowledge on Ecology, Evolution,
K2	CO2	To understand the estimation of different water quality parameters, microbial culture and morphometric measurement of fish.
K3	CO3	To access the micro environment and report preparation.
K4	CO4	To acquire knowledge about sericulture and Aquaculture
K5	CO5	To understand the techniques of Biotechnology and Microbiology,

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/ Microbiology

- E-Coli
- Plasmids
- Biodiesel Plant – Jatropha
- PCR
- Micropipette
- Magnetic stirrer
- Laminar Air Flow
- Gel Electrophoresis

Sericulture

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

Aquaculture

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

Total Contact Hrs	**52**

Mark Distribution:

Total Marks	**Internal(CIA)**	**Marks**	**End of semester Practical Examination (ESE)**	**Marks**
100	Practical Skill/observation	10	Experiments	20
			Spotters	20
	Model Practical Examination	20	Field visit /Micro-environmental study/ report preparation	10
	Record work	10	Record	10
	Total Marks	**40**	**Total Marks**	**60**

Hands on experience in practicals, Activity,

Books for Reference:

1. Ganga, G and Sulochana chetty (1999). An introduction to sericulture. Oxford and IBH Publishing company Pvt. Ltd. New Delhi
2. Jayasurya, (2016). Economic Zoology. Saras publication. Nagarcoil, Kanyakumari Dist. Tamil Nadu
3. Kumaresan. V (2016) Biotechnology. Saras publication. Nagarcoil, Kanyakumari Dist. Tamil Nadu
4. Odum, E. P (1971) Fundamentals of ecology W.B. Sanders Company, London
5. Arumugam, N. (2016) Aquaculture SARAS Publications, Nagercoil, Tamilnadu.
6. ICAR Publication (2006) 1st edition. Hand book of fisheries and aquaculture, Directorate of information and publicatios of agriculture. Indian Council of Agricultural Research, New Delhi
7. Sinha.J., Chatterjee.A.K. and Chattopadhyay. P. (2011) Advanced practical Zoology. Books and Allied pvt. Limited , Kolkata.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20 UZY510	**Title**	**Batch :**	2020-2023
		Core Paper - X Biochemistry and Bioinformatics	**Semester**	V
Hrs/Week:	5		**Credits:**	5

Course Objectives

- To study the metabolism of biomolecules.
- To understand the disorders of metabolism.
- To study the basic bioinformatics tools and it uses
- To acquire the knowledge on biological databases.
- To know the chemical structure of macromolecules and their metabolic activity.

Course Outcomes (CO)

K1	CO1	To keep in mind the basic bioinformatic tools and its uses.
K2	CO2	To comprehend the genomic study and sequence analysis
K3	CO3	To apply the basic and applied knowledge of Biochemistry
K4	CO4	To sort the core principles of biochemistry.
K5	CO5	To acquire knowledge about the phylogenetic analysis

Unit	Content	Hrs
Unit I	**Biochemistry** • **Classification of Carbohydrates:** o Monosaccharides : Pentoses o Disaccharides o Polysaccharides - Homopolysaccharide and Heteropolysaccharide **Classification of Lipids:** o Simple Lipids - Fats o Compound lipids -Phospholipids o Derived lipids -Glycerol • **Classification of Proteins:** o Structure : Simple – Conjugated and Derived proteins. o Solubility: Globular and Fibrous proteins	**13Hrs**
Unit II	• Metabolism of carbohydrates: Glycolysis-Glycogenesis- Kreb's cycle & Glycogenolysis • Metabolism of lipids :β-oxidation of fatty acids • Metabolism of proteins :Transamination and Deamination	**13Hrs**
Unit III	• Scope of Bioinformatics • Databases o Biological database (Properties and classification) o Specialized database • Protein sequence database – SWISS-PROT • Data mining • Virtual Library	**13Hrs**
Unit IV	• Genomics –Classification and applications • Proteomics –Classification and applications • Drug designing • Human genome project o Goals and techniques o Potential benefits • *Bioinformatics tools and its uses*	**13Hrs**

Unit V	• Similarity tool : BLAST • Visualizing tool : RasMol • Miscellaneous tool : Webcutter • Phylogenetic analysis - Definition and applications • Construction of phylogenetic tree • Structure of rooted tree	**13Hrs**
Total Contact Hrs		**65**

➢ *Italics denoted as self study topics*

Power point Presentations, Seminar, Assignment, group discussions, Google class room ,Case study

Books for Study:

1. Sundaralingam R.& Kumaresan V. (2018) Bioinformatics , Saras Publication, 114/35G . A.R.P Camp road, Periavillai, Kottar PO, Nagercoil, Kanyakumari,
2. Thulsi Fatima, (2016) Biochemistry - Saras Publication,114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamil nadu, India

Books for Reference:

1. Simminder Kaur Thukral, (2007) Bioinformatics-Orpita Bosu, Oxford University Press, New Delhi 110001
2. Attwood T.K. and Parrysmith D.J. (1999) Introduction to Bioinformatics - Addison Wesley Longman, Harlow.
3. Fuelker , M.H. (2009) Bioinformatics – Applications in Life and Environmental Sciences Capital Publishing Company, New Delhi.
4. Ignacimuthu, S. (2005) Basic Bioinformatics –Narosa Publishing House, New Delhi.
5. Sharma, Munjal & Shankar (2008) A text book of Bioinformatics –, Rastogi Publications, Meerut, India,
6. Jin Xiong, (2006) Essential Bioinformatics Cambridge University Press
   Subramanian C. (2010) Genomic Bioinformatics- Dominent Publisher, New Delhi.
7. Rastogi, S. C. (1995) Biochemistry - Tata McGraw-Hill Education,
8. Sathyanarayana U.& Chakrapani, U. (2009) 2nd Edition, Essential of Biochemistry - Books & Allied pvt.ltd 83/1, Beliaghata main road, Kolkata 700010, India

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Mariselvi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY5E1	**Title**	**Batch :**	2020-2023
		Core Elective Paper – I Medical Laboratory Techniques	**Semester**	V
Hrs/Week:	4		**Credits:**	5

Course Objectives

- To understand the basic principles and applications of MLT.
- To understand the laboratory techniques
- To acquire the knowledge about instruments usage
- To know about the laboratory diagnosis methods
- To study the sexual diseases and cryopreservation methods

Course Outcomes (CO)

K1	CO1	To remember the structure and function of medical laboratory instruments
K2	CO2	To understand the methods used in medical laboratory
K3	CO3	To apply knowledge about laboratory diagnosis
K4	CO4	To analyze and estimation of blood, urine, faeces, sputum and semen
K5	CO5	To acquire the knowledge about laboratory techniques

Unit	Content	Hrs
Unit I	• **Introduction** o Code of conduct for laboratory personnel o Structure of a laboratory • **Laboratory instruments** o Centrifuge o Autoclave o ECG o B. P. apparatus and stethoscope o Urinometer o Albumino meter o General procedure – Cleaning -Sterilization and disposal of infected materials o *Safety measures and first aid*	**11Hrs**
Unit II	• **Haematology** o Blood collection o Anticoagulant - Ammonium & Potassium oxalate mixture o Bleeding time and clotting time o Staining of blood films o Estimation of haemoglobin o Blood cell total count - RBC and WBC o Erythrocyte Sedimentation Rate (ESR) o Glucose Tolerance Test (GTT) o Blood glucose o *Anaemia- Iron deficiency anaemia*	**10Hrs**
Unit III	• **Urine Analysis** o Collection & preservation of urine o Physical examination o Chemical examination o Microscopic analysis • **Faeces Analysis** o Collection & preservation o Physical examination o Microscopic examination-Various ova seen o Occult blood test	**11Hrs**

Unit IV	• **Sputum Analysis** o Collection & preservation o Naked eye inspection o Microscopic examination o Chemical examination • **Semen Analysis** o Collection of semen o Physical examination o Microscopic analysis o Preparation of smear and staining	**10Hrs**
Unit V	• **Pregnancy test** o Immunolological methods o Pregnancy card • **Sexual Diseases** o Syphilis o Gonorrhoea Disease • **Clonal Bank** o Ova Bank o Semen Bank o Gene Bank	**10Hrs**
Total Contact Hrs		**52**

- *Italics denoted as self study topics*

- Assignment , Seminar , Power point presentation, Google class room

Books for Study:

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

Books for Reference:

1. Sachdev, K. N. (1991) Clinical pathology and bacteriology. Jaypee brothers- medical publishers, New Delhi
2. John Macleod and John Munro, (1988) Clinical Examination. ELBS publishers
3. Samuel, K. M. (1982) Notes on Clinical Lab Techniques. K. Gopalan publishers, Madras

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	H	H	M	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Ms. S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY5E2	**Title**	**Batch :**	2020-2023
		Core Elective paper II Poultry Science And Management Technology	**Semester**	V
Hrs/Week:	5		**Credits:**	5

Course Objective

- To know the basic concept of poultry science
- To understand the construction of poultry farm
- To get the knowledge about different breeders
- To study about the diseases of poultry birds.
- To acquire knowledge about the nutritive value of egg.

Course Outcomes (CO)

K1	CO1	To keep in mind the role of poultry science
K2	CO2	To get the idea on poultry house and management.
K3	CO3	To execute feed formulation for broiler, layer and breeders.
K4	CO4	To evaluate the nutritive value of poultry meat and egg.
K5	CO5	To analyze the transport and marketing.

Unit	Content	Hrs
Unit I	• Importance and role of the poultry in rural development and employment potential. • Anatomy and physiology of poultry birds (hen) with reference to digestive and reproductive systems.	**11Hrs**
Unit II	• Poultry house and equipment • Space requirements • Types of houses • *Summer management - Winter management* • Sterilization of room	**10Hrs**
Unit III	• Classification of feed stuffs • Availability of raw materials and their cost • Feed formulation and Feeding programme • Equipment for feeding and drinking.	**11Hrs**
Unit IV	• Management of Broilers • Management of layers • Management of Breeders • Common diseases – Bird flu disease • Antibiotics - Vaccination and deworming • Insecticide treatment and Bio-remedies	**10Hrs**
Unit V	• *Nutritive value of poultry meat and egg* • Grading and Preservation of eggs • Packing and Transport and Marketing • Different uses of eggs • Poultry manure**.**	**10Hrs**
Total Contact Hrs		**52**

➢ *Italics denoted as self study topics*

Power point Presentations, Seminar, Assignment, Case study

Book for study

1. Arumugam, N. (2018) Applied Zoology, Saras Publication, 114/35 G ARP Camp Road, Periavilai, Nagercoil, Kanyakumari – 629 002

Books for Reference:

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

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Ms. S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY5S1	**Title**	**Batch :**	2020-2023
		Network and Information Security (SBE- Online)	**Semester**	V
Hrs/Week:	1		**Credits:**	2

Course Objective

- To impart knowledge of Network security, Wi-Fi security and hackers.
- To understand the secure networking and password management.
- To study about the network monitoring.
- To gain knowledge about the Security Vulnerabilities
- To understand the various operating system.

Course Outcomes (CO)

K1	CO1	To remember the basic concepts of network
K2	CO2	To understand the network hacking techniques
K3	CO3	To deploy information and network security
K4	CO4	To interpret the common threats today in computer network
K5	CO5	To understand about the network monitoring.

Unit	Content	Hrs
Unit I	Basics of Network – Network Media – Various Operating Systems – Basics of Firewalls on all Platforms including Windows, MacOS and Linux.	**3Hrs**
Unit II	Security Vulnerabilities across an entire network – Network Hacking techniques and Vulnerability scanning.	**3Hrs**
Unit III	Configure and architect a small network for physical and wireless security – Firewalls configuration on Windows platform and Linux platform. Network privacy issues	**2Hrs**
Unit IV	Network monitoring to discover and identify potential hackers and malware using tools like WIRESHARK and SYSLOG. Online tracking by hackers	**2Hrs**
Unit V	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.	**3Hrs**
Total Contact Hrs		**13**

Google classroom

Reference:

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

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY5S2	**Title**	**Batch :**	2020-2023
		Cyber security – Ethical Hacking (SBE – Online)	**Semester**	V
Hrs/Week:	1		**Credits:**	2

Course Objective

- To understand the basics of cyber security
- To know about the ethical hacking is done on Cyber space
- To secure and protect them like security experts
- To study the details about internet connection
- To acquire the knowledge about the use of hacking tools

Course Outcomes (CO)

K1	CO1	To remember the basic concepts of cyber security
K2	CO2	To understand the knowledge about ethical hacking
K3	CO3	To deploy the use of hacking tools
K4	CO4	To analyze the details about internet connection
K5	CO5	To create awareness about cyber security

Unit	Content	Hrs
Unit I	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.	**3Hrs**
Unit II	Ethical hacking in Cyber space - its fields and the different types of hackers. Hack & secure both Wi-Fi & wired networks	**3Hrs**
Unit III	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.	**2Hrs**
Unit IV	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.	**2Hrs**
Unit V	Explore the threat landscape - Darknets, dark markets, zero day vulnerabilities, exploit kits, malware, phishing and much more. Master defenses against phishing, SMShing, vishing, identity theft, scam, cons and other social engineering threats.	**3Hrs**
Total Contact Hrs		**13**

Google classroom

Reference:

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

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	M	H	H
CO2	H	M	H	M	H
CO3	M	H	M	M	M
CO4	M	M	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY 611	**Title**	**Batch :**	2019-2022
		Core Paper – XI Animal Physiology and Endocrinology	**Semester**	VI
Hrs/Week:	5		**Credits:**	5

Course Objectives

- The complete understanding of all the chemical process associated with living cell
- To study the basis for various organ systems in the animal kingdom
- To understand the mechanism of hormonal actions
- To study the various types of metabolism.
- To gain knowledge about the functions of various organs.

Course Outcomes (CO)

K1	CO1	To remember the bio chemical and physiological structure and activity of individual cell level
K2	CO2	To comprehend physiological activity of organ system and bio chemical activity of cells
K3	CO3	To apply functional knowledge on various organs, endocrine glands and its status
K4	CO4	To sort of animal is physiology
K5	CO5	To gain the knowledge on endocrinology

Unit	Content	Hrs
Unit- I	• **Digestion** o Functional anatomy of digestive system o Digestion and absorption. o Neuroendocrine regulation of gastro – intestinal movements and secretions. • **Respiration:** o Aerobic & Anaerobic respiration o Respiratory pigments in animals o Transport of gases - O_2 and CO_2	**13Hrs**
Unit- II	• **Circulation:** o Myogenic & Neurogenic heart o Pacemaker and electrical activity of heart in man o Composition and functions of blood • *Composition and functions of Lymph* • **Water Balance:** o Osmatic and Ionic regulations in aquatic animal (Fish) • **Receptors:** o Chemoreceptors - Gustatoreceptors & o Olfactoreceptors o Photoreceptor (Eye) o Phonoreceptor (Ear)	**13Hrs**
Unit -III	• **Effectors:** o Types of muscles : Striped- unstriped and cardiac muscles o Structure and properties of striped muscle • Mechanism of muscular contraction- sliding filament theory. **Nervous system:** o Structure of vertebrate neuron o Conduction of nerve impulse through : Non-myelinated neuron Synapse o Neuromuscular junction o Reflex action and reflex arc	**13Hrs**

	• **Excretion**: o *Structure of mammalian kidney* o Structure of Nephron o Synthesis of ammonia - urea and uric acid o Formation of urine in Human • **Reproductive system:** o Male and female reproductive system structure	
Unit- IV	• Scope of Endocrinology • **Endocrine glands** (Structure & Functions) o Pituitary o Thyroid o Parathyroid o Pancreas o Testes & ovary • Hormonal interactions- Feedback control mechanisms.	**13Hrs**
Unit- V	• **Mechanism of hormone action:** peptide, steroid & thyroid. • **Hormonal disorders:** o Pancreas (Diabetes mellitus) o Thyroid (Goiter) o Pituitary (Gigantism - Dwarfism) o Sex hormones (Infertility).	**13Hrs**
Total Contact Hrs		**65**

➢ *Italics denoted as self study topics*

Power point Presentations, Seminar , Assignment, Discussion, Activity, Case study,Google classroom

Books for Study:

1. Rastogi S.C. (2008) Essentials of Animal Physiology, 4th Edition . New age international publishers.
2. Arumugam N. (2018) Animal physiology- Saras Publication, 114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamil nadu, India

Books for Reference:

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

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	L	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology		
Course Code:	20UZY612	**Title** **Core Paper – XII** Ecology and Evolution	**Batch :** **Semester**	2020-2023 VI	
Hrs/Week:	5		**Credits:**	4	

Course Objective

- To know about the basic concepts of Ecology and Evolution
- To acquire knowledge about the origin of life
- To understand the animal relationships.
- To study about animal population
- To understand the organic evolution of man

Course Outcomes (CO)

K1	CO1	To recollect the importance of abiotic factors and origin of life
K2	CO2	To understand the basic concepts of animal relationship and fossils
K3	CO3	To apply knowledge about animal ethics and evidences of evolution
K4	CO4	To analyze the animal population and organic evolution of man
K5	CO5	To gain the knowledge about biogeochemical cycles.

Unit	Content	Hrs
Unit I	• **Scope of ecology** • **Abiotic factors** o Soil: Pedogenesis - Soil texture- Soil profile – Soil fauna, types of soil erosion. o *Water: Properties of water* o Temperature: Range of temperature- Thermal stratification- biological effects of temperature o Light: light on water – biological effects of light	**13Hrs**
Unit II	• **Biogeochemical cycle** o Gaseous cycle : Carbon cycle- Nitrogen cycle o Sedimentary cycle: Sulphur cycle- Phosphorus cycle • **Animal relationship** o Commensalism o Mutualism o Parasitism • **Animal population** o Characteristics of population - Natality- mortality-growth-density • **Human Ecology** o Population growth (Explosion), Population control • **Space Ecology** o Physiological changes during space travel.	**13Hrs**
Unit III	• **Biochemical origin of life** • ***Urey and Miller's experiment*** • **Geological time scale** • **Fossils**: Types and Dating of fossils	**13Hrs**
Unit IV	• **Evidences of evolution** o Morphological: Homologous structures – vestigial organs – connecting links o Embryological: Recapitulation theory o Palaeontological : Missing links	**13Hrs**
Unit V	• **Darwinism :** Over production – variation – survival of the fittest – struggle for existence – origin of species • **Lamarckism**- Principle of Lamarckism • **Organic evolution of man**	**13Hrs**
Total Contact Hrs		**65**

➢ *Italics denoted as self study topics*

Assignment ,Seminar, PPT, discussions, Case study

Books for Study:

1. Arumugam N. (2019) Concepts of ecology. Saras publication 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari
2. Arumugam N. (2015) Organic Evolution–- Saras publication 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari

Books for Reference:

1. Odum E. P. (1971) 1st edition. Fundamentals of ecology . W. B. Saunders Company, London.
2. Verma and Agarwal. (2003) 5th edition. Principles of Ecology. S. Chand & Company, Ltd. New Delhi, 110055
3. Tomar and Singh, (2010) 8th edition. Evolutionary Biology – Rastogi Publication, Meerut. 250 002
4. Saha, T. K. (2002) 1st edition. Life: Origin, evolution and adaptation. Books and allied (P) Ltd. Kolkata – 700 010
5. N.Arumugam(2015) - Ecology, Toxicology and Evolution, Saras Publications, Kanyakumari

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	M	H
CO2	H	H	H	M	H
CO3	H	M	M	H	M
CO4	M	M	H	M	H

H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Dr. M. Durairaju Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY613	**Title**	**Batch :**	2020-2023
		Core Paper – XIII Microbiology and Immunology	**Semester**	VI
Hrs/Week:	5		**Credits:**	4

Course Objectives

- To acquire a basic knowledge of microbiology and immunology
- To know the working mechanism of immunity
- To study the basic methods in microbiology
- To understand the classification of microganisms and Immunity
- To study the applications of microbiology and immunology

Course Outcomes (CO)

K1	CO1	To keep in mind the scope of microbiology and immunology
K2	CO2	To understand the classification of microorganisms and immunity
K3	CO3	To apply the knowledge about food microbiology,Agricultural microbiology,Medical microbiology
K4	CO4	To analyse the disease producing microorganism
K5	CO5	To acquire the knowledge of immunity level of human body

Unit	Content	Hrs
Unit I	• Introduction and scope of microbiology • Classification of microorganisms • Basic methods in Microbiology o Pure culture - Isolation and purification techniques o Types of culture media o Preparation of Culture media o Culture techniques of microorganisms • Staining procedure and types of staining o Simple staining o Negative staining o Gram staining o Acid-fast staining	**13Hrs**
Unit II	• **Bacteria**: o Major features and structure of bacteria o Economic importance of bacteria o Bacterial growth and Growth curve o Bacterial culture – Culture of *E.Coli* • **Viruses**: o Characteristic and structure of viruses o Classification of virus o Structure of Bacteriophage	**13Hrs**
Unit III	• **Applied microbiology** o **Agricultural microbiology**: ▪ Role of microorganism in soil fertility ▪ Biofertilizers ▪ Harmful role of microorganism. o **Food microbiology**: ▪ Microorganisms of food ▪ Factors influence microbial growth ▪ Bio chemical changes of Food spoilage ▪ *Food preservation* o **Medical microbiology** ▪ Normal microflora of human body ▪ Bacterial Diseases -Boutilism, Cholera ▪ Viral Diseases – Measles, Viral hepatitis	**13Hrs**

Unit IV	• **Immunology** o Introduction and scope of immunology • **Classification of Immunity** – Innate and Acquired Immunity • **Immune Response** o Mechanism of Humoral immune response o Mechanism of Cell mediated immune response • **Lymphoid Organs** o Primary lymphoid organs o Secondary lymphoid organs • **Cells of the immune system** o Lymphoid lineage o Myeloid lineage	**13Hrs**
Unit V	• **Immunoglobulins** o Structure of immunoglobulin o Classes and properties of immunoglobulin • **Classification of Major Histocompatability Complex- (MHC)** • **Tumor immunology** o Types of tumor o *Properties of tumor cells ,* o Causes of tumor o Factors involved in tumor immunity o Immune diagnosis and immunotherapy of tumor	**13Hrs**
Total contact Hrs		**65**

- *Italics denoted as self study topics*

Assignment, Seminar, Power point

Books for Study:

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

Reference:

1. Dubey R. C. and Maheswari, D.K. (2013) A Text book of Microbiology, Cambridge University Press
2. Ignacimuthu, S. (1995) Basic Biotechnology –Tata McGraw Hill Publishing Company Ltd, New Delhi.
3. Dubey, R. C. (1996) A text book of Biotechnology –Cambridge University Press
4. John.E.Smith, (1993) Biotechnology – Vikas Publishing House Pvt. Ltd, New Delhi
5. Gupta. P. K. (2004) Elements of biotechnology –Rastogi Publications, Meerut
6. Shyamasree ghosh, (2017) Immunology and Immunotechnology –Books and allied (P) Ltd.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	M	M	H	H	M
CO3	H	H	H	M	H
CO4	H	M	H	M	M

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Ms. S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	Programme Title :	Zoology	
Course Code:	20UZY6E3	Title	Batch :	2020-2023
		Core Elective Paper - III Sericulture	Semester	VI
Hrs/Week:	4		Credits:	3

Course Objectives

- To study the culture of mulberry plantation and values of mulberry leaves.
- To acquire knowledge about the silkworm rearing
- To understand the silk reeling techniques.
- To know about the Central Silk Board and its functions.
- To gain knowledge about the economic importance of sericulture.

Course Outcomes (CO)

K1	CO1	To remember the historical background of Sericulture and importance of agricultural production.
K2	CO2	To get the idea for increasing cocoon productivity and to prevent silkworm diseases
K3	CO3	To execute the construction of rearing house and self employment in silkworm rearing
K4	CO4	To analyze this course for employment and job opportunities in the public, private and Govt. sectors.
K5	CO5	To understand the Central Silk Board and its functions.

Unit	Content	Hrs
Unit I	• Definition and History of Sericulture • Economic importance of sericulture • Varieties of silkworms: Mulberry silk worm: Bombyx mori Non- Mulberry silk worm: Tasar- Muga and Eri silk worms • *Uses of silk* • Moriculture: Optimum conditions for mulberry growth • Planting direction and season • Planting systems	**10 Hrs**
Unit II	• Methods of vegetative Propagation o Cutting o Layering o Grafting • Pruning: Low cut–High cut and Rejuvenation pruning • Methods of Leaf harvesting • Preservation of leaves • Diseases of Mulberry: Fusarium Root Rot – Powdery Mildew – Leaf Blight – Leaf Mosaic disease	**11 Hrs**
Unit III	• Life cycle of Bombyx mori • Structure of silk worm • Structure of Silk gland • Grainages • Incubation and its methods • Brushing and its methods • **Bed cleaning and its methods** • Silkworm rearing appliances	**10 Hrs**
Unit IV	• Disinfection • **Rearing of young age silkworm : Chawki rearing in India** • Rearing of mature larvae: Shelf- Floor and shoot rearing • Mounting: Methods and precaution during mounting	**11 Hrs**

	• Diseases of silk worms: o Pebrine o Viral Flacherie (IFV) o Grasserie :Nuclear Polyhedrosis (NPV)	
Unit V	• **Indian Uzi fly (Pest of silk worm)** • Physical characteristics of cocoons • *Defective cocoons* • Reeling appliance - Country Charkha • Cocoon Markets • Raw silk testing	**10 Hrs**
Total Contact Hrs		**52**

➢ *Italics denoted as self study topics*

Power point Presentations, Seminar , Assignment, Discussions, Google class room, Subject video play

Books for Study:

1. Ganga G. and Sulochana Chetty. J. (2012) An Introduction to sericulture – Oxford and IBH Publishing Co. PVT. LTD.

Books for Reference:

1. Ullal and Narasimhanna. M.N. 2nd Ed.(1981) Hand Book of practical sericulture –SBS Publishers, Bangalore
2. Manual on sericulture – FAO (1977), Central Silk Board Bangalore.
3. Ezhili N. & Thirumathal K. (2008) A hand book for sericulture –Shrishti Impression, Coimbatore

Mapping

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Mariselvi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology		
Course Code:	20UZY6E4	**Title**	**Batch :**	2020-2023	
		Core Elective Paper- IV Insect Pest Management	**Semester**	VI	
Hrs/Week:	5		**Credits:**	3	

Course Objectives

- To study the insect available in the agricultural field
- To know about the pesticides
- To get knowledge about the pest control management
- To know about the Integrated Pest Management
- To acquire the knowledge about major agricultural pests.

Course Outcomes (CO)

K1	CO1	To remember agricultural pest and their management
K2	CO2	To understand the control of pest management
K3	CO3	To apply modern methods in agricultural field
K4	CO4	To interpret application of pesticide
K5	CO5	To acquire the knowledge about different types of pests

Unit	Content	Hrs
Unit I	• Pest definition – Definition - Classification • Reasons for insect pest • Insect pest out break • Injuries and Damage caused by insect pest	**13 Hrs**
Unit II	• Assessment of insect pest population • Assessment of insect pest damage • Pest surveillance and forecasting pest outbreak • Need for insect pest management	**13 Hrs**
Unit III	• Pest control • Climatic factors • Natural enemies • Physical • Mechanical • *Cultural - biological and legal control*	**13 Hrs**
Unit IV	• Insecticide- Definition - Formulation of insecticides • Classification based on modern entry • Classification based on modern action • Brief account of Attractants- Antifeedants and Chemosterilants • *Integrated Pest Management*	**13 Hrs**
Unit V	Major Local Agricultural pest and their Management • Cotton – The cotton Boll worm – *Helicoverpa armigera* • Coconut – The Rhinoceros beetle – *Oryctes rhinoceros* • Groundnut – The Red hairy caterpillar – *Amsacta albistriga* • Sugarcane – The sugarcane stem bore- *Chilo infuscatellus*	**13 Hrs**
Total Contact Hrs		**65**

- *Italics denoted as self study topics*

Assignment, Seminar

Books for study:

1. Chapman, R.F.(2015).The insects: Structure and Function, Hodder and Bhoughton Ltd., Kent, U.S.A.,
2. Nalina Sundari, M.S., and R. Santhi, (2006) Entomology, MJP Publishers, Chennai.

Books for Reference:

1. Mani, M.S., (1982) General Entomology, Oxford and IBH publishing Co., New Delhi.
2. Snodgrass, R.E., (1985) Principles of Insect Morphology, McGraw Hill and Co., New York.
3. Nayar, K.K.., Ananthakrishnan,T.N., and David., M., (1995) General and Applied Entomology, Tata McGraw Hill Pub. Co., Ltd., New York.
4. Vasantharaj David, B., (2001)Elements of Economic Entomology, Popular Book Depot., Chennai – 15.
5. Nayar, K.K. (1983) Economic Entomology and Applied Entomology, Oxford and IBH Publishing Co., New Delhi.
6. Rathinaswamy,T.K., (1986) Medical Entomology, S. Viswanathan and Co., Madras.
7. Shukla. Upadhyay (2003). Economic Zoology –. Rastogi Publications, Shivaji Road, Meerut-250002. India.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H
CO2	H	M	H	H	H
CO3	H	H	H	M	M
CO4	H	H	H	M	H

H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Dr. S. Mariselvi Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B.Sc	**Programme Title :**	Zoology	
Course Code:	20UZY6E5	**Title**	**Batch :**	2020-2023
		Core Elective Paper–V Aquaculture	**Semester**	VI
Hrs/Week:	5		**Credits:**	5

Course Objectives

- To study the nature and habitat of different aquatic animals
- To get knowledge about fresh water and marine water fishes
- To know the preparation of fish feed.
- To understand the structure and functions of aquatic ecosystems
- To know about the nutritive value of fishes.

Course Outcomes (CO)

K1	CO1	To keep in mind the environmental assessment strategies and management systems.
K2	CO2	To deduce the techniques involved in the culture of various organisms
K3	CO3	To apply the knowledge in food sectors, hatchery and nursery operations
K4	CO4	To sort of the structure and functions of aquatic ecosystems
K5	CO5	To gain knowledge about the adaptations of fishes

Unit	Content	Hrs
Unit I	• Scope of aquaculture • *Aquaculture in India* • General character and adaptations in fishes • General Organization of fish o Teleost – *Labeo rohita* o Morphology and anatomy ▪ Digestive system ▪ Reproductive system ▪ Economic importance of fish : Nutritive value of fish • Pond culture- different kinds of fish ponds in a model fish farm.	**13hrs**
Unit II	o Culture methods o mono culture o poly culture o integrated culture • Fresh water culture • Marine culture • Age and growth study • Hypophysation • Fish feed o Classification of feed o Composition of feed o Live feed	**13hrs**
Unit III	• Bionomics of some important aquatic animals • Fresh water fishes ▪ Indian major carps- Catla catla Cyrhinus mrigala Labeo rohita (Rohu) ▪ Exotic fishes - Common carp - Tilapia • Marine fish-Oil Sardine • Prawn culture • Oyster culture • Pearl culture	**13hrs**

Unit IV	• Fish crafts – different types of fishing boats.
	• Gears
	  o Hooks
	  o Simple dipnets
	  o Chinese dipnets
	  o Gill nets
	  o Purse seine
	  o Trawl nets
	• Fish processing
	  o Identification of good and spoiled fish
	  o Refrigeration
	  o Freeze drying
	  o Fumigation
	  o Canning
	  o Salting
		13hrs

Unit V	• Ornamental fish culture
	  o Requirements and setting of an aquarium
	  o Aquarium fishes
	• Fish pathology and major diseases
	  o Bacterial diseases- Dropsy, Gill Rot
	  o Viral diseases - Ebizootic ulcerative syndrome, Haemorrhagic septicaemia
	  o Fungal diseases - Gill Rot, Saprolegniasis
	  o Fish parasites - lernaeasis
	• Principles of harvesting- transport and marketing
	• By-products of fishes
	• *Role of fishes in mosquito control*
	• Transgenic fishes
		13hrs

Total Contact Hrs		**65**

- *Italics denoted as self study topics*

Power point Presentations, Seminar, Assignment, Case study

Books for Study:

1. Arumugam, N. (2019) Aquaculture SARAS Publications, Nagercoil, Tamilnadu.
2. Shanmugham, K. (1992) Fishery biology and aquaculture, LEO Pathippagam, Madras.

Books for Reference:

1. Vadapalli and Satyanarayanan, (1996) Fish culture. Narendra publishing house, Delhi.
2. Datta Munshi and Srivastava, (1988) Natural history of fishes and systematic of Fresh-water fishes of India. Narendra Publishing House, New Delhi.
3. Jordan E. L. and Verma. P. S. (2000) Chordate Zoology. S. Chand and company LTD, New Delhi
4. Agarwal. S. C. (1994) A hand book on fish farming. Narendra publishing house. Delhi
5. Pandey and Shukla, (2010) Fish and fisheries. Rastogi publication
6. Charls L Cutting, (1999) Fish processing and preservation. Agrobotanical publishers (India)
7. ICAR Publication (2006) 1st edition. Hand book of fisheries and aquaculture, Directorate of information and publicatios of agriculture. Indian Council of Agricultural Research, New Delhi
8. Jhingran, V.G. 1988. Fish and Fisheries of India – Hindustan Publishing Corporation India Delhi. Printed in India at Gopsons paper Pvt. Ltd. Noida.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology		
Course Code:	20UZY6E6	**Title**	**Batch :**	2020-2023	
		Core Elective Paper – VI Wildlife Conservation	**Semester**	VI	
Hrs/Week:	5		**Credits:**	5	

Course Objectives

- To understand the basic principles wild life and its conservation.
- To know the knowledge about wildlife conservation techniques
- To acquire the knowledge about forest types
- To study the biodiversity conservation and its value.
- To study about the different animal population

Course Outcomes (CO)

K1	CO1	To remember the importance of wildlife and its management techniques
K2	CO2	To understand the methods used in wildlife census
K3	CO3	To apply knowledge about conservation on Indian wildlife
K4	CO4	To analyze and estimate different animal population
K5	CO5	To acquire the knowledge about prioritize of wildlife conservation

Unit	Content	Hrs
Unit I	Scope and importance of Wildlife of India. Definition of Wildlife: Causes of wildlife depletion; Economic importance of wildlife; need for wildlife conservation; rare, endangered, threatened and endemic species of fishes, amphibians, reptiles, birds and mammals in India- *India as a mega wildlife diversity country.*	**13Hrs**
Unit II	Forestry and forest entomology: Forest types in India- identification, dendrology; Deforestation & Impacts; Forest Inventory; Natural and artificial regeneration of forests; Harmful Insects and their role in forest economy: Insect pests of important trees of India -Teak, Sal and Bamboo; Beneficial Insects and their role in forest economy: Scavenger insects dung beetles; Pollinators, Predatory insects, and parasitic insects on insect pests; control of forest insects.	**13Hrs**
Unit III	Wildlife management techniques: Vegetative analyses – Point Centered Quadrat, Quadrat, Strip transect; GIS and Remote sensing in wildlife habitat surveys-Habitat manipulation: food, water, shade improvement; impact and removal of invasive alien species; Making observations and records: field notes, datasheets; Wildlife Photography - Types of cameras, camera traps; Field equipments-altimeter, pedometer, field compass, binoculars; radio collaring; GPS; GIS; Remote sensing in Wildlife management.	**13Hrs**
Unit IV	Wildlife census techniques: Planning census – Total counts - Sample counts – Basic concepts and applications - 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)- Identifying animals based on indirect signs; Capture-recapture techniques.	**13Hrs**
Unit V	Conservation of Wildlife: in-situ and ex-situ conservation: *Wildlife Sanctuaries, National Parks, Tiger Reserves and Biosphere reserves*: Definition, formation, management and administration; Wildlife Projects:	**13Hrs**

	Tiger, Elephant, Lion and Hangul; Zoos and Zoological Parks: Definition- Aims of Zoos- Formation and Management of Zoos and Zoological Parks - Central Zoo Authority of India; Captive breeding: Aims, Principles, methods; Role of Government and Non-Governmental organizations in conservation.	
Total Contact Hrs		**65**

- *Italics denoted as self study topics*

- Assignment , Seminar , Power point presentation

Books for Study:

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

Reference

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

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	M	H	H
CO2	M	H	H	M	H
CO3	H	H	H	M	M
CO4	H	M	H	M	H

H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY 6E7	**Title**	**Batch :**	2020-2023
		Core Elective Paper–VI Dairy Farming and Management Technology	**Semester**	VI
Hrs/Week:	5		**Credits:**	5

Course Objectives

- To know about the basic processing technology in dairy farm.
- To get idea about manufacturing technology of Ice-cream and frozen desserts
- To understand the physico chemical properties of dairy products.
- To study of food safety and quality assurance
- To know about the Production of condensed and dried milks

Course Outcomes (CO)

K1	CO1	To keep in mind the dairy by-products
K2	CO2	To deduce the Breeding practices in dairy farm
K3	CO3	To apply the knowledge in Production of condensed and dried milks
K4	CO4	To sort of the Food safety and quality assurance.
K5	CO5	To understand the nutritive value of milk.

Unit	Content	Hrs
Unit- I	• Scope of dairy farming • Dairy progress in India • Milk and Milk Products • Nutritive value of milk • ICMR recommendation of nutrients • Milk production in India and Tamil Nadu • Role of milk and milk products in human nutrition.	**13Hrs**
Unit -II	**QUALITY ANALYSIS OF MILK:** • Determination of Specific gravity, fat, Acidity & pH in milk • Significance of milk • Determination and significance common adulterants in milk and their detection techniques • Advanced analytical techniques in milk and milk products.	**13Hrs**
Unit -III	**DAIRY HUSBANDRY:** • Dairy Cattle Breeds • Indigenous and exotic Breeds – Dairy Cattle – Anatomy • Nutrition – Physiology – Genetics and Breeding – A1 • Health and Hygiene Vaccination schedule	**13Hrs**
Unit- IV	**DAIRY CHEMISTRY:** • Milk Composition • Physico Chemical properties of milk • Animal, Feed and Environmental factors influencing the composition of milk • Milk lipids, Proteins, Sugar , Minerals and vitamins **DAIRY MICROBIOLOGY:** • Milk and microbes – Common micro organisms in milk spoilage of milk • Fermentation of milk - Desirable and undesirable	**13Hrs**

	fermentation • Milk borne diseases • Clean milk production	
Unit -V	**DAIRY PROCESSING AND TECHNOLOGY:** • Dairy processing – Milk collection, transportation & Grading of milk • Standardization – Pasteurization – Homogenization of milk - packaging of milk – cleaning and sanitation • Butter – ghee and Ice cream • Concentrated and dried milk products • Cheese and other fermented products • Indigenous milk products • Effective utilization of dairy by - products	**13Hrs**
Total Contact Hrs		**65**

Reference Books

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

Books for Reference

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

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Dr. S. Christobher Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY6S3	**Title**	**Batch :**	2020-2023
		Vermiculture (SBE)	**Semester**	VI
Hrs/Week:	1		**Credits:**	2

Course Objectives

- To study the importance of vermiculture
- To acquire the knowledge of external and internal structure of earthworm
- To study the life cycle of earthworm
- To know the knowledge about nutrient value of vermicompost
- To understand the preparation methods of vermibed

Course Outcomes (CO)

K1	CO1	To remember the role of worm farming in Modern Farming
K2	CO2	To understand Economic importance of vermiculture
K3	CO3	To deploy role of Vermiculture in protecting the environment and managing the waste
K4	CO4	To analyze the potential of vermicompost as an alternative to chemical fertilizers
K5	CO5	To acquire the knowledge about various type of earthworm

Unit	Content	Hrs
Unit I	• Systematic position of Earthworm – Habit and Habitat Commercial varieties of Earthworm for Vermicomposting. o *Economic importance of Earth worm*	**3Hrs**
Unit II	• Type study: Earthworm: Megascolex sp., o External character o Digestive system- o Respiratory system o Excretory system o Reproductive system	**3Hrs**
Unit III	• Life cycle of Earthworm • Collection of earth worms, • Methods of vermicomposting	**2Hrs**
Unit IV	o Types of soil o Indoor vermicomposting o Precautions need for vermicomposting o Biodegradable wastes o Nutrient Content of vermicompost	**2Hrs**
Unit V	o Preparation of Vermibed o Maintenance of Composting pit o Collection of vermicompost o *Vermiwash* o Marketing of vermicompost	**3Hrs**
Total Contact Hrs		**13**

- *Italics denoted as self study topics*

Power point Presentations, Seminar, Assignment , Case study

Books for study:

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

Books for Reference:

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

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	H	H

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Ms. S. Jayalakshmi Signature:	Dr. S. Somasundaram Signature:	Mr. K . Srinivasan Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	20UZY6S4	**Title** Biopharmaceuticals (SBE)	**Batch :**	2020-2023
			Semester	VI
Hrs/Week:	1		**Credits:**	2

Course Objectives

- To study the biological systems.
- To enable the students to know the actual path of metabolism of drugs.
- To understand the method o f drug discovery.
- To study the DNA technology in Pharmaceutical products
- To gain the knowledge about probiotics.

Course Outcomes (CO)

K1	CO1	To keep in mind the Routes of administration in biological systems and models
K2	CO2	To understand the drug metabolism
K3	CO3	To implement the microbial products in pharmaceutical industry
K4	CO4	To discuss the DNA technology in Pharmaceutical products
K5	CO5	To understand the uses of probiotics.

Unit	Content	Hrs
Unit I	• **Biological systems and models**: Routes of administration- adsorption enhancement- bioavailability- site specific delivery; Pharmacodynamics of protein therapeutics- Inter species scaling	**3hrs**
Unit II	• **Drug metabolism:** Oxidation- reduction- hydrolysis- conjugation. Need for developing new drugs: Procedure followed in drug design; Prodrug and soft drugs; Drug toxicity.	**3hrs**
Unit III	• **Drug discovery & cardiovascular drugs:** Substances derived from bacteria- plants- insects- and animals; Sources of active principles; drugs used in atherosclerosis	**3hrs**
Unit IV	• **Pharmaceutical products:** Microbial products - Antibiotics (penicillin- streptomycin- tetracycline)- *vitamins* -probiotics. Animal vaccines- Anti platelets drugs.	**2hrs**
Unit V	• **Quality assurance and quality control** Fundamental of quality assurance, benefits, structure of quality management, documentation, quality assurance in manufacturing.	**2hrs**
Total Contact Hrs		**13**

- *Italics denoted as self study topics*

- Assignment, Seminar

Books for Reference:

1. Heinrich Klefenz, (2002) Industrial Pharmaceutical Biotechnology, WILEY-VCH Publication, Germany,
2. Daan Crommelin and Robert D Sindelar, (2002) Pharmaceutical Biotechnology, Tailor and Francis Publications, New york,
3. Jay P Rho and Stan G Louie, (2003) Hand book of Pharmaceutical Biotechnology,Pharmaceutical products press, New york,
4. Lachman L Lieberman, HA, and Kanig, J, (1986) Theory and practice of industrial pharmacy, 3rd edition, Varghese publishing & Co, New Delhi,
5. Remington's Pharamaceutial sciences, (2000) 18th edtion, Mack publishing & Co., Easton, PA.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	M	M

H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Dr. S. Somasundaram Signature:	Dr. S. Somasundaram Signature:	Mr. K. Srinivasan Signature:	Dr. R. Muthukumaran Signature: