DEPARTMENT OF ZOOLOGY

B.SC. ZOOLOGY
SYLLABUS

BATCH: 2019-2022

FACULTY MEMBERS

DR. M. DURAIRAJU, M. SC.,M.PHIL.,B.ED.,PGDGC.,PH.D, (HOD)
DR. S. SOMASUNDARAM M.SC.,B.ED.,PH.D.,P.G.MBT
MS. 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)
ACCREDITED WITH 'A' GRADE BY NAAC
AN ISO 9001:2015 CERTIFIED INSTITUTION
POLLACHI – 642 001
COIMBATORE (DT.) TAMIL NADU

NALLAMUTHU GOUNDER MAHALINGAM COLLEGE, POLLACHI

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.

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

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.

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	19UTL101	Tamil/Hindi Paper – I	6	3	25	75	100	3
II	19UEN101	English Paper – I	5	3	25	75	100	3
III	19UZY101	**Core Major Paper –I** Non-Chordata	7	3	25	75	100	4
		Major Practical – I (Non-Semester Pattern) Non-Chordata & Chordata	2	-	-	-	-	-
	19UBY1A1	**Ancillary Zoology Paper–I** Non-Chordata & Chordata	6	3	25	75	100	4
		Ancillary Zoology Practical (Paper–I &II)	2	-	-	-	-	-
IV	19UHR101	Human Rights	1	2	-	50	50	2
	19HEC101	HE – (Personal values & SKY Yoga practice -I)	1	2	25	25	50	1
V		Extension activities (See Annexure –I)						
							500	**17**
	Semester II							
I	19UTL202	Tamil/ Hindi Paper – II	6	3	25	75	100	3
II	19UEN202	English Paper – II	5	3	25	75	100	3
III	19UZY202	**Core Major Paper –II** Chordata	6	3	25	75	100	4
	19UZY203	**Major Practical – I** (Non-Semester Pattern) Non-Chordata & Chordata	2	3	40	60	100	4
	19UBY2A2	**Ancillary Zoology Paper –II** Economic Zoology	6	3	25	75	100	4
	19UBY2A3	**Ancillary Zoology Practical** (Non-Semester Pattern) Paper I & II	2	3	40	60	100	2
IV	19EVS201	Environmental Studies (EVS)	2	2	-	50	50	2
	19HEC202	HE – Family values SKY Yoga practice –II	1	2	25	25	50	1
V		Extension activities (See Annexure –I)						
							700	**23**

	Semester III							
I	19UTL303	Tamil/ Hindi Paper – III	5	3	25	75	100	3
II	19UEN303	English Paper – III	6	3	25	75	100	3
III	19UZY304	**Core Major Paper –IV** Cell Biology	7	3	25	75	100	4
		Major Practical – II (Non-Semester Pattern) Cell biology & Genetics	2	3	-	-	-	-
	19UZY3A4	Ancillary Chemistry Paper – I	6	3	25	75	100	4
		Ancillary Chemistry Practical	2	-	-	-	-	-
IV	19UZY3N1/ 19UZY3N2	**Non-Major Elective (NME)** Public health and hygiene/ Ornamental fish culture/ Basic Tamil paper/ AD Tamil paper	1	2	-	50	50	2
	19HEC303	HE – (Professional values & SKY Yoga practice -III)	1	2	25	25	50	1
V		Extension activities (See Annexure –I)						
							500	**17**
	Semester IV							
I	19UTL404	Tamil/ Hindi Paper – IV	5	3	25	75	100	3
II	19UEN404	English Paper – IV	6	3	25	75	100	3
III	19UZY405	**Core Major Paper –V** Genetics	7	3	25	75	100	4
	19UZY406	**Major Practical – II** (Non-Semester Pattern) Cell biology & Genetics	2	3	40	60	100	4
	19UZY4A5	Ancillary Chemistry Paper – II	6	3	25	75	100	4
	19UZY4A6	Ancillary Chemistry Practical	2	3	40	60	100	2
IV	19UZY4N3 / 9UZY4N4	**Non-Major Elective (NME)** Food and nutrition/ Apiculture / Basic Tamil paper/AD Tamil paper	1	2	-	50	50	2
	19HEC404	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	19UZY507	**Core Major Paper – VII** Developmental Biology	5	3	25	75	100	4
	19UZY508	**Core Major Paper – VIII** Biotechnology	5	3	25	75	100	4
	19UZY509	**Core Major Paper – IX** Biostatistics& Biophysics	5	3	25	75	100	4
	19UZY510	**Core Major Paper – X** Bioinformatics and Biochemistry	5	3	25	75	100	5
	19UZY5E1/ 19UZY5E2	**Core Elective Paper – I & II** Medical Laboratory Technique / Poultry Science And Management Technology	4	3	25	75	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	19UZY5S1/ 19UZY5S2	**Skill Based Elective (SBE)–Online** Network and Information Security Cyber security – Ethical Hacking	1	2	-	50	50	2
	19GKL501	**Skill Based Elective (SBE)–Online** General Knowledge & General Awareness	SS	2	-	50	50	2
	19HEC505	HE – (National values & SKY Yoga practice -V)	1	2	25	25	50	1
							650	**25**
	Semester VI							
III	19UZY611	**Core Major Paper –XI** Animal Physiology & Endocrinology	5	3	25	75	100	5
	19UZY612	**Core Major Paper – XII** Ecology & Evolution	5	3	25	75	100	4
	19UZY613	**Core Major Paper – XIII** Microbiology & Immunology	5	3	25	75	100	4
	19UZY6E3/ 19UZY6E4	**Core Elelctive Paper-III & IV** Sericulture/ Insect Pest Management	4	3	25	75	100	3
	19UZY6E5/ 19UZY6E6	**Core Elective Paper –V&VI** Aquaculture/ Dairy farming and management Technology	5	3	25	75	100	5
	19UZY614	**Major Practical – III** (Non-Semester Pattern) Developmental Biology, Animal Physiology & Endocrinology, Biostatistics &Biophysics, Bioinformatics &Biochemistry & MLT	2	3	40	60	100	4
	19 UZY615	**Major Practical – IV** (Non-Semester Pattern) Ecology, Evolution, Biotechnology, Microbiology , Sericulture and Aquaculture	2	3	40	60	100	4
IV	19UZY6S3	**Skill Based Elective (SBE)** Vermiculture	1	2	-	50	50	2
	19UZY6S4	**Skill Based Elective (SBE)** Biopharmaceuticals						
	19 HEC606	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.	19 UNC 401	NCC
2.	19 UNS 402	NSS
3.	19 USG 403	Sports and Games
4.	19 URO 404	Rotract Club
5.	19 URR 405	Red Ribbon Club
6.	19 UYR 406	Youth Red Cross
7.	19 UCA 407	Consumer Awareness Club
8.	19 UED 408	Entrepreneurship Development Cell
9.	19 UCR 409	Center for Rural Development
10.	19 USS 410	Student Guild of Service
11.	19 UGS 411	Green Society
12.	19 UEO 412	Equal Opportunity Cell
13.	19 UFA 413	Fine Arts Club

List of Part III Subjects (Core Elective Papers)

S.No	Subject Code	Subjects
1.	19UZY5E1	Medical Laboratory Technique
2.	19UZY5E2	Poultry Science And Management
3.	19UZY6E3	Sericulture
4.	19UZY6E4	Insect Pest Management
5.	19UZY6E5	Aquaculture
6.	19UZY6E6	Dairy farming and management

General Question Pattern
PART I,II & III

Max. Marks: 100	**Internal: 25**	**External : 75**	
Section	Pattern	Mark	Total
Part A	1-5 Multiple choice with 4 options (One question from each unit)	10X1	10
	6-10 Short answers (One question from each unit)		
Part B	11-15 Either /Or type (One question from each unit)	5X5	25
Part C	16-21 Four out of six (Question no. 16 is compulsory)	4X10	40
		Total :	75

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	5X1	5
	6-10 Short answers (One question from each unit)	5X1	5
Part B	Answer any questions five out of eight (11-18)	5X8	40
		Total :	50

Bloom's Taxonomy Based Assessment Pattern

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

1. Theory: 75 Marks

(i) TEST- I & II and ESE:

Knowledge Level	Section	Marks	Description	Total
K1 & K2	A(Answer all)	10x1=10	MCQ/Define	75
K3	B (Either or pattern)	5x5=25	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	75	$\frac{75+75+25}{7}$	25
Test 2	75		
Assignment/Seminar	25		

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 vermiculture, sericulture, apiculture, aquaculture, Medical laboratory techniques, microbiology, animal tissue culture, bioinformatics etc.

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. M. Durairaju Signature:	**Dr. M. Durairaju** Signature:	**Dr. R. Muthukumaran** Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY101	**Title**	**Batch :**	2019-2022
		Core Major Paper – I Non -Chordata	**Semester**	I
Hrs/Week:	7		**Credits:**	4

Course Objectives

- To understand the different animal groups under different phyla
- To know the Economic importance of Non- chordata
- To keep in mind the internal structure of Non-chordate organisms

Course Outcomes (CO)

K1	CO1	To remember the outline Classification of Nonchordata
K2	CO2	To understand the structure and inter-relationship between non-chordate animals.
K3	CO3	To deploy the each phylum with an example
K4	CO4	To discuss the general topics of each phylum

Unit	Content	Hrs
Unit I	• Outline Classification up to class level with two examples each. General characteristics under mentioned Non- Chordate phyla (Ekambaranatha Iyer Text book to be followed) • **Phylum – Protozoa:** *Plasmodium vivax* – structure Life cycle – Cycle of Golgi - Cycle of Ross o ***Pathogenicity and control of Malaria*** o Economic importance of Protozoa.	**19Hrs**
Unit II	• **Phylum – Porifera** : Leucosolenia - Structure - Reproduction and Life cycle, Canal system in sponges. • **Phylum – Coelenterata:** Obelia – Structure - Reproduction and Life cycle. o Coral reefs – Types and Formation. • **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 o Economic importance of Aschelminthes • **Phylum – Annelida** : Earthworm – Structure - Digestive system - Excretory system and Reproductive system.	**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**.** (2018) A text book of Invertebrates – Saras Publication, Nagercoil.

Books for Reference:

1. Ekambaranatha Iyyer, (1990) A Manual of Zoology, Part I & II, Invertebrata, Revised edition. S. Viswanathan(Printers and Publishers)
2. Jordan E.L & Verma J. K (1995) Invertebrate Zoology, S. Chand & Company, New Delhi.
3. Dhami P.S & Dhami J.K (1990) Invertebrate Zoology, S. Chand & Company
4. Ganguly B.B Sinha.A & Adhikari.S. (1977) 3rdEdition Biology of Animals, Vol –I, Invertebrates New Central Book Agencies.
5. Kotpal R. Agarwal S.K& Khetarpal R.P. (1992) 7th Edition Modern Text Book of Zoology, Invertebrata, , Rastogi Publications.

Mapping

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

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY203	**Title**	**Batch :**	2019-2022
		Major Practical -I Non - Chordata and Chordata	**Semester**	I & II
Hrs/Week:	2		**Credits:**	4

Course Objectives

- To study the morphology and anatomy of invertebrates and vertebrates
- To identify the organisms by field visit
- To get awareness on biodiversity conservation

Course Outcomes (CO)

K3	CO1	To remember external and internal features of organisms
K4	CO2	To understand the unity of life with the rich diversity of organisms and their ecological and evolutionary significance
K5	CO3	To evaluate the conservation awareness of the biosphere by field visit

CONTENT

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

1. Non-Chordata – 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) Obelia
3) *Taenia solium*
4) *Ascaris lumbricoides*
5) Earth worm
6) Sea star
7) Shark
8) Calotes
9) Pigeon
10) Rabbit

B. Draw labeled sketch:

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

C. Biological significance:

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

D. Write descriptive notes:

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

3. 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 campus/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**

Books for Reference:

1. Lal, S. S. (2004) A text book of Practical Zoology Invertebrate. Rastogi Publications, Shivaji Road, Meerut, 250 002, India
2. Lal, S. S. (2004) A text book of Practical Zoology Vertebrate. Rastogi Publications, Shivaji Road, Meerut, 250 002, 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

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19 UBY1A1	**Title**	**Batch :**	2019-2022
		Ancillary Zoology Paper – I Non-chordata and chordata	**Semester**	I
Hrs/Week:	6		**Credits:**	4

Course Objectives

- To study the structure and classification of different animal kingdom.
- To understand the general characters of both chordate and non-chordate phyla
- To know about the different biological systems

Course Outcomes (CO)

K1	CO1	To remember animal external characters and its kingdom wise classification
K2	CO2	To comprehend animal systems and its peculiar characters
K3	CO3	To execute animal general characters and classification strategies
K4	CO4	To sort of animal classification system and its importance

Unit	Content	Hrs
Unit- I	**Classification of the following Phyla up to the class level with suitable examples.** • **Phylum: Protozoa**: Paramecium – Structure- Feeding- Binary fission and Conjugation. • **Phylum: Coelenterata:** Obelia **–** Structure and Life cycle.	**16Hrs**
Unit- II	• **Phylum: Platyhelminthes : *Taenia solium* –** Structure - Reproduction and Life cycle. • **Phylum: Arthropoda**: *Cockroach – Structure*- Mouthparts, Digestive system – Circulatory system, Nervous system and Reproductive system.	**16Hrs**
Unit- III	• **Phylum: Mollusca :** Freshwater mussel **–** Structure – Digestive system- Respiratory system – Circulatory system – Reproductive system. • **Phylum: Echinodermata:** Sea star **–** Structure and Water Vascular system.	**16Hrs**
Unit -IV	• **Phylum: Chordata** • **Sub Phylum: Prochordata –** General Characters of o Amphioxus o Balanoglossus o Ascidian • **Sub Phylum: Vertebrata Class : Pisces** Shark **-** External structure – Digestive & Urinogenital systems o Migration of fishes • **Class : Amphibia:** Frog – External structure – Respiratory system – Heart – Reproductive system.	**15Hrs**
Unit -V	• **Class : Reptilia:** Calotes –*External structure*– Circulatory system- Brain- Reproductive system. • **Class : Aves:** Pigeon – External structure – Flight muscles – Respiratory system – Reproductive system. • **Class : Mammal:** Rabbit **-** External structure – Heart – Excretory system – 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. (2018) Allied Zoology Part I & Part – II – Saras Publications, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari

Books for 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) 3rd Edition Biology of Animals, Vol. –I, Invertebrates, New Central Book Agencies.
5. Kotpal R.L. (1983) Modern Text Book of Zoology, Rastogi Publications.
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	S	M	H	S
CO2	H	M	H	S	H
CO3	M	S	S	M	M
CO4	M	H	H	L	H

S-Strong; 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. M. Durairaju Signature:	Dr.M.Durairaju Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UBY2A3	**Title**	**Batch :**	2019-2022
		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

Course Outcomes (CO)

K3	CO1	To remember the anatomical and morphological structure of animals and micro organisms
K4	CO2	To understand the ecological and biological importance of vertebrates and invertebrates
K5	CO3	To validate the practical efficiency in the animal kingdom structure and function

CONTENT

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

1. **Non-Chordata – Cockroach**
   - External Male
   - External Female
   - Mouth Parts of Cockroach
   - Digestive system
   - Nervous system
   - Male Reproductive system
   - Female Reproductive system
2. **Chordata – Frog**
   - External
   - Digestive system
   - Heart
   - Brain
   - Limbs
   - Male Urinogenital system
   - Female Urinogenital system

2. SPOTTERS

A. Classify giving reasons:

1) Paramecium
2) *Taenia solium*
3) Penaeus
4) Sea star
5) Amphioxus
6) Calotes
7) Pigeon
8) Rabbit

B. Draw labeled sketch:

1) Obelia colony
2) *Taenia solium* – Scolex
3) Frog – Pectoral girdle
4) Calotes – Brain
5) Snake - Poison apparatus
6) Pigeon – Quill feather
7) Rabbit – Dentition
8) Human – Digestive system

C. Biological significance: 1) Obelia Medusa 2) Balanoglossus 3) Honey bee 4) Culex mosquito 5) Earthworm 6) Salamander 7) Silkworm 8) Kangaroo	
D. Write descriptive notes: 1) Paramecium - conjugation 2) Gold fish 3) Sea horse 4) Foot and mouth disease virus 5) Bird flu virus 6) Tortoise 7) Owl 8) Bat	
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**

Books for 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	S	M	H	S
CO2	H	M	H	S	H
CO3	M	S	S	M	M

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology		
Course Code:	19UZY202	**Title**	**Batch :**	2019-2022	
		Core Major Paper – II Chordata	**Semester**	II	
Hrs/Week:	6		**Credits:**	4	

Course Objectives

- To acquire a basic knowledge of chordates
- To know the knowledge about the animal behaviours
- To understand the animals inter- relationships

Course Outcomes (CO)

K1	CO1	To keep in mind the outline Classification of Chordata
K2	CO2	To understand the morphology and anatomy of vertebrates
K3	CO3	To execute interrelationship between Each class
K4	CO4	To discuss the biodiversity of chordates

Unit	Content	Hrs
Unit I	**General characters and outline classification of Phylum Chordata up to class level with suitable examples. (Ekambaranatha Iyer Text Book to be followed)** General characters and affinities of a) Amphioxus b) Balanoglossus c) Ascidian • **Class: Pisces Type – Shark** **Systems:** Externals - Digestive system - Respiratory and Urino– genital system. o ***Parental care in Fishes***	**16Hrs**
Unit II	• **Class: Amphibia Type – Frog** **Systems:** Externals - Girdles and Limbs - Respiratory system – Brain - Cranial nerves and Urino-genital system. o Origin of Amphibia.	**16Hrs**
Unit III	• **Class: Reptilia Type – Calotes** **Systems:** Externals - Digestive system – Brain- Urino–genital system. o South Indian Poisonous and Non-Poisonous Snakes. o Poison apparatus and biting mechanism in Snakes - ***First –Aid for Snake Bite.***	**16Hrs**
Unit IV	• **Class: Aves Type: Pigeon** **Systems**: Externals – Synsacrum - Flight muscles - Digestive system - Respiratory system- Brain- Eye and Urino – genital system. o Flightless Birds o Migration in Birds	**15Hrs**
Unit V	• **Class: Mammalia Type – Rabbit** **Systems:** Externals– 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. (2018) (9th Edition)A text book of Chordata, Saras publications, 114/35 G, A.R.P Camp Road, Periavillai, Kottar PO, Nagercoil -629 002, Kanyakumari

Books for Reference:

1. Ekambaranatha Iyer, (1995) Manual of Zoology, Vol.II (4th 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	S	M	H	H
CO2	M	M	H	H	M
CO3	S	H	S	M	M
CO4	M	M	H	M	M

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UBY2A2	**Title**	**Batch :**	2019-2022
		Ancillary Zoology Paper – II Economic Zoology	**Semester**	II
Hrs/Week:	6		**Credits:**	4

Course Objectives

- To understand the applications of Zoology for developing skills
- To study the ecological and economical aspects of beekeeping, silkworm rearing, poultry keeping, dairy farming and aquaculture
- To understand the arthropod vectors and Human diseases.

Course Outcomes (CO)

K1	CO1	To remember zoological application in day to day life
K2	CO2	To get the idea of ecological and economical application of modern zoology
K3	CO3	To apply zoological knowledge in self employment and functional ecology
K4	CO4	To sort of technical, ecological and economical knowledge in the zoology

Unit	Content	Hrs
Unit- I	**AQUACULTURE** • Scope of Aquaculture • Types of Fisheries 1. Inland fisheries 2. Marine fisheries • Culturable organisms 1. Fin fishes 2. Fishes diseases o Bacteria - Erythroderma , Bacterial Gill Rot o Virus - EUS,IPN, VHS o Fungal - Saprolegniasis • Oyster culture 1. Edible oyster 2. Pearl oyster	**16Hrs**
Unit -II	**APICULTURE** • Scope of Apiculture • Brief account of *A. indica, A. mellifera and A. dorsata* • Products of Bee Keeping 1. Royal jelly 2. Honey 3. Wax 4. Bee venom **DAIRY FARMING** • Scope of dairy farming • A typical dairy farm(dairy house) • Dairy animals: cow • Live stock diseases 1. Mastitis 2. Foot and Mouth disease(FMD) • *Nutritive value of milk* Dairy By-products	**16Hrs**

Unit -III	**SERICULTURE** • Optimum conditions for mulberry growth • Mulberry cutting preparation • Structure of silkworm • Structure of silk gland • Life cycle of *Bombyx mori* • Rearing appliances • Disinfection • Diseases of silkworm 1. Pebrine 2. Viral flacherie • Cocoon market	**16Hrs**
Unit- IV	**POULTRY KEEPING** • 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	**ARTHROPOD VECTORS** o Head louse o Bed bug o Mosquito o Ticks o Fleas –(Rat flea) **HUMAN DISEASES** o Bacterial Diseases : Typhoid fever and Tuberculosis o Viral Diseases : AIDS and Hepatitis o Fungal Diseases	**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.

Mapping

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

S-Strong; 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. M. Durairaju Signature:	Dr.M.Durairaju Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19EVS201	**Title**	**Batch :**	2019-2022
		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

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

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	S	S	M	M
CO4	M	H	H	H	H

S-Strong; H-High; M-Medium; L-Low

Compiled By
Dr. M.Durairaju M.Sc., M.Phil., B.Ed., PGDGC., Ph.D.,
Associate Professor and Head, Department of Zoology
Co-ordinator, Curriculum Development Cell (CDC)
NGM College, Pollachi – 642 001

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Course Teacher	Verified by HOD	Checked by	Approved by
Name and Signature	**Name and Signature**	**CDC**	**COE**
Ms. S. Mariselvi Signature:	Dr. M. Durairaju Signature:	Dr.M.Durairaju Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY304	**Title**	**Batch :**	2019-2022
		Core Major Paper – IV Cell Biology	**Semester**	III
Hrs/Week:	7		**Credits:**	4

Course Objectives

- To study the basic concepts of cell biology
- To acquire the basic knowledge about recent development in cell biology
- To understand the techniques in cytology.

Course Outcomes (CO)

K1	CO1	To remember the overview of cells and their origin and evolution.
K2	CO2	To get the fundamental ideas of prokaryotic and eukaryotic cell.
K3	CO3	To deploy the structure and functions of cell organelles.
K4	CO4	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:** o Fixation o Dehydration o Embedding o Sectioning o Staining o Mounting • *Virus – HIV* • Prokaryotic Cell (*E.coli* bacterium) • Eukaryotic Cell (Typical animal cell)	**19Hrs**
Unit II	• **Organelles**: **Plasma membrane** Structure – Trilaminar model - Bimolecular leaflet model and Fluid mosaic model. General functions of plasma membrane. • **Cytoplasmic matrix:** o Structure o Properties • **Endoplasmic Reticulum**: Ultra Structure – Rough and Smooth types - Functions. • **Ribosomes**: Types – Chemical composition – Biogenesis of 70s - Function	**18Hrs**
Unit III	• **Golgi complex**: Structure and Functions. • **Lysosomes**: Polymorphism – Enzymes and Functions • **Mitochondria**: Structure – mDNA - Origin of mitochondria– General functions. • **Nucleus**: Ultra structure of interface nucleus and function. • **Nucleolus**: Ultra structure and function	**18Hrs**
Unit IV	• **Chromosomes**: Structure – Giant chromosomes – Polytene and Lamp brush. • **Nucleic acids** DNA Structure (Watson & Crick model) o Replication of DNA (Semi-conservative model) o Types of RNA	**18Hrs**

	• **Protein synthesis** o Central dogma and Central dogma reverse o Mechanism of protein synthesis o Components Transcription and Translation.	
Unit V	• **Genetic Code** – Salient features • **Cell division** o Cell cycle o Amitosis, Mitosis and Meiosis • **Cell signaling:** o Characteristics o Cell transduction Pathways • **Cancer cells** o Characteristics – Properties –Types - Diagnosis and Treatment o Oncogenes. • *Cell aging - Causes – Changes and Apoptosis*	**18Hrs**
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

Books for Reference:

1. Verma P.S. and Agarwal V.K. (1993) Cytology–.S.Chand & Company LTD. Ram Nagar, New Delhi -110055
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
3. Singh & Tomar, (2008). 9th revised edition Cell Biology –Rastogi Publications, Shivaji road, Meerut – 250 002, India.
4. E.D.P. De Robertis and E.M.F. De Robertis Jr - Cell and Molecular Biology – 8th Edition, Lippincott Williams and Williams Publishers.

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

S-Strong; 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. Mariselvi Signature:	Dr. M. Durairaju Signature:	Dr.M.Durairaju Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY406	**Title**	**Batch :**	2019-2022
		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 acquire the knowledge in blood grouping.
- To understand the basic concepts in genetics through experiments.

Course Outcomes (CO)

K3	CO1	To keep in mind for identify the different stages of mitosis.
K4	CO2	To understand the concepts of genetics through experiments.
K5	CO3	To access the practical experience in instrument handling.

Syllabus

Content	Hrs
EXPERIMENTS • Measurements of cell using - Stage Micrometer and Ocular Micrometer • Squash preparation from Onion – Root tip – Mitosis • Identification of squamous epithelial cells in buccal smear. • Human Traits survey and gene frequency calculations. • ABO Blood grouping in man – Slide method. • 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. Mitosis – stages 7. Meiosis - stages 8. DNA – Watson & Crick Model 9. Cell cycle 10. Cancer cells 11. tRNA - structure 12. Haemoglobin - Structure **GENETICS** 1. Drosophilla – Male and Female 2. Gynandromorph 3. Hairy Pinna 4. Twins 5. Erythroblastosis Foetalis 6. Kleinfelter's Syndrome 7. Down Syndrome 8. Turner's Syndrome 9. Free – martin cattle 10. Sickle cell anemia 11. Atavism 12. Pedigree of Albinism	
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 (2017) Practical Zoology Vol.3 Saras Publication, Nagarcoil, Tamil Nadu
2. Lal, S. S. (2008). A text book of Practical Zoology. Rastogi Publications, Shivaji Road, Meerut.

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

S-Strong; 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. Mariselvi Signature:	Dr. M. Durairaju Signature:	Dr.M.Durairaju Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY3N1	**Title**	**Batch :**	2019-2022
		Public Health and Hygiene Non- Major Elective (NME)	**Semester**	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

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

Unit	Content	Hrs
Unit I	• Introduction to public health • **Health indicators** *Personal hygiene, Public health* • **Health** Dynamics of disease transmission – 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, Malaria, Filariasis, 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 and Global health council • *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

Books for 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	S	H	H	S
CO2	H	H	H	S	H
CO3	H	S	S	M	H
CO4	S	H	H	H	S

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY3N2	**Title**	**Batch :**	2019-2022
		Ornamental Fish Culture Non- Major Elective (NME)	**Semester**	III
Hrs/Week:	1		**Credits:**	2

Course Objectives

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

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

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	S	M	H	S
CO2	H	M	H	S	H
CO3	M	S	S	M	M
CO4	M	H	H	M	H

S-Strong; H-High; M-Medium; L-Low

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Dr. S. Christobher Signature:	Dr. M. Durairaju Signature:	Dr.M.Durairaju Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY405	**Title**	**Batch :**	2019-2022
		Core Major 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 acquire knowledge of Cancer cells and treatment.

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

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 Interference and Coincidence o Chromosome map in Drosophila (Three Point Cross) • **Sex determination**: o XX – XY type – Man o ZZ –ZW type – Fowl o XX-XO type - Grasshopper o Bridge's genic balance theory o Hymenopteran type – Honey bee o Gynandromorph – Drosophila o Hormonal control – Free Martin Cattle.	**18Hrs**
Unit III	• **Sex linked inheritance** o Eye colour in Drosophila o Haemophilia and colour blindness in man – problems o Hairy pinna in man. • **Variation in chromosome number** Euploidy and Aneuploidy	**18Hrs**
Unit IV	• **Syndromes** o Autosomal – Down syndrome and Patau's syndrome. o Allosomal – Klienfelter's syndrome and Turner's syndrome • Pedigree analysis • Twins • **Inborn Errors of metabolism** o Phenylketoneuria o Alcaptonuria o Albinism	**18Hrs**

	• ***Eugenics –*** *Positive and Negative Eugenics*	
Unit V	• **Nucleic acids as genetic material:** - DNA as Genetic material: ✓ Bacterial transformation ✓ Bacterial conjugation ✓ Transduction ✓ Bacteriophageinfection - Indirect evidences of DNA as genetic material - Biochemical evidences of DNA as genetic material - RNA as Genetic material (TMV) • **Mutation**: o Detection of mutations – CIB method in Drosophila o Molecular basis of gene mutation – Substitution mutations and Frame shift mutations • **Population Genetics** o Gene pool o Gene frequency and genotype frequency o Hardy Weinberg law.	**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

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

S-Strong; 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. Mariselvi Signature:	Dr. M. Durairaju Signature:	Dr.M.Durairaju Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19 UZY 4N3	**Title**	**Batch :**	2019-2022
		Food and Nutrition Non- Major Elective (NME)	**Semester**	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.

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

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	S	H	H	M	S
CO2	S	M	S	M	S
CO3	H	H	H	H	H
CO4	M	S	M	H	M

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY4N4	**Title**	**Batch :**	2019-2022
		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

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 and its byproducts

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* o *Apis mellifera* 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 Modern bee hive o Langstroth hive o Newton's hive	**3Hrs**
Unit- III	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	S	M	H	S
CO2	H	M	H	S	H
CO3	M	S	S	M	M
CO4	M	H	H	L	H

S-Strong; 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. M. Durairaju Signature:	Dr. M .Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19 UZY 507	**Title**	**Batch :**	2019-2022
		Core Major 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.

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

Unit	Content	Hrs
Unit -I	• Definition-Ontogeny - Phylogeny 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** comparison of the cleavage and gastrulation of frog and 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 • **Neoteny** types-factors affecting neoteny- Evolutionary significance	**13Hrs**

	• **Organizer** structure-properties- types of induction– embryonic induction - mechanism of induction • **Nuclear transplantation** types- techniques • **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. Arumugam .N. (2018) Developmental Zoology - Saras Publication,114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamilnadu, India, 2011
2. Veer Bal Rastogi 2017. Chordate embryology Kedar nath ram nath , 132. R.G. College road, Meerut-250 001

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.

Mapping

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

S-Strong; 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.M.Durairaju Signature:	Dr.M.Durairaju Signature:	Dr. R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY508	**Title:**	**Batch :**	2019-2022
		Core Major Paper – VIII Biotechnology	**Semester**	V
Hrs/Week:	5		**Credits:**	4

Course Objectives

- To study the basics and applied aspects of biotechnology
- To understand the different applications of biotechnology
- To acquire the knowledge on bioethics and patenting in biotechnology.

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 analyze the application of biotechnology and make interest in Bio safety Measure.

Unit	Content	Hrs
Unit I	• Introduction- scope and importance of biotechnology • Plasmids pBR 322 • Cosmids • Transposons • Gene map of λDNA • Construction of recombinant DNA	**13Hrs**
Unit II	• **Blotting Techniques:** ➢ Southern Blotting ➢ Northern Blotting ➢ Western Blotting • Polymerase Chain Reaction (PCR) – Applications of PCR in Biotechnology • DNA Finger printing • *Genomic library*	**13Hrs**
Unit III	• Establish cell lines • Kinetics of cell growth • Hybridoma technology • Monoclonal antibodies • Transgenic animals – Mice Retroviral method Microinjection method Embryonic stem cell 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 o Application of animal bio-reactors o Nano- biotechnology	**13Hrs**
Unit V	• Bacillus thuringensis as a pesticide • Biofertilizer • Biosensors- Biochips • Biosafety	**13Hrs**

	○ *Possible dangers of GEO's* ○ Implementation of biosafety guidelines • Bioethics ○ Monitoring the welfare of transgenic animals ○ Keeping of transgenic animals Patenting- Biotechnology inventions ▪ 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. Kumaresan V. and Arumugam N (2017) Animal Biotechnology –Saras publications, 114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamilnadu, India
3. 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

Mapping

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

S-Strong; 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. M. Durairaju Signature:	Dr.M.Durairaju Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY509	**Title**	**Batch :**	2019-2022
		Core Major Paper –IX Biostatistics and Biophysics	**Semester**	V
Hrs/Week:	5		**Credits:**	4

Course Objectives

- The basic knowledge about Biostatistics and Biophysics.
- To understand the basic principles of instruments
- To acquire knowledge about the basic formula used in biology.

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.

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 of table o Simple and complex table • **Diagrammatic presentation** o Line diagram o Bar diagram o *Pie diagram* • **Measures of central tendency** o Arithmetic mean o Individual - Discrete and Continuous series o Median o Mode	**13Hrs**
Unit II	• **Standard deviation** o Individual - Discrete and Continues series o Merits and demerits • **Correlation** o Karl Pearson's coefficient of correlation o Positive and negative correlation • **Regression analysis** o Types and methods	**13Hrs**
Unit III	• **Chi-square Test** o Degrees of freedom o Null hypothesis • **Probability** o Types of probability o Rules of probability • **Analysis of Variance (ANOVA) -** One-way analysis	**13Hrs**
Unit IV	• **Scope of biophysics** • **Thermodynamics principles** o First and second law • **Bioluminescence** o Types o Mechanisms o Functions	**13Hrs**

Unit V	• **Instrumentation** o *Compound microscope* o Electron microscope - Transmission Electron Microscope (TEM) and Scanning Electron Microscope (SEM) o Chromatography - Thin layer chromatography (TLC) o Spectrophotometer o Electrophoresis – Polyacrylamide Gel Electrophoresis (PAGE)	**13Hrs**
Total Contact Hrs		**65**

➢ *Italics denoted as self study topic*

Assignment , PPT, Seminar, group discussions

Books for Study:

1. Arumugam N. (2018), 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.

Mapping

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

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY614	**Title** **MAJOR PRACTICAL-III** (Developmental biology, Biostatistics& Biophysics, Animal Physiology and Endocrinology, Bioinformatics and Biochemistry and Medical Laboratory Technique)	**Batch :** **Semester**	2019-2022 V & VI
Hrs/Week:	2		**Credits:**	4

Course Objectives

- To study the practical knowledge about the Developmental Biology, Biostatistics& Biophysics, Bioinformatics and Biochemistry , Animal Physiology & Endocrinology, MLT
- To know about the structure and functions of various biomolecules
- To get knowledge on blood cell count and its importance

Course Outcomes (CO)(for Practicals Only)

K3	CO1	To recollect the importance of laboratory test
K4	CO2	To understand the normal level of human samples
K5	CO3	To apply the instruments used in biological experiment.

Content

EXPERIMENTS

- Qualitative detection of Excretory products
- Total count of RBC
- Total count of WBC
- Estimation of heamoglobin
- Preparation of Blood smear
- Bleeding and clotting time
- Preparation of haemin crystals
- Find the mean and Standard deviation of the given samples

SPOTTERS

Developmental Biology (structure/developments)

- Frog- Egg
- Frog- Cleavage
- Frog- Yolk plug
- Chick- Egg
- Chick embryo - 24 hours
- Chick embryo - 72 hours
- Chick embryo - 96 hours

Animal physiology & Endocrinology (structure and function)

- T. S. of Thyroid gland
- T. S. of Ovary
- T. S. of Testis
- Mammalian Eye
- Mammalian Ear
- Mammalian Heart
- Mammalian Kidney

Biostatistics and Biophysics (statistical importance)

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

• Electrophoresis – PAGE • pH meter **Medical Laboratory Technique (MLT) – (structure, principle and uses)** • Heamocyto meter • Sahli's heamometer • Albuminometer • BP apparatus • Urinometer • Ultra Centrifuge • Autoclave • UV Spectrophotometer **Bioinformatics and Biochemistry (Structure and uses)** • Phylogenetic tree (Rooted tree) • RasMol (Visualization tool) • Structure of pentose • Structure of sucrose • Structure of starch • 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	S	H	S	H
CO2	M	H	M	H	M
CO3	S	H	H	M	M

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY615	**Title**	**Batch :**	2019-2022
		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, sericulture and aquaculture
- To study the physico-chemical nature of environment.
- To understand the different water quality analysis

Course Outcomes (CO)

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

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

- Sacculina on Crab
- Albunea
- Hippa
- Anguilla
- Coccyx
- Fossil
- Peppered moth
- Vermiform appendix

Biotechnology/ Microbiology

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

Sericulture

- Silkworm
- Cocoon

- Mulberry shoot
- Mulberry leaf
- Netrika/chandrika
- Leaf Mosaic disease
- Leaf Blight disease

Aquaculture

- Common Carp
- Gill net
- Hook
- Fish parasite – Argulus
- Chinese dip net
- Edible Oyster
- Pearl oyster – *Pinctada vulgaris*

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

Mapping

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

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

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY510	**Title**	**Batch :**	2019-2022
		Core Major Paper - X Bioinformatics and Biochemistry	**Semester**	V
Hrs/Week:	5		**Credits:**	5

Course Objectives

- 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, phylogenetic analysis and sequence analysis
K3	CO3	To apply the basic and applied knowledge of Biochemistry
K4	CO4	To sort the core principles of biochemistry.

Unit	Content	Hrs

Unit I	• Scope of Bioinformatics
	• Databases
	  o Biological database (Properties and classification)
	  o Specialized database
	• Protein sequence database – SWISS-PROT
	• Data mining
	• Virtual Library
		13Hrs

Unit II	• Genomics – Definition, classification and applications
	• Proteomics – Definition, classification and applications
	• Drug designing
	• Human genome project
	  o Goals and techniques
	  o Potential benefits
	• *Bioinformatics tools and its uses*
		13Hrs

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

Unit IV	**Biochemistry**
	• **Classification of Carbohydrates:**
	  o Monosaccharides : Pentoses- Hexoses
	  o Disaccharides:
	  ▪ -Non-reducing sugar C1- C1-Sucrose
	  o Reducing Sugar C1 – C4 -Lactose
	  o Polysaccharides - Homopolysaccharide - Starch
	  Heteropolysaccharide - Heparin
	• **Classification of Lipids:**
	  o Simple Lipids - Fats and Waxes
	  o Compound lipids -Phospholipids- Glycolipids
	  o Derived lipids -Glycerol - Fatty acids and Cholesterol
		13Hrs

	• **Classification of Proteins:** o Based on structure : Simple – Conjugated and Derived proteins. o Based on solubility: Globular and Fibrous proteins	
Unit V	• **Metabolism:** o Metabolism of carbohydrates: Glycolysis-Glycogenesis- Kreb's cycle & Glycogenolysis o Metabolism of lipids :β-oxidation of fatty acids o Metabolism of proteins :Transamination and Deamination o *Vitamins: Water soluble & Fat soluble*.	**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. (2015) 5th edition 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	S	M	H	H
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	H	H

S-Strong; 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. Mariselvi Signature:	Dr. M. Durairaju Signature:	Dr.M.Durairaju Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology		
Course Code:	19UZY5E1	**Title**	**Batch :**	2019-2022	
		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 know the knowledge about sexual diseases
- To acquire the knowledge about instruments usage

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

Unit	Content	Hrs
Unit I	• **Introduction & instruments** 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 Automatic analyzer -Blood 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	**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 Venereal 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. Samuel, K. M. (1982) Notes on Clinical Lab Techniques. K. Gopalan publishers, Madras
3. 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

Mapping

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

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY5E2	**Title**	**Batch :**	2019-2022
		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

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. 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	S	S	M	M
CO4	M	H	H	H	H

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY5S1	**Title**	**Batch :**	2019-2022
		Network and Information Security (SBE- Online)	**Semester**	V
Hrs/Week:	1		**Credits:**	2

Course Objective

- To impart knowledge of Network security, Wi-Fi security, hackers, secure networking and password managers.

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

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	S	M	H	S
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	H	H

S-Strong; 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. M. Durairaju Signature:	Dr.M.Durairaju Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY5S2	**Title**	**Batch :**	2019-2022
		Cyber security – Ethical Hacking (SBE – Online)	**Semester**	V
Hrs/Week:	1		**Credits:**	2

Course Objective

- To understand the basics of cyber security and how ethical hacking is done on Cyber space and how to secure and protect them like security experts

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

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	S	M	H	S
CO2	H	M	H	M	H
CO3	M	H	M	M	M
CO4	M	M	H	H	H

S-Strong; 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. M. Durairaju Signature:	Dr.M.Durairaju Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY 611	**Title**	**Batch :**	2019-2022
		Core Major 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

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 and 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 • **Circulation:** o Myogenic & Neurogenic heart o Pacemaker and electrical activity of heart in man o Composition and functions of blood o *Composition and functions of Lymph*	**13Hrs**
Unit- II	• **Water Balance:** o Osmatic and Ionic regulations in aquatic animal (Fish) • **Receptors:** o Chemoreceptors - Gustatoreceptors & o Olfactoreceptors o Photoreceptor (Eye) o Phonoreceptor (Ear) • **Effectors:** o Types of muscles : Striped- unstriped and cardiac muscles o Structure and properties of striped muscle o Mechanism of muscular contraction- sliding filament theory.	**13Hrs**
Unit -III	• **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 • **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	**13Hrs**

	• **Sexual cycle in human**: o Puberty o Spermiation o Ovulation o Menstrual cycle o Pregnancy and Parturition.	
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. Arumugam N. (2017) Animal physiology- Saras Publication, 114/35G, A.R.P Camp Road, Periavilai, Kottar Post, Nagercoil - 629002 , Tamil nadu, India
2. Rastogi S.C. (2008) Essentials of Animal Physiology, 4th Edition . New age international publishers.

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.

Mapping

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

S-Strong; 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. M. Durairaju Signature:	Dr.M.Durairaju Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology		
Course Code:	19UZY612	**Title**	**Batch :**	2019-2022	
		Core Major Paper – XII Ecology and Evolution	**Semester**	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.

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

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 • **Isolating mechanism** o Geographic isolation o Reproductive isolation • **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. (2018) 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

Mapping

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

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology		
Course Code:	19UZY613	**Title**	**Batch :**	2019-2022	
		Core Major 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

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

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 Bacteriophages – life cycle - lytic - lysogenic	**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 ▪ *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 *Properties of tumor cells* 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

Books for 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	S	S	H	H	S
CO2	H	H	S	S	H
CO3	S	S	S	H	S
CO4	H	H	H	H	H

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY6E3	**Title**	**Batch :**	2019-2022
		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 and silk reeling techniques.
- To know about the Central Silk Board and its functions.

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.

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* • Central and state silk board - Functions • 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 Brushing • Silkworm rearing appliances	**10 Hrs**
Unit IV	• Disinfection • Rearing of mature larvae: Shelf- Floor and shoot rearing • Characteristics features of ripeworm • Mounting: Methods and precaution during mounting • Diseases of silk worms: o Pebrine o Viral Flacherie (IFV) o Grasserie :Nuclear Polyhedrosis (NPV)	**11 Hrs**

	• Indian Uzi fly (Pest of silk worm)	
Unit V	• 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. (2008) 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

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

S-Strong; 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. Mariselvi Signature:	Dr. M. Durairaju Signature:	Dr.M.Durairaju Signature:	R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology		
Course Code:	19UZY6E4	**Title**	**Batch :**	2019-2021	
		Core Elective Paper- IV Insect Pest Management	**Semester**	VI	
Hrs/Week:	5		**Credits:**	5	

Course Objectives

- To study the insect available in the agricultural field
- To know about the pesticides
- To get knowledge about the pest control management

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

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	S
CO2	S	M	H	H	H
CO3	S	S	S	M	M
CO4	H	H	H	M	H

S-Strong; 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. Mariselvi Signature:	Dr. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B.Sc	**Programme Title :**	Zoology	
Course Code:	19UZY6E5	**Title**	**Batch :**	2019-2022
		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.

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

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. (2018) 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	S	M	H	H
CO2	H	M	H	S	H
CO3	M	H	S	M	M
CO4	M	H	H	H	H

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY 6E6	**Title**	**Batch :**	2019-2022
		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.

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.

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	S	M	H	H
CO2	H	M	H	S	H
CO3	M	H	S	M	M
CO4	M	H	H	H	H

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY6S3	**Title**	**Batch :**	2019-2022
		Vermiculture (SBE)	**Semester**	VI
Hrs/Week:	1		**Credits:**	2

Course Objectives

- To study the importance of vermiculture
- 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

Unit	Content	Hrs
Unit I	• Systematic position of Earthworm – Habit and Habitat Commercial varieties of Earthworm for Vermicomposting. o *Economic importance of vermiculture*	**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 Diseases and Predators of Earthworm Control measures	**2Hrs**
Unit IV	o Types of soil o Biomass o Biodegradable wastes o Nutrient content of Soil and Biomass	**2Hrs**
Unit V	o Preparation of Vermibed o Maintenance of Composting pit o Collection of vermicompost o Nutrient value 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	S	M	H	S
CO2	H	M	H	H	H
CO3	M	H	H	M	M
CO4	M	H	H	H	H

S-Strong; 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. M. Durairaju Signature:	Dr.M.Durairaju Signature:	Dr.R.Muthukumaran Signature:

Programme code:	B. Sc	**Programme Title :**	Zoology	
Course Code:	19UZY6S4	**Title**	**Batch :**	2019-2022
		Biopharmaceuticals (SBE)	**Semester**	IV
Hrs/Week:	1		**Credits:**	2

Course Objectives

- To enable the students to know the actual path of metabolism of drugs and drug discovery.

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

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	• **Pharmaceutical products of DNA technology:** Therapeutic proteins – Insulin- human growth hormone- Diuretics- clotting factors-Vector usage strategies for gene therapy; *Clinical trials*	**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	S	S	M	H	S
CO2	H	M	H	H	H
CO3	M	S	S	M	M
CO4	M	H	H	M	M

S-Strong; 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. M. Durairaju Signature:	Dr. M. Durairaju Signature:	Dr. R. Muthukumaran Signature: