THIRUVALLUVAR UNIVERSITY

BACHELOR OF SCIENCE
B.Sc. ZOOLOGY
DEGREE COURSE

(With effect from 2022 - 2023)

The Course of Study and the Scheme of Examinations

S. No.	Part	Study Components Course Title		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
		SEMESTER I					**CIA**	**Uni. Exam**	**Total**
1.	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2.	II	English (CE)	Paper-1	6	4	**Communicative English I**	25	75	100
3.	III	Core Theory	Paper-1	6	4	Invertebrata	25	75	100
	III	Core Practical	Practical-1	4	0	Invertebrata and chordata	0	0	0
4.	III	Allied -1	Paper-1	4	3	(To choose 1 out of 3) 1. Chemistry – I 2. Botany – I 3. Economic Entomology – I	25	75	100
	III	Allied- 1	Practical-1	2	0		0	0	0
5.	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English I**	**25**	**75**	**100**
6.	IV	Environmental Studies		2	2	Environmental studies	25	75	100
		Sem. Total		**36**	**20**		**150**	**450**	**600**
		SEMESTER II					**CIA**	**Uni. Exam**	**Total**
7.	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
8.	II	English (CE)	Paper-2	4	4	**Communicative English II**	25	75	100
9.	**II**	**NMSDC I : Language Proficiency for Employability**	**Paper 1**	**2**	**2**	**Effective English**	**25**	**75**	**100**
10.	III	Core Theory	Paper-2	5	4	Chordata	25	75	100
11.	III	Core Practical	Practical-1	3	2	Invertebrata and chordata	25	75	100
12.	III	Allied-1	Paper-2	4	3	(To choose 1 out of 3) 1. Chemistry II 2. Botany II 3. Economic Entomology II	25	75	100
13.	III	Allied Practical - 1	Practical-1	2	2		25	75	100
14.	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English II**	25	75	100
15.	IV	Value Education		2	2		25	75	100

16.	IV	Soft Skill		2	1		25	75	100
		Sem. Total		**36**	**27**		**250**	**750**	**1000**
		SEMESTER III					**CIA**	**Uni. Exam**	**Total**
17.	I	Language	Paper-3	6	4	Tamil/Other Languages	25	75	100
18.	II	English	Paper-3	6	4	English	25	75	100
19.	III	Core Theory	Paper-3	4	4	Cell and molecular Biology	25	75	100
	III	Core Practical	Practical- II	3	0	Cell and molecular Biology	0	0	0
20.	III	Allied-2	Paper-3	4	3	**(To choose 1 out of 3)** 1. Chemistry - I 2. Botany - I 3. Economic Entomology - I	25	75	100
		Allied Practical - 2	Practical-2	3	0		0	0	0
21.	IV	Skill Based Subject	Paper-1	2	2	**(To choose 1 out of 2)** 1.Vermiculture 2. Single Cell Protein Culture	25	75	100
22.	IV	Non-Major Elective	Paper-1	2	2	**(To choose 1 out of 2)** 1.Public Health and Hygine 2.Poultry Farming	25	75	100
		Sem. Total		**30**	**19**		**150**	**450**	**600**
		SEMESTER IV					**CIA**	**Uni. Exam**	**Total**
23.	I	Language	Paper-4	6	4	Tamil/Other Languages	25	75	100
24.	II	English	Paper-4	6	4	English	25	75	100
25.	III	Core Theory	Paper-4	4	4	Genetics and Biotechnology	25	75	100
26.	III	Core Practical	Practical-2	3	3	Cell and molecular Biology and Genetics and Biotechnology	25	75	100
27.	III	Allied-2	Paper-4	4	3	(To choose 1 out of 3) 1. Chemistry II 2. Botany II 3. Economic Entomology II	25	75	100
28.	III	Allied Practical - 2	Practical-2	3	2		25	75	100
29.	IV	**NMSDC II : Digital Skills for Employability**	**Paper-2**	**2**	**2**	**Office Fundamentals**	**25**	**75**	**100**
30.	IV	Non-Major Elective	Paper-2	2	2	**(To choose 1 out of 2)** 1. Bio-Fertilizer Production 2. Aquarium Fish keeping	25	75	100
		Sem. Total		**30**	**24**		**200**	**600**	**800**
		SEMESTER V					**CIA**	**Uni.**	**Total**

								Exam	
30.	III	Core Theory	Paper-5	6	6	Bio-Statistics and Bio-Informatics	25	75	100
	III	Core Practical	Practical-3	3	0	Bio-Statistics and Bio-Informatics Developmental Biology and Immunology Animal Physiology	0	0	0
31.	III	Core Theory	Paper-6	6	6	Developmental Biology and Immunology	25	75	100
		Core Practical	Practical-4	3	0	Environmental Biology Economic Zoology	0	0	0
32.	III	Core Theory	Paper-7	6	5	Animal Physiology	25	75	100
33.	III	Internal Elective	Paper-1	3	3	(To choose 1 out of 2) 1. NanoTechnology in Life Sciences 2.Human Endocrinology	25	75	100
34.	IV	Skill Based Subject	Paper-2	3	2	(To choose 1 out of 2) 1. Animal Behavior 2.VegetableMeat Culture	25	75	100
		Sem. Total		**30**	**22**		**125**	**375**	**500**
		SEMESTER VI					**CIA**	**Uni. Exam**	**Total**
35.	III	Core Theory	Paper-8	5	5	Environmental Biology	25	75	100
36.	III	Core Theory	Paper-9	5	5	Economic Zoology	25	75	100
37.	III	Core Practical	Practical-3	3	3	Bio-Statistics and Bio-Informatics Developmental Biology and Immunology Animal Physiology	25	75	100
38.	III	Core Practical	Practical-4	3	3	Environmental Biology Economic Zoology	25	75	100
39.	III	Compulsory Project	Paper-10	5	5	Individual / Group Project	25	75	100
40.	III	Internal Elective	Paper-2	3	3	(To choose 1 out of 2) 1. Evolution 2.Microbiology	25	75	100
41.	III	Internal Elective	Paper-3	3	3	(To choose 1 out of 2) 1. Bio Chemistry 2.Applied Entomology	25	75	100
42.	IV	Skill based Subject	Paper-3	3	2	(To choose 1 out of 2) 1.Medical Lab Technology 2.Industrial Fishery Management	25	75	100
43.	V	Extension Activities		0	1		100	0	100

44.		**NMSDC III : Employability Readiness**		**--**	**--**	**(choose any one)** • **Naandi** • **Unnati** • **Quest** • **Izpay** • **IBM Skills build**			
		Sem. Total		**30**	**30**		**300**	**600**	**900**
					142				

திருவள்ளுவர்பல்கலைக்கழகம்
THIRUVALLUVAR UNIVERSITY
SERKKADU, VELLORE - 632 115

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
B.Sc. Zoology
with effect from 2022-2023 onwards

Semester: I **Paper type: core**

Paper code:CZO11Name of the Paper: Invertebrata **Credit: 4**

Total Hours per Week:6 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

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Course Objectives

1. To acquire wide knowledge on the biological diversity of invertebrata.
2. To understand the systematic and functional morphology of invertebrates.
3. To impart knowledge on parasitic forms of lower invertebrates.
4. To study the Economic importance, Affinities and various adaptive features of invertebrates.
5. To understand evolutionary significance of invertebrates

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied Unit I : Students will be able to summarise the general characters, classify the animals of the phylum Protozoa. Understand and illustrates life history of Protozoans parasites.

2. After studied Unit II : Students will be able to summarise the general characters, classify the animals of the phylum Porifera and Coelenterata. Understands and illustrates life history of Sycon and Obelia. Narrates Polymorphism inCoelenterata.

3. After studied Unit III : Students will be able to summarise the general characters, Classify the animals of the phylum Helminthes and Annelida. Understands and illustrates parasitic adaptations and life history of Taenia solium - able to explains all the systems in Neries.

4. After studied Unit IV : Students will be able to summarise the general characters,

classify the animals of the phylum Arthropoda.
Narrates all the systems of Prawn. Illustrate the affinities of Peripatus.

5. After studied Unit V : Students will be able to summarise the general characters, classify the animals of the phylum Mollusca and Echinodermata. Understands and illustrates life history of Freshwater mussel and Sea star. Illustrate the larval forms of Echinodermata and their significance.

Matching Table (put Yes / No in the appropriate box)

Unit	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
1	YES	YES	YES	YES	NO	NO
2	YES	YES	YES	YES	NO	NO
3	YES	YES	YES	YES	NO	NO
4	YES	YES	YES	YES	NO	NO
5	YES	YES	YES	YES	NO	NO

Unit-1: Principles of Taxonomy – Binomial nomenclature-rules of nomenclature – classification of the animal kingdom. PROTOZOA: General characters and classification up to classes with examples. Type study- paramecium, parasitic protozoans [Entamoeba, Trypanosoma and plasmodium]

Teaching Hours: 12

Unit-2: PORIFERA: General characters and classification up to classes with examples. Type study - sycon, spicules and canal system in sponges. COELENTERATA: General characters and classification up to classes with examples. Type study – Obelia, polymorphism in coelenterates – corals and coral reefs.

. Teaching Hours: 12

Unit-3: HELMINTHES: General characters and classification up to classes with examples. Type study – Taenia solium. helminthes parasites (Wuchereriabancrofti, Ascaris and Faciola). ANNELIDA: General characters and classification up to classes with examples. Type study: Nereis, metamerism in Annelids, parasitic adaptations of Leech. Teaching Hours: 12

Unit-4: ARTHROPODA: General characters and classification up to classes with examples. Type study – Prawn, Peripatus and its affinities, Mouth parts of insects.Teaching Hours: 12

Unit-5: MOLLUSCA: General characters and classification up to classes with examples. Type study – Fresh water Mussel, Economic importance of mollusca. ECHINODERMATA: General

characters and classification up to classes with examples. Type Study- Sea star, Echinoderm larvae and their significance. Teaching Hours: 12

Internal Assessment Methods: (refer the instructions)

Text book:

1. EkambaraathaAyyar. M. and T.N. Anantha Krishnan, 1992 Mannual of zoology Vol. 1 (Invertebrata
2. E.L. Jordan &Dr. P.S. Verma - Invertebrate Zoology.
3. R.L. Kotpal - Modern Text book of Zoology – Invertebrates.
4. N. Arumugam, M.G. Ragunathan. - A text book of Invertebrates.
5. Dr. Dev Bhattacharya - Text book of Invertebrate Zoology.
6. S. Chand - Invertebrate Zoology.
7. S.S. Lal - Invertebrate Zoology.
8. Rajesh Kumar Shal - Invertebrate Zoology.
9. P.S. Dhami and J.K. Dhami – Invertebrate Zoology.
10. Dr. Veer Bala Rastogi – Invertebrate Zoology.

Reference Book:

1. Viswanathan (Printers and Publishers) pvt. Ltd, Madras
2. Kotpal, R.L. 1988-1992 Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. L.A Borrandile and F.A. Pott. The invertebrates. Cambridge university press. UK.
4. Adam Sedgwick 1972. A student text book of zoology Vol. I and II. Central book Depot. Allahabad.
5. Hyman L.H. The invertebrate Vol. I – IV, 1995 MCGraw Hill co. New York.
6. Barrington, E J W 1969 – Invertebrate structure and function. ELBS Publication.
7. Barnes. Invertebrate Zoology. Toppan International Co.
8. Marshall & Williams - Text book of Invertebrate zoology – 8th Edition.
9. Jan A. Pechenik - Biology of the Invertebrates.
10. Parker and Haswell - Text book of Invertebrate Zoology.

Course Material: website links, e-Books and e-journals

1. **Error! Hyperlink reference not valid.**>
2. **Error! Hyperlink reference not valid.**
3. https://www.merriam-webster.com
4. **Error! Hyperlink reference not valid.**
5. https://www.biodiversitylibrary.org>

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	M	M	S	S	M
CO2	S	S	S	-	M	M		S	S	M
CO3	S	S	-	M	-	M		S	S	M
CO4	S	S	S	-	M	M	M	S	S	M
CO5	S	S	S	M	M	M	M	S	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: I **Paper type: Allied**

Paper code: **Name of the Paper: Economic Entomology-I** **Credit: 3….**

Total Hours per Week: …4.. Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

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Course Objectives

1.To enable learners to categorize insects on the basis of morphological characteristics

2.To study the general anatomy and physiology of specific useful and harmful insects.

3.To study the different life processes of harmful insects

4.To study the versatile roles of insects in agriculture

5.To study the economic importance of insects as vectors, pollinators, predators & parasites

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand basis of classification

2. After studied unit-2, the student will be able to be able to understand the difference in the life cycles of insects

3. After studied unit-3, the student will be able to understand life processes of certain harmful insects

4. After studied unit-4, the student will be able to understand the various ecological importance of insects

5. After studied unit-5, the student will be able to understand need for conservation of insects

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	Yes	No	Yes

Unit-1: Classification of insects [Major orders]

Biology of Butterfly Teaching Hours: 12

Unit-2: Beneficial insects. Mode of life, economic importance and development of Honey bee Silk worm (Bombyx Mori) - Silk worm [Bombyx mori] rearing Equipment required

Rearing procedure for harvesting of cocoons. Teaching Hours: 12

Unit-3: Harmful insects

An account of any three pests of :

1. Rice 2. Cotton 3. Coconut Teaching Hours: 12

Unit-4: Principles and method of pest control – conventional, Physical, Mechanical, Chemical and Biological control Teaching Hours: 12

Unit-5: Vector borne diseases. A brief account of insect vectors affecting the health of man and domestic animals. Teaching Hours: 12

Internal Assessment Methods: (refer the instructions)

Text book:

1. B. Vasantharaj David and T. Kumaraswami 1982. Elements of Economic Entomology, Popular book Depot, Chennai.
2. Nayar, K.K., Ananthakrishnan, T.N. and B.V. David, V 1992 General and Applied Entomology Tata McGraw, New Delhi
3. P.G. Fenemore Manual. Silkworm Rearing. FAO Agricultural Service Bulletin, Rome
4. A General textbook of entomology -- A D Imms. Asia Publication
5. Agricultural insect pests and their control. V.B. Awasthi. Scientific Publication.
6. . Economic Zoology- Shukla, Upaddhaya and Srivastava. S. Chand Publication

Reference Book:

1. Entomology and Pest Management –Larry P. Pedigo. Pearson Education.
2. .General and applied Entomology – David and Ananthakrishnan. Tata McGraw Hill
3. Irwin, M. E. and Kampmeier, G. E. (2002): Commercial products, from Insect. In V. H. Resh and R. Carde (eds.) Encyclopedia of insects. Academic press, San Diego.
4. Text book of Entomology—Ross – John Wiley publ.
5. The Insects - Structure and Function - 4th Edition, R. F. Chapman (ed.). CambridgeUniversity Press 1998.
6. Photographic Atlas of Entomology and guide to insect identification.-Castner. Seline press Florida. Marketed by Scientific Publication

Course Material: website links, e-Books and e-journals

1. **https://doi.org/10.1093/jee/toac095**

2. **https://www.researchgate.net/publication/327282644_A_Text-book_of_Economic_Entomology_M_Dayib**
3. **https://drive.google.com/file/d/1dcPkKmGl9QJTTfMNqHw2hY7F3gAKmWEp/view?usp=sharing**
4. **https://drive.google.com/file/d/1cZ8Y_B3Ofau2ir6CMoGZDMBc2STfflF1/view?usp=sharing**
5. **https://drive.google.com/file/d/1w6ViPEOLbFz3o8_U-dqFArFN50ihZZF9/view?usp=sharing**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	M	M	M
CO2	S	M	S	M	M	M	M	S	S	M
CO3	M	M	M	S	M	S	S	M	S	M
CO4	M	S	M	M	S	M	M	M	S	S
CO5	S	M	S	M	M	S	S	S	M	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(Name of the Programme) – 2022-2023 onwards

Semester: I Paper type: Core

Paper code: Name of the Paper: CHORDATA Credit: 4

Total Hours per Week: 4 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

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Course Objectives

1. To understand the animal kingdom .

2. To understand the taxonomic position of Animals.

3. To understand the general characteristics of animals belonging to different classes.

4. To understand the body organization of chordate animals.

5. To understand the origin and evolutionary relationship of different classes of chordata.

Course Outcome

1. After studied unit-1, the student will be able to facilitate the students to understand basics of Phylum Chordata uptoorders..

2. After studied unit-2, the student will be able to learn the General characters and classification of Pisces up to orders

3. After studied unit-3, the student will be able to make the students Familiar with General characters and classification up to order level

4. After studied unit-4, the student will be able learn the General characters and classification of Aves up to orders.

5. After studied unit-5, the student will be able to make the students Familiar with General characters and classification of Mammals up to order level

UNIT-I 1. UNIT-II UNIT-III. UNIT-V

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	No	No	No
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	Yes	No	No	No
4	Yes	Yes	No	Yes	Yes	Yes
5	Yes	Yes	Yes	No	No	No

Unit-1: (50 to 100 contents) **Teaching Hours:15**

Salient Features, General classification of Phylum Chordata upto orders. 2. Origin of Chordata. 3. Prochordata: General Characters and affinities of Hemichordata, Cephalochordata& Urochordata **Unit-2: (50 to 100 contents)** **Teaching Hours:15**

PISCES 1. General characters and classification up to orders. 2. Type study : Shark. 3. Parental care. AMPHIBIA 1. General characters and classification up to orders. 2. Type study : frog 3. Adaptive features of Anura, urodela& Apoda. 4. Parental care in Amphibia

Unit-3: (50 to 100 contents) **Teaching Hours:15**

REPTILIA 1. General characters and classification up to order level. 2. Type study-Calotes. 3. Poison apparatus and biting mechanism of poisonous snakes. 4. Identification of poisonous and non-poisonous snakes

Unit-4: (50 to 100 contents) **Teaching Hours:15** AVES
1. General characters and classification upto orders 2. Type study-Pigeon 3. Characters of Archaeopteryx. 4. Ratitae. 5. Flight adaptation.

Unit-5: (50 to 100 contents) **Teaching Hours:15**
MAMMALIA 1. General characters and classification upto orders. 2. Type study-Rabbit. 10 3. Flying Mammals. 4. Dentition in mammals. 5. Aquatic mammals.

Internal Assessment Methods: (refer the instructions)

Text Books:
1. EkambaranthaAyyar, M and T.N Ananthakrishnan 1992, A manual of Zoology Vol. II[Chordata]. S. Viswanaathan (Printers and Publishers] Pvt. Ltd., Madras.
2. Jordan E.L. and P.S. Verma 1995. Chordata Zoology and elements of Animal Physiology. S. Chand and Co., New Delhi.
Reference Books : 1. Kotpal R.L. 1992. Vertebrata, Rastogi Publications, Meerut 2. Nigam.H.C. 1983 Zoology of chordates, Vishal publications, Jalandhar.
3. Waterman, Allyn J.et al.1971, Chordate Structure and functions. Mac.Millan and Co., New York.
4. Jollie. M. 1968. Chordate Morphology. East west press Pvt. Ltd., New Delhi. 5. Hyman. L.H. Comparative vertebrate Zoology. McGraw Hill Co., New York.

Course Material: website links, e-Books and e-journals

https://www.vedantu.com/question-answer/connecting-link-between-chordates-and-class-12-biology-cbse-5f70e8fdc8f93c434adb7ad6

https://manoa.hawaii.edu/exploringourfluidearth/biological/invertebrates/phylum-chordata

https://link.springer.com/10.1007/3-540-31078-9_33

https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=7711

https://royalsocietypublishing.org/doi/10.1098/rspb.2014.1729

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	S	M	M	S	M
CO2	M	S	S	M	M	S	M	S	S	M
CO3	M	M	M	M	S	M	M	M	M	M
CO4	S	M	S	M	M	S	M	S	M	M
CO5	M	M	S	M	S	M	M	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: II **Paper type: Core Practical I**

Paper code: **Name of the Paper: INVERTEBRATA AND CHORDATACredit: 2**

Total Hours per Week: 6 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

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Course Objectives

1.Learn and be familiar with the Laboratory techniques

2.To understand the taxonomic position, body organization and evolutionary

relationship of animals

3.To inculcate the significance of various non chordates and chordates.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to dessect and display various systems of invertebrates an chordates

2. After studied unit-2, the student will be able to mount the mouth parts, appendages of prawn,boy setae of earthworm an placoid scales of shark.

3. After studied unit-3, the student will be able to understand the adaptations of animals to their respective modes of life

4. After studied unit-4, the student will be able to understand the biological significance of animals

5. After studied unit-5, the student will be able to understand theoesteology

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	No	No	No
2	Yes	Yes	Yes	No	No	No
3	Yes	Yes	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	Yes	Yes	No

Unit-1: DISSECTIONS

Cockroach – Digestive and Nervous system, **Prawn** – Nervous system, **Fish** (any one) – Digestive and Arterial system **Teaching Hours: 12**

Unit-2: MINOR PARCTICAL

MOUNTING **-Insect Mouth parts :**Cockroach, Honey bee, House Fly and Mosquito

Prawn – Appendages, **Shark** - Placoid scales, **Earthworm** – Body setae **Teaching Hours:12**

Unit-3: SPOTTERS

Study of the following specimens

1.Classify by giving reasons

Paramecium,Sycon, Obelia, Taenia solium, Neries, Prawn, Freshwater mussel, Seastar Amphioxus, Shark, Hyla, Rhacophorus, Calotes, Pigeon, Rat/Rabbit.

2.Adaptations to their respective modes of life

Entamoeba, Trypanosoma, Plasmodium, Corals [any 2], Ascaris, Fasiola, Wuchereriabancrofti, Cheatopterus, Leech, Limulus, Nauplius, Mysis, Zoea, Balanoglossus, Ascidian, Ichthyophis, Draco, sea snake and Bat. **Teaching Hours: 12**

Unit-4: SPOTTERS

Study of the following specimens

3.Biological significance:

Paramecium conjugation and binary fission, physalia, Trochophore Larva, Peripatus, SacculinaOn Crab, Sea Anemone on Hermit Crab, Pearl Oyster, Bipinnaria Larva, Anabas, Hippocampus, Narcine, Echeneis, Arius, Exocoetus, Eel, Amblystoma, Axolotl Larva, Bufo, Cobra, Krait, Russels Viper, EchisCarinata, Turtle, Parrot, Woodpecker, King Fisher and Ant eater

4. Relate structure and function:

Sponge Spicules, Obelia Polyp, Taenia Scolex, Nereis - Parapodium, Book lungs of scorpion/Honey bee sting apparatus, Pedicellaria of Sea star, Ctenoid Scale and Quill Feather of pigeon. **Teaching Hours:12**

Unit-5: SPOTTERS

Study of the following specimens

5.Draw labeled sketches:

T.S. of Nereis, T.S. of Leech, Obelia medusa, T.S. of Amphioxus through Pharynx, T.S. through arm of Sea star.

6.Osteology

Skeleton - Pectoral girdles of Frog and Pigeon.,Pelvic Girdles of Frog and Pigeon.

Fore and Hind limbs of Frog and Pigeon., Synsacrum of Pigeon. **Dentition -** Dog, Rabbit and Man **Teaching Hours: 12**

Internal Assessment Methods: (refer the instructions)

Text book:

1. Verma. P.S. 2011 A Manual of Practical Zoology INVERTEBRATES Chand & Co, Ltd, Ram Nagar -New Delhi.

2. Verma. P.S. 2011 A Manual of Practical Zoology CHORDATES, Chand & co, Ltd. Ram Nagar – New Delhi.
3. JayanpaSinha . 2010 Advanced Practical Zoology, Books & Allied (p) Ltd. No.1. Subham Plaza IFloor, Calcutta.
4. Practical Zoology- Invertebrates S.S. Lal
5. Practical Zoology - Invertebrates K.P. Kurl

Reference Book:

1. A manual of Zoology - Part I, Invertebrata; Ayyar, M. Ekambaranath
2. Modern text book of Zoology - Invertebrates; Eleventh; Edition Professor R.L. Kotpal; Rastogi publication
3. Invertebrate Zoology by Fatik Baran 2012, PHI Learning
4. Biology of the invertebrates by Jan A. Pechenik, 7th edition,2014 publications McGraw Hill
5. An introduction to the invertebrates by Janet Moore, 2ndedition2006, publications Cambridge

Course Material: website links, e-Books and e-journals

1. **https://www.earthlife.net/inverts/an-phyla.html**
2. **http://www.biologydiscussion.com/invertebrate-zoology/invertebrates-phyla/study-notes-/**
3. **http://www.asfa.k12.al.us/ourpages/auto/2014/4/23/64232119/invertebrate-animal-/**
4. **http://instruction2.mtsac.edu/mcooper/biology%202/labs/protistalab1.pdf/**
5. **https://portals.iucn.org/library/sites/library/files/documents/2012-064.pdf/**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	S	S	M	M
CO2	S	M	M	S	M	S	M	S	M	M
CO3	S	S	S	S	S	M	S	M	M	M
CO4	S	S	M	M	M	M	S	S	M	M
CO5	S	S	S	M	S	S	M	M	M	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: II **Paper type: Allied**

Paper code: **Name of the Paper: Economic Entomology-II** **Credit: 3**

Total Hours per Week: 4 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1.To study the basic concepts of pesticides and integrated pest control
2. To acquaint the students with external morphology and internal systems of the insect's body.

3.To Attain mastery of the essential aspects of practice and study in the field of agricultural entomology and pest management

4.To understand the ecological interactions among crops, pests and their natural enemies

5. To familiarize the students with principles of insect pest management, including concept and philosophy of IPM

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand the economic, ecological, and sociological benefits of IPM.

2. After studied unit-2, the student will be able to Distinguish positive and negative impacts of pesticide use.

3. After studied unit-3, the student will be able to Understand problems resulting from misuse, overuse, and abuse of chemical pesticides

4. After studied unit-4, the student will be able to Define and describe pesticide resistance and how it develops.

5. After studied unit-5, the student will be able to Identify ecological and biological characteristics important in development of pest populations.

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	Yes	Yes	No	No	Yes

3	Yes	Yes	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	Yes	No	Yes

Unit-1: Insects and their interrelations with environments, insects as Pollinators parasitoids, Scavengers and weed killers. Teaching Hours: 12

Unit-2: Classification of insecticides – based on mode of action, contact, systemic, fumigants, nerve and stomach poison. Biological control. Integrated pest control Teaching Hours: 12

Unit-3: Basic principles of insecticide formulation and their application in pest control – plant protection appliances used – working and applicationTeaching Hours: 12

Unit-4: Precautions in handling of pesticides. Pesticides and environmental pollution Teaching Hours: 12

Unit-5: Assessment to pest population, Estimation of pest damage – pest outbreak – pest surveillance. Teaching Hours: 12

Internal Assessment Methods: (refer the instructions)

Text book:

1. Entomology and Pest Management –Larry P. Pedigo. Pearson Education.
2. .General and applied Entomology – David and Ananthakrishnan. Tata McGraw Hill
3. Irwin, M. E. and Kampmeier, G. E. (2002): Commercial products, from Insect. In V. H. Resh and R. Carde (eds.) Encyclopedia of insects. Academic press, San Diego.
4. Text book of Entomology—Ross – John Wiley publ.
5. The Insects - Structure and Function - 4th Edition, R. F. Chapman (ed.). CambridgeUniversity Press 1998.
6. Photographic Atlas of Entomology and guide to insect identification.-Castner. Seline press Florida. Marketed by Scientific Publication

Reference Book:

1. Entomology and Pest Management –Larry P. Pedigo. Pearson Education.
2. .General and applied Entomology – David and Ananthakrishnan. Tata McGraw Hill
3. Irwin, M. E. and Kampmeier, G. E. (2002): Commercial products, from Insect. In V. H. Resh and R. Carde (eds.) Encyclopedia of insects. Academic press, San Diego.
4. Text book of Entomology—Ross – John Wiley publ.
5. The Insects - Structure and Function - 4th Edition, R. F. Chapman (ed.). CambridgeUniversity Press 1998.
6. Photographic Atlas of Entomology and guide to insect identification.-Castner. Seline press Florida. Marketed by Scientific Publication

Course Material: website links, e-Books and e-journals

1. **https://doi.org/10.1093/jee/toac095**
2. **https://www.researchgate.net/publication/327282644_A_Text-book_of_Economic_Entomology_M_Dayib**
3. **https://drive.google.com/file/d/1dcPkKmGl9QJTTfMNqHw2hY7F3gAKmWEp/view?usp=sharing**
4. **https://drive.google.com/file/d/1cZ8Y_B3Ofau2ir6CMoGZDMBc2STfflF1/view?usp=sharing**
5. **https://drive.google.com/file/d/1w6ViPEOLbFz3o8_U-dqFArFN50ihZZF9/view?usp=sharing**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	M	M	M
CO2	S	M	S	M	M	M	M	S	S	M
CO3	M	M	M	S	M	S	S	M	S	M
CO4	M	S	M	M	S	M	M	M	S	S
CO5	S	M	S	M	M	S	S	S	M	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: II **Paper type: ALLIED PRACTICAL**

Paper code: **Name of the Paper: ECONOMIC ENTOMOLOGY – I & II** **Credit: 2**

Total Hours per Week: 2 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1.To attain knowledge about the life cycle of various insects

2.To attain knowledge about the structure of mouthparts an sting

3.To attain knowledge about the pest of agricultureimportance

4.To attain knowledge about the pest of medical importance

5.To attain knowledge about the collection anpreparation of insect box

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to the life cycle of various insects

2. After studied unit-2, the student will be able to understand the structure of mouthparts an sting

3. After studied unit-3, the student will be able to understand the pest of agriculture

4. After studied unit-4, the student will be able to understand the pest of medical importance

5. After studied unit-5, the student will be able to prepare insect box

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	No	Yes
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	No	Yes	Yes

Unit-1: MAJOR PRACTICAL

1. Model / chart – Draw and comment
2. Life cycle of Holometabolous, Hemimetabolous and Ametbolous Insects [Atleast one example in each]

3. Insect formulations and plant protection appliances**Teaching Hours: 10**

Unit-2: MINOR PRACTICAL

1. Mounting -Mouth parts – Bed Bug, Mosquito and House fly
2. Sting apparatus of Honeybee **Teaching Hours: 10**

Unit-3: SPOTTERS

Pests of agricultural Importance – citrus Butterfly, Rhinocerous beetle, Stem borer – Rice, Sugar cane, maize, Cotton, Fruit borer, Root borer, six spotted beetle, grasshopper, Crickets, Pod Borer [pulses], Rice weevil, Mango nut weevil.

Teaching Hours: 10

Unit-4: SPOTTERS

Pest of Medical Importance – Mosquito, Housefly, cockroach, Ticks, Mites, Louse, Bed Bug, Plasmodium, Filarial Worm, Loa Loa, Dust mite.**Teaching Hours: 10**

Unit-5: RECORD

Collection and preservation of insects – insect store box

Note: The Students may be asked to submit a minimum of 10 whole mounts of the insects

Teaching Hours: 10

Internal Assessment Methods: (refer the instructions)

Text book:

1. A manual of practical entomology. – M MTrigunayat. Scientific Publication.
2. .Laboratory manual of entomology – Alaka Prakash. New Age Publishers.
3. Photographic Atlas of Entomology and guide to insect identification.-Castner. Seline press Florida. Marketed by Scientific Publication.
4. The Insects - Structure and Function - 4th Edition, R. F. Chapman (ed.). CambridgeUniversity Press 1998.
5. A Text book of insect morphology, physiology and endocrinology – Tembhare D. B.– Chand Publication.

Reference Book:

7. Entomology and Pest Management –Larry P. Pedigo. Pearson Education.
8. .General and applied Entomology – David and Ananthakrishnan. Tata McGraw Hill
9. Irwin, M. E. and Kampmeier, G. E. (2002): Commercial products, from Insect. In V. H. Resh and R. Carde (eds.) Encyclopedia of insects. Academic press, San Diego.
10. Text book of Entomology—Ross – John Wiley publ.
11. The Insects - Structure and Function - 4th Edition, R. F. Chapman (ed.). CambridgeUniversity Press 1998.

12. Photographic Atlas of Entomology and guide to insect identification.-Castner. Seline press Florida. Marketed by Scientific Publication

Course Material: website links, e-Books and e-journals

1. **https://doi.org/10.1093/jee/toac095**
2. **https://www.researchgate.net/publication/327282644_A_Text-book_of_Economic_Entomology_M_Dayib**
3. **https://drive.google.com/file/d/1dcPkKmGl9QJTTfMNqHw2hY7F3gAKmWEp/view?usp=sharing**
4. **https://drive.google.com/file/d/1cZ8Y_B3Ofau2ir6CMoGZDMBc2STfflF1/view?usp=sharing**
5. **https://drive.google.com/file/d/1w6ViPEOLbFz3o8_U-dqFArFN50ihZZF9/view?usp=sharing**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	M	M	M
CO2	S	M	S	M	M	M	M	S	S	M
CO3	M	M	M	S	M	S	S	M	S	M
CO4	M	S	M	M	S	M	M	M	S	S
CO5	S	M	S	M	M	S	S	S	M	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: II Paper type: Core

Paper code:Name of the Paper: CELL AND MOLECULAR BIOLOGYCredit: 4

Total Hours per Week: 4 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1.To Have an enhanced knowledge on microscopes, cytological techniques.

2.To provide a basic information on structure and functions of cell and cell

organelles.

3.To gain an understanding of chemical and molecular processes that occur in and

between cells.

4.To provide the basic knowledge on biochemical and cell culture techniques .

5.To give in-depth knowledge of biological and medicinal processes through the

investigation of the underlying molecular mechanisms.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand the Principles of microscopes ,Cytological techniques and to describe theCell theory, Ultra structure of animal cell .

2. After studied unit-2, the student will be able to recognize the properties of cytoplasm ,cell cycle , cell division, Ultra structure andfunctions cell organelles.

3. After studied unit-3, the student will be able to get knowledge on biochemical and cell culture techniques

4. After studied unit-4, the student will be able to understand the structure and function of chromosomes,giant chromosomes, DNA andtypes of RNA.

5. After studied unit-5, the student will be able to describe the mechanism of DNA replication and Protein synthesis.

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	No	No	Yes

3	Yes	Yes	Yes	No	No	No
4	Yes	Yes	No	Yes	No	Yes
5	Yes	Yes	No	Yes	No	Yes

Unit-1: History of Cell and Molecular Biology - Principles of microscopes light and electron, Cytological techniques - cell fractionation, Homogenization Centrifugation, Isolation of Sub-cellular components. Biochemical techniques - Electrophoresis and their applications. Cell culture techniques and applications **Teaching Hours:12**

Unit-2: Cell - Cell theory, Ultra structure of animal cell - structure, composition and functions - cell components - Plasma Membrane - Endoplasmic reticulum, Ribosomes, Golgi Complex, Lysomes, Peroxisomes, Centrioles and Mitochondria. **Teaching Hours: 12**

Unit-3: Cytoplasm - Physical, chemical and biological properties. Nucleus - Ultrastructure, Composition and Function - Chromosomes - Giant chromosomes (Polytene and Lamp brush chromosomes). **Teaching Hours: 12**

Unit-4: Cell cycle and cell division - Amitosis, Mitosis and meiosis and their significance. Cancer biology - structure of cancer cell, carcinogenesis. Aging - Cell death and apoptosis. **Teaching Hours: 12**

Unit-5: Structure and functions of DNA & types of RNA [mRNA, tRNA, rRNA]. Semi conservative replication, mechanism and enzymology of DNA replication. Protein synthesis. **Teaching Hours: 12**

Internal Assessment Methods: (refer the instructions)

Text book:

1. Cohn, N.S., 1979, Elements of Cytology, Freeman Book co., New Delhi.
2. De Robertis, E.D.P. and E.M.F. De Robertis, 1988. Cell and molecular Biology, 8th Edition, International edition Informes Hongkong.
3. Gies, A.C., 1979. Cell Physiology, Saunders co., Philiadelphia, London, Toronto.
4. Powar, C.B.,1989.Essentials of Cytology, Himalaya Publishing House, Bombay.
5. Verma, P.S., and V.K. Agarwal, 1995. Cell and Molecular Biology, 8th Edition, S. Chand & Co., NewDelhi.
6. Rastogi. S.C. Cell and Molecular Biology, 2008 2nd Edition, New Age International (p) Ltd., New Delhi.
7. G.P. Jayanthi 2009 Molecular Biology, M.J P Publ. Chennai.
8. Philip Sheeler, Donald E. Bianchi, 1987.Cell and Molecular Biology - John Wiley and Sons, Inc, 3rd Edition.
9. M. Prakash, C.K. Arora,1998- Microscopical Methods - Anmol Publications Pvt. Ltd., First Edition.
10. M. Prakash, C.K. Arora, 1998 - Laboratory Instrumentation - Anmol Publications Pvt. Ltd. First edition

Reference Book:

1. Lehninger, Nelson and Micheal Cox (2017). Principles of Biochemistry 7 th Edition. W. H. Freeman and Macmillan Learning, New York
2. Lewin B. Micheal Stone (2008). Genes IX. Jones and Barlett Publishers Ltd.
3. Russell P. (2010). iGenetics: A Molecular Approach 3rd Edition. Pearson Publishlers
4. Benjamin Pierce (2013). Genetics: A conceptual Approach 5th Edition. W. H. Freeman And Company
5. Geoffrey Cooper (2018). The Cell: A Molecular Approach 8th Edition. Oxford University Press
6. Brown T. A (2021). Gene Cloning and DNA Analysis: An Introduction. 8th Edition. Wiley and Sons
7. Walker John M. and Ralph Rapley (2015). Molecular Biology and Biotechnology 6th Edition. RSC Publishing
8. . K. Gerald (2007) Cell and Molecular Biology, Concept and Experiment, 5thEdn., Wiley.
9. .B. Alberts et al. (2010) Essential Cell Biology, 3rdEdn., Garland Science.
10. K. Roberts, J. Lewis, B. Alberts, P. Walter, A. Johnson and M. Raff. (2008) Molecular Biology of the Cell, 5thEdn., Garland Publishing Inc. New York.

Course Material: website links, e-Books and e-journals

1. **https://www.edx.org/learn/molecular-biology**
2. **https://www.uou.ac.in/sites/default/files/slm/BSCZO-102.pdf**
3. **https://www.commonsense.org/education/top-picks/best-molecular-and-cell-biology-apps-and-websites**
4. **https://www.tru.ca/distance/courses/biol2131.html**
5. **https://www.cdc.gov/labtraining/training-courses/basic-molecular-biology/index.html**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	S	S	S	S	S
CO2	M	S	S	S	M	S	M	M	M	S
CO3	S	M	M	M	S	M	S	S	S	S
CO4	S	S	S	S	M	S	M	M	M	M
CO5	S	S	S	S	M	S	M	S	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(Name of the Programme) – 2022-2023 onwards

Semester: III Paper type: Skill Based Subject

Paper code: Name of the Paper: VermicultureCredit: 2

Total Hours per Week: 2 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To acquire knowledge about biofertilizer
2. To impart training on Earthworm culture technology
3. To create knowledge on Self - Employment opportunity

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to Learn about the characteristics and biology of earthworm.

2. After studied unit-2, the student will be able to Get an in depth knowledge about the culture techniques.

3. After studied unit-3, the student will be able to Understand about the methods of composting.

4. After studied unit-4, the student will be able to Learn the factors for proper maintenance of the vermicomposting beds.

5 After studied unit-5, the student will be able to Learn about the application and marketing of the compost.

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

Unit-1: Eathworm types – Morphological and Anatomical characteristics. Biology of *Lampito maruitti* **Teaching Hours:12**

Unit-2: Vermicompost process -Types of Vermicomposting materials. Monoculture and polyculture techniques, factors affecting vermicomposting - pH, Moisture, temperature etc

Teaching Hours: 12

Unit-3: Vermicomposting methods – Small scale and large scale pit method, heap method, Wind row method and bin method. Vermiwash.

Teaching Hours: 12

Unit-4: Vermicomposting: General procedure in Homes. Maintenance of vermicomposting beds. Harvesting the worms. Earthworm Predators, parasites and pathogens **Teaching Hours: 12**

Unit-5: Nutrients availability- Application of Vermicomposting in Agriculture and Horticultural practices. Advantages of Vermicompost and marketing. **Teaching Hours: 12**

Internal Assessment Methods: (refer the instructions)

Text book:

1. Edwards, C.A., and Bother, B. 1996: Biology of Earthworms – Chapman Hall Publ. Co., London.
2. Ismail, S.A. 1997: Vermitechnology – the Biology of Earthworms – Orient Longman Publ. – India.
3. Ranganathan, L.S. 2006: Vermibiotechnology from soil health to Human health – Agrobios – India.
4. Talashikar, S.C. 2008: Earthworms in Agriculture – Agrobios - India
5. Gupta, P.K. 2008: Vermicomposting for sustainable agriculture [2nd edition] – Agrobios – India.
6. EIRI Board, 2015: Handbook of Biofertilizers and Vermiculture, New Delhi, India.
7. NIIR Board: The complete technology book on Biofertilizers and organic farming New Delhi, India.
8. Mary Violet Christy, A. 2008: Vermitechnology - MJP Publishers, Chennai , India.
9. Rajeev Prathap Singh. 2012: Organic Fertilizers: Types, Production and Environmental Impact Nova Science Inc. New York.
10. Keshav Singh, 2014: A textbook on Vermicompost, Vermiwash and Biopesticide. Biotech Books, Astral International, New Delhi, India.

Reference Book:

Course Material: website links, e-Books and e-journals

1. https://www.researchgate.net/publication/333892881_Vermiculture_and_Vermicomposting
2. https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/E-Learning/Moocs/Solid_Waste/W4/Manual_On_Farm_Vermicomposting_Vermiculture.pdf
3. http://faunaofindia.nic.in/PDFVolumes/spb/022/index.pdf
4. https://www.bbau.ac.in/dept/dz/TM/ZL(OE)-02%20Vermicomposting.pdf
5. https://mgsubikaner.ac.in/wp-content/uploads/2020/10/Vermicomposting-GKM.pdf

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	M	S	S
CO3	S	S	S	S	M
CO4	S	S	S	S	S
CO5	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(Name of the Programme) – 2022-2023 onwards

Semester: III Paper type: Skill Based Subject

Paper code: Name of the Paper: Single Cell Protein Culture Credit: 2

Total Hours per Week: 2 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To have knowledge and importance of Single cell protein (SCP) culture techniques.

2. To emphasize the importance of integrating new knowledge of Food Biotechnology.

3. To update the technological innovations of Microbial organisms and its applications in Nutrition

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to Acquire knowledge about the scope and organisms used in SCP.
2. After studied unit-2, the student will be able to Get an in-depth knowledge about the Algal SCP.
3. After studied unit-3, the student will be able to Understand about the culture and extraction of Bacterial SCP.
4. After studied unit-4, the student will be able to Understand the culture techniques of Fungal SCP.
5. After studied unit-5, the student will be able toLearn about the application of SCP.

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

Unit-1: The scope of food biotechnology- characterization, classification and identification of Microorganisms employed in single cell protein (SCP) cultivation. **Teaching Hours: 12**

Unit-2: Algal sources of single cell proteins – Culture and extraction of SCP From spirulina Maxima, chlorella species. **Teaching Hours: 12**

Unit-3: Bacterial sources of single cell proteins – culture and extraction of SCP from Bacillus species and *Methylococcuscapsulatus* **Teaching Hours: 12**

Unit-4: Fungal sources of single cell proteins – Culture and extraction from yeasts - Candida species. Extraction from filamentous fungi - Agaricus species **Teaching Hours: 12**

Unit-5: General account on the production of SCP from Biomass and Waste Materials. Nutritive values of SCP – Dietary supplements for Human, Cattle and Birds. **Teaching Hours: 12**

Internal Assessment Methods: (refer the instructions

Text book:

1 – 10

Reference Book:

1. Arumugam, N. 2006: Microbiology, Saras Publ. Nagercoil – India.
2. Kumarasan, V. 2001: Biotechnology, Saras Publ Nagercoil – india.
3. Agarwal, A.K. and Parihar, P.2006: Industrial microbiology – student edition –India.
4. Dubey, R.C and Maheswari, D.K. 2005: A Text Book of Microbiology – S. Chand & co., New Delhi.
5. Rao, A.S. 1997: Introduction to Microbiology – prentice – Hall, New Delhi, New Delhi- India.
6. Sullia, S.B. and Shantharam, S.2005: General Microbiology, Oxford IBH – Publ.. New Delhi – India.
7. Krishnan, A. 2005: Students Dictionary of Microbiology – Student edition – India.
8. Dubey R.C. 2013.- A textbook of Biotechnology, S.Chand and Company Pvt. Ltd. New Delhi.
9. Israel Goldberg, 1985: Single Cell Protein Springer , New York.
10. Steven R. Tannenbaum and Daniel I-chyau Wang, 1975: Single Cell Protein – II-M I T press, London

Course Material: website links, e-Books and e-journals

1. https://www.slideshare.net/FIRDOUS88/single-cell-protein
2. https://nitsri.ac.in/Department/Chemical%20Engineering/BRTL9.pdf
3. https://www.slideserve.com/teenie/single-cell-protein
4. http://www.brahmanandcollege.org.in/pg_biochemistry/Single-cell-protein.pdf
5. https://www.basu.org.in/wp-content/uploads/2020/06/19th-PPT-of-Foods-and-Industrial-MicrobiologyCourse-No.-DTM-321.pdf

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	S	S	S
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

Thiruvalluvar University, Vellore - 632115
Course writing format

Name of the course/subject: ZOOLOGY **Semester: III**
Name of the Paper: PUBLIC HEALTH AND HYGINE **Credits: 3 Hours of teaching:**
Paper type: Skilled Based subject

……

Course Objectives

1. To impart awareness on public health, Hygiene and diseases.
2 To educate and emphasize on preventive measures of diseases.
3. To create knowledge on Health Education.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand Scope of Public Health and Hygiene – Nutrition and health – classification of foods.

2. After studied unit-2, the student will be able to understand Environment and Health Hazards.

3. After studied unit-3, the student will be able to understand Communicable diseases and their control measures.

4. After studied unit-4, To acquire the knowledge about Non – communicable diseases and their preventive measures.

5. After studied unit-5, the student to acquire the knowledge Health Education and Health programmes in India and WHO programmes.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	No	No	No
2	Yes	Yes	Yes	No	No	No
3	Yes	Yes	Yes	No	No	No
4	No	Yes	Yes	No	No	No
5	No	Yes	Yes	No	No	No

UNIT – I

Scope of Public Health and Hygiene – Nutrition and health – classification of foods – Balanced Diet – malnutrition – Kwashirkor, Marasmus, Obesity, Anaemias,– Vitamin deficiencies. Nutritional requirements of special groups.

UNIT – II

Environment and Health Hazards – Causes and effects of Environmental degradation – pollution and associated health Hazards – Health problems due to industrializations – Hospital waste management.

UNIT – III

Communicable diseases and their control measures such as Cholera, Hepatatis, Measles, Polio, Chikungunya, Rabies, Plauge, Leprosy and AIDS.

UNIT – IV

Non – communicable diseases and their preventive measures such as Cancer, Chronic kidney diseases, Chronic respiratory diseases, Hypertension, Coronary Heart Diseases, Stroke, Diabetes, and Obesity. Alcoholism and drug dependence.

.

UNIT – V

Health Education and Health programmes in India – WHO programmes – government and voluntary Organizations and their health service – Precautions first Aid and awareness on sporadic diseases.

Text Books

Unit-1: Park and Park, 1995: Text book of preventive and social medicine – BanarsidasBhanot Publ. jodhpur- India.

Unit-2 Verma, S. 1998: Medical zoology, Rastogi Publ.- Meerut- India

Unit-3 Singh, H.s. and Rastogi, P. 2009: Parasitology, Rastogi Publ. India.

Unit-4 Dubey, R.C and Maheswari, D.K. 2007: Text Book of Microbiology – S. Chand & co. Publ. New Delhi– India.

Unit-5 Park and Park, 1995: Text book of preventive and social medicine – BanarsidasBhanot Publ. jodhpur- India.

E- Materials

1. https://www.perlego.com/browse/biological-sciences/zoology
2. http://www.freebookcentre.net/Biology/Zoology-Books.html

3. https://www.pdfdrive.com/zoology-textbooks-online-e10983221.html
4. http://www.freebookcentre.net/biology-books-download/Textbook-of-zoology.html
5. https://www.e-booksdirectory.com/listing.php?category=134
6. https://www.ikbooks.com/subject/life-sciences/zoology/151
7. http://rastogipublications.com/index.php?route=product/category&path=25
8. https://bookwindow.in/zoology-textbooks
9. https://www.routledge.com/life-science/zoology
10. https://www.fullonstudy.com/bsc-1st-year-zoology-books
11. https://link.springer.com/book/10.1007/978-1-349-00198-9
12. https://vertebrate-zoology.arphahub.com/
13. https://www.quora.com/From-which-websites-can-I-download-free-e-books-in-PDF-format-botany-microbiology-zoology
14. https://www.mheducation.com/highered/category.12255.zoology.html
15. https://library.si.edu/research/vertebrate-zoology

Mapping with Programme Outcomes

COs	**PO1**	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	s	M	M	M	S	S	M	M
CO2	S	S	s	M	S	S	M	M	S	M
CO3	M	S	M	S	S	S	M	M	M	S
CO4	M	M	s	S	S	M	s	M	S	M
CO5	S	S	M	M	s	M	S	S	M	S

PO – Programme Outcome, CO – Course outcomeS – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: III Paper type: Non-Major Elective Paper -I

Paper code: Name of the Paper: POULTRY FARMING Credit: 2

Total Hours per Week: 2 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

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Course Objectives

1.To understand the poultry industry based on the past, present and emphasis of future growth

2. To study the statistical data and various functions involved in poultry industry.

3. To identify many types of poultry that exist other than chickens

4. To understand the biology, nutritional needs and reproductive traits of poultry

5. To understand the equipment utilized in a poultry operation

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will have a Knowledge about the Prospects Of Poultry Industry

2. After studied unit-2, the student will have a Knowledge about the poultry production systems, housing, automation and equipments3. After studied unit-

3, the student will have a Knowledge about the food and feeding of poultry farming

4. After studied unit-4, the student willhave a Knowledge about the incubation and hatchery management

5. After studied unit-5, the student will have a Knowledge about the environment, poultry production and diseases

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	No	No	No
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	No	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	No	No

Unit-1: PROSPECTS OF POULTRY INDUSTRY

Introduction - definition of poultry - broiler, layer and breeder - common terms related topoultry - development of poultry industry in India. Past and present scenario of poultry industry -domestication of poultry. Role of government/private agencies in poultry development. Importance of broiler and layer production under Indian scenario - poultry population and other poultry related statistics, per capita meat and egg availability in India. Teaching Hours: 12

Unit-2:POULTRY PRODUCTION SYSTEMS, HOUSING, AUTOMATION AND

EQUIPMENTS

Selection of site and location of poultry farm - importance of poultry housing and equipment.Principles of housing - location of poultry houses - basic principles of construction. System ofrearing - backyard system, semi-intensive system, intensive system - cage, deep litter and slatsystem, floor space, watering and feeding space requirements for different age groups andrearing conditions. Advantages and disadvantages. Rearing of Turkeys, Ducks, Japanese Quails,Guinea fowls and Geese for meat and egg production

Teaching Hours: 12

Unit-3: FOOD AND FEEDING OF POULTRY FARMING

Feed ingredients, processing of feed - forms of feed - mash, pellet and crumble feedpreparation and feeding methods. Feeding chicks, growers, layers, broiler and breeders – feedingin different seasons - nutritional and metabolic disorders in poultry. Physical and sensoryevaluation of feed ingredients - sampling techniques - proximate analysis - poultry feedformulae. Commonly occurring anti nutrients and toxicants in poultry feed ingredients -Mycotoxins and their prevention
Teaching Hours: 12

Unit-4: INCUBATION AND HATCHERY MANAGEMENT

Layout, design and location of hatchery; Methods of incubation; Physical requirements ofincubation - collection, selection, cleaning and sanitation of eggs. Storage of hatching eggs -incubation methods - single and multistage incubators. Hatchery operations - setting, candling,transfer, hatching, pedigree hatching, chicks pull out, grading, packing and chick dispatch - In-ovo and in-hatch vaccinations and medications. Teaching Hours: 12

Unit-5: ENVIRONMENT, POULTRY PRODUCTION AND DISEASES

Climatic differentiation for avian production: micro &macro climate - temperature, temperaturezones, air - composition, speed and movement, relative humidity andlight. Climatic factorsaffecting poultry production in housed conditions. Definition of disease, Classification of poultrydiseases - Viral, Bacterial, Fungal and Parasitic. Nutritional deficiency diseases Teaching Hours: 12

Internal Assessment Methods: (refer the instructions)

Text book:

1. Bell D. Donald and Weaver D. William Jr., 2007. Commercial Chicken Meat and Egg Production. 5th Edition. Springer India Pvt. Ltd., Noida.
2. Colin G. Scanes., 2015. Sturkie's Avian Physiology. 6th Edition. Academic Press, Elsevier Inc., New York.
3. Hurd M. Louis, 2003. Modern Poultry Farming. 1st Edition. International Book Distributing Company, Lucknow
4. Leeson S., & Summers J. D., 2001. Scott's Nutrition of the Chicken. 4th Edition. University Books, Cananda.
5. Mahajan Naresh, 2015. Poultry Nutrition and Management. 1st Edition. Anmol Publications Pvt. Ltd., New Delhi.
6. Mountney J. George and Parkhurst R. Carmen, 2001. Poultry Products Technology. 1st Edition. The Harwoth Press Inc., USA.
7. Narahari D., and Kumararaj R., 2008. Handbook of Applied Broiler Production. 1st Edition. Poultry Punch Publication (I) Pvt. Ltd., New Delhi, India.
8. Prasab Sushil, 2012. Handbook of Poultry Production. 1st Edition. Enkay Publishing House, New Delhi.
9. Reddy Ramasubba V., and Bhosale T. Dinesh, 2004. Handbook of Poultry Nutrition. 1st Edition. International Book Distribution Co., Lucknow, India.
10. Saif., Y. M., et al., 2013. Diseases of Poultry. 12th Edition. Blackwell Publishing, USA.
11. Sathapathy S., Singh M. K., and Joshi S. K., 2015. A Handbook on Anatomy & Physiology of Domestic Animals and Birds. Sathish Serial Publishing House, New Delhi, India.
12. Susan E. Aiello and Michael a. Moses, 2014. Merck Veterinary Manual. 11th Edition. Merck Vet Manual.
13. Taylor W. Lewts, 2003. Fertility and Hatchability of Chicken & Turkey Eggs. 1st Edition. International book Distributing Co., Lucknow, India.
14. Vegad J. L., 2004. Poultry Diseases: a guide for farmers and poultry professionals. 2nd Edition. International Book Distributing Co., Lucknow, UP.

Reference Book:

1. Ensmiger. M. E., 2015. Poultry Science. 3rd Edition. International Book Distribution Co., Lucknow, India.
2. Bell D. Donald and Weaver D. William Jr., 2007. Commercial Chicken Meat and Egg Production. 5th Edition. Springer India Pvt. Ltd., Noida.
3. Singh, R. A., 2011. Poultry Production. 3rd Edition. Kalyani Publishers, New Delhi.
4. Sreenivasaiah., P. V., 2015. Textbook of Poultry Science. 1st Edition. Write & Print Publications, New Delhi
5. Jull A. Morley, 2007. Successful Poultry Management. 2nd Edition. Biotech Books, New Delhi.

6. Jadhav N. V., and Siddique M. F., 2007. Handbook of Poultry Production and Management. 2nd Edition. Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.
7. Bell D. Donald and Weaver D. William Jr., 2007. Commercial Chicken Meat and Egg Production. 5th Edition. Springer India Pvt. Ltd., Noida.
8. Wiseman. J, and Garnsworthy. P. C., 1999. Recent Development in Poultry Nutrition.
9. Titus Harry. W, and Fritz James. C, 1971. The Scientific Feeding of Chickens. 5th Edition.
10. Sreenivasaiah., P. V., 2015. Textbook of Poultry Science. 1st Edition. Write & Print Publications, New Delhi
11. Rajini Asha R., 2011. Simply….Poultry Science. 1st Edition. Alfa Publications, New Delhi.
12. Suguna Management System: Standard Operating Manual - Feed Lab, 2012. Suguna Foods Pvt. Ltd.
13. Sreenivasaiah., P. V., 2006. Scientific Poultry Production-A unique encyclopedia. International Book Distributing Co., Lucknow, India.
14. Sreenivasaiah., P. V., 2015. Textbook of Poultry Science. 1st Edition. Write & Print Publications, New Delhi
15. Jadhav N. V., and Siddique M. F., 2007. Handbook of Poultry Production and Management. 2nd Edition. Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.
16. Sreenivasaiah., P. V., 2015. Textbook of Poultry Science. 1st Edition. Write & Print Publications, New Delhi
17. Thyagarajan. D., 2011. Diseases of Poultry. 1st Edition. Satish Serial Publishing House, New Delhi, India.
18. Narahari D., and Kumararaj R., 2008. Handbook of applied Broiler Production. 1st Edition. Poultry Punch Publication (I) Pvt. Ltd., New Delhi.

Course Material: website links, e-Books and e-journals

1. **https://www.classcentral.com/course/swayam-introduction-to-poultry-farming-14160**
2. **http://lms.tanuvas.ac.in/course/view.php?id=32**
3. **http://ecoursesonline.iasri.res.in/course/view.php?id=335**
4. **https://iproject.com.ng/computer-science/e-learning-system-development-for-poultry-farming/index.html**
5. **https://core.ac.uk/download/pdf/343499189.pdf**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	S	S	S	M
CO2	S	S	S	S	M	S	M	S	M	S
CO3	M	M	S	M	S	M	S	S	S	S
CO4	M	S	M	S	M	S	S	M	S	S
CO5	S	S	S	M	S	M	M	M	M	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: IV Paper type: Core

Paper code: Name of the Paper: Genetics and Biotechnology**Credit: 4**

Total Hours per Week: 4 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To enable the students understand the basic principles of inheritance.
2. To learn polygenic inheritance, linkage and crossing over.
3. To understand genetics of Sex determination and sex linked inheritance.
4. To determining the applicability of different kind of cloning vectors.
5. To understand recombinant DNA technology

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to explain the key concepts in genes and its expression and Interpret phenotypicexpressions based on genotype.

2. After studied unit-2, the student will be able to Interpret genetics of sex determination and inheritance.

3. After studied unit-3, the student will be able to Understand the gene structure, expression and regulation and understand thealterations of chromosome number arise during mitosis and meiosis.

4. After studied unit-4, the student will be able to determine the applicability of difference kinds of cloning vectors, techniques of genetic engineering, illustrating the use of genomic libraries in gene detection and characterization.

5. After studied unit-5, the student will be able to analyse the function of applied genetic research in technology, nature and society, understanding the applications of rDNA technology, and identifying the ethical issues related to gene manipulation**.**

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	No	Yes	Yes	No

4	Yes	Yes	Yes	Yes	No	Yes
5	Yes	Yes	Yes	No	No	Yes

Unit-1: Introduction to genetics – Basis of Mendelian Inheritance and Mendelian Laws–Genetic Interaction of Genes – Non-Epistatic Interaction, Epistasis, Meoticdrive,Segregation, distortion and Selfish genes. Multiple Alleles – Blood Groups and theirInheritance in Human, Tissue Typing. **Teaching Hours: 12**

Unit-2: Linkage and crossing over – Drosophila – Morgan's Experiments – CytologicalEvidence for Crossing Over. Sex determining mechanisms-Genetical, Metabolical,and Environmental. Sex determination in human beings - Cytoplasmic Inheritance–,Fine Structure of Gene – Cistron – Recon, Muton – Gene Regulation – Operonconcept – Lac Operon.

Teaching Hours: 12

Unit-3: Gene Mutation-Types of mutation-Physical and Chemical mutagens, DNA Repair.Applied Genetics – Animal Breeding – Heterosis, Inbreeding, Out breeding, OutCrossing, Hybrid Vigour. Population Genetics: Hardy weinberg Law –GeneticPolymorphism.

Teaching Hours: 12

Unit-4: Definition – Scope and applications – Molecular tools for gene cloningexperiments.Cloning vectors, [plasmids, pBr322, Phage vector, Cosmids and phagemids].Techniques of Genetic Engineering _ recombinant DNA Technology and geneCloning in prokaryotes [cDNA and Genomic Library]. **Teaching Hours: 12**

Unit-5: Transgeneic plants and animals – DNA finger printing – gene therapy – biosensors– biochips - Application of Recombinant DNA technology in Medicine &Agriculture –Legal and Ethical issues in Biotechnology **Teaching Hours: 12**

Internal Assessment Methods: (refer the instructions)

Text book:

1. Verma, P.S. and V.K. Agarwal, 1995 Genectis, 8th edition, S. Chand &Co, New Delhi - 110 055.580pp.
2. Verma, P.S. and V.K. Agarwal, 2009.9th edition, S. Chand & Co, New Delhi.
3. S.C. Rastogi Biotechnology, Principles and Applications 2007 Narosa Publishing house, Pvt.Ltd.
4. Verma.P.S and Agarwal.V.K (2004) Genetics, S.Chand& Co., New Delhi .
5. Dalela.R.C and Verma.S.R (1970) A Textbook of Genetics,Jaiprakash Nath and Company., Meerut.
6. Gunther S. Stent, 1986. Molecular Genetics.Macmillan Publishing Co Inc. 773pp.

7. Higgins II, Best GJ and Jones J [1996] Biotechnology - Principles and application Black well scientific Publication Oxford London.
8. Gupta P.K. Elements of Biotechnology [2001] Rastogi publication, Meerut.
9. Dubey 2006 Text Book of Biotechnology S. Chand & co. New Delhi.
10. Gardener. 1991. Principles of Genetics. 8th edition.Johnwiley& sons Inc. New York. Chichester,Brisbane, Toronto, Singapore. .

Reference Book:

1. Robert Tamarin. (2017). Principles of Genetics. McGraw Hill, USA.
2. James D. Watson, A. Baker Tania and P. Bell Stephen.(2017). Molecular Biology of theGene. Pearson Education, New Delhi.
3. Gangane S.D. (2017). Human Genetics. Elsevier India.
4. William S. Klug, Michael R. Cummings and Chariotte A. Spencer. (2016). Genetics.
    a. Pearson Education, New Delhi.
5. Gardener, E.J. & M.J. Simmons. 2009. Principles of Genetics. John Wiley & Sons.Inc. New York**.**
6. Monroe. W. Strick Berger 2004 Genetics.Printice Hall of India New Delhi.
7. Kumar H. D.1998 A text book of Biotechnology, affiliated East West pvt. Ltd., New Delhi.
8. Nicholls. 2002 Genetic Engineering, Cambridge University Press. UK.
9. S. Gladis Helen Hepsyba and CR. Hemalatha 2009 Basic Bioinformatics MJP Publ. Chennai.
10. Vijayaraman, ChellammalK.S and Manikkili.P 1998.UyiriyaeThozhilnutpam. Chimeeraa, Trichy

Course Material: website links, e-Books and e-journals

1. **https://www.melioeducation.com/academic-programmes/biotechnology-genetics/**
2. **https://online.stanford.edu/courses/xgen203-genetic-engineering-and-biotechnology**
3. **https://unacademy.com/batch/rank-booster-batch-for-biology-with-experts/82N0ZD72/topics/NLMON/courses/OGUGK**
4. **https://ocw.mit.edu/courses/7-03-genetics-fall-2004/**
5. **https://www.classcentral.com/tag/genetics**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	M	S	M	S	S	M
CO2	S	S	S	S	S	M	M	S	M	S
CO3	M	S	M	S	M	S	S	M	S	M
CO4	S	S	S	S	M	S	S	S	M	M
CO5	M	S	M	M	M	M	M	M	S	S

PO – Programme Outcome, CO – Course outcome, S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: IV Paper type: Core / Practical

Paper code: Name of the Paper: Core Practical II Credit: 3

Total Hours per Week: 3. Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To understand the cytometrical analysis

2.To perform blood related analysis

3. Tostudy the histological slides

4.To do Genetics experiments

5.To understand the biotechnological techniques

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to do cytometrical analysis

2. After studied unit-2, the student will be able to perform blood smear prepapration

3. After studied unit-3, the student will be able to study the histological slides

4. After studied unit-4, the student will be able to do Genetics experiments

5. After studied unit-5, the student will be able to understand the biotechnological techniques

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	No	No	Yes
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	Yes	No	No	Yes
4	Yes	Yes	Yes	No	No	Yes
5	Yes	Yes	Yes	No	No	Yes

Unit-1: CELL AND MOLECULAR BIOLOGY

Cytometry
Compound microscope, camera Lucida, Stage ad Ocular Micrometers

Blood Smear Preparation - Differential count of W.B.C.
Total count of RBC using Haemocytometer.

Total count of WBC using Haemocytometer. **Teaching Hours: 12**

Unit-2: Slide Preparation
Mounting of Buccal Epithelium.
Mitosis in onion root tip squash.
Squash preparation of Grass hopper testes **Teaching Hours: 12**

Unit-3: Study of prepared slides of histology.
Columnar Epithelium, Ciliated epithelium, Glandular Epithelium. Cartilage T.S., Bone T.S., Cardiac Muscle, Striated muscle, Non Striated muscle, Neuron, Male germ cell, Female germ cell. **Teaching Hours: 12**

Unit-4: GENETICS
Squash preparation of Salivary glands of chironomous larva.
Male & Female identification.
Observation of common Mutants of Drosophila.
Human Blood Grouping analysis **Teaching Hours: 12**

Unit-5:BIOTECHNOLOGY
Study of prepared slides, Models or specimen.
Escherichia coli, Bacteriophage, Plasmid.
Demonstration of P.C.R technique: Southern blot, Electrophoresis.
Visit to Biotechnology lab and Report - compulsory. **Teaching Hours: 12**

Internal Assessment Methods: (refer the instructions)

Text book:

1. Cohn, N.S., 1979, Elements of Cytology, Freeman Book co., New Delhi.
2. De Robertis, E.D.P. and E.M.F. De Robertis, 1988. Cell and molecular Biology, 8th Edition, International edition Informes Hongkong.
3. Philip Sheeler, Donald E. Bianchi, 1987.Cell and Molecular Biology - John Wiley and Sons, Inc, 3rd Edition.
4. M. Prakash, C.K. Arora,1998 - Microscopical Methods - Anmol Publications Pvt. Ltd., First Edition.
5. M. Prakash, C.K. Arora, 1998 - Laboratory Instrumentation - Anmol Publications Pvt. Ltd. First edition.
6. **:** Verma, P.S. and V.K. Agarwal, 1995 Genectis, 8th edition, S. Chand &Co, New Delhi - 110 055.580pp.
7. Verma, P.S. and V.K. Agarwal, 2009.9th edition, S. Chand & Co, New Delhi.
8. S.C. Rastogi Biotechnology, Principles and Applications 2007 Narosa Publishing house, Pvt.Ltd.
9. Verma.P.S and Agarwal.V.K (2004) Genetics, S.Chand& Co., New Delhi .

Reference Book:

1. . Gies, A.C., 1979. Cell Physiology, Saunders co., Philiadelphia, London, Toronto.
2. 4. Powar, C.B.,1989.Essentials of Cytology, Himalaya Publishing House, Bombay.
3. Verma, P.S., and V.K. Agarwal, 1995. Cell and Molecular Biology, 8th Edition, S. Chand & Co., NewDelhi.
4. Rastogi. S.C. Cell and Molecular Biology, 2008 2nd Edition, New Age International (p) Ltd., New Delhi
5. Dalela.R.C and Verma.S.R (1970) A Textbook of Genetics,Jaiprakash Nath and Company., Meerut.
6. Gunther S. Stent, 1986. Molecular Genetics.Macmillan Publishing Co Inc. 773pp.
7. Higgins II, Best GJ and Jones J [1996] Biotechnology - Principles and application Black well scientific Publication Oxford London.
8. Gupta P.K. Elements of Biotechnology [2001] Rastogi publication, Meerut.
9. Dubey 2006 Text Book of Biotechnology S. Chand & co. New Delhi.

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Course Material: website links, e-Books and e-journals

1. **https://www.bjcancer.org/Sites_OldFiles/_Library/UserFiles/pdf/Cell_Biology_Laboratory_Manual.pdf**
2. **http://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/BT0213%20-%20CELL%20BIOLOGY%20PRACTICAL%20MANUAL.pdf**
3. **https://sjce.ac.in/wp-content/uploads/2018/04/Cell-Biology-Genetics-Laboratory-Manual-17-18.pdf**
4. **https://www.deanza.edu/faculty/heyerbruce/b6b_pdf/Bio6B-Manual_W19.pdf**
5. **https://cellbiolady.com/wp-content/uploads/2019/05/CellBioLab-Manual-1.pdf**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	S	S	M	S
CO2	M	M	S	S	M	M	S	M	S	M
CO3	S	S	S	M	S	S	S	S	S	S
CO4	M	S	S	S	S	S	M	S	S	M
CO5	S	M	M	S	S	M	S	M	M	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: IV Paper type: Non Major Elective

A. Paper code: Name of the Paper: Biofertillizer Production Credit: 2
Total Hours per Week: 2Non Major Elective . Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

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Course Objectives

1. To impart awareness on Bio fertilizer Technology

2. .To exploit the microbial diversity in various agro-ecologies for biofertilizer application in diversified systems.

3. To study the impact of soil management practices on microbial functions and soil health.

4. To improve biofertilizer technology to ensure high quality and improved delivery.

5. To diversify biofertilizer research and application in drylands, degraded soils and tribal areas.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to facilitate the students to understand basics of biofertilizers
2. After studied unit-2, the student will be able to learn the use of biofertilizers is being emphasized along with chemical fertilizers and organic manures
3. After studied unit-3, the student will be able to learn about Biofertilizer Production: Media preparation, sterilization, microbial propagation, mass-scale production
4. After studied unit-4, the student will be able to promote organic farming in the region through technical capacity building of all stakeholders.
5. After studied unit-5, the student will be able to improve the professional competencies and upgrade the knowledge and develop technical skills of biofertilizer production

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	No	No	No
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	No	Yes	No	No
4	Yes	Yes	No	Yes	No	No
5	Yes	Yes	Yes	No	Yes	Yes

Unit-1: (50 to 100 contents) **Teaching Hours: 9**
Scope of Bio fertilizers - Types of soil - Physical and Chemical composition of Soil. Types of microorganisms in soil.

Unit-2: (50 to 100 contents) **Teaching Hours:9**Production of Bacterial bio fertilizers - Mass production and utilization of different strains of Cyanobacteria. Mass cultivation of Azolla and its utilization.

Unit-3: (50 to 100 contents) **Teaching Hours: 9**

Isolation and identification of Endophytic nitrogen fixers. Rhizobium and Legume root nodulation and nitrification process.

Unit-4: (50 to 100 contents) **Teaching Hours:9**Production of Micorrhizal bio fertilizer - Phosphate solublising microorganisms - VAM - Vesicular Arbuscular Mycorrhizal Fungi and its applications as bio fertilzers.

Unit-5: (50 to 100 contents) **Teaching Hours:9**Use of Composite Bio fertilizers - Methods for enhancing soil fertility. Renewable properties of bio fertilizers. The cost / benefit analysis of production and application of bio fertilizers. .
Internal Assessment Methods: (refer the instructions)

Text Books:
1. Singh,T. and Purohit,S.S. 2008: Bio fertilizer technology, Agrobio - India
2. Sharma,A.K. 2007 : Bio fertilizer for sustainable Agriculture - Agrobios-India.

Reference Books :
1.Pandiyarajan,P. 2008 : Techniques in Agricultural Microbiology- Agrobios-India
2. Purohit, S.S. 2005 : Microbiology - Fundamentals and Applications (6th Edition) Student Edition - Jodhpur - India.
3. Dubey,R.C., and Maheswari, D.K. 2007 : A Text Book of Microbiology - S. Chand & Co., New Delhi, India.
Course Material: website links, e-Books and e-journals

1. **https://www.indiastudychannel.com/courses/2893-diploma-biopesticides-technology-biofertilizer-production**
2. **https://www.mouthshut.com/websites/Indiastudychannel-com-reviews-925641113**
3. **https://www.crunchbase.com/organization/indiastudychannel-com**
4. **https://www.zoominfo.com/c/indiastudychannel/347498412**
5. **https://targetstudy.com/colleges/certificate-course-in-bio-fertilizer-production-certificate-colleges-in-india.html**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	M	M	M	S	S

CO2	S	M	M	S	M	M	S	S	M	M
CO3	M	M	S	S	M	S	M	S	S	M
CO4	M	S	S	S	M	S	M	S	S	M
CO5	S	S	M	S	S	M	S	S	M	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: IVPaper type:NON-MAJOR ELECTIVE

Paper code: Name of the Paper: AQUARIUM FISH KEEPING Credit: 2

Total Hours per Week: 2 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1.To understand the basic knowledge of Aquarium fish keeping

2.To know how to maintain an aquarium

3.To get knowledge about different varieties of ornamental fish.

4.To acquire knowledge about disease management in aquarium fish culture.

5.To acquire knowledge about the feeding techniques of aquarium fishes.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand the basic knowledge of Aquarium fish keeping

2. After studied unit-2, the student will be able to know how to maintain an aquarium

3. After studied unit-3, the student will be able to get knowledge about different varieties of ornamental fish.

4. After studied unit-4, the student will be able to acquire knowledge about disease management in aquarium fish culture.

5. After studied unit-5, the student will be able to acquire knowledge about the feeding techniques of aquarium fishes.

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	Yes
2	Yes	Yes	Yes	No	Yes	Yes
3	Yes	Yes	No	No	No	Yes
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: Fish Aquarium - Introduction - Types of aquarium - Importance of aquarium - Accessories of aquarium - Aquarium fabrication- Setting of aquarium **Teaching Hours: 12**

Unit-2: Care and maintenance of aquarium - Aquarium water quality and management - Aquarium plants - Food for Aquarium fishes. **Teaching Hours: 12**

Unit-3: Study of ornamental fishes (Taxonomy general characters, food and feeding and breeding habits) A. Egg Layers i) Gold fish ii) Zebra fish iii) Koi carp vi) Angel fish v) Gourami B. Live Bearers i) Guppy ii) Mollies iii)Sword tail iv) Platies - Breeding and rearing of ornamental fishes: i) Identification of brooders ii) Breeding behaviour iii) Induced breeding iv) Management of water quality In breeding and rearing of fishes. v) Transportation of ornamental fishes **Teaching Hours: 12**

Unit-4: Disease management of ornamental fishes (Symptoms, life cycle, and control measures) i. protozon disease ii. Bacterial disease iii. Crustacian disease iv. Fungal disease and v. Helminth disesase **Teaching Hours: 12**

Unit-5: Food and feeding of Aquarium fishes - use of live fish feed organisms. Preparation and composition of formulated fish feeds- Live fish transport - fish handling, packing and forwarding techniques - General aquarium maintenance - budget for setting up an aquarium fish as a cottage industry **Teaching Hours: 12**

Internal Assessment Methods: (refer the instructions)

Text book:

1. Jingran V.G., 1991: Fish and fisheries in India - Hindustan Publ. co New Delhi - India.
2. Shanmugam K. 1992, Fishery Biology and Aqua Culture - Leo Pathipagam - Chennai-India.
3. Mill Dick, 1993: Aquarium fish, DK Publ.Co,Inc. New York -USA
4. Yadav. 1995: Fish and fisheries, Daya publ. co., New Delhi - India
5. Hall, C.B. 2005: Ponds and Fish culture - Agrobios - Jodhpur - India.
6. Day,F. 1978: Fishes of India Vol. I & II, William Danisan& Sons, India
7. Alappat, H.J. & A. Biju Kumar 1996. Aquarium Fishes (A Colourful Profile). B.R. Publ., Delhi, 106 pp.
8. Alderton, D., 2019. Encyclopedia of aquarium and pond fish. DK Publishers, UK. 400 pp.
9. Bailey M., & Sanford, G., 2017. Aquarium fish- a definitive guide to identify and keeping freshwater and marine fishes. Smithmark Publishers, USA. 256 pp.
10. Biju Kumar, A. &Alappat, H.J., 1996. A Complete Guide to Aquarium Keeping. Books for All, Delhi, 80 pp.
11. Dholakia, A.D., 2009. Ornamental fish Culture & Aquarium Management. Daya Publishing House, Delhi, 313 pp.
12. Favre, H., 1977. Dictionary of the Freshwater Aquarium. Wardlock Ltd., London, 160 pp.
13. Frey, H., 1961. Illustrated Dictionary of Tropical Fish. TFH. Publ. Inc., NJ, 768 pp.
14. Geck, J., 2010. Nano-aquarium: A Complete Pet Owners Manual. Barrons Educational Series, USA. 128 pp.

Reference Book:

1. Aquarium : Fish Keeping C B L Srivastava Published by Kitab Mahal

2. Marine Aquarium (Fish: Keeping and Breeding Them in Captivity) Boruchowitz, Davie. Published by Chelsea House Publications (1998)

3. Aquarium Setting Up (Fish: Keeping and Breeding Them in Captivity) Axelrod, Herbert R. Published by Chelsea House Publications (1998)

4. The Tropical Freshwater Aquarium Problem Solver: Practical and Expert Advice on Keeping Fish and Plants Sand ford, Gina Published by Voyageur Press (MN) (1998)

5. Aquariums: The Complete Guide to Freshwater and Saltwater Aquariums, Jan 2009 by Thierry Maitre-alain (Author), ChrisitanPiednoir (Author)

Course Material: website links, e-Books and e-journals

1. **https://www.kopykitab.com/ZOO-506-B-Aquarium-Fish-Keeping-KBCNMU-by-Prof-Dr-S-S-Patole-Dr-V-R-Borane-Dr-R-K-Petare**
2. **https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004150935214277sptrivedi_MAINTENANCE_OF_FISHES.pdf**
3. **https://www.acs.edu.au/courses/aquarium-management-636.aspx**
4. **http://ecoursesonline.iasri.res.in/course/view.php?id=297**
5. **https://www.learndirect.com/course/aquarium-and-fishkeeping**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	M	S	S	M
CO2	S	S	S	S	S	M	S	S	M	S
CO3	S	M	S	M	S	S	S	M	S	S
CO4	M	S	M	S	M	S	M	S	S	S
CO5	M	S	S	S	S	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: V Paper type: Core

Paper code: Name of the Paper: Biostatistics And Bioinformatics

Credit: 6

Total Hours per Week: 6. Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To get a basic knowledge of statistical methods and computations in biology.
2. To study the application of information sciences (mathematics, statistics and computer sciences) in biology.
3. To study the application of information technology to the management and analysis of biological data.
4. To get a basic knowledge of Bioinformatics and Literature databases.
5. 5.To study the statistics of alignment.

Course Out Comes

1. After studied unit-1, the student will be able to understand about Biostatistics - Definition and Scope
2. After studied unit-2, the student will be able to understand about Measures of Central tendency
3. After studied unit-3, the student will be able to learn about Use of Internet, Messenger and e-mail-Basic knowledge of Medical transcription and Bio-informatics
4. After studied unit-4, the student will be able to learn about structure visualization Tools
5. After studied unit-5, the student will be able to get the knowledge about Pairwise sequence Alignment

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Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	No	No	No
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	No	Yes	Yes	Yes
4	Yes	No	No	Yes	No	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: (50 to 100 contents) **Teaching Hours: 15**

Biostatistics - Definition and Scope - Census and sampling methods - collection and presentation of Data. Diagrams and graphs; bar, pie Histogram, line graph - Concept of Statistical population and sample characteristics of frequency distribution sampling.

Unit-2: (50 to 100 contents) **Teaching Hours: 15**

Measures of Central tendency: mean, median mode and Measures of Dispersion, Range, Quartile deviation, Mean deviation & Standard deviation.

Unit-3: (50 to 100 contents) **Teaching Hours:15**

MS-WORD: File Operations New, Save & Print - Editing: Cut, copy, Paste, Find and Replace - Insert: Page numbers and Pictures - Format: Font, Bullet & Numbering, Paragraph and Background Tools: Spelling and Grammar - Data: Sort - MS. EXCEL: Presentation of Bio statistical data using Excel: Auto sum, Paste function, Chart wizard, sort function and Drawing - Use of Internet, Messenger and e-mail-Basic knowledge of Medical transcription and Bio-informatics.

Unit-4: (50 to 100 contents) **Teaching Hours: 15**

Bioinformatics - Definition - Literature databases - NCBI-Pubmed, Medline, Protein and nucleic sequence databases - PIR, Swiss-prot, GeneBank, DDBJ - structure databases - PDB, SCOP, CATH, structure visualization Tools, RasMol, Swiss PDB viewer.

Unit-5: (50 to 100 contents) **Teaching Hours:15**

Pairwise sequence Alignment - Scoring Matrice - PAM and BLOSUM - Statistics of alignment scored Dot plot - local and global alignment - Database Searching - FASTA and BLAST multiple sequence alignment clustal W-Phylogenetic trees-PHYLIP.

Internal Assessment Methods: (refer the instructions)

Text Books:

1. Biostatistics P. Ramakrishnan Saras Publications 1996 A.R.P. Camp Road, Kottar, Nagarkoil, Kanyakumari District.
2. Elements of Biostatistics by Gurumani ,Nithi Publishers 1998.
3. Developing Bioinformatics Computer Skills Cynthia Gibbs, Sheoff Publishers &Distribtors Pvt. Ltd., Mumbai.
   Arthur. M. Lesk, Introduction to Bioinformatics, Oxford University Press, New Delhi, 2003.

Reference Books:

1. Statistics - SP Gupta 1996 S. Chand and Co., New Delhi.
2. Jerold H. Zar Bio statistical analysis [2nd Edition] Printice Hall of International edition, 1984 [Relevant portions]

3. Goutham Roy. Introduction to Computing and Computing lab and Cad[2002] Books and allied [pvt] Ltd. Kolkata
4. MS. OFFICE for Win-Microsoft office press.
5. Developing Application with MS. OFFICE - Christine. Solomon- Microsoft Office Press.
8.Arthur. M.Lesk, Introduction to Protein Structures Oxford University Press, New Delhi, 2000
9. Baxevanis, A and Outllette. Bioinformatics a practical guide to the analysis of genes and proteins, Wily - Interscience, Hoboken, NJ. USA 2005.

Course Material: website links, e-Books and e-journals

https://www.yoh.com/blog/bioinformatics-vs-biostatistics

https://link.springer.com/book/10.1007/978-3-319-99389-8

https://link.springer.com/chapter/10.1007/978-3-642-35686-5_2

https://cellcarta.com/bioinformaticsandbiostatistics/

https://www.labtoo.com/en/page/bioinformatics-and-biostatistics-analysis-of-biological-data

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	M	M	M	M	S
CO2	S	M	S	M	M	S	M	S	S	S
CO3	M	M	M		M	M	M	M	M	S
CO4	M	S	M	S	M	M	S	M	S	M
CO5	S	M	S	M	M	S	M	S	M	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(Name of the Programme) – 2022-2023 onwards

Semester: V Paper type: Core

Paper code: Name of the Paper: Developmental biology &Immunology Credit: ….

Total Hours per Week: ….. Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. To understand the mechanisms of reproduction and types of eggs

2. To understand the development of organogenesis of brain and eye in chick and frog

3. To understand the embryonic membrancesplacentations in chick and mammals

4. To understand the structure of lymphoid organs

5. To learn types of immunoglobulins and prevention of diseases

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to study ontogenesis, the development of animals including parthenogenesis.

2. After studied unit-2, the student will be able to study embryonic adaptations, human reproduction and reproductive technology in man.

3. After studied unit-3, the student will be able to study the process of immune response and mechanism

4. After studied unit-4, the student will be able to understand the advances in Immunology

5. After studied unit-5, the student will be able to understand the role of development in defining biological process

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	No	No	No
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	No	Yes	No	No
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	No	No	No

Unit-1: Gametogenesis – Fertilization - polarity & symmetry of eggs – types of eggs – Fertilization Mechanism, Physiology & theories – parthenogenesis –Natural –artificial – Experiments on Artificial Parthenogenesis **Teaching Hours: …**

Unit-2: Cleavage – Factors influencing cleavage – fate map – blastulation and gastrulation inamphioxus, morphogenetic movements in frog and chick – Experimental works of speeman and Mangold- Development of brain and eye in frog. **Teaching Hours: …**

Unit-3: Embryonic adaptations; Embryonic membranes and their functions in chick – placentation in mammals. Puberty – Menstrual cycle-contraception – family welfare reproductive technology; Artificial insemination - cryopreservation - IVF - Embryotransfer – Test tube babies – Bioethics **Teaching Hours: …**

Unit-4: Introduction - Lymphoid organs, cells of immune system – their role in immune response –Antigen – Antibody reaction. Types of immunity –immunity to infections,Transplantation Immunology **Teaching Hours: …**

Unit-5: Immunoglobulin – types, structure, Physico chemical and biological properties – Immunoprophylaxis – Immunization schedule of children. Immuno deficiency –AIDS, Immunotechniques **Teaching Hours: …**

Internal Assessment Methods: (refer the instructions)

Text book:

1. Balinsky, B.L., 1981. Introduction to embryology Saundeers, Philadelphia. Berril& Corp Developmental Biology. McGraw Hill Book Company, MC.,New York.
2. M.S.JayarajAn Introduction to embryology Veer BalaRastogi Publication.
3. Verma, P.S., V.K. Agarwal and Tyagi, 1995.Chordate embryology. S. Chand & co., New Delhi.
4. Nandhini shetty 2003 published by K.K. Gupta for new age international publiocation.
5. MadhaveeLatha. P, 2012.Text book of Immunology, S. Chand & Company.

Reference Book:

1. Balinsky, B.L., 1981. Introduction to embryology Saundeers, Philadelphia.
2. Berril& Corp Developmental Biology. McGraw Hill Book Company, MC.,New York.
3. M.S.JayarajAn Introduction to embryology Veer BalaRastogi Publication.
4. Verma, P.S., V.K. Agarwal and Tyagi, 1995.Chordate embryology. S. Chand & co., New Delhi.
5. Majumdar, N.N. 1990. Text Book of Vertebrate embryology. Tata McGraw - hill Publishing company Ltd. New Delhi.
6. McEwen, R.S., 1969.Vertebrate Embryology. Oxford and IBH Publishing Co., New Delhi.
7. Jain, P.C 1998, Elements of Developmental Biology. Vishal Publication, New Delhi.
8. Dubey 2006 Text book of Biotechnology S. Chand and Co., New Delhi.
9. Roitt.I.M 2000 Essential Immunology, Blackwell Scientific Publishers.

10. Paul, W.E.M. 1989,Fundamental Immunology, Raven Press, New York.
11. Kuby.J.1999, Immunology.W. H. Free man and Co. New York.
12. Current protocols in Immunology - 3 Volumes 1994 Wiley Publications.
13. Roitt.I, Brostoff, J. and Male. D. 2002. Immunology, Mosby, New York.
14. Richard, A. Golds, Thomas I, Kindt& Barbara A. Osborne 2000 Kuby Immunology, Freeman and Co.New York.

Course Material: website links, e-Books and e-journals

1. **https://examstime.in/development-biology-study-materials/**
2. **http://bgc.ac.in/pdf/study-material/developmental-biology-7th-ed-sf-gilbert.pdf**
3. **https://www.sdbonline.org/sites/archive/other/VL_DB_EducaRes.html**
4. **https://journals.physiology.org/doi/full/10.1152/advan.00116.2018**
5. **http://www.helmberg.at/immunology.pdf**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	S	S	S	S
CO2	M	S	S	S	M	S	M	M	S	M
CO3	S	M	S	S	S	S	S	S	M	S
CO4	M	S	M	S	M	S	S	M	S	M
CO5	S	M	S	S	S	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

Thiruvalluvar University, Vellore - 632115
Course writing format

Name of the course/subject: ZOOLOGY **Semester: V**
Name of the Paper: ANIMAL PHYSIOLOGY **Credits: 6 Hours of teaching:**
Paper type: Core

……

Course Objectives

1. To emphasize the basic needs of macromolecules of food and their importance
2. To study the basic principles of animal Physiology
3. To understand the physiology of various organs and organ systems.
4. To understand the energy metabolism
5. To understand the cardio vascular diseases
6. To understand the Chemical co-ordination

Course Outcomes:
1. After studied unit-1, the student will be able to understand importance of food and digestion.
2. After studied unit-2, the student will be able to gain knowledge on respiration and circulation.
3. After studied unit-3, the student will be able to understand the how to formation of urine and Kidney failure.
4. After studied unit-4, the student will be able to understand different theories of muscle contraction and transmission of nerve impulses.
5. After studied unit-5, the student will be able to acquire knowledge on Receptors and Endocrine system

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	No	No	No
2	Yes	Yes	Yes	No	No	No
3	Yes	Yes	Yes	No	No	No
4	No	Yes	Yes	No	No	No
5	Yes	Yes	Yes	No	No	No

UNIT – I
Nutrition and Digestion (18 Hours)

Introduction– Definition of food, Classification of food constituents – Carbohydrates, proteins, fats, minerals, water and vitamins. Types of nutrition, Ingestion, Feeding mechanisms, Digestion, Enzymes, Physiology of digestion – absorption, assimilation,

egestion or defaecation. Metabolism- Definition of metabolism -Carbohydrate metabolism

UNIT – II
Respiration and Circulation(18 Hours)

Definition of Respiration, Respiratory Pigments and functions. Respiratory mechanism-inspiration, Expiration. Transport of gases [Co2 and O2] – Respiratory quotient.
Circulation Types of hearts-Myogenic heart, Neurogenic heart, Composition, Properties and Function of Blood – Coagulation of Blood, Human – Cardiac Cycle – Cardiac Rhythm – Origin of heart Beat – Regulation of heart Beat – ECG – Blood Pressure – Factors Contributing to heart Problems – Coronary circulation.
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UNIT – III
Excretion and Osmoionoregulation(18 Hours)

Definition of Excretion– kinds of excretory products- Ammonotelism, Ureotelism, Uricotelism, Environmental influence on Excretion. Kidney of man, Nephron structure and formation of urine in mammals- ultrafiltration, reabsorption, secretion hormonal regulation of excretion. Kidney failure and Transplantation. **Osmoionoregulation**Definition; Types of medium, Osmosis, Osmoregulation in fishes and mammals.

UNIT – IV
Neuromuscular Co-ordination (18 Hours)

Nervous tissue – Neuron – Structure, types of neurons. Nerve impulse – Synapse – Synaptic transmission, neuromuscular junction, Reflex actions transmission of impulses – Neurotransmitters. Muscles – Types of muscles –Chemistry of Muscles – Ultrastructure of muscle fiber, Types of muscle contraction – Physical and chemical changes of muscle contraction – Theories of muscle contraction.

UNIT – V
Receptors and Endocrine system (18 Hours)

Receptors – Photoreceptor – mammalian eye –structure of retina – visual pigments – physiology of vision – phonoreceptors – mammalian ear.

Endocrine glands – structure, secretions and functions of endocrine glands of vertebrates –Pituitary-Hormones of the Adenohypophysis, Hormones of the Neurohypophysis and disorders, Hypothalamus, -Thyroid- Hormones of the thyroid gland and disorders – Parathyroid- Hormones of the parathyroid gland and disorders, Adrenal- Hormones of the

adrenal gland and disorders, Thymus, Islets of Langherhans- Hormones of the Islets of langherhans and disorders, Sex organs-testis, ovary.

Text Books

Unit-1: Sambasivaiah, Kamalakararao and Augustine chellappa 1990. A Text book of Animal physiology and ecology, S. Chand & co., Ltd., New Delhi – 110 055.

Unit-2 Parameswaran, Anantakrishnan and Ananta Subramanyam, 1975. Outlines of Animal Physiology, S. Viswanathan [printers &Publishers]Pvt. Ltd.

Unit-3 Sambasivaiah, Kamalakararao and Augustine chellappa 1990. A Text book of Animal physiology and ecology, S. Chand & co., Ltd., New Delhi – 110 055.

Unit-4 A Text Book of Animal physiologySaras Publication Nagercoil Tamil Nadu

Unit-5 Sambasivaiah, Kamalakararao and Augustine chellappa 1990. A Text book of Animal physiology and ecology, S. Chand & co., Ltd., New Delhi – 110 055.

Reference Items: books, Journal

1 - William S. Hoar, 1976. General and comparative physiology, prentice Hall of India Pvt. Ltd., New Delhi. 110 001.

2. Wood. D.W, 1983, Principles of Animal Physiology 3rd Ed.,

3. Prosser, C.L. Brown, 1985, Comparative Animal Physiology, Satish Book Enterprise, Agra – 282 003.

E- Materials

1. 2https://www.perlego.com/browse/biological-sciences/zoology
2. http://www.freebookcentre.net/Biology/Zoology-Books.html
3. https://www.pdfdrive.com/zoology-textbooks-online-e10983221.html
4. http://www.freebookcentre.net/biology-books-download/Textbook-of-zoology.html
5. https://www.e-booksdirectory.com/listing.php?category=134
6. https://www.ikbooks.com/subject/life-sciences/zoology/151
7. http://rastogipublications.com/index.php?route=product/category&path=25
8. https://bookwindow.in/zoology-textbooks

9. https://www.routledge.com/life-science/zoology
10. https://www.fullonstudy.com/bsc-1st-year-zoology-books
11. https://link.springer.com/book/10.1007/978-1-349-00198-9
12. https://vertebrate-zoology.arphahub.com/
13. https://www.quora.com/From-which-websites-can-I-download-free-e-books-in-PDF-format-botany-microbiology-zoology
14. https://www.mheducation.com/highered/category.12255.zoology.html
15. https://library.si.edu/research/vertebrate-zoology
16. 1https://www.kopykitab.com/Zoology-eBooks

Mapping with Programme Outcomes

COs	**PO1**	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	M	M	M	S	M	M
CO2	M	S	M	S	M	M	S	M	M	M
CO3	M	S	S	M	S	M	S	M	M	M
CO4	M	M	M	S	S	S	M	m	S	M
CO5	S	M	S	S	M	M	S	s	M	M

PO – Programme Outcome, CO – Course outcome S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.Sc Zoology) – 2022-2023 onwards
Semester: III Paper type: Internal Elective

Paper code: Name of the Paper:NANOTECHNOLOGY IN LIFE SCIENCE

Total Hours per Week: 3 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

ELECTIVE
PAPER – 3
A. NANOTECHNOLOGY IN LIFE SCIENCE

Objectives:

1. To impart current knowledge in Nanotechnology.
2. To create fundamental understanding of usage of Nanometerial in life science.

COURSE OUTCOME: After completion of the course the student will ..

1. After studied unit-1, the student will be able to Understand the basics of nanotechnology.
2. After studied unit-2, the student will be able to Get knowledge about the levels and devices in nanotechnology.
3. After studied unit-3, the student will be able to Acquire knowledge about nanotechniques at molecular level.
4. After studied unit-4, the student will be able to Learn the evaluation of nanomaterials.
5. After studied unit-5, the student will be able to Learn about the application of nanomaterials in various fields.

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT – I

Scope – Fundamental Understanding of concepts and Methods of Nanotechnology – overview on Nanotechnology and Interdisciplinary field.

UNIT – II

Basic and structural Nanotechnology. Molecular and Macromolecular Levels – Nanoscales – devices and systems developed in Nanotechnology.

UNIT – III

Nanotechnology adopted in DNA computing, Molecular Nanotechnology, Quantum Nanotechnology, Optical and Particles used in Nanotechnology.

UNIT – IV

Use of carbon nanotubules, Better and cheaper nanomaterials – Evaluation of nanomaterials and nanosystemsby using conventional materials.

UNIT – V

Application of nanotechnology in the fields of Agriculture, Medicine. Future perspectives of Nanotechnology in life Sciences.

Reference Books:

1. Shanmugam, S.2009 : Nanotechnology, MJP-Publ. Chennai – India.
2. Kumar,U, 2008 : Nanotechnology – A Fundamental Approach – Agrobios – India.
3. Ratner, 2008 : Nanotechnology-A Gentle Introduction to next big idea Tamilnadu Book House, Chennai – India.
4. Goodshell, D.S, 2004 – Biotechnology : Lessons from Nature – John Wiley & Sons (Asia) Publ.Ltd, Singapore.
5. Jeremy Ramsden, 2016: Nanotechnology 2nd edition, William Andrew, Cranfield University
6. Murty, B.S., Shankar, P., Raj, B., Rath, B.B., Murday, J, 2012: .Textbook of Nanoscience and Nanotechnology, Orient Blackswan Private Limited - New Delhi.
7. T. Pradeep A, 2017: Textbook of Nanoscience and Nanotechnology- McGraw Hill Education; 1 edition.
8. Gabor L Hornyak., Harry F. Tibbals., Joydeep Dutta and John J. Moore.,2011: Introduction to Nanoscience and Nanotechnology CRC Press Taylor And Francis Group Boca Raton, New York.
9. Guozhong Cao, 2004: Nanostructures and Nanomaterials Synthesis, Properties and Applications, Imperial College Press, London.
10. Michael S Ashby, Paulo J.Ferreira., Daniel L. Schodek, 2009: Nanomaterials, Nanotechnologies and Design. An Introduction for Engineers and Architects. Elsevier, Oxford, UK.

Course Material: website links, e-Books and e-journals

1. https://www.researchgate.net/publication/261638569_Biological_Applications_of_Nanobiotechnology
2. https://web.pdx.edu/~pmoeck/phy381/intro-nanotech.pdf
3. https://onlinelibrary.wiley.com/doi/abs/10.1002/9781119509868.ch17
4. https://www.hilarispublisher.com/open-access/novel-applications-of-nanotechnology-in-life-sciences-1948-593X.S11-001.pdf
5. https://www.aist.go.jp/Portals/0/resource_images/aist_e/research_results/publications/pamphlet/today/nanotechnology_e.pdf

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	S	S	S
CO3	M	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	M

PO – Programme Outcome, CO – Course outcome
S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.Sc Zoology) – 2022-2023 onwards
Semester: III Paper type: Internal Elective

Paper code: Name of the Paper: HUMAN ENDOCRINOLOGY
Credit: 3
Total Hours per Week: 3 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

B. HUMAN ENDOCRINOLOGY

Objectives:

1. To understand the structure and functions of endocrine glands in human.
2. To learn about the hormonal regulation and their defects in human.

COURSE OUTCOME: After completion of the course the student will ..

1. After studied unit-1, the student will be able to Learn about the structure and function of Pituitary.
2. After studied unit-2, the student will be able to Understand the biological actions of the thyroid and parathyroid.
3. After studied unit-3, the student will be able to Know about the emergency hormones.
4. After studied unit-4, the student will be able to Learn the Mechanism of action and regulation of pancreatic hormones.
5. After studied unit-5, the student will be able to Understand about the function of the male and female reproductive hormones.

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT – I

Pituitary Gland: Classification and characteristic features of hormones. Structure of hypothalamus and pituitary Gland – Hormones of Adenohypophysis, Pars intermedia and Neurohypophysis. Effects of hypo and hyper secretions - Hypothalamic regulation for release of pituitary hormones.

UNIT – II

Thyroid and Parathyroid: Structure of thyroid Gland – Biosynthesis of thyroid hormones. Biological functions of Thyroxine, Regulation of Thyroid secretion-Thyroid Dysfunction – Parathyroid Glands- Biological Action of parathyroid Hormones – Parathyroid Dysfunction

UNIT – III

Adrenal gland: Structural features- hormones of Adrenal medulla and Cortex and their functions - Biological Action of Adrenaline and Noradrenalin – Emergency Hormones.

UNIT – IV

Islets of Langerhans: Histology – hormones Insulin and Glucagon – Biosynthesis of Insulin-Regulation and Mechanism of Action.

UNIT – V

Testes and ovaries: Male reproductive system – Hormonal control of testes Chemistry and Biosynthesis of Testosterone – functions of testosterone Female reproduction system – role of Hormones in Female sexual Cycle Placental hormones – parturition – Lactation.

Reference Books:

1. Mac E Hadley, 1992 Endocrinology, Third edition, prentice Hall, New Delhi.
2. Matsumoto A. and Ishi S., 1992. Atlas of endocrine organs, vertebrates and invertebrates Springier Verlag, Germany.
3. Wilson J.D and Foster D.W 1992, William's textbook of endocrinology, 8th edition, WB saunders company, Philadelphia.
4. World health organization Technical report series, 1992, Oral contraceptives and Neoplasia WHO, Geneva.
5. Turnerm C.D and Bagnarr, J.T., 1994, General Endocrinology, 6th edition, WB saunder's company, Philadelphia [saunder's international students edition]
6. Lamming, G.E. 1984. Marshll,s Physiology of Reproduction; Reproductive cycles of vertebrates. Churchill livingstone, Edinburgh.
7. Prakash S Lohar Endocrinology, Hormones and Human Health.
8. Parameswaran, Anantakrishnan and Ananta Subramanian, 1975- Outlines of Animal Physiology - S. Viswanathan (Printers and Publishers) Pvt. Ltd.,
9. William S.Hoar,1976- General and Comparative Physiology - Prentice Hall of India Pvt., Ltd., New Delhi.
10. Guyton, A. 2001. Textbook of Medical physiology, Tenth Edition, W.B. Saunders, London.

Course Material: website links, e-Books and e-journals

1. https://www.uc.edu/content/dam/uc/ce/docs/OLLI/Page%20Content/The%20Endocrine%20System.pdf
2. https://pubs.niaaa.nih.gov/publications/arh22-3/153.pdf
3. http://acbrdu.edu/ClassNotes/Human_physiology16032020.pdf
4. http://www.uop.edu.pk/ocontents/Lec%20no%203(3).pdf
5. https://www.researchgate.net/publication/325680983_Endocrine_System

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	S	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	S
CO5	S	S	M	S	S

PO – Programme Outcome, CO – Course outcome
S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: V Paper type: SKILL BASED SUBJECT

Paper code Name of the Paper: ANIMAL BEHAVIOUR Credit: 2

Total Hours per Week: 3 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. Distinguish between the four major categories (mechanism, ontogeny, adaptive value, and phylogeny) of explanations for animal behaviour
2. Explain how behavioural hypotheses are created and formulate hypotheses that explain a given behaviour
3. Understand the role of natural and sexual selection in the evolution of behaviour
4. Understand the ecological context of an animal's behavioural sequence
5. Understand some of the mechanisms involved in the production of a behavioural sequenceby an animal

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be capable of understanding and identify behaviour in a variety of taxa.

2. After studied unit-2, the student will be able to competently discuss the evolutionary origins of various behaviours

3. After studied unit-3, the student will be able to design and implement experiment to test hypothesis relating to animal behaviour

4. After studied unit-4, the student will be able to demonstrate knowledge of key concepts in animal behaviour

5. After studied unit-5, the student will be able to exhibit quantitative research skills.

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	No	No	No
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: Introduction and mechanisms of behaviour -origin and history of Ethology - types of behaviour - proximate and ultimate behaviour - objective of behaviour- behaviour as a basis of evolution - behaviour as a discipline of science **Teaching Hours: 12**

Unit-2: Patterns of behaviour reflexes - reflex path, characteristics of reflexes latency, after discharge, summation, fatigue, inhibition and it comparision with complex behaviour- orientation- primary and secondary orientation - learning - associative learning, classical and conditioning, habituation and imprinting **Teaching Hours: 12**

Unit-3: Social behaviour with reference to insect society, Honey bee - society organization, polyethism foraging, round dance - waggle dance - experiment to prove distance and direction compound of dance, learning ability in honey bee -formation of new hive/queen, supersedure, reciprocal altruism, Hamiltons rule and include fitness with suitable example **Teaching Hours: 12**

Unit-4: Sexual behaviour, asymmetry of sex, sexual dimorphism-intra sexual selection (male rivalry) intersexual selection (female choice) infanticide, consequence of mate choice for female fitness, sexual conflict for male versus female - parental care and courtship behaviour in three spine stickleback **Teaching Hours: 12**

Unit-5: Biology rhythm - types and characteristics of biological rhythms - short and long term rhythms -circardian rhythm- lunar rhythms- circannual rhythm- photoperiod and regulation seasonal reproduction of vertebrates - biological adaptic significance of biological clock. **Teaching Hours: 12**

Internal Assessment Methods: (refer the instructions)

Text book:

1. Dugatkin, L.A. 2013. Principles of Animal Behavior. 3rd Edition.WW Norton and Co.
2. R. Dukas& J.M. Ratcliffe. 2009. Cognitive ecology II. University of Chicago Press, 2009
3. Kappeler, P.M. 2010. Animal Behaviour: Evolution and Mechanisms (electronic resource).
4. Berlin, Heidelberg : Springer-Verlag Berlin Heidelberg. Grier, J.W. and T. Burk. 1992. Biology of Animal Behaviour. 2nd Edition, Mosby.
5. Alcock, J. 2009. Animal Behavior: An Evolutionary Approach. 9th Edition, Sinauer.
6. Drickamer, L.C., Vessey, S.H. and Meikle, D. 2002. Animal Behavior: Mechanisms, Ecology and Evolution. WMC Brown Publishers.
7. Goodenough, J., McGuire, B., and Jakob, E. 2010. Perspectives on Animal Behavior. 3rd Edition. John Wiley and Sons.
8. Martin, P. and Bateson, P. 1986. Measuring Behaviour: An Introductory Guide. Cambridge University Press.

Reference Book:

1. Animal behavior - an evolutionary approach by JOHN ALCOCK - Ninth edition.
2. Animal behaviour (ETHOLOGY) V.K. Agarwal - S. Chand publishers.

3. Animal behaviour - a very short introduction -wyattTristram D- oxford publishers.
4. Altmann, J. 1974. Observational study of behavior: sampling methods. Behaviour 49:227-266.
5. Sherman, P.W. and J. Alcock. 2013. Exploring Animal Behavior: Readings from American Scientist. Sixth Edition. ISBN-13: 978-1605351957
6. Nordell SE and Valone, TJ. 2017. Animal Behavior: Concepts, Methods, and Application. Second edition. Oxford University Press: New York

Course Material: website links, e-Books and e-journals

1. **http://www.exeter.ac.uk/undergraduate/degrees/biosciences/animal/**
2. **https://www.coursera.org/lecture/animal-welfare/welcome-QNEYh**
3. **https://www.studyandscore.com/study-material/animal-behaviour**
4. **https://www.bbau.ac.in/dept/dz/TM/ZL%20202%20Animal%20Behaviour.pdf**
5. **https://www.ias.ac.in/Publications/e-Books/Experiments_in_Animal_Behaviour**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	M	S	S	M	S
CO2	S	S	M	M	M	S	M	M	S	S
CO3	M	M	S	S	S	M	S	S	S	S
CO4	S	S	S	M	S	S	S	S	S	M
CO5	S	S	M	S	S	S	S	M	M	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: IV Paper type: SKILL BASED SUBJECT

Paper code: Name of the Paper: VEGETABLE MEAT CULTURE Credit: 2

Total Hours per Week: 3 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1.To understand the principles of mushroom cultivation

2.To acquire the practical knowledge to grow several species of fungi,

3. To have the confidence to approach the mushroom industry for potential employment opportunities

4. To procure knowledge about the nutritive values of mushroom.

5. To understand the medicinal values of mushrooms

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand the principles of mushroom cultivation

2. After studied unit-2, the student will be able to acquire the practical knowledge to grow several species of fungi,

3. After studied unit-3, the student will have the confidence to approach the mushroom industry for potential employment opportunities

4. After studied unit-4, the student will be able to procure knowledge about the nutritive values of mushroom.

5. After studied unit-5, the student will be able to understand the medicinal values of mushrooms

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	No	No	No
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	Yes	Yes	No	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: Introduction, history and scope of mushroom cultivation; biology of mushrooms; Nutritional value: (Proteins, amino acids, mineral elements, carbohydrates, fibers, vitamins); Medicinal value of mushrooms; Poisonous mushrooms and mushroom poisoning; edible mushrooms and cultivation in India and world **Teaching Hours: 12**

Unit-2: Structure and key for identification of edible mushrooms-Button mushroom (Agaricusbisporus), Milky mushroom (Calocybe indica), Oyster mushroom (Pleurotussajorcaju) and paddy straw mushroom (Volvariellavolvcea). Structure and key for identification of poisonous mushrooms-Truffles (Tuber elanosporum), Ammanitasp, Galerina marginata, and Chlorophyllum molybdites **Teaching Hours: 12**

Unit-3: Cultivation Technology: Infrastructure, equipments and substrates in mushroom cultivation: Polythene bags, vessels, inoculation hook, inoculation loop, culture racks, mushroom unit or mushroom house, water sprayer, tray, boilers, driers, pure culture, Spawn: types of spawn, preparation of spawn, mushroom bed preparation and factors affecting mushroom bed preparation; Compost: materials used for compost preparation, compost technology in mushroom production **Teaching Hours: 12**

Unit-4: Nutrient Profile of Mushroom: Protein, aminoacids, calorific values, carbohydrates, fats, vitamins & minerals- Nutrient supplements for human consumption as vegetable meat. Nature, Medicinal and nutritional value, Health benefits: Microbicidal effects. Therapeutic Aspects: Antitumour effect **Teaching Hours: 12**

Unit-5: Factors influence contamination, diseases in mushrooms in mushroom cultivation-Environmental, fungal, bacterial, viral, insect pests, Nematode diseases, and competitor moulds. National level and regional level, Marketing of mushrooms in India and world **Teaching Hours: 12**

Internal Assessment Methods: (refer the instructions)

Text book:

1.Nita Bhal. (2000). Handbook on Mushrooms. 2nd ed. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2.Marimuthu, T. et al. (1991). Oyster Mushroom. Department of Plant Pathology. Tamil Nadu Agricultural University, Coimbatore.
3.Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication, New Delhi.
4.Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
5.Kannaiyan,S.Ramasamy,K. (1980). A hand book of edible mushroom, Today & Tomorrows Printers &Publishers, New Delhi.
6.Mushroom Cultivation, Tripathi, D.P.(2005) Oxford & IBH Publishing Co. PVT.LTD, New Delhi.
7. Mushroom Production and Processing Technology, PathakYadavGour (2010) Published by Agrobios (India).

Reference Book:

1. Pandey R.K, S. K Ghosh, 1996. A Hand Book on Mushroom Cultivation. Emkey Publications.
2. Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. PVT.LTD, New Delhi.
3. V.N. Pathak, Nagendra Yadav and Maneesha Gaur, Mushroom Production and Processing Technology/ VedamsEbooks Pvt Ltd., New Delhi (2000)
4. Paul Stamets, J.S. and Chilton, J.S. 2004. Mushroom cultivation A practical guide to growing mushrooms at home, Agarikon Press.
5. Shu Fing Chang, Philip G. Miles and Chang, S.T. 2004. Mushrooms Cultivation, nutritional value, medicinal effect and environmental impact. 2nd ed., CRC press

Course Material: website links, e-Books and e-journals

1. **https://extension.psu.edu/six-steps-to-mushroom-farming**
2. **https://www.mushroomoffice.com/mushroom-cultivation/**
3. **https://www.researchgate.net/publication/339616804_MUSHROOM_CULTIVATION_A_BEGINNERS_GUIDE_SECOND_EDITION**
4. **https://vikaspedia.in/agriculture/farm-based-enterprises/mushroom-production/button-mushroom-production**
5. **https://www.kolhapur-mushrooms.in/2021/01/what-are-equipment-required-for.html**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	M	S	S	S
CO2	M	S	S	M	S	S	S	M	S	S
CO3	S	S	M	S	S	M	S	S	S	M
CO4	S	S	S	M	M	S	S	S	M	S
CO5	S	S	S	S	S	S	S	M	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

Thiruvalluvar University, Vellore - 632115
Course writing format

Name of the course/subject: ZOOLOGY

Semester: VI
Name of the Paper: ENVIRONMENTAL BIOLOGY Credits: 5 Hours of teaching: 5
Paper type: Core
……

Course Objectives

1. To emphasize the basic needs of abiotic factors

2. To study the basic fundamental units of ecosystem and different habitats

3. To realize the importance of inter relationship between every organism and environment
4. To understand the population and community ecology

5. To understand the Natural resourses

6. To create awareness towards recent changes in the environment and preventive measures.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand Scope, concept, Branches in ecology andEnvironmental factors (soil, light, temperature, water and air).

2. After studied unit-2, the student will be able to understand fundamental units of ecosystem, Tropic levels of ecosystem and Food chain.

3. After studied unit-3, the student will be able to understand Biogeochemical cycles and importance of inter relationship between every organism and environment

4. After studied unit-4, To acquire the knowledge about population and community ecology, ecological succession, aims of wild life conservation and Natural resources.

5. After studied unit-5, the student to acquire the knowledge environmental hazards, Environmental ethics and laws.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	No	No	No
2	Yes	Yes	Yes	No	No	No
3	Yes	Yes	Yes	No	No	No
4	No	Yes	Yes	No	No	No
5	Yes	Yes	Yes	No	No	No

UNIT – I
Definition of Ecology, **(18 Hours)**

Derivation of the term, Scope – concept – Branches in ecology. **Environmental factors-- Soil** -Types, soil formation, Soil group of India, Soil components, Soil chemistry, soil pH, Soil air, Soil organisms. **Light**—Spectrum, Light on land, Light in water, Biological effects of light. **Temperature**—Range of temperature Homeiothermic and poikilothermic organism, Methods of meeting temperature extremes, Effect of temperature. **Water:** Properties of water, Soft and hard water, Composition of natural waters, Water problem in different habitats, Effects of humidity on growth and distribution of animals, Precipitation. **Air** composition – properties

UNIT – II
Definition of ecosystem, Abiotic substances, Producer, Consumers, Decomposers, Transformers, Tropic levels in an ecosystem, Food chain, Food web, Ecological pyramids, pyramid of numbers, pyramid of biomass,
Habitat ecology—Freshwater Habitats, Types of freshwater Habitats –Lentic habitats, Lotic habitats, freshwater adaptations. Marine habitats -- Types of marine water habitats, pelagic adaptations, adaptations of deep sea.

UNIT – III
Biogeochemical cycles – gaseous cycle [Carban cycle, Nitrogen cycle] sedimentary cycle, [phosphates].
Animal association - Intra specific and inter specific - colony formation, social organization, predation, parasitism, commensalisms, mutualism, inter specific competition – competitive principle or Gause's principle.

UNIT – IV

Population: Definition – characteristics – Natality, Mortality, age distribution of Population growth forms, population fluctuation. Community Ecotone and edge effects– ecological succession.
Wild life Conservation-aims of wild life conservation, methods of conservation, endangered species– sanctuaries and National parks.
Natural resources –types of resources, forest resources.

UNIT – V
Environmental degradation – deforestation, urbanization, population explosion and other environmental hazards – Environmental ethics and laws – Earth summits – role of governmental agencies for environmental monitoring.
Space ecology—environmental problems of space travel.

Text Books

Unit-1: Sambasivaiah, Kamalakararao and Augustine chellappa 1990. A Text book of Animal physiology and ecology, S. Chand & co., Ltd., New Delhi – 110 055.

Unit-2 Kotpal. R.L, and N.P. Bali, 1986. Concepts of Ecology, Vishal Publications, New Delhi – 7

Unit-3 Rastogi V.B, and M.S. Jayaraji, 1988 – 1989. Animal Ecology and Distribution of animals, Kedarnath, Ram Nath Meerut – 250 001.
110 055.

Unit-4 Concepts of Ecology Saras Publication Nagercoil Tamil Nadu.

Unit-5 Verma, P.S and Agarwal 1986, Environmental Biology, S. Chand & Co Ltd.
Richard, Manual of wild life conservation.

Reference Items: books, Journal

1 - Clark, G.L. 1954, Elements of Eology, John wiley& Sons Inc., New York, London

2. Eugene P. Odum, 1971. Fundamentals of ecology, Saunders International Student Edition, W.B. Saunders Company, Philadelphia London, Toronto

3. SunakarPanda , Environmental & Ecology .

E- Materials

1. https://www.perlego.com/browse/biological-sciences/zoology

2. http://www.freebookcentre.net/Biology/Zoology-Books.html
3. https://www.pdfdrive.com/zoology-textbooks-online-e10983221.html
4. http://www.freebookcentre.net/biology-books-download/Textbook-of-zoology.html
5. https://www.e-booksdirectory.com/listing.php?category=134
6. https://www.ikbooks.com/subject/life-sciences/zoology/151
7. http://rastogipublications.com/index.php?route=product/category&path=25
8. https://bookwindow.in/zoology-textbooks
9. https://www.routledge.com/life-science/zoology
10. https://www.fullonstudy.com/bsc-1st-year-zoology-books
11. https://link.springer.com/book/10.1007/978-1-349-00198-9
12. https://vertebrate-zoology.arphahub.com/
13. https://www.quora.com/From-which-websites-can-I-download-free-e-books-in-PDF-format-botany-microbiology-zoology
14. https://www.mheducation.com/highered/category.12255.zoology.html
15. https://library.si.edu/research/vertebrate-zoology

Mapping with Programme Outcomes

COs	**PO1**	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	M	M	M	S	M	M
CO2	M	S	M	S	M	M	S	M	M	M
CO3	M	S	S	M	S	M	S	M	M	M
CO4	M	M	M	S	S	S	M	m	S	M
CO5	S	M	S	S	M	M	S	s	M	M

PO – Programme Outcome, CO – Course outcome S – Strong, M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: VI Paper type: Core

Paper code: Name of the Paper: ECONOMIC ZOOLOGY Credit: 5

Total Hours per Week: 5 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1. 1.To encourage young learners to take up the small scale industries
2. 2.To generate motivation for Self-Employment
3. 3.To disseminate information on economic aspects of Zoology
4. 4.To inculcate knowledge on useful animals to Mankind
5. 5.To satisfy the learners with modern techniques of Animal culture

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to will be able to understand Vermiculture
2. After studied unit-2, the student will be able to learn about Pisciculture - Techniques
3. After studied unit-3, the student will be able to learn about Economics of Poultry keeping.
4. After studied unit-4, the student will be able to learn about Dairy farm management
5. After studied unit-5, the student will be able to learn about Future strategies for Livestock Development

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	Yes
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	No	No	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: (50 to 100 contents) **Teaching Hours: 15**

A) Vermiculture and Composting

Economic Entomology: Useful Insects of commercial values,

B) A piculture - Species of Honeybees - Honey extraction - Economics of Apiculture and management.

C) Sericulture - Nature and economic importance of Sericulture in India

Unit-2: (50 to 100 contents) **Teaching Hours: 15**

Economics of aquaculture-
A] Pisciculture - Techniques of induced breeding Commercial culture of catla& cat fish By-Products of Fishing and its commercial values.
B] Prawn culture -Culture techniques of fresh water (Macrobrachiumrosembergii) & Marine water (Penaeus monodon) preservation - processing and export techniques adopted in Prawn fishiery.
C] Pearl culture: Formation and nature of Pearls - Commercial importance of Pearl Culture in India.

Unit-3: (50 to 100 contents) **Teaching Hours: 15**

Economics of Poultry keeping: Morphology of different breeds of Chicken - Brooding and Rearing of Chicks-Processing of Egg, Meat and By-Products of Poultry.

Unit-4: (50 to 100 contents) **Teaching Hours: 15**

A]: Dairy farm management, Milch breeds. Draught breeds, Dual purpose breeds and New Cross breeds of Cows and Buffaloes in India.
B]: Sheep farming: Indigenous and Exotic breeds of Sheep.

Unit-5: (50 to 100 contents) **Teaching Hours:15**Future strategies for Livestock Development - Transgenic Animal Technology - Genetic Improvement for best breeds - Economic importance of Dairy, Leather, Wool, Fur and Pharmaceutical Industries in India.

Internal Assessment Methods: (refer the instructions)

Text Books:

1. Sukla, G.S. and Upadhyay, V.B., 2000 Economic Zoology - ISBN - 81-7133-137-8
2. Rastogi Publications, Meerut, India.
3. Jawaid Ahsan and Subhas Prasad Sinha, 2000 A Handbook on Economic Zoology-ISBN-81-219-0876-O S. Chand & Co., Ltd., New Delhi.

Reference Books:

1. Ashok Kumar and Prem mohan Nigam, 1991 Economic and Applied Entomology Emkay Publications, New Delhi.
2. Shammi, Q.J. and Bhatnagar, S., 2002 Applied Fisheries: ISBN-81-7754-114-5 Agrobios (India), Jodhpur - India.
3. Major Hall, C.B. 2005 Ponds and Fish culture - ISBN-81-7754-146-3 Agrobios (India), Jodhpur - India.
4. Keith Wilson, N.D.P., 2005 A Handbook of Poultry Practice - ISBN-81-7754-O-69-6 Agrobios (India), Jodhpur - India.
5. Banerjee, G.C. 1992 Poultry - III- Edition - ISBN-81-204-008-4 Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

6. Banerjee, 1988 A Text Book of Animal husbandry-VIII-Edition-ISBN-81-204-1260-5 Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Kaushish, S.K., 2001 Trends in Livestock Research - ISBN-81-7754-112-9 Agrobios (India), Jodhpur - India.
8. Ismail, S.A. 1997. Vermicology the Biology of Earth worm Orient Longman, India
9. A. Mary violet Christy 2008 vermy technology MJP Publ. Chennai

Course Material: website links, e-Books and e-journals

https://onlinecourses.swayam2.ac.in/cec20_ge23/preview

https://www.classcentral.com/course/swayam-applied-and-economic-zoology-20222

https://programs.online/top-basic-sciences-programs/p/cec/applied-and-economic-zoology

https://unacademy.com/lesson/branch-of-economic-zoology-in-hindi/XMLCXRN9

https://onlinelibrary.wiley.com/doi/pdf/10.1002/sce.3730330509

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	M	M	M	S	M
CO2	M	S	M	S	M	M	S	M	S	M
CO3	M	M	S	M	S	M	M	M	M	M
CO4	S	M	M	M	S	M	S	M	M	M
CO5	M	S	M	M	M	S	M	S	M	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: VI Paper type: PRACTICAL

Paper code: Name of the Paper: CORE PRACTICAL - III Credit: 3

Total Hours per Week: 3 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1.To give students competent lab skills in Biostatistics

2. To give students competent lab skills in animal physiology.

3. To give students competent lab skills in developmental biology

4. Use experimental techniques to address immunological questions.

5. To give students competent recording skills

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to solve biostatistic problems

2. After studied unit-2, the student will be able to understand experimental physiology

3. After studied unit-3, the student will be able to understand experimental Developmental biology

4. After studied unit-4, the student will be able to understand Immunological techniques

5. After studied unit-5, the student will be able to record the experimental findings

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	No	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	No	No	No	No

Unit-1: BIOSTATISTICS:
Biological data - calculation of mean, median, mode, Mean and standard deviation.
Graphical representation - Bar, Pie, frequency distribution.
Demonstration of MS- word, MS-Excel and MS-PPT. **Teaching Hours: 12**

Unit-2: ANIMAL PHYSIOLOGY:
Activity of human salivary amylase in relation to Ph, Enzyme concentrate and Temperature.
Estimation of Oxygen consumption in a fish with reference to body weight.
Detection of nitrogenous waste products in fish tank water, frog tank water, bird excreta and mammalian urine/ Kidney.
Use of Kymograph Unit, B.P. apparatus, stethoscope. **Teaching Hours: 12**

Unit-3: DEVELOPMENT BIOLOGY:
Study of the following prepared slides / museum specimens.
Section of testis and Ovary [Mammalian].
Slides of Mammalian sperm and ovum.
Study of Egg types - Frog's Egg, Hen's Egg.
Study of cleavage stages 2 Cell, 4Cell, 8Cell - Blastula and gastrula of Frog.
Slides of different stages of chick embryo - 18 hours [primitive streak stage], 24 hours, 48 hours 72 hours and 96 hours.
Placenta of Sheep, Pig and Man. **Teaching Hours: 12**

Unit-4: IMMUNOLOGY:
Study of Antigen - Antibody reaction - Human Blood grouping [ABO and Rh].
Study of prepared slides of histology: Thymus, Spleen, Bone marrow, Lymph node.
Teaching Hours: 12

Unit-5: Record Note **Teaching Hours: 12**

Internal Assessment Methods: (refer the instructions)

Text book:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata
2. Textbook - Principles Of Animal Physiology 3/e By Moyes & Schulte Published by Pearson.
3. Developmental Biology – Scott F. Gilbert – 8 th Edition, Sinauer Associates Inc., 2006
4. Practical immunology, Frank Hay, 4th Edition , Blackwell Science
5. A Handbook of Practical Immunology – G P Talkwar

Reference Book:

1. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co.Ltd.
2. Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley & Sons, Inc.

3. Principles of Development – L. Wolpert – 4 th Edition, Oxford University Press, 2011.
4. Fundamental Immunology 5th edition (August 2003): by William E., Md. Paul (Editor) By Lippincott Williams & Wilkins Publishers
5. Lab Manual: Cell/Immunology Laboratory Manual

Course Material: website links, e-Books and e-journals

1. **https://bioboot.github.io/bioinf525_w16/class-material/BI525W16Lec2.1.pdf**
2. **https://ctools.umich.edu/access/content/group/cd806bd4-a051-4873-9be1-4a158109a66b/Module%202/Labs/Lab1%20with%20Key.pdf**
3. **https://www.slideshare.net/vidhyakalaivani29/animal-physiology-and-biochemistry-lab-manual-64718095**
4. **https://www.researchgate.net/publication/241594386_Key_Experiments_in_Practical_Developmental_Biology**
5. **https://www.urmc.rochester.edu/MediaLibraries/URMCMedia/labs/frelinger-lab/documents/Immunology-Lab-Manual.pdf**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	M	S	M	S
CO2	M	S	S	S	M	M	S	S	S	S
CO3	S	M	S	M	S	S	S	S	S	M
CO4	S	S	S	S	M	S	M	M	M	S
CO5	S	S	S	S	S	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: IV Paper type: Core Practical

Paper code: Name of the Paper: Core Practical IV Credit: 3

Total Hours per Week: 3 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

……

Course Objectives

1.To introduce the basics of Ecology and Environmental Sciences to students

2.To study the economic importance of apiculture

3.To know practices and economic importance of vermiculture

4.To understand the evidences of evolution and theories of evolution

5.The study of evolution will enable the student to gain knowledge about adaptations

behavioral pattern of animals and their role in evolution.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to perform ecological experiments

2. After studied unit-2, the student will be able to identify the parasites of fish and cultivable earthworms

3. After studied unit-3, the student will be able to identify the larvivorous fish and pest

4. After studied unit-4, the student will be able to identify the fossils of evolutionary importance

5. After studied unit-5, the student will be able to Record their findings

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	No	Yes	Yes
3	Yes	Yes	Yes	No	No	No
4	Yes	Yes	Yes	No	No	No
5						

Unit-1: ENVIRONMENTAL BIOLOGY

Estimation of Dissolved oxygen, salinity, pH, Free Co2, Carbonate and Bicarbonates in water

samples.
Use of rain gauge, Maximum and Minimum thermometer, Hygrometer and Anemometer.
Plankton study - fresh water and Marine plankton.
Study of natural ecosystem and field report. **Teaching Hours: 12**

Unit-2: ECONOMIC ZOOLOGY

Study of the following prepared slides / specimens

Earthworm types [any two] - [vermiculture].
Megacolexmauritii- south Indian species - surface crawlers.
Drawidamodesta– Redsoil with calciferous gland.
Pheretimaposthuma- North Indian - Large specimen.
Eudrilus eugenia - Redworm, Exotic.
Fish parasites [Lernea, Argulus **Teaching Hours: 12**

Unit-3: ECONOMIC ZOOLOGY

Study of the following prepared slides / specimens

Larvivorousfishes :
Poecelia reticulate - Guppy.
Gambusia Affinis-Gambusi.
Colisa labia - Dwarf gowrami.
Different stage of **Silk worm.**
Types of **Bees.**
Common **Pests.** **Teaching Hours: 12**

Unit-4: EVOLUTION

Study of the following prepared slides / specimens

EVOLUTION
Fossils - ammonite.
Living fossils - Limulus, sphenodon.
Conneting link -peripatus, archaeopteryx.
Evolutionary significance -exocoetus, draco, hippocampus.
Mimicry - monarch butterfly.
Camouflage - chameleon. **Teaching Hours: 12**

Unit-5: Record Work **Teaching Hours: 12**

Internal Assessment Methods: (refer the instructions)

Text book:

1. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Sounders.
2. Purohit, S.S. & Ranjan, R. 2007. Ecology, Environment & Pollution. Agrobios Publications.
3. Freeman, A.M. 2003. Millennium Ecosystem Assessment: Conceptual Framework. Island Press.
4. Shukla, G.S. &Upadhyay, V.B. : Economic Zoology, 4e, 2002, Rastogi.
5. Shukla, G.S. &Upadhyay, V.B. : Economic Zoology, 4e, 2002, Rastogi.
6. Singh, S. : Bee keeping in India, ICAR.
7. Srivastava, C.B.L. : Fishery Science and Indian Fisheries, 2002, Kitab Mahal
8.

Reference Book:

1. Singh, J.S., S.P & Gupta, S.R. 2006. Ecology, Environment and Resource conservation. Anamaya Publ., New Delhi, 688 pp.
2. Miller. G.T. 2004. Environmental Science. Thomson, California. 538 pgs.
3. Chapman, J.L.& M.J. Reiss. 1998. Ecology: Principles and Applications. Cambridge Univ. press. 2 nd edition. 336 pgs.
4. Krebs, C.J. 2008. Ecology: The experimental Analysis of Distribution and Abundance (6th Edition), Benjamin Cummings Publ. 688pgs

Course Material: website links, e-Books and e-journals

1. http://bioweb.uwlax.edu/bio203/s2008/krout_bria/hostinteractions.htm
2. http://www.biologydiscussion.com/invertebrate-zoology/phylum-nemathelminthes/wuchereria-bancrofti-structure-morphology-and-pathogenesis/34293
3. https://nptel.ac.in/courses/126104003/LectureNotes/Week-1_04 Pest,pdf
4. https://www.khanacademy.org/science/high-school-biology/hs-evolution/hs-evolution-and-natural-selection/a/hs-evolution-and-natural-selection-review
5. https://www.jagranjosh.com/general-knowledge/environment-ecology-a-complete-study-material-1464852780-1

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	M	S	S	S	S
CO2	M	S	S	S	M	S	S	M	S	M
CO3	S	S	M	S	M	S	S	S	S	S
CO4	S	S	S	M	S	S	M	S	M	S
CO5	S	M	S	S	S	M	S	S	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

Thiruvalluvar University vellore – 632 115

2022 – 2023 onwards

Course structure

B.Sc., ZOOLOGY

EVOLUTION

Semester	**:** VI	**Paper type**	: Core
Paper Code	**:** CEZO 63A	**Name of the Paper**: Evolution	
Credit	: 03		
Total Hours Per Week : 3		**Lecture Hours**	: 45
		Tutorial Hours	:
		Practical Hours	:

COURSE OBJECTIVE:

1. To understand and acquire knowledge about the concepts of origin of life
2. To constract the phylogenetic tree of evolution
3. To demonstrate the origin of speciation
4. To understand the evidences of evolution and theories of evolution
5. The study of evolution will enable the student to gain knowledge about adaptations behavioral pattern of animals and their role in evolution.

COURSE OUT COMES (FIVE OUTCOMES FOR EACH UNITS SHOULD BE MENTIONED)

1. After studied Unit I: Students will be able to understand the origin of life from various evidences of evolution.
2. After studied Unit II: Students will be able to explain the various theories of evolution.
3. After studied Unit III: Students will be able to analyze the Natural selection and Role of variation in evolution.
4. After studied Unit IV: Students will be able to evaluate the animal behavior and its distribution and their role in evolutions.
5. After studied Unit V: Students will be able to understand and analyze the knowledge on Mechanism of isolation for speciation and evolution of Man.

MATCHING TABLE (Put YES/ NO in the appropriate box)

Unit	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
1	YES	YES	YES	YES	-	-
2	YES	YES	YES	YES	-	-
3	YES	YES	-	YES	-	-
4	YES	YES	-	YES	YES	-
5	YES	YES	YES	YES	-	YES

Unit 1 : Evidences: The need of evidences for the fact of evolution – Morphological, anatomical,Embryological,Physiological and Biochemical evidences.
Teaching Hours : 9 Hrs

Unit 2 : Theories: Lamarckism, Neolamarckism, Darwinism, NeoDarwinism, Devries concept ofMutation. Teaching Hours : 9 Hrs

Unit 3 : Natural selection: Types, stabilizing and diversifying directional selection. Variation:Types of variation Teaching Hours : 9 Hrs

Unit 4 : Mimicry – Batesian and mullerian mimicry and evolution, living fossils. Distribution ofanimals Teaching Hours : 9 Hrs

Unit 5 :Isolation – Premating and post mating isolating mechanism, speciation. Evolution of man– Biological and cultural Teaching Hours : 9 Hrs

Internal Assessment Methods:

Text Book : 1 – 10

1. Edward J. Larson - Evolution .
2. Veer Bala Rastogi. Organic Evolution, Meerut Publications.
3. Arumuganm. N. Organic evolution, 2009 Saras. Publ. Nagarcoil, Kanyakumari Dt.
4. Carl Zimmer - Evolution
5. Agarwal, V.K and Usha Gupta- Evolution and animal distribution, Chand and Co.,
6. Gopalakrishnan. T. S. Itta Sambasivaiah and A.P. Kamalakara Rao. Principles of organic Evolution.
7. T.K. Ranganathan, Evolution. 1994 Rainbow Printers, Palayankottai.
8. Tomar. Singh - Evolutionary Biology 9th Edition.

9. Dr. Manoj Kumar Jha – Theories of Evolution East and West.
10. Kailash Choudhary and Ram Prakash Saran – Evolution Animal Behaviour.

Reference Book 1 – 10

1. Charles Darwin - The origin of species
2. Strickberger's - Evolution
3. Veer Bala Rastogi - The story of life By Katie Scott organic evolution.
4. Richard Dawkins - The greatest show on earth – The evidences of evolution.
5. Allen D. Macneill - Evolutionary Biology I.
6. Dobzhansky, Ayala etc., Evolution, Freeman and Co., 1977.
7. Dodson, E.o. Evolution Process and Product. Reinhold Pnb, Co., 1990
8. Matt Ridley - The evolution of everything.
9. Roger Lewin - Human evolution an illustrated introduction fifth edition.
10. Richard Milner- The encyclopedia of evolution

Course Material : Website Links, / e- Books and e- Journals

1. www.Natcenscied.org
2. http://evolution.Berkely.Edu
3. www.Ucmp. berkeley.Edu/exhibite/eduxhibits.html
4. http://www.pbs.org/wgbh/evolution
5. http://www.tolweb.org

e- Journals

1. Journal of evolutionary Biology – by eseb featured in Journal of Evolutionary Biology Daniel Berner, Valentin Amrhein.
2. Journal of Zoological systematic and evolutionary research – Alexander Blanke, Elisabeth Haring, Martin Husemann, Stephan Koblmuller, Barna Pall-Gergely, ThamasStach.

MAPPING WITH PROGRAM OUTCOME

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	M	S	M	
CO2	S	S	M	S						
CO3	S	S		M		S		M		
CO4	S	S			M			M	M	
CO5	S	S	M	M	S		M			

PO – Programme Outcome, CO – Course Outcome
S- Strong, M – Medium, L- Low (May be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: VI Paper type:Internal Elective

Paper code: Name of the Paper: MICRO-BIOLOGY Credit: 3

Total Hours per Week: 3 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

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Course Objectives

1. To emphasize the importance of integrating new knowledge on Microorganisms.
2. To update the Technology innovations of Microbial genetics and its Application.
3. To understand the general morphology of micro organism
4. To understand the epidemology of various infectious diseases
5. To understand the role of micro organisms in Agriculture,Industry and environment

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand the importance of Microorganisms

2. After studied unit-2, the student will be able to understand the Technology innovations of Microbial genetics and its Application.

3. After studied unit-3, the student will be able to understand the general morphology of micro organism

4. After studied unit-4, the student will be able to the epidemology of various infectious diseases

5. After studied unit-5, the student will be able to understand the role of micro organisms in Agriculture,Industry and environment

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	No	No	No
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	No	No	No	No
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: The scope of microbiology – characterization, classification and identification ofMicroorganisms **Teaching Hours: 12**

Unit-2: Bacteria – General morphology, and physiology – pathogenic and non – pathogenicbacteria, economic importance **Teaching Hours: 12**

Unit-3: Micro organisms – general morphology of Fungi – Moulds and yeasts, Algae, Protozoaand Viruses. **Teaching Hours: 12**

Unit-4: Epidemiology of infectious diseases with reference to Human – such as Bacterial[Tuberculosis], Viral [Hepatitis], protozoan [Amoebiasis] and Fungal [any one] diseases -Host. Microbe interaction – immune responses – Antibiotics and other Chemotherapeuticagents. **Teaching Hours: 12**

Unit-5: Applied Microbiology in the fields of food, Agriculture, Industry and environment **Teaching Hours: 12**

Internal Assessment Methods: (refer the instructions)

Text book:

1. Mani, A., Selvaraj, A.M, Narayanan, L.M & Arumugam, N. 1996 : Microbiology – saras publicagtions – Nagercoil – India.
2. Sharma,P.D 1998 : Microbiology – Rastogi Publ. Meerut, India.
3. Subba Rao, N.S, 1999 : Soil Microbiology, Oxford IBH Co. New Delhi, India.
4. Sullia, S.B. & Santharam, S. 2004 – GeneralMicrobiology, Oxford IBH, India.
5. Meenakumari,S. Microbial Physiology, MJB-Publ. – Chennai, India.
6. Purushotam Kaushik, 2005 : Microbiology – S.Chand& Co., New Delhi, India.
7. Vijaya Ramesh, 2005 : Environmental Microbiology, MJP.publ, Chennai, India.
8. Vijaya Ramesh, 2007 : Food Microbiology, MJP.Publ. Chennai, India.
9. Rajan,S 2007 : Medical Microbiology – MJP.Publ. Chennai, India.
10. Mosharaffudin, Ahmed & Basumatary2006 : Applied Microbiology – MJP Publ. India.

Reference Book:

1. Purohit, S.S.2007 :Microbiogy – Agrobios Publ. India.
2. Trivedi, P.C.2008 : Applied Microbiology – Agrobios Publ. India.
3. Prescott, 2009 : Industrial Micobiology – Agrobios Publ. India.
4. Parihar, L. 2008 : Advances in Applied Microbiology – Agrobios Publ. India.
5. Agarwal, A.K 2008 : Industrial Microbiology, AgrobiosPubl.India.
6. Bohra, A.2006 :Fod Microbiology, Agrobios Publ. India

Course Material: website links, e-Books and e-journals

1. **https://sites.google.com/a/uasd.in/ecourse/agricultural-microbiology**
2. **http://www.ignouhelp.in/ignou-mfn-03-study-material/**
3. **https://mltcollege.org/wp-content/uploads/2020/07/microbiology.pdf**
4. **https://microbiologysociety.org/why-microbiology-matters/what-is-microbiology/viruses.html**
5. **https://www.iaritoppers.com/2019/06/fundamentals-of-microbiology-icar-ecourse-pdf-book-download.html**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	M	S	S	M	S
CO2	S	M	S	S	M	S	S	S	S	M
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	M	S	M	M	S	M	M
CO5	S	S	M	S	M	S	S	M	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

BIOCHEMISTRY

Semester : VI **Paper type** : Elective

Paper Code : CEZO 64A **Name of the Paper**: Biochemistry
Credit : 3

Total Hours Per Week : 3 **Lecture Hours** : 45

Tutorial Hours :

Practical Hours :

Course Objectives:

1. This course will define explain the basic concepts and principles of Biochemistry.
2. To understand the biomolecules structure and their importance.
3. To demonstrate the basic knowledge of the bioenergetics.
4. To acquire deep knowledge about the classification, metabolism and biological significance of Carbohydrates, Lipids, and Protein.
5. To emphasize the need to understand enzymes and its role.

COURSE OUT COMES (FIVE OUTCOMES FOR EACH UNITS SHOULD BE MENTIONED)

1. After studied Unit I: The students will be able to understand acid, base, buffer, pH and their biological importance.

2. After studied Unit II: The students will be able to analyze different forms of energy and Bioenergetics.

3. After studied Unit III: The students will be able to classify Biomolecules, and explain the structure of Carbohydrates, Lipids, Proteins and their metabolism.

4. After studied Unit IV : The students should be able to explain the properties , classifications the mechanism of enzyme Action.

5. After studied Unit V: The students should be able to understand the biochemistry of antibiotics and analyze the principles and application of technologies for biomolecules separations.

MATCHING TABLE (Put YES/ NO in the appropriate box)

Unit	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
1	YES	YES	YES	YES	YES	-
2	YES	YES	-	-	-	-
3	YES	YES	-	-	-	-
4	YES	YES	-	-	-	YES
5	YES	YES	YES	YES	-	-

Unit 1 :Aqueous solutions - properties of water - hydrogen ion concentration, acids bases and their concept - buffers and electrolytes and functions - acidity, alkalinity and pH determination. Teaching Hours : 9 Hrs

Unit 2 :**Bioenergetics** - energy and its forms - free energy - laws of thermodynamics - enthalpy and entropy - redox coupling and ATP bioenergetics Teaching Hours : 9 Hrs

Unit 3 :Classification, metabolism and biological significance of carbohydrates, lipids, protein - primary, secondary, tertiary and quaternary structure and characteristics of proteins, vitamin types - source & deficiency.
Classification, structure and biological significance of carbohydrates, lipids, protein.
Metabolism of carbohydrate Teaching Hours : 9 Hrs

Unit 4 :Enzymes: classification and nomenclature - Physico-chemical - properties of enzymes - enzyme kinetics - mechanism of enzyme action - factors affecting enzyme activity. Teaching Hours : 9 Hrs

Unit 5 :A brief account on the biochemistry of antibiotics & their mode of action.
Fractionation of Biological materials by chromatography [PC, TLC] electrophoresis [Principle & types] centrifugation [Principle & Types]. Teaching Hours : 9 Hrs

Internal Assessment Methods:

Text Book : 1 – 10

1. Prasad R. Manjeshwar fifth Edition 2019-2020 Text Book of Biochemistry.
2. DM. Vasudevan Sreekumari S. Kannan Vaidyanathan Text Book of Biochemistry.
3. R.P. Maurya, Shilpa Maurya, Biochemistry and Clinical Pathology.
4. Ambika Shanmugam's , Fundamentals of Biochemistry for Medical students, Editor K. Ramadevi.
5. N. Arumugam, S. Prasanna Kumar. L.M. Narayanan, R.P. Meyyan.K, Biochemistry, Saras Publication.
6. U. Satyanarayana, U. Chakrapani, Biochemistry.

7. L. Veerakumari – Biochemistry.
8. Dr. J.L. Jain, Dr.Sanjai Jain and Nitin Jain – Fundamentals of Biochemistry
9. Seema pavgiUpadhye, Text Book of Biochemistry.
10. Raji MD, Text Book of Biochemistry for Undergraduates, 3rd Edition.

Reference Book

1. L. Stryer, 1999 Biochemistry IV Edition. Freeman Company, New York.
2. Lehninger. 1992 Biochemistry worth Publication Inc., CBS Publication New Delhi.
3. H.S. Srivastava Elements of Biochemistry, Rastogi Publications.
4. Outline of Biochemistry, Corn & Stump.
5. G.P. Talwar & L.M. Srivastava , 2003 Text Book of Biochemistry and Human Biology Eastern Economy Edition Prentice Half of India. New Delhi.
6. Namrata Chhabra, Sahil Chhabra, Hand Book of Biochemistry Spotting.
7. Denise R. Ferrier, LippoincottIlluistrated Reviews Biochemistry, South Asian Edition.
8. David A. Bender, Nutritional Biochemistry of the vitamins, Second Edition.
9. Kenneth P. Murphy, Protein structure stability and folding.
10. John L. Tymoczko Jeremy M. Berg Biochemistry third Edition.

Course Material : Website Links, e- Books and e- Journals

Links:

1. https://onlinelearning.hms.harvard.edu/biochemistry
2. https://www.organic-chemistry.org
3. https://www.qmul.ac.uk
4. https://biochem.oregonstate.edu
5. https://themedicalbiochemistrypage.org

e- Books

1. Introduction to Biochemistry and Metabolism (D.Anandhi -2014) books.google.co.in>books.
2. Text book of Medical Biochemistry (Rajinder Chawla - 2017) books.google.co.in>books.
3. Biochemistry – e-book – (U. Satyanarayana. 2017. Preview) books.google.com>books.
4. Guide to Biochemistry (James C. Black stock-2014) books.google.co.in.>books.
5. Clinical Biochemistry: An illustrated colour Text books.google.co.in.>books.

E- Journals:

1. International Journal of Science and Research (IJSR)
2. The journal of Biochemistry (JB).

3. Advances in Biochemistry.
4. Biochemistry and Molecular Biology.

MAPPING WITH PROGRAM OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M		M			S		
CO2	S	S	M		M			S		M
CO3	S	S	M			M	S	S	M	
CO4	S	S	M					S		
CO5	S	S	S	S			M	S		S

PO – Programme Outcome, CO – Course Outcome

S- Strong, M – Medium, L- Low (May be avoided)

Thiruvalluvar University, Vellore - 632115
Course writing format

Name of the course/subject: ZOOLOGY **Semester: VI**
Name of the Paper: APPLIED ENTOMOLOGY **Credits: 3 Hours of teaching: 3**
Paper type: Internal Elective

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Course Objectives

1. To study the insect morphology and types of pest.
2. To study the insect species causing damage to the crops in the field as well as under storage condition and the effective control measure against them.
3. To realize the importance of pest in relation to public health-Houseflies diseases and their control measures.
4. To understand Recent trends in pest control and Integrated pest management, its importance &applications
5. To study Household pests effective control measure against them.
6. To create awareness towards insect borne diseases.

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand the insect morphology and types of pest.

2. After studied unit-2, the student will be able to understand insect species causing damage to the crops in the field as well as under storage condition and the effective control measure against them.

3. After studied unit-3, the student will be able to understand the awareness of pest in relation to public health-Houseflies diseases and their control measures,
4. After studied unit-4, To acquire the knowledge about the effective control measure against insect pest.
5. After studied unit-5, the student to acquire the knowledge Recent trends in pest control and Integrated pest management, its importance &applications.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	No	No	No
2	yes	Yes	yes	No	No	No
3	Yes	Yes	Yes	No	No	No
4	Yes	Yes	Yes	No	No	No
5	Yes	Yes	Yes	No	No	No

UNIT – I

Introduction -Morphology of insects – Economic importance of insects**-** beneficial insects and harmful insects- Types of pests – types of damage caused by pests in crops – causes for insects assuming pest status – outbreak of pests.

UNIT – II

Types of insect development – ametabola and metabola (hemimetabola, holometabole) - Pests of agricultural importance, their bionomics, life cycle and control measures of paddy, ground nut, cotton, tomato, coffee & Banana.

UNIT – III

Pests of stored products and their control – Household pests – cockroach and termities – and their control – pest in relation to public health-Houseflies diseases and their control measures, Lice diseases and their control measures. Mosquitoes borne diseases and their control measures.

UNIT- IV

Pest control methods and application: cultural, mechanical, biological and chemical methods – classification of pesticides – LC 50 and LD 50 values – First Aid & precautions in handling pesticides –Plant protection appliances, duster-hand operated duster, wet duster, sprayers-hand syringe, knapsack sprayer, power-operated sprayer, miscellaneous appliances-mist bower, fog generator .

UNIT – V

Insect vectors of virus disease in crop plants. Recent trends in pest control – pheromones, attractants, repellants, antifeedants and chemosterilants, Integrated pest management, its importance &applications

Text Books

Unit-1: Temphare D.B., 1984 A. Text Book of Insects Morphology, Physiology and Endocrinology. S. Chand and Co., New Delhi.

Unit-2 Nayar, K.K., Ananthakrishnan, T.N. and B.V. David 1992 General and Applied Entomology Tata McGraw, New Delhi.

Unit-3 Economic Entomology, N. T. Krishnan. Kedarnath, Ram Nath Meerut – 250 001. 110 055.

Unit-4 Vasantharaj David and T. Kumaraswami 1988. Elements of Economic Entomology Popular Book Depot, Chennai

Unit-5 Nayar, K.K., Ananthakrishnan, T.N. and B.V. David 1992 General and Applied Entomology Tata McGraw, New Delhi.

Reference Items: books, Journal

1 - P.G. Fenemore, Alka Prakash 1997 Allied Entomology, Wiley Eastern Ltd., New York.

2.Wigglesworth J.B., 1994. Insect Physiology, Chapman and Hall, London Edition, W.B. Saunders Company, Philadelphia London, Toronto

E- Materials

1. https://www.perlego.com/browse/biological-sciences/zoology
2. http://www.freebookcentre.net/Biology/Zoology-Books.html
3. https://www.pdfdrive.com/zoology-textbooks-online-e10983221.html
4. http://www.freebookcentre.net/biology-books-download/Textbook-of-zoology.html
5. https://www.e-booksdirectory.com/listing.php?category=134
6. https://www.ikbooks.com/subject/life-sciences/zoology/151
7. http://rastogipublications.com/index.php?route=product/category&path=25
8. https://bookwindow.in/zoology-textbooks
9. https://www.routledge.com/life-science/zoology
10. https://www.fullonstudy.com/bsc-1st-year-zoology-books
11. https://link.springer.com/book/10.1007/978-1-349-00198-9
12. https://vertebrate-zoology.arphahub.com/

13. https://www.quora.com/From-which-websites-can-I-download-free-e-books-in-PDF-format-botany-microbiology-zoology
14. https://www.mheducation.com/highered/category.12255.zoology.html
15. https://library.si.edu/research/vertebrate-zoology

Mapping with Programme Outcomes

COs	**PO1**	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	s	M	M	M	S	S	M	M
CO2	S	S	s	M	S	S	M	M	S	M
CO3	M	S	M	S	S	S	M	M	M	S
CO4	M	M	s	S	S	M	s	M	S	M
CO5	S	S	M	M	s	M	S	S	M	S

PO – Programme Outcome, CO – Course outcomeS – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: Vi Paper type: Skill Based Subject

Paper code: Name of the Paper: Medical Lab Technology Credit: 2

Total Hours per Week: 3 Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

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Course Objectives

1) To impart awareness on clinical lab-technology
2) To create knowledge on self- employment opportunity

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to understand the sterilization techniques

2. After studied unit-2, the student will be able to apply and analyse the haematalogical parameters

3. After studied unit-3, the student will be able to diagnose different diseases.

4. After studied unit-4, the student will be able toanalyse the physical examination of urine and faeces.

5. After studied unit-5, the student will be able to get a thorough knowledge about cerebro-spinal fluid.

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	No	No	No
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: Medical Laboratory scope- general procedures- Laboratory requirements, Sterilization, Dry heat (Hot air oven),Moist heat (Autoclave, Pressure cooker),Laboratory equipments - Spectrophotometer, Incubator Refrigerator, Auto analyzer, Micro centrifuge, Automatic pipettes.

Teaching Hours: 12

Unit-2: Collection of blood samples, Packed cell volume (PVC), Erythrocyte sedimentation Rate (ESR),RBC Count, WBC Count, Reticulocyte count, Total count, Differential Count, Pulse rate, Use of blood pressure Apparatus, Electrocardiogram, Echocardiogram, Estimation of Haemoglobin, Artificial pacemaker **Teaching Hours: 12**

Unit-3: Blood cross matching - Hepatitis test - Haemolytic jaundice, ELISA, Estimation of blood glucose fasting two hour post prandial - Diabetes mellitus, Estimation of blood Cholesterol, Blood Urea, Blood Uric Acid. **Teaching Hours: 12**

Unit-4: Analysis of urine - Physical examination, Blood cells, Urine glucose, Urine albumin, Bile salts, Ketone bodies, Urine culture - Antibiotic susceptibility test. Pregnancy Test (Detection of HCG). Analysis of faeces - Components of faeces their characteristics, factors affecting faeces.composition. Analysis of sputum - Pathological conditions that can be detected in sputum - their causes - Detection of Group A - Streptococcus.T**eaching Hours:12**

Unit-5: Cerebrospinal fluid - Formation, Composition function, Conditions altering its composition - their causes. Seminal fluid - Composition of seminal fluid, Sperm count, Abnormal sperms, Common pathological conditions detected in semen - their causes. Aminotic fluid - Sex determination, Diagnosis of pathological conditions of developing foetusthrough analysis of amniotic fluid **Teaching Hours: 12**

Internal Assessment Methods: (refer the instructions)

Text book:

1. Biswajit Mohanty and SharbariBasu - Fundamentals of Practical Clinical Biochemistry, B.I. Publications PVT., LTD.,54, Janpath, New Delhi - 110001.
2. Estridge B.H. Raynold A.P and Walters N.J. Basic Medical Laboratory Techniques,4th edition, Thomson Delmar Learning, Eastern press (Bangalore)Pvt., Ltd., Boommasandra Industrial Area, Hosur Road, Bangalore - 562158.
3. Kannai, L. Mukherjee, Medical Laboratory Technology Vol - I, Vol - II and Vol - III. Tata MC Graw Hill Publishing Company Limited,No:444/1,Sri Ekambara Naicker Industrial Estate, Alapakkam, Porur, Chennai - 600116.
4. RamnikSood, Medical Laboratory Technology, Methods and Interpretations. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi.
5. Venkadesan, O. Essential of Medical Laboratory technology, Bicobas P.G and Research Department of Zoology, Loyola College, Madras - 60003

Reference Book:

1. 1 Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata Mcgraw Hill
2. SoodRamnik,(2015), Text book of Medical Laboratory Technology,2nd edition, Jaypee Publications
3. Wintrobe's Clinical Haematology,(2014),13th edition, Lippincott Williams & Wilkins
4. De Gruchy's Clinical Haematology in Medical Practice,(2012),Sixth edition, Wiley Publications

5. Dacie& Lewis Practical Haematology, (2011),11th edition, Elsevier Publications
6. Contemporary Practice in Clinical Chemistry by William Clarke; American Association for Clinical Chemistry Staff .

Course Material: website links, e-Books and e-journals

1. **https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/med_lab_tech_students/medicallabtechnology.pdf**
2. **https://nic.libguides.com/medlabtech**
3. **https://www.university.youth4work.com/study-material/mlt,medical-lab-technology-lectures**
4. **https://library.fvtc.edu/MLT/Books**
5. **https://www.slideshare.net/HusseinAltameemi2/introduction-to-medical-laboratory-technology**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	M	S	S	S
CO2	M	S	S	M	S	S	M	M	M	S
CO3	S	M	S	S	M	S	S	S	S	S
CO4	S	M	M	S	M	S	S	M	S	M
CO5	M	S	S	M	S	M	M	S	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632115
(Name of the Programme) – 2022-2023 onwards

Semester: VI Paper type: Skill Based Subject

Paper code: Name of the Paper: Industrial Fishery Management Credit: 2

Total Hours per Week: 3Lecture Hours: ….. Tutorial Hours: ….. Practical Hours: …..

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Course Objectives

1. .To introduce basic knowledge of industrial fishery management and export practices.
2. .To realize the need augmenting food production from aquatic resource.
3. .To give the students a holistic understanding of the subject giving substantial weight age to both the core content and techniques used in Industrial Fish and Fisheries.
4. .To acquire knowledge about various fisheries institutions of India

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able toget the basic information about the scope of aquacultures in India.

2. After studied unit-2, the student will be able toacquire knowledge about fish farming

3. After studied unit-3, the student will be able toacquire knowledge about various culture techniques

4. After studied unit-4, the student will be able toacquire knowledge about feed formulations

5. After studied unit-5, the student will be able to acquire knowledge about disease management in fish farming

Matching Table (put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	No	No	No
2	Yes	Yes	Yes	No	No	Yes
3	Yes	Yes	Yes	Yes	No	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes
5	Yes	Yes	Yes	Yes	Yes	Yes

Unit-1: Definition and History of Aquaculture, Scope and importance with reference to Marine, Freshwater and estuarine fishes - Status of aquaculture in India - in Tamilnadu - Hatchery technology, important hatcheries, river-rine seed collection - Different stages of seed - spawn, fry and fingerlings **Teaching Hours: 12**

Unit-2: Principles of site selection in fish farm construction - Quality and productivity of water, soil character and other parameters - Nursery and rearing ponds Management

Teaching Hours: 12

Unit-3: Harvesting of fry and fingerlings - Transportation of fish seed and brood fish (Various methods of transportation) - Induced breeding techniques - Different systems of Aquaculture - Monoculture, polyculture, Cage culture - Integrated fish culture. Extensive, Semi-intensive and intensive fish culture Raceway culture, culture in re-circulatory systems Warm, water and cold water aquaculture, sewage-fed fish culture **Teaching Hours: 12**

Unit-4: Feed resources - Nutritional value of feed ingredients and live feed - importance of natural food to nutrient requirement of fish - feed additives - attractants - growth stimulant and probiotics and binders - supplementary feed - feeding methods and scheduling.

Teaching Hours: 12

Unit-5: Disease management of culturable fishes - protozoan - Bacterial - crustacians - fungal - helminths disease and their control measures -fish marketing- quality management - Role of MPEDA and IIP - fisheries institutions of India - CMFRI - CIFT - CIFE -CIFA- FSI - NIO - FFDA. **Teaching Hours: 12**

Internal Assessment Methods: (refer the instructions)

Text book:

1. . V. G. Jhingran, (1991). Fish and fisheries of India. Edition-3, Hindustan Pub. Corp. (India), 727.
2. S. Ayyappan, J. K. Jena, A. Gopalakrishnan, Dr. A. K. Pandey, (2011). Handbook of Fisheries and Aquaculture, Indian Council of Agricultural Research, New Delhi, 755.
3. FAO Technical Paper No.361. Manual on production and use of live food in aquaculture.
4. Pronob Das, Sagar C. Mandal, S. K. Bhagabati, M. S. Akhtar and S. K. Singh (2012). Important Live Food Organisms And Their Role In Aquaculture, Frontiers in Aquaculture, 2012: 69-86.
5. Handbook of Aquafarming: Aquaculture Feed, MPEDA

Reference Book:

1. 1 GangulyB.A.,Sinha A.K., Adhikari S., Goswami B.C.B.(2018). Biology of Animals(Vol I& II). NCBA
2. Khanna S.S.(214). Introduction to Fishes. Silver Line
3. Srivastava C.B.L.(2014). Fishery Science and Indian Fisheries
4. FAO. 1992. Manual of Seed Production of Carps. FAO Publ.
5. ICAR. 2006. Hand Book of Fisheries and Aquaculture. ICAR.
6. Jhingran VG &Pullin RSV. 1985. Hatchery Manual for the Common, Chinese and Indian Major Carps. ICLARM, Philippines.

Course Material: website links, e-Books and e-journals

1. **https://www.fao.org/3/y3427e/y3427e03.htm**
2. **https://www.ipcc.ch/apps/njlite/ar5wg2/njlite_download2.php?id=10686**
3. **https://www.britannica.com/technology/commercial-fishing**
4. **https://leap.unep.org/knowledge/glossary/fisheries-management**
5. **https://bookauthority.org/books/best-fisheries-books**

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	M	M	S	M	M	S
CO2	M	S	M	M	S	S	M	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	M	S	S	M	M	M	M	M
CO5	M	M	S	M	M	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome, S – Strong , M – Medium, L – Low (may be avoided)