

# **SRI SARADA COLLEGE FOR WOMEN**

**(AUTONOMOUS)**

**Reaccredited with 'B++' Grade by NAAC**

**(Affiliated to Periyar University)**

**SALEM-16**



**DEPARTMENT OF ZOOLOGY**

**SYLLABUS AND QUESTION PAPER**

**PATTERN**

**B.Sc., ZOOLOGY**

**(For the Students admitted from 2022-2023)**

## PROGRAMME OUTCOME

On completion of the Programme, students will be able to

<b>PO Number</b>	<b>PO Statement</b>
<b>PO1</b>	Acquire in depth knowledge in life sciences and ensuring the inculcation of Employability skills in young women students and will be aware of basic concepts, fundamental principles and scientific theories of various branches of zoology and their relevancies in day to day life.
<b>PO2</b>	Design and develop analytical approach, critical thinking, understanding and interpretation of the data, facts, related to biological sciences as well as procuring basic skills in the observation of biological organization and relevant technologies in zoology in conducting experimental investigation
<b>PO3</b>	Imbibe ethical, moral, social, scientific values and concern towards advancement in biological sciences, sustainable environmental conservation and able to work as a member and a leader in a team to contribute in the field of animal sciences for nation building and social welfare.
<b>PO4</b>	Ability to develop practical analysis, logical and rational thinking in the field of animal sciences and engage in an independent, lifelong learning and imbibe scientific values
<b>PO5</b>	Develop computer based knowledge, computer skills, presentation ability and biological skill development to procure career and to become an entrepreneur in the various fields of zoology

## **PROGRAMME SPECIFIC OUTCOMES**

- PSO 1 :** Our students acquire basic knowledge in observation, study of nature, biological techniques, experimental skills and scientific investigation. They understand the utility of life with the rich diversity of organisms and their ecological and evolutionary significance.
- PSO 2 :** Our students will have knowledge in basic and modern concepts that cater the day-to-day needs and advancements in Zoology.
- PSO 3 :** Our students apply their knowledge in various branches of Zoology that enable them to undergo higher studies with holistic, spiritual and ethical values.
- PSO 4 :** Our students will have training exposure in skill enhancement courses, internship and clinical laboratory techniques.
- PSO 5 :** Our students will have exposure in skill development in multidisciplinary fields that facilitate them to get the job or to become an entrepreneur.
- PSO 6 :** Our students will render their selfless services for the Nation and extend their services to the society.

**SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS) SALEM-16****DEPARTMENT OF ZOOLOGY****B.Sc. ZOOLOGY****PROGRAMME STRUCTURE UNDER****CBCS****(For the students admitted from 2022-23) Total****Credits: 140+ Extra Credit (Maximum 28)****SEMESTER- I**

<b>Part</b>	<b>Course</b>	<b>Course Title</b>	<b>Code</b>	<b>Hours / Week</b>	<b>Credits</b>
I	Language – I	Tamil / Hindi / Sanskrit – I	22ULTC1 22ULHC1 22ULSC1	6	3
II	English –I	Communicative English – I	22ULEC1	6	3
III	Core Course – I	Invertebrata	22UZOC1	7	6
	Core Practical – I	Core Practical – I (Invertebrata & Chordata)	22UZOQC1	3	-
III	Allied Course- I	Allied Chemistry –I	22UZOAC1	3	3
III	Allied - Practical	Allied Chemistry – Practical	22UZOAC1	2	-
IV	Skill based-I	Vermiculture	22UZOSC1	2	2
V	Extension Activity	Group Project Based on Extension Activity	22UEXAC	1	1
		<b>TOTAL</b>		<b>30</b>	<b>18</b>
VI	Articulation and Idea Fixation Skills				
	Physical Fitness Practice - 35 Hours Per Semester				
	Advanced Diploma in Sericulture Level -1: Certificate Course 100 hours per year				

## SEMESTER - II

Part	Course	Course Title	Code	Hours/ Week	Credits
I	Language – II	Tamil / Hindi / Sanskrit - II	22ULTC2 22ULHC2 22ULSC2	6	3
II	English – II	Communicative English –II	22ULEC2	6	3
III	Core Course– III	Chordata	22UZOC2	6	5
III	Core Practical – I	Core Practical – I (Invertebrata & Chordata)	22UZOQC1	3	3
III	Allied Course – I	Allied Chemistry –II	22UZOAC2	3	3
III	Allied – Practical	Allied Chemistry – Practical	22UZOAC1	2	4
IV	Skill based -II	Apiculture	22UZOSC2	2	2
IV	Environmental Studies	Environmental Studies	22UEVSC	2	1
		Group Project Based on Environmental Studies	22UEVSPC		1
		<b>TOTAL</b>		<b>30</b>	<b>25</b>
VI	Articulation and Idea Fixation Skills -1 Extra Credit				
	Physical Fitness Practice - 35 Hours Per Semester- 1 Extra Credit				
	Certificate Course in Yoga – 30 hours – 1 Extra Credit				
	Advanced Diploma in Sericulture Level -1: Certificate Course 100 hours per year – 2 Extra Credits				
	Extra credits are given for extra skills and courses qualified in MOOC/NPTEL				

### SEMESTER - III

Part	Course	Course Title	Code	Hours/ Week	Credits
I	Language – III	Tamil / Hindi / Sanskrit - III	22ULTC3 22ULHC3 22ULSC3	6	3
II	English – III	Communicative English – III	22ULEC3	6	3
III	Core Course – IV	Cell Biology	22UZOC3	6	5
III	Core Practical – II	Core Practical – II (Cell Biology & Genetics)	22UZOQC2	3	-
III	Allied Course– II	Allied Botany – I	22UBOAC3	3	3
III	Allied – Practical	Allied Botany – Practical	22UZOAC2	2	-
IV	Skill based -III	Aquaculture	22UZOSC3	2	2
IV	Non- Major Elective I			2	2
		<b>TOTAL</b>		<b>30</b>	<b>18</b>
VI	Extension Activity	Group Project Based on Extension Activity			
	Life Skill Courses	Course I: Communication Skills		2	2(Extra)
	Articulation and Idea Fixation Skills				
	Physical Fitness Practice – 35 hours per Semester				
	Advanced Diploma in Sericulture Level -2: Diploma Course 100 hours per year				
	Extra credits are given for extra skills and courses qualified in MOOC/NPTEL				

Non-Major Elective – I For II B.A/ B.Sc./ B.Com.	Communicable diseases and Management	22UZONEC1
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### SEMESTER- IV

Part	Course	Course Title	Code	Hours/ Week	Credits
I	Language – IV	Tamil / Hindi / Sanskrit - IV	22ULTC4 22ULHC4 22ULSC4	6	3
II	English - IV	Communicative English – IV	22ULEC4	6	3
III	Core Course– V	Genetics	22UZOC4	3	3
III	Major Elective -I	Economic Entomology and Pest Management / Bioinformatics	22UZOEC1 22UZOESC1	3	3
III	Core Practical – II	Core Practical – II (Cell Biology & Genetics)	22UZOQC2	3	3
III	Allied Course - II	Allied Botany – II	22UBOAC4	3	3
IV	Allied Practical	Allied Botany Practical	22UZOAQC2	2	2+2
IV	Skill based - IV	Clinical Laboratory Techniques (Practical)	22UZOSCQ	2	2
IV	Non- Major Elective II			2	2
		<b>TOTAL</b>		<b>30</b>	<b>26</b>
VI	Extension Activity	Group Project Based on Extension Activity			2(Extra)
	Life Skill Courses	Course II: Professional Skills		2	2(Extra)
	Articulation and Idea Fixation Skills - 1 Extra Credit				
	Physical Fitness Practice – 35 hours per Semester – 1 Extra Credit				
	Advanced Diploma in Sericulture Level -2: Diploma Course 100 hours per year – 2 Extra Credits				
	Extra credits are given for extra skills and courses qualified in MOOC/NPTEL and societal oriented group projects				

Non-Major Elective – II For II B.A/ B.Sc./B.Com.	Ornamental Fish Culture	22UZONEC2
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### SEMESTER- V

Part	Course	Course Title	Code	Hours/Week	Credits
III	Core Course - VI	Developmental Biology	22UZOC5	5	5
III	Core Course - VII	Ecology	22UZOC6	4	4
III	Core Course - VIII	Evolution	22UZOC7	4	4
III	Core Course - IX	Microbiology and Immunology	22UZOC8	4	4
III	Core Practical – III	Core Practical – III (Developmental Biology, Ecology, Evolution, Microbiology and Immunology)	22UZOQC3	3	-
III	Core Practical – IV	Core Practical – IV (Animal Physiology, Biochemistry, Animal Biotechnology)	22UZOQC4	3	-
III	Major Elective II	Sericulture / Human Nutrition	22UZOEC2 22UZOESC2	5	4
IV	Non- Major Skill Based I			2	2
IV	Value Education		22UZOVEC	1	-
		<b>TOTAL</b>		<b>30</b>	<b>23</b>
VI	Extension Activity	Group Project Based on Extension Activity			
	Life Skill Course	Course III: Leadership and Management Skills		2	2(Extra)
	Articulation and Idea Fixation Skills				
	Physical Fitness Practice – 35 hours per Semester				
	Advanced Diploma in Sericulture Level -3: Advanced Diploma Course 100 hours per year				
	Internship Training – 1 Extra Credit				
	Extra credits are given for extra skills and courses qualified in MOOC/NPTEL				



Non-Major Skill Based-I For III BA/ B.Sc.B.Com.	Public Health and Hygiene	22UZONSC1
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### SEMESTER VI

Part	Course	Course Title	Code	Hours/ Week	Credits
III	Core Course - IX	Animal Physiology	22UZOC9	6	5
III	Core Course- X	Biochemistry	22UZOC10	5	5
III	Core Course- XI	Animal Biotechnology	22UZOC11	5	5
III	Core Practical– III	Core Practical – III (Developmental Biology, Ecology, Evolution, Microbiology and Immunology)	22UZOQC3	3	3
III	Core Practical– IV	Core Practical – IV(Animal Physiology, Biochemistry, Animal Biotechnology)	22UZOQC4	3	3
III	Major Elective - III	Group Project	22UZOEPC	5	5
IV	Non- Major Skill Based II			2	2
IV	Value Education		22UZOVEC	1	2
		<b>TOTAL</b>		<b>30</b>	<b>30</b>
VI	Extension Activity	Group Project Based on Extension Activity			2(Extra)
	Life Skill Courses	Course IV: Universal Human Values		2	2(Extra)
	Articulation and Idea Fixation Skills – 1 Extra Credit				
	Physical Fitness Practice – 35 hours per Semester - 1 Extra Credit				
	Advanced Diploma in Sericulture Level -3: Advanced Diploma Course 100 hours per year – 2 Extra Credits				
	Extra credits are given for extra skills and courses qualified in MOOC/NPTEL				

Non-Major Skill Based-II For III BA/ B.Sc.B.Com.	Applied Zoology	22UZONSC2
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**Programme Title : B.Sc. Zoology**

**Course Title : INVERTEBRATA**

**Course Code : 22UZOC1**

**Hours/Week: 7**

**Semester : I**

**Course Credit:6**

**Objectives**

- To understand the taxonomy, relationship and evolution of animals.
- To identify the animals of invertebrate phyla and to recognize their distinguishing features.
- To appraise the diversity of animals in a phylogenetic context.
- To understand how different body designs solve biological problems related to physiological and environmental challenges.
- To develop an appreciation for the role of invertebrates in biological communities, ecological interactions, and conservation problems

**Unit I: Classification & Protista**

Concept of five kingdom classification of life. Introduction to Protista & Animal kingdom – Systems of classification & nomenclature - levels of organization - Types of symmetry. General characters of Protista & Classification (up to class) with examples.

**Type study:**Paramecium

**General topics:** Protozoan parasites, Life Cycle of Plasmodium, Locomotion & Nutrition in Protozoa.

**Unit II: Porifera & Coelenterata**

Characters & classification (up to class) of Porifera & Coelenterata with examples –Salient features of *Ctenophora*.

**Type study:** Leucosolenia, Obelia Colony

**General topics:** Canal system in sponges, Polymorphism in Coelenterata, Diversity (Types) of corals, Structure of coral polyp & coral reefs.

**Unit III: Platy helminthes, Aschelminthes& Annelida**

Characters & classification (up to class) - Platyhelminthes, Aschelminthes& Annelida with examples.

**Type study:** Liverfluke, *Ascaris*, *Megascolex*

**General topics:** Nematode parasites & their adaptations, Coelom & coelomoducts, Metamerism in Annelida, Filter feeding in Polychaetes.

**Unit IV: Arthropoda**

Characters & classification (up to class) -Arthropoda with examples. Brief descriptions of

*Limulus* & *Sacculina*,

**Type study:** Prawn

**General topics:** Crustacean larvae, Mouth parts of Insects, Beneficial Insects, Salient features of Arachnids, Affinities of Peripatus.

**Unit V: Mollusca and Echinodermata.**

Characters & classification (up to class) - Mollusca and Echinodermata with examples.

**Type study:** *Pila*, Starfish.

**General topics:** Torsion & de-torsion in Gastropods, Cephalopods as an advanced Mollusc, Economically important Mollusca, Echinoderm larva.

**Text Book:**

1. Ekambaranatha Ayyar & T.N. Ananthakrishnan, *Manual of Zoology Vol - I , Part I & II* S.Viswanathan Pvt. Ltd.Chennai..

**Books for reference**

2. Barnes, R.D. *Invertebrate Zoology* (1982) Vi Edition. Holt Saunders International Edition.
3. Kotpal RL, Agarwal SK & Khetarpal RP *Invertebrates*, (1992) Rastogi Publications, Meerut.
4. Jordan And Verma *Invertebrate Zoology* (1995) S. Chand & Co, New Delhi
5. Anderson TA, *Invertebrate Zoology*, Oxford University Press, New Delhi.
6. Barrington EJW, *Invertebrate Structure and Functions*. English Language Book Society.
7. Hyman LH, *The Invertebrates (6 vols)*. McGraw-Hill Companies Inc. NY
8. Nair NC, *Invertebrata & Chordata*, (2009) Saras Publication Nagercoil.
9. Nair NC, Leelavathy S, Soundara Pandian N Murugan T & Arumugam N *A Text Book of Invertebrates*, (2011) Saras Publication Nagercoil.
10. Ebanasar J & and Sheeja BD *Outlines of five kingdoms of life*, Shine and Twinkle Publication, Nagercoil.

Course Outcomes (CO):  
On completion of the course, students should be able to

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	The learner will be able to understand the diversity and basic taxonomy of Non chordates.	<b>K1</b>
<b>CO2</b>	The learner will get an idea of adaptation and importance of non-chordates.	<b>K2</b>
<b>CO3</b>	The learner will be able to identify the animal at basic level.	<b>K3</b>
<b>CO4</b>	The paper will give a strong observation skill and prompt the learners to think about its conservation, sustainable economic utilisation and its potentials in technological prospects.	<b>K4</b>

**Recall, K-2 Understand, K-3 Apply, K-4 Analyse**

**Mapping of COs with POs:**

<b>CO</b>	<b>PO</b>				
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	S	S	M	S	M
<b>CO2</b>	S	S	M	S	M
<b>CO3</b>	S	S	M	S	M
<b>CO4</b>	S	S	S	S	M

**S-Strong**

**M-Medium**

**L-Low**

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

**Course Title : SKILL BASED SUBJECT - I - VERMICULTURE**

**Course Code : 22UZOSC1**

**Hours/Week: 2**

**Semester : I**

**Course Credit: 2**

**Course Objectives:**

- To understand the different species of earthworm
- To analyze the importance and application of earthworm in Agricultural field.
- To acquire knowledge on culture methods
- To apply knowledge on Solid waste management
- To Enhances the skill based knowledge on the field to be an entrepreneur.

**UNIT- I**

Earthworm taxonomy - morphological and anatomical- classification of earthworms - food habits - digestive system - excretion - reproduction and life cycle - Earthworm as farmer's friend

**UNIT- II**

Types of earthworms - Exotic and Native species - south Indian and north Indian species used in vermicomposting - collection and preservation of earthworms for vermicomposting - culture techniques of earthworms.

**UNIT- III**

Vermicompost production - requirements - different methods of vermicomposting - heap method - pot method - tray method - changes during vermicomposting - Role of earthworms in soil fertility - use of vermicompost for crop production - use of earthworms in land improvement and land reclamation.

**UNIT- IV**

Economics of vermicompost and vermiwash production. Earthworm as animal feed - medicinal value of earthworm meal - role of earthworms in solid waste, sewage and faecal waste management and vermifilters. Earthworm as bioreactors.

## UNIT- V

Integration of earthworms with other organisms - influence of chemical inputs on earthworm activities - large scale manufacture of vermicompost, packaging of vermicompost and its marketing - financial supporting - government and NGOs for vermiculture work.

### TEXT BOOK

1. Mary Violet Christy A. (2008) Vermitechnology, MJP Publishers. 47, Nallathambi St, Triplicane, Chennai – 600005.

### REFERENCE BOOKS

1. Gupta, P.K. (2006). Vermicomposting for sustainable agriculture. Agrobios (India), Agro House, Behind Nasrani Cinema, Chopasani Road, Jodhpur – 342002.
2. Ranganathan, L.S. (2006). Vermibiotechnoogy from soil Health to human health, Agrobios (India), Agro House, Behind Nasrani Cinema, Chopasani Road, Jodhpur – 342002.
3. Talashilkar, S.C. and Dosani, A.A.K. (2005). Earthworms in Agriculture. Agrobios (India), Agro House, Behind Nasrani Cinema, Chopasani Road, Jodhpur – 342002.
4. Sultan Mohamedhmed Ismail (2005). The Earthworm Book, Second Revised Edition. Mother India Press, Goa, India.

#### Course Outcomes (CO)

On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	To acquire basic knowledge on Earthworm species	K1

<b>CO2</b>	To acquire knowledge on the steps involved in Vermiculture techniques and Vermicomposting	<b>K2</b>
<b>CO3</b>	To create awareness on applications of Vermiculture	<b>K3</b>
<b>CO4</b>	To analyse the nutrient value of worm cast and vermicompost	<b>K3</b>
<b>CO5</b>	To adopt eco friendly method of solid waste management and Able to become a self – Employee	<b>K4</b>

**Recall, K-2 Understand, K-3 Apply, K-4 Analyse**

#### **Mapping of COs with POs**

<b>PO/ CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	S	M	M	S	L
<b>CO2</b>	S	M	M	S	L
<b>CO3</b>	S	M	L	M	L
<b>CO4</b>	S	L	L	L	L
<b>CO5</b>	S	L	L	L	L

**S-Strong      M-Medium      L-Low**

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

**Course Title : CORE PRACTICAL I (INVERTEBRATA & CHORDATA)**

**Course Code : 22UZOQC1**

**Hours/Week:3**

**Semester : I & II**

**Course Credit:3**

**Course Objectives:**

- To get experience in anatomy through simple dissections
- To familiarize organ system
- To identify the various preserved specimen

**1. DISSECTIONS**

- a. Earthworm :Nervous system
- b. Prawn :Nervous system
- c. Cockroach :Digestive, Nervous and Reproductive systems.
- d. Fish :Digestive System. Virtual dissections only.

**2. MOUNTINGS**

- a. Earthworm : Bodysetae
- b. Cockroach : Salivary glands
- c. Mouthparts of : Cockroach, Mosquito, Housefly, Honeybee
- d. Teleost fish : Ctenoidscales.
- e. Teleost fish : Brain (Dorsal view and Ventral view.)

**3. SPOTTERS**

Examination of prepared slides and Museum specimens included in the type study under Phylum Invertebrata and Chordata.

**SPOTTERS LIST**

**I Classify Giving Reasons**

1. Simple sponge
2. Sea anemone
3. Liver fluke



4. Ascaris
5. Amphioxus
6. Doliolum
7. Pigeon

## **II Draw labelled Sketch**

8. Paramecium -Entire
9. Obelia –Medusa
10. Bipinnarialarva
11. Frog – Pectoralgirdle
12. Frog – Pelvic girdle
13. T.S of Ascaris
14. T.S of Amphioxus through pharynx.

## **III. Write Descriptive Notes on**

15. Obeliacolony
16. Taeniasolium
17. Sepia
18. Echeneis
19. Chaetopterus
20. Draco
21. Owl
22. Manis

## **IV Comment on Biological significance**

23. Sponge -Gemmule
24. Physalia
25. Peripatus
26. Hippocampus
27. Narcine
28. AxolotlLarva
29. Bat

## **V. Relate Structure and Function**

30. Sponge – Spicules
31. Taenia – Scolex

32. Nereis – Parapodium
33. Starfish – Pedicellaria
34. Chelone –carapace
35. Pigeon- Quill feather

**4. Certified and Bonafide practical record should be submitted at the time of practical examination.**

**Course Outcomes (CO):**

**On completion of the course, students should be able to**

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	To identify the Invertebrates and Chordates	<b>K1</b>
<b>CO2</b>	To recognise the taxonomy of Invertebrates and Chordates.	<b>K2</b>
<b>CO3</b>	To gain knowledge about biodiversity of organisms.	<b>K3</b>
<b>CO4</b>	To interpret the significance of specific structure and function.	<b>K4</b>
<b>CO5</b>	To implement the biological significance of Invertebrates and Chordates.	<b>K1</b>

**Recall, K-2 Understand, K-3 Apply, K-4**

**AnalyseMapping of COs with POs:**

<b>PO/ CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	S	M	L	S	L
<b>CO2</b>	S	M	L	S	L
<b>CO3</b>	S	M	L	S	L
<b>CO4</b>	S	M	L	S	L
<b>CO5</b>	S	M	L	S	L

**S - Strong M - Medium L -Low**

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

**Course Title : CHORDATA**

**Course Code : 22UZOC2**

**Hours/Week:6**

**Semester : II**

**Course Credit:5**

**Course Objectives:**

- To understand the taxonomy, relationship and evolution of animals.
- To identify the classes of vertebrate animals and recognize their distinguishing features.
- To appraise the diversity of animals in a phylogenetic context.
- To understand how different body designs solve biological problems related to physiological and environmental challenges.
- To develop an appreciation for the role of vertebrates in biological communities, ecological interactions, and conservation problems

**Unit I Prochordata& Pisces**

General characters and classification of Chordata (up to class) with examples.

**Type Study:**

*Amphioxus, Scolidon.*

**General topics:** Affinities of Hemichordates, Retrogressive metamorphosis in Ascidia, Salient features of Cyclostomata, Accessory respiratory organs in fishes, Types of Fins and function, Migration of Fishes.

**Unit II Amphibia**

Classification and characters -Amphibia (up to order with examples). Type Study: Frog

**General topics:** Metamorphosis of Amphibian, Limbless Amphibians, Parental care in Amphibian, Paedomorphosis.

**Unit III Reptilita**

Classification and characters of Reptilia (up to order with examples). Type Study: *Calotes*

**General topics:** Identification of Poisonous and non-poisonous snakes – Poison apparatus and types of poison, Skull of Reptiles, Salient features of Chelonia & Crocodilia.

**Unit IV Aves**

Classification and characters of Aves (up to order with examples). Type Study: Pigeon.

**General topics:** Flightless Birds, Flight Adaptations in Birds, Feet and Beak

modifications, Acoustics in Birds, Migration in Birds.

### Unit V Mammals

Classification and characters of Mammals (up to order with examples). Type Study: Rabbit

General topics: Diversity of Marsupials, Affinities of Prototheria, Aquatic mammals and adaptation, Dentition in Mammals, Adaptive radiation in Mammals.

### Books for references

1. Arumugam N *Animal Diversity - Volume - 2 - Chordata*, Saras Publication, Nagercoil
2. Thangamani A, Prasannakumar S, Narayanan LM, Arumugam N A *Text Book of Chordates*, Saras Publication, Nagercoil.
3. Ekambaranatha Ayyar & T.N. Ananthakrishnan, *Manual of Zoology Vol - II*, S. Viswanathan Pvt. Ltd. Chennai..
4. Kotpal RL *Modern Text Book of Zoology Vertebrates*, Rastogi Publications, Meerut.
5. Young, J.Z. 1950. *Life of Vertebrates*. Clarendon Press, Oxford, UK.
6. Pough Harvey F, Christine M. Janis and John B. Heiser .2002. *Vertebrate Life*, Pearson Education Inc. New Delhi.
7. Verma PS, *Chordate Zoology*, S Chand Publishers, New Delhi

### Course Outcomes (CO)

On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	The learner will be able to understand the diversity and basic taxonomy of chordates .	K1
CO2	The learner will get an idea of adaptation and importance of chordates.	K2
CO3	The learner will be able to identify any vertebrate animal at basic level.	K3
CO4	The paper will give a strong observation skill and prompt him to think about its conservation, sustainable economic utilisation and its potentials in technological prospects.	K4

K-1 Recall, K-2 Understand, K-3 Apply, K-4 Analysis

**Mapping of COs with POs:**

<b>PO/ CO</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	S	S	S	M	S
<b>CO2</b>	S	S	S	M	S
<b>CO3</b>	S	S	S	M	S
<b>CO4</b>	M	S	M	S	S

**S - Strong**

**M - Medium**

**L -Low**

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

**Course Title : SKILL BASED SUBJECT - II - APICULTURE**

**Course Code : 22UZOSC2**

**Hours/Week:2**

**Semester : II**

**Course Credit:2**

**Course objectives:**

- To Understand the social life of honey bees and their behavior
- To remember the types of beehives
- To apply knowledge on care and management of apiary
- To identify major bee keeping challenges and opportunities
- Purchase of Honey and Wax byproducts from bee keeping industry

### **UNIT- I**

Honey bee: systematic position - Species of honey bees - Life history of honey bee - behaviour - Swarming - role of Pheromones

### **UNIT- II**

Bee colony : Castes - Natural colonies and their yields - Types of beehives - Structure - Location, Care and management

### **UNIT- III**

Apiary : Care and management – Artificial bee hives - Types - Construction of space frames - Selection of sites - Handling – Maintenance.

### **UNIT- IV**

Instruments employed in Apiary : Extraction instruments - Honey - Composition - Uses: Medicinal values – Beeswax and its uses – Economics of Bee culture.

### **UNIT- V**

Diseases: Honey bee diseases and their control methods – Modern methods employing Honey bees for cross pollination in horticultural gardens - Apiculture as self-employment venture.

### **TEXT BOOK**

1. Addison Webb (2004) Bee Keeping: For profit and pleasure. Agrobios,

Jodhpur, India.

## REFERENCE BOOKS

1. Cherian,R.J.,Ramanathan,K.R.(1992).BeekeepinginIndia.
2. Mishra, R.C. (1985). Honey bees and their management in India, ICAIR.
3. Singh, S. (1982). Bee Keeping,ICAR.

### Course Outcomes (CO)

On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	To remember the types of species and the steps involved in modern bee keeping techniques and its practical difficulties	K1
CO2	To Understand the medicinal values of honey and commercial products of apiary reveals the importance of apiculture	K2
CO3	To comprehend methodologies involved in bee keeping	K3
CO4	To apply modern tools in bee keeping techniques and its by products	K3
CO5	To get aware of medicinal values of honey and their Self employment opportunities	K4

K-1Recall, K-2 Understand, K-3 Apply,K-4 Analyse

### Mapping of COs with POs:

PO/ CO	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	M	S	S	S
CO4	L	M	S	S	S
CO5	L	M	S	M	S
S-Strong		M-Medium		L-Low	

**Programme Title : B.Sc. Zoology****Course Title : ENVIRONMENTAL STUDIES****Course Code : 22UEVSC****Hours/Week:2****Semester : II****Course Credit:2****Course Objectives**

- To educate the students regarding the environmental issues and problems.
- To give an exposure towards the scientific and socio – economic dimensions of the environment.
- To impart and enhance the basic knowledge about environment and develop concern towards it.
- To develop the ability to evaluate the measures for the improvement and protection of environment.
- To sensitize the students on the various environmental issues.
- To integrate different disciplines and fields that intersect with environmental concerns
- To make the younger generations aware of the values of natural resources.

**UNIT I - FUNDAMENTALS**

Environment-Definition: Scope, Structure and Function of Ecosystems - Producers. Consumers and Decomposers - Energy flow in the Ecosystem - Ecological Succession - Food Chain, Food Webs and Ecological Pyramids - Concept of Sustainable Development.

**UNIT II - NATURAL RESOURCES**

Renewable Resources - Air, Water, Soil, Land and Wildlife resources; Non-Renewable Resources - Minerals, Coal, Oil and Natural Gas; Environmental problems related to the Extraction and use of Natural Resources.

**UNIT III - BIODIVERSITY**

Biodiversity – Definition – values - consumption use, Productive social, Ethical, Aesthetic and option Values Threats to Biodiversity - Hotspots of Biodiversity - conservation of Biodiversity: In-situ, Ex-situ, Bio-Wealth National and Global Level.

**UNIT IV- ENVIRONMENTAL POLLUTION**



Definition - Causes, Effects and Mitigation Measures - Air, Water and Soil Pollution. Noise Pollution, Thermal pollution, Nuclear Hazards, Solid Wastes, Acid Rain, Climate Change and Global Warming, Environmental Laws and Regulations in India - Earth Summit.

## **UNIT V- POLLUTION AND ENVIRONMENT**

Population Explosion - Environment and Human Health - HIV/AIDS - Women and Child Welfare - Resettlement and rehabilitation of people, Role of Information Technology in Environmental Health. Environmental Awareness. Environmental Disaster Management - Fire Safety and Prevention.

### **Field work**

- Visit to area to document environmental assets: river/forest/flora/fauna, etc.,
- Visit to a local polluted site - Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystem - pond, river, Delhi ridge, etc.,

**(Equal to 5 lectures)**

### **References:**

1. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. This Fissured land: An Ecological History of India. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339:36-37.
7. McCully, P. 1996. Rivers no more: the environmental effects of dams (pp. 29-64). Zed Books.

8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. Waste Water Treatment. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8<sup>th</sup> edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. Environmental Law and policy in India. Tripathi 1992.
14. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics John Wiley & Sons.
17. Thapar. V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.
18. Warren, C. E. 1971, Biology and Water pollution Control. WB Saunders.
19. Wilson, E. O. 2006. The Creation: An appeal to save life on earth. New York: Norton.
20. World Commission on Environment and Development 1987. Our common Future. Oxford University Press.,

**Course Outcomes (CO):**

**On completion of the course, students should be able to**

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	Demonstrate critical thinking skills In relation to environmental issues.	<b>K2</b>
<b>CO2</b>	Develop an integrative approach to environmental issues with a focus on sustainability.	<b>K3</b>
<b>CO3</b>	Bring an awareness, knowledge and appreciation of intrinsic values of ecological processes and communities.	<b>K1</b>
<b>CO4</b>	Reflect critically about their roles and identities ascitizens, consumers and an environmentalist in the complex, interconnected world.	<b>K4</b>
<b>CO5</b>	Apply systems, concepts and methodologies to analyse and understand interactions between social and environmental processes.	<b>K1</b>

**K-1 Recall, K-2 Understand, K-3 Apply, K-4 Analyse**

**Mapping of COs with POs:**

<b>PO CO</b>					
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	S	S	L	M	S
<b>CO2</b>	S	M	S	L	M
<b>CO3</b>	S	L	M	S	M
<b>CO4</b>	S	M	M	M	S
<b>CO5</b>	S	S	M	M	S

**S - Strong M - Medium L - Low**

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

**Course Title : CELL**

**BIOLOGY**

**Course Code : 22UZOC3**

**Hours/Week: 6**

**Semester : III**

**Course Credit: 5**

**Course objectives:**

- To give an insight to the ultra-structure of cellular components.
- To give a clear idea about how the basic metabolism occur inside the cell.
- To enable the students to explore the intricacies of cell architecture and their Complex biochemical interactions

### **UNIT- I Introductory Cytology**

Cell theory - Prokaryotic and Eukaryotic cells.

**Cytological techniques:** Principle, Resolving power & uses of compound microscope, confocal microscope and electron microscope. Cell fractionation- Homogenization, Centrifugation Fundamentals of micro techniques- fixation, staining and microtome.

### **UNIT- II Cell Organelles**

<b>Plasma Membrane</b>	:	Ultrastructure and functions
<b>Endoplasmic reticulum</b>	:	Ultra structure and functions
<b>Golgi complex</b>	:	Ultra structure and functions
<b>Lysosomes</b>	:	Structure and functions, polymorphism in lysosomes

### **UNIT- III Cell Organelles**

<b>Mitochondria</b>	:	Ultra structure functions
<b>Ribosome</b>	:	Ultrastructure and functions
<b>Centrosome</b>	:	Ultra structure and functions
<b>Chromosomes</b>	:	Structure, types, Giant chromosomes.

## **UNIT- IV**

**Nucleus & Nucleolus** : Structure and functions of Nucleus, and nucleolus

**Nucleic acids** : DNA- structure, chemical composition, Watson and Crick, Replication;  
RNA- structure, chemical composition, types – mRNA, tRNA, rRNA;

**Protein synthesis** : Mechanism – Transcription, Translation, post translational processing, central dogma

## **UNIT- V**

**Cell cycle** : Interphase, Mitosis – Meiosis.

**Cancer** : Characteristic features of cancer cells – Carcinogens – diagnosis and treatment

**Cell Growth and Aging:** Cell growth – subcellular changes – causes – theories.

## **TEXT BOOK**

1. Verma P.S. and Agarwal V.K. (2016). S.Chand& Company LTD. Ram Nagar, New Delhi-110055

## **REFERENCE BOOKS**

1. De Robertis and De Robertis – Cell Biology and Molecular Biology” (7<sup>th</sup>Edition) (1980) W.B.Saunders.
2. Giese, A.C (1979) “Cell Physiology” (5<sup>th</sup>Edition) W.B. Saunders, Philadelphia, London.
3. Powar C.E. (1983) “Essentials of Cytology” 7<sup>th</sup> Edition. Himalaya Publishing house
4. Singh & Tomar, (2008).9th revised edition Cell Biology –Rastogi Publications, Shivaji road, Meerut – 250 002, India.

**Course Outcomes (CO):**

**On completion of the course, students should be able to**

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	Students can learn the structures and purposes of basic components of cells, especially biomolecules, membranes, and organelles.	<b>K2</b>
<b>CO2</b>	Students will develop an idea how cellular components are used to generate and utilize energy in cells.	<b>K3</b>
<b>CO3</b>	Students will explain the cellular components underlying mitotic cell division.	<b>K3</b>
<b>CO4</b>	Students will be able apply their knowledge of cell biology to selected examples of changes or losses in cell function.	<b>K4</b>
<b>CO5</b>	These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation..	<b>K1</b>

**K-1 Recall, K-2 Understand, K-3 Apply, K-4 Analyse**

**Mapping of COs with POs:**

<b>PO/ CO</b>	<b>PO</b>				
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	S	M	L	M	L
<b>CO2</b>	S	M	L	M	L
<b>CO3</b>	S	M	L	L	L
<b>CO4</b>	S	M	L	L	L
<b>CO5</b>	S	M	L	L	L

**S - Strong    M Medium    L -Low**

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

**Course Title : SKILL BASED III - AQUACULTURE**

**Course Code : 22UZOSC3** **Hours/Week : 2**

**Semester : III** **Course Credit : 2**

**Course Objectives:**

- Syllabus deals with the freshwater, marine, brackish water fish and other cultivable organisms
- Provides commercial and economical knowledge on the field and its marketing

**UNIT - I**

**Introduction and scope:** Scope for Aquaculture in India and the world – physical and chemical characteristic features of water bodies-selection criteria for cultivable species-Cultivable organisms: indigenous and exotic cultivable species of fish

**UNIT II**

**Fish farming:** site selection- construction of fish pond-Types of farming: Extensive, intensive, semi intensive culture – Integrated fish farming – Advantages of poly culture, monosex and monoculture.

**UNIT - III**

**Culture techniques:** culture of carp species – Edible oyster culture – pearl oyster culture – Fresh water prawn culture– ornamental fish culture – common species for ornamental fish farming.

**UNIT - IV**

**Fish disease management :** Common bacterial, viral, fungal, protozoan and crustacean diseases, their symptoms and treatment – water quality maintenance – importance and composition of feeds – types of feed – wet and dry feeds.

## **UNIT V**

**Marketing the products:** Marketing the fish to local markets and for export – Harvesting and transport –Government participation in Aquaculture – preservation of fishes canning and freezing.

### **TEXT BOOK:**

1. C.B.L Srivastava, a text book of fishery science and Indian fisheries (2006), Kitab Mahal distributions

### **REFERENCE BOOKS:**

1. Bardah, Ryther and MC Larrey (1972). Aquaculture, John Wiley, New York.
2. David Cushing, (1971) Fisheries Resources of the sea and their Managements, OUP & ELBS Edition, London, 87 PP.
3. Jameson, J.D. and R. Santhanam (1996) Manual of ornamental fisheries and farming technology. Fisheries college and Research Institute, Thoothukudi.
4. Thingra, A.V. G. (1991) Fish and Fisheries of India. Hidustan Publishing Co.
5. Rath. R.K (2000) Freshwater Aquaculture. Scientific Publishers (India) Po Box 91, Jodhpur.
6. Trivedi, K.K. (Ed) (1986) Fisheries Development 2000 A.D. Association of India Fisheries Industrial, Oxford and I.B.H. New Delhi.



**Course Outcomes (CO) :**

**On completion of the course, students should be able to**

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	Understand the scope of aquaculture and cultivable organisms	<b>K1</b>
<b>CO2</b>	Acquire knowledge of various types and methods of aquaculture practices.	<b>K2</b>
<b>CO3</b>	Apply the modern techniques and methods of fishery industries.	<b>K3</b>
<b>CO4</b>	To analyse the different types of diseases and their treatments and to execute feed formulation for fishes	<b>K3</b>
<b>CO5</b>	To attained knowledge about importance of value added fishery products.	<b>K4</b>

**K-1 Recall, K-2 Understand, K-3 Apply, K-4 Analyse**

**Mapping of COs with POs:**

<div>PO/ CO</div>	PO				
	PO1	PO2	PO3	PO4	PO5
<b>CO1</b>	S	M	M	M	M
<b>CO2</b>	L	S	S	L	S
<b>CO3</b>	S	L	S	S	M
<b>CO4</b>	S	S	S	S	S
<b>CO5</b>	S	S	M	L	S

**S - Strong      M - Medium      L - Low**

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

**Course Title : NON MAJOR ELECTIVE - I**

**COMMUNICABLE DISEASES AND MANAGEMENT**

**Course Code : 22UZONEC1**

**Hours/Week : 2**

**Semester : III**

**Course Credit : 2**

**Course objectives:**

- To aware the students for various virus and its diseases which spreads in human with the help of study of host-parasite relationship.
- A Basic approach to the bacterial disease and their diseases.
- To aware the students for various protozoan and their diseases which spreads in human
- To aware about the causative organism, modes of transmission, symptoms of Taeniasis, Ascariasis and Elephantiasis .
- To increase awareness about the immunity and related health issues.

#### **UNIT I**

Viral diseases: Rabies, Mumps, Influenza, Measles, Hepatitis and AIDS.

#### **UNIT II**

Bacterial diseases: Cholera, Tuberculosis, Tetanus, Diphtheria, Typhoid.

#### **UNIT III**

Protozoan diseases: Malaria, Amoebiasis, Leishmaniasis and Trypanosomiasis

#### **UNIT IV**

Nematode parasites: Taeniasis, Ascariasis and Elephantiasis.

#### **UNIT V**

Immunology: Immune response: Humoral immunity and Cell mediated immunity, Vaccines and vaccination

#### **TEXT BOOK**

1. Medical microbiology by S.Rajan,2007, M.J.P Publishers, Chennai

## REFERENCE BOOKS

1. Charkaravarthy, A.K. (1996) : Immunology, Tata Mc Graw Hill Publishing Company Limited, New Delhi.
2. Deepak Kumar (2001) : Diseases and medicines in India: A Historical overview, Tulika, New Delhi.
3. Park, A. (2007) : Text book of social and preventive medicine. M/s Banarsidas Bhanot Publishers, 1167, Prem Nagar Jabalpur 482001 (India).
4. Sharma and Ratna (1984) : Introduction to Parasitology, Chand and Company Limited New Delhi
5. Dennis, H. (2009). Agricultural Entomology. Timber Press

### Course Outcomes (CO):

**On completion of the course, students should be able to**

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	To understand the morphology , mode of transmission and control of viral diseases	<b>K1</b>
<b>CO2</b>	To study the morphology mode of transmission and control of bacterial diseases	<b>K2</b>
<b>CO3</b>	To describe the morphology mode of transmission and control of protozoan diseases	<b>K1</b>
<b>CO4</b>	To examine the morphology mode of transmission and control of parasitic Diseases	<b>K3</b>
<b>CO5</b>	To study the importance of immune system	<b>K2</b>

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

**Course Title : GENETICS**

**Course Code : 22UZOC4**

**Hours/Week 3**

**Semester : IV**

**Course Credit 3**

**Course Objectives:**

- Students will learn the basic principles of inheritance at the molecular, cellular and organism levels.
- Students will understand causal relationships between molecule/cell level phenomena (“modern” genetics) and organism-level patterns of heredity (“classical” genetics).
- Students will learn the mechanism of Mutation and will be able to understand how mutations bring changes in an organism.

### **UNIT- I Mendelian Genetics**

**Mendel’s Principles of Heredity:** Mendelian laws – Monohybrid and dihybrid crosses – backcross and testcross – Phenotype and genotype. Importance of *Drosophila* in genetics – Culture methods – sex identification – Mutants of *Drosophila*.

**Interaction of Genes:** Incomplete dominance and co-dominance. Complementary genes, supplementary genes – polygenic inheritance skin colour in Man. Epistasis, Lethal genes.

**Multiple Alleles:** Blood groups and their inheritance in man – Rh factor – Erythroblastosis foetalis.

### **UNIT- II Linkage & Crossing Over**

**Linkage in Drosophila:** complete and incomplete linkage, theories of linkage, factors affecting linkage.

**Crossing over:** Types, mechanisms, theories, cytological basis of Crossing over (Stern's experiment), significance and factors affecting crossing over.

**Chromosomal Map:** Chromosomal map & its construction

**Sex Determination:** Sex determination in Man and *Drosophila*, Gynandromorphism – Barr bodies.

### **UNIT- III Inheritance**

**Sex Linked Inheritance:** Sex linked inheritance in Man (Colourblindness and Haemophilia in man); Y linked inheritance. hypertrichosis, Sex influenced and sex limited characters.

**Cytoplasmic inheritance** – Maternal effect on *Limnaea* (shell coiling) – Kappa particles in Paramecium and milk factor in Mice.

**Chemical Basis of Inheritance:** Fine structure of gene – Cistron – Recon Muton – DNA Genetic material – Genetic code.

### **Unit IV Mutations and Animal Breeding**

**Gene mutation** – molecular basis – tautomerism, base analogues, Spontaneous and Induced mutations. Detection of mutation by CIB method. Mutagens – physical and chemical

**Chromosomal aberration** – deficiencies, duplication, inversion, shift, and isomerism. Inter chromosomal aberration, translocation, ploidy – Euploidy, aneuploidy.

**In Born Errors of Metabolism:** Phenylketonuria, Alkaptonuria, Albinism **Animal breeding** – Inbreeding – pure lines – out breeding – Hybrid vigour, (Heterosis) – General effects of inbreeding and out breeding.

### **UNIT- V Modern Genetics and population genetics**

**Concept of Gene:** Cistron – split gene – promoter – repetitive DNA – Transposons. Bacterial genome- Transformation – Conjugation – F factor - Sexduction – Transduction –Generalised & Specialised - Plasmids. –Operon concept- Lac & trp operons (outlines).

**Population Genetics:** Gene pool - Gene frequency – Factors affecting Hardy – Weinberg law - Genetic equilibrium - Factors affecting gene frequency.

**Genetic disorders in Man:** Down's syndrome, Turner's and Klinefelter's syndrome, Cri-du-chat, Inherited single gene disorder – sickle cell anemia, cystic fibrosis, Thalassaemia

**Genetic Counselling:** Pedigree Analysis, positive and Negative Eugenics – Euphenics – Euthenics.

## TEXT BOOKS

1. Verma, P.S. Agarwal, V.K. (2018) Genetics, S. Chand and company (Pvt) LTD, Ram Nagar, New Delhi.

## REFERENCES

1. Anna C.Pai., Helen Marcus, Roberts (1981). Genetics its concepts and implications Prentice Hall Inc, Engle Wood Cliffs, New Jersey.
2. Benjamin Lewin (1983). Genes Wiley, Eastern limited, New Delhi.
- Winchester, A.M. (1972). Genetics, Oxford and IBH Publishing Co.
3. Gardner, F. J (1938). Principles of Genetics, Wiley Eastern.
4. Gupta. P.K. Genetics (1997). Rastogi Publications, Meerut.
5. Strickberger, W.M. (1977). Genetics, 2<sup>nd</sup> Edition, Mac Millan. Watson, J.D. (1986) Molecular Biology of the Gene (3<sup>rd</sup> Edition) W.B. Benjamin.
6. Alice Marcus (2009) Genetics, 1st edition, MJP publishers. India

**Course Outcomes (CO):**  
**On completion of the course, students should be able to**

CO Number	CO Statement	Knowledge Level
CO1	Understand the core principles of genetics, the historical background, genetic crosses, basic laws governing the pattern of qualitative characters	K1
CO2	Provide outline on the heredity and hereditary factors involved in Linkage, crossing over, sex linked inheritance and sex determination.	K3
CO3	Apply knowledge about transcription, translation, and the genetic code to understand the flow of genetic information from DNA to proteins	K4
CO4	Understand the range of molecular events in mutation and comprehensive view on the in and out breeding	K4
CO5	Understanding the applications of genetics for the welfare of health and treatment of disease, and the impact of sensitive advantage and natural selection on human genetic disorders	K2

**Recall, K-2 Understand, K-3 Apply, K-4 Analyse**

### Mapping of COs with POs:

<div>PO/ CO</div>	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	M
CO2	S	M	S	M	M
CO3	M	S	M	M	L
CO4	S	S	M	M	M
CO5	S	M	M	S	M

**S - Strong**      **M - Medium**      **L -Low**

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

**Course Title : MAJOR ELECTIVE - I :**

**ECONOMIC ENTOMOLOGY&PEST MANAGEMENT**

**Course Code : 22UZOEC1**

**Hours/Week :3**

**Semester : IV**

**Course Credit :3**

**Course Objectives:**

- To understand the importance of Pest Management.
- To impart the knowledge of beneficial and harmful insects.

**UNIT - I**

General characters and classification of insects up to order level with examples. General Morphology and Metamorphosis of Insects. Agro Support and Conservation of Insects.

**UNIT - II**

Beneficial and harmful insects. Economic importance of honeybees, silk worm and lac insect – Parasitic and predatory insects. Damages to plants, animals and man by insects.

**UNIT - III**

Pests of paddy (*Leptocorisa varicornis*, *Tryporyzaincertulas*), Sugarcane (*Pyrillamperpusilla*, *chiloin fuscateilus*), Coconut (*Oryctes rhinoceros*, *Rhynchophorus ferrugineus*), Brinjal (*Leucinodesorbonalis*, *Euzapharaparticella*). Pests of stored products and their control:-Rice weevil, Wheat Weevil, Pulse Beetle – Household pests: Cockroach, flies and mosquitoes.

**UNIT - IV**

Insects damaging other household goods -Termite, Black Ants and Silver fish. Pest control methods: Natural, Applied, Cultural, Mechanical, physical,– Integrated Pest Management (IPM) and its importance.

**UNIT - V**

Chemosterilants – Pheromones- semiochemicals – Attractants - Repellents- Pesticide industry- Production and marketing, Preparation of pesticides - Formulations – Packages - Pesticide spraying appliances. Pesticide Marketing



## TEXT BOOK

1. David, B.V. and V.V. Ramamurthy, (2016). Elements of Economic Entomology, Brilliant Publishing, 8 th Edition.

## REFERENCES:

1. Larry P. Pedigo (2014). Economic Entomology and Pest management, Wave land Pr Ic, 6<sup>th</sup> Edition
2. Ipsita Samal (2020) . Insights on Entomology ,New Vishal Publications.
3. Singh (2005) Integrated Pest Management: Principles And Applications, CBS Publishers and Distributors
4. David and T.N. Anatha Krishnan (2003) General and Applied Entomology Mc Graw Hill Publications.
5. Chapman Stephen (2013). Insects Structure and functions , Cambridge University Press..
6. Ramakrishna Iyer, T.V., - Economic Entomology, Government Publications, Madras.

## Course Outcomes (CO):

**On completion of the course, students should be able to**

CO Number	CO Statement	Knowledge Level
CO1	Develop Understanding on the diversity and classification of Insects	K2
CO2	Know the beneficial and Harmful Insects	K1
CO3	Compare the type of insect pests and the damage caused by them	K3
CO4	Understand the mode of action of Pesticides and the consequences of their use	K2
CO5	Understand the effective way of insect pest management strategy	K2

**Recall, K-2 Understand, K-3 Apply, K-4 Analyse**

### Mapping of COs with POs:

<div> <div>PO</div> <div>CO</div> </div>	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	M	M	L
CO3	S	S	S	S	M
CO4	S	M	M	M	M
CO5	S	M	M	M	S
<div> <div>S - Strong</div> <div>M - Medium</div> <div>L - Low</div> </div>					

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

**Course Title : MAJOR ELECTIVE SUBJECT- I : BIOINFORMATICS**

**Course Code : 22UZOESC1**

**Hours/Week:3**

**Semester : IV**

**Course Credit:3**

**Course Objective:**

- To understand the basic principles and applications of bioinformatics.

**UNIT-I**

Computer networking LAN, WAN, MODEM and Fiberoptics Networks - introduction to internet, WWW, NICNET, ERNET, VSNL, ISDN.

**UNIT-II**

Scope of bioinformatics – Useful bioinformatics sites – Bioinformatics in Pharmaceutical industry – Bioinformatics orientation in IT industry.

**UNIT-III**

Database – Definition – Biological database – Primary Dtabase (Genbank) – Protein Database (SWISS – PROT, TREMBL, NRL – 3D PIR MIPS) - Secondary database (PROSITE, Pfam, BLOCKS, PRINTS, IDENTIFY)- Composite database(NRDB, OWL MIPSX); - Protein structure database (PDB, MMDB)

**UNIT-IV**

Pair wise alignment – Local and global alignment – BLAST, FASTA, Multiple sequence Analysis (MSA).

**UNIT-V**

Evolution of bioinformatics – Potential of Bioinformatics – Human Genome Project–Bioinformatics in India–Futurein Bioinformatics.

**REFERENCE BOOKS**

1. T.K. Attwood and D.J. Parry – Smith, Introduction to Bioinformatics, Pearson Education Ltd., New Delhi (2004).
2. Arthur M. Lesk, Introduction to Bioinformatics, Oxford University Press, New Delhi(2003).

3. S.Sundara Rajan and R. Balaji, Introduction to Bioinformatics, Himalaya Publishing House - New Delhi (2002).
4. Irfan A. Khan and Atiya Khanum, Emerging trends in Bioinformatics Ukaaz Publications, Andhra Pradesh (2002).

### Course Outcomes (CO):

On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the basics of Computer application in Biology	K2
CO2	Know the theory behind fundamental bioinformatics analysis methods.	K1
CO3	Be familiar with widely used bioinformatics databases	K1
CO4	Understand the interpretation of bioinformatics and statistical analyses with real molecular biology data.	K1
CO5	Understand the data mining tool and its practical application.	K2

Recall, K-2 Understand

### Mapping of COs with POs:

CO \ PO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	S	L	L	M	M
CO2	M	S	M	M	L
CO3	M	L	H	S	M
CO4	M	M	M	M	M
CO5	M	M	M	M	S

S - Strong M- Medium L -Low

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

**Course Title : CORE PRACTICAL-II: (CELL BIOLOGY AND GENETICS)**

**Course Code : 22UZOQC2**

**Hours/Week:3**

**Semester : III & IV**

**Course Credit:3**

**Course Objectives**

- To understand the different types of cell structure
- To understand the process of Mounting
- To identify the instruments and their uses
- To get aware of Syndromes

**CELL BIOLOGY**

1. Micrometry
2. Squash preparation of onion root tip
3. Squash preparation of grasshopper testis
4. Fixation and preparation of tissue for permanent histological study

**Spotters**

1. Centrifuge
2. Homogenizer
3. Microtome
4. Phase contrast microscope
5. Inclined Monocular Microscope
6. Columnar Epithelium
7. Ciliated Epithelium
8. Glandular Epithelium
9. Striated Muscle
10. Non- Striated Muscle

**GENETICS**

1. Drosophila culture technique
2. Preparation and identification of Salivary gland chromosomes in Chironomous larva
3. Observation of barr body in Human epithelia
4. Observation of Mendelian traits among student Volunteers
5. Verification of monohybrid and dihybrid cross by Chi Square
6. Sex identification in Drosophila

- Human blood grouping

### Spotters

- Normal karyotypemale
- Normal karyotypefemale
- Klinefelter's Syndrome
- Turner's Syndrome
- Down's syndrome
- Comb pattern in Poultry
- Coat colour in Mice

Certified and Bonafide practical record work should be submitted at the time of Practical examination.

### Course Outcomes (CO):

On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
<b>CO1</b>	Students can learn the structures and purposes of basic components of cells, especially biomolecules, membranes, and organelles.	<b>K1</b>
<b>CO2</b>	Understand the different stages of mitosis and meiosis.	<b>K2</b>
<b>CO3</b>	Deploy slide preparation to observe Giant chromosome, epithelial and blood cells.	<b>K3</b>
<b>CO4</b>	Analyse inheritance of Mendelian traits by direct observation among students.	<b>K3</b>
<b>CO5</b>	To access the practical experience in instrument handling and gain Practical skill for further research and job opportunities	<b>K4</b>

**Recall, K-2 Understand, K-3 Apply, K-4 Analyse**

### Mapping of Cos with POs

PO/C O	PO1	PO2	PO3	PO4	PO5
<b>CO1</b>	S	S	S	M	S
<b>CO2</b>	S	S	S	M	S
<b>CO3</b>	S	S	S	M	S
<b>CO4</b>	M	S	L	S	S
<b>CO5</b>	S	M	M	S	S
	<b>S-Strong</b>	<b>M-Medium</b>	<b>L-Low</b>		

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

**Course Title : SKILL BASED IV -PRACTICAL CLINICAL  
LABORATORY TECHNIQUES**

**Course Code : 22UZOSQC4**

**Hours/Week:2**

**Semester : IV**

**Course Credit:2**

**Course objectives:**

- To understand the different types of blood cells and cell counting
- To know about Haemoglobin estimation and haemin crystals
- To study the qualitative analysis of urine
- To identify the instruments and their uses

### **I MAJOR EXPERIMENTS**

1. Differential count of White blood corpuscles.
2. Enumeration of White Blood Corpuscles.
3. Enumeration of Red Blood Corpuscles.
4. Estimation of Haemoglobin in Human blood.
5. Preparation of Haemin crystals.
6. Qualitative analysis of albumin and sugar in urine.

### **II MINOREXPERIMENTS**

1. Bleeding time of blood.
2. Clotting time of blood.
3. Specific gravity of urine.
4. Analysis of bile salts in urine.
5. Analysis of bile pigment in Urine.
6. Analysis of blood in Urine.

### **III SPOTTERS**

1. Albuminometer
2. Ryles tube
3. Carwardine Saccharometer
4. Urinometer



5. Folin Wutube
6. Glucometer
7. ESRstand
8. Wintrobstand
9. Haemoglobinometer
10. Haemocytometer

Certified and Bonafide practical record work should be submitted at the time of Practical examination.

### Course Outcomes (CO)

On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
<b>CO1</b>	Remember the differential count of white blood corpuscles	<b>K1</b>
<b>CO2</b>	Understand the enumeration of white blood corpuscles and red blood corpuscles	<b>K2</b>
<b>CO3</b>	Know the estimation of Haemoglobin and preparation of haemin crystals	<b>K3</b>
<b>CO4</b>	Remember various haematological and urinary tests	<b>K3</b>
<b>CO5</b>	Understand the qualitative analysis of urine	<b>K4</b>
<b>CO6</b>	Students gain the practical skill for further research and job opportunities	<b>K4</b>

**K-1 Recall, K-2 Understand, K-3 Apply, K-4 Analyse**

### Mapping of COs with POs:

CO \ PO	PO				
	PO1	PO2	PO3	PO4	PO5
<b>CO1</b>	S	S	S	M	S
<b>CO2</b>	S	S	S	M	S
<b>CO3</b>	S	S	S	M	S
<b>CO4</b>	M	S	M	S	S
<b>CO5</b>	L	M	M	S	M

**S- Strong M-Medium L -Low**

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

**Course Title : NON MAJOR ELECTIVE-II:  
ORNAMENTAL FISH CULTURE**

**Course Code : 22UZONEC2**

**Hours/Week:2**

**Semester : IV**

**Course Credit:2**

**Course Objectives**

- To learn the rearing of ornamental fishes.
- Describe the Fish nutrition and its nutritional requirements.
- To study the breeding habits of fish
- To understand the diseases of fish
- To understand the ideas of construction of home aquarium.

**UNIT I**

Scope of ornamental fish culture – ornamental fish farming in the world and India.

**Popular Ornamental fishes :** Gold fish, Guppies, angels and butterfly fishes

**UNIT II**

**Construction of Home aquarium** – Materials needed – metals, wooden frame and frameless tanks, Aerators and filters – hand net – suction tube – Temperature control and lighting .

**UNIT III**

**Fish Nutrition :** Feeding habits – Nutritional requirements of fish – Live feed, artificial feed – feed preparation.

**UNIT IV**

**Breeding habits:** Water quality, Diet, Spawning – induced breeding and parental care, Monoculture and polyculture.

**UNIT V**

**Common diseases of Ornamental fishes:** Protozoan–Velvet, Bacterial–Fin rot, Viral – Springviraemia of Carp, Fungal – Gill Rot, Deficiency diseases.

## TEXT BOOK

1. Jayashree, K.V., Tharadevi, C.S., Arumugam, N. (2015). Home aquarium and ornamental fish culture. Saras Publication, Kanyakumari.

## REFERENCE BOOKS

1. Jameson, J.D. and R. Santhanam (1996). Manual of ornamental fisheries and farming technology. Fisheries college and research institute, Thoothukudi.
2. Jhingran, A.V.G. (1991). Fish and Fisheries of India. Hindustan Publishing Company.
3. Thingra, A.V. G. (1991) Fish and Fisheries of India. Hindustan Publishing Co.

### Course Outcomes (CO):

On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	To understand the ornamental fisheries in world wide	K2
CO2	Relate the entire breeding patterns in fishes	K2
CO3	Compare the various diseases and control measure of fishes	K2
CO4	Outline the construction of home aquarium	K2
CO5	To acquire knowledge on fish culture and self-employment opportunities	K1

**K-1 Recall, K-2 Understand**

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

**Course Title : ALLIED ZOOLOGY- I**

**Course Code : 22UBOAC3**

**Hours/Week: 3**

**Semester : III**

**Course Credit:3**

**Course Objective**

- Taxonomy and outline classification of animal kingdom is detailed in the syllabus
- To understand the diversity of animals and environment and interrelationship between man and animals
- General characters, structure, Physiology and phylogenetic affinities of the invertebrate Phyla is included in the syllabus.
- General characteristics and classification of Phylum Chordata up to order level with important examples.
- Structure, physiology and affinities of the chordate animal is included in syllabus

**INVERTEBRATA**

**UNIT I**

**PROTOZOA :** External morphology of Paramecium – Conjugation

**PORIFERA :** Cellular structure of Leucosolenia

**COELENTERATA:** External morphology of Obelia and its life history

**General Topic:**

1. Nutrition in protozoa.
2. Canal system in sponges.
3. Polymorphism in Hydrozoa

**UNIT II**

**PLATYHELMINTHES:** External morphology of Fasciola hepatica, Life history & its excretory system.

**ANNELIDA:** Leech- Digestive system and Excretory system

**General topic:**

1. Human Helminth Parasites
2. Adaptive radiation in Polychaetes.

### UNIT III

**ARTHROPODA:** External Morphology of Prawn and its appendages

**MOLLUSCA-** External morphology of pila, Respiratory system and Nervous system

**ECHINODERMATA:** Starfish- External features, Digestive system and respiratory system

**General topic:**

1. Mouthparts of Insects
2. Torsion in Gastropods
3. Water vascular system & Larval forms in Echinodermata.

### UNIT IV

(9 Hours)

**CEPHALOCHORDATA:** Amphioxus- External morphology and Digestive system

**PISCES:** Shark- External morphology , Digestive system and urinogenital system

**AMPHIBIA:** Frog -External morphology, Respiratory and circulatory system.

**REPTILIA:** Calotes- External morphology, Nervous system and Excretory system.

**General topic:**

1. Affinities of cephalochordata
2. Parental care in fishes
3. Parental care in Amphibia
4. Identification of poisonous and non- poisonous snakes

### UNIT V

**AVES-** Pigeon – Digestive system, Respiratory system and Reproductive system

**MAMMALS-** Rabbit – External feature, Digestive system structure of brain, Dentition

**GENERAL TOPIC:**

1. Flight adaptation of birds
2. Aquatic Mammals and their adaptations

**TEXT BOOK**

1. Arumugam. N (2005). Invertebrate and chordate Zoology. Saras Publication, Nagarcoil, Kanyakumari.

**REFERENCE BOOKS**

1. Barnes. R.D :(1968) Invertebrate Zoology – W.B. Saunders company
2. Jordan E.L and Verma P.S (1983) Invertebrate Zoology, .Chand& Co.
3. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
4. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition
5. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
6. Jordan E.H. and Verma P.S. (1987) Chordate zoology. Chand and company. New Delhi.
7. Kotpal. R.L.(1992) Modern Text Book of Zoology, Rastogi Publications, Shivaji Road, Meerut - 250 002.

**Course Outcomes (CO):****On completion of the course, students should be able to**

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	To understand the structure and inter-relationship between the species of Invertebrates	<b>K1</b>
<b>CO2</b>	To deploy the entire phylum and various parasitic diseases	<b>K2</b>
<b>CO3</b>	To study the phylum and its economic Importance	<b>K1</b>
<b>CO4</b>	To understand the structure and inter-relationship between chordates	<b>K2</b>
<b>CO5</b>	To study the phylum and characteristics of different animals	<b>K1</b>

**Mapping of COs with POs:**

<div>PO</div> <div>CO</div>	PO				
	PO1	PO2	PO3	PO4	PO5
<b>CO1</b>	S	L	L	M	M
<b>CO2</b>	M	S	M	M	L
<b>CO3</b>	M	L	H	S	M
<b>CO4</b>	M	M	M	M	M
<b>CO5</b>	M	M	M	M	S

**S - Strong M - Medium L - Low**

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

**Title : ALLIED**

**ZOOLOGY- II**

**Course Code : 22UBOAC4**

**Hours/Week:3**

**Semester : IV**

**Course Credit:3**

**Course objectives:**

- Understand the various cell types and cell divisions and to aware about the genetic orders.
- To aware of the developmental process and reproductive techniques.
- To study the evolutionary process.
- Understand the Digestion and Excretion process, by studying the Organs of it.
- Describe the immunity and related health problems.

**UNIT-I**

**(9 Hours)**

**Cell Biology:** Structure – Animal Cell, Cell division - Mitosis and Meiosis.

**Genetics:** Sex linked inheritance. Genetic Disorders – Turner's, Klinefelter's and Down syndrome. ABO Blood group, Rhfactor

**UNIT-II**

**(9 Hours)**

**Developmental Biology:** Fertilization - Cleavage and Gastrulation of Frog- Placentation in mammals.

**UNITIII**

**(9 Hours)**

**Evolution:** Lamarckism, Darwinism, cultural evolution of Man. Homologou, analogous and vestigialorgans.

**UNITIV**

**(9Hours)**

**Physiology:** Digestive organs and its associated glands in man – Digestion of carbohydrate, protein, fat – Absorption.

Respiration - Types of Respiratory organs – Respiratory pigment Hb – Transport of respiratory gases.



## **UNITV**

**(9 Hours)**

**Immunology:** Types of immunity – innate and acquired. Types and properties of immune globulins, Immunization schedule for children and pregnant mother.

### **TEXT BOOKS**

1. Arumugam.N,(2005). Cytology, Genetics and Evolution. Saras Publication, Nagarcoil, Kanyakumari.
2. Arumugam.N,(2005). Embryology, Ecology and Physiology. Saras Publication, Nagarcoil, Kanyakumari.
3. Verma P.S. &. Agarwal V.K (2006) Cell Biology , Genetics, Molecular Biology, Evolution and Ecology–S.Chand& Company LTD. Ram Nagar, New Delhi -110055

### **REFERENCES**

1. Arumugam.N, Organic Evolution (2007), Saras Publication, Nagarcoil, Kanyakumari.
2. Arumugam.N – Text book of Embryology, Saras publications.
3. Balinsky, B.T. (1981) An Introduction to Embryology. 5th Edition. W.B. Saunders Company, London.
4. Mariakuttikan, A. and Arumugam.N (2002) Animal Physiology, Saras Publications, Nagercoil, Kanyakumari.
5. Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and Bartlett Publishers

### Course Outcomes (CO):

On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
<b>CO1</b>	Understand the functioning of nucleus and extra nuclear organelles and intricate cellular mechanisms involved	<b>K2</b>
<b>CO2</b>	Develop an understanding the genetics of how cells working healthy and diseased states	<b>K2</b>
<b>CO3</b>	Develop understanding how a single celled fertilized egg becomes an embryo through gradual transformation	<b>K3</b>
<b>CO4</b>	Understand on the process and theories in evolutionary biology. Understand the process of digestion, respiration and transport of gases	<b>K2</b>
<b>CO5</b>	Outline the Major cellular and tissue components which comprise the innate and adaptive immune system	<b>K2</b>

**K-1 Recall, K-2 Understand, K-3 Apply, K-4 Analyse**

### Mapping of COs with POs:

PO CO	PO				
	PO1	PO2	PO3	PO4	PO5
<b>CO1</b>	S	S	M	L	M
<b>CO2</b>	S	L	S	S	M
<b>CO3</b>	S	S	L	L	L
<b>CO4</b>	S	L	M	S	M
<b>CO5</b>	S	S	M	S	M

**S-Strong M-Medium L-Low**

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

**Course Title : ALLIED ZOOLOGY-PRACTICAL**

**Course Code : 22UBOAQC2**

**Hours/Week:2**

**Semester : IV**

**Course Credit:2**

**Course objectives:**

- To remember the anatomical and morphological structure of animals and microorganism
- To understand the ecological and biological importance of vertebrates and invertebrates
- To validate the practical efficiency in the animal kingdom, structure and function

### **I. Dissections**

- a) **Cockroach:** Digestive system and Nervous system
- b) **Fish:** Digestive system (Demonstration of anatomy)

**II. Mountings:** Mouth parts of Cockroach, Honey bee

### **III. Experiments**

1. Human blood grouping
2. Estimation of Haemoglobin in human blood
3. Preparation and examination of Haemin crystals
4. Qualitative analysis of Carbohydrate and Protein

### **IV. Spotters**

1. Paramecium- Entire
2. Paramecium Conjugation
3. Simple sponge
4. Obelia colony
5. Obelia Medusa
6. Taeniasolium- Scolex
7. Amphioxus
8. Starfish – Bipinnaria larva

9. Shark- Entire
10. Shark – Placoid scales
11. Pigeon-Quill feather
12. Archaeopteryx
13. Rabbit- Entire
14. Cleavage stages of frog (2 celled, 4 celled, and 8 celled stage)
15. Blastula of frog
16. Gastrula of frog with yolk plug
17. Human placenta
18. Homologous organs
19. Analogous organs
20. Vestigial organs

Certified and Bonafide practical record should be submitted at the time of practical examination.

**Course Outcomes(CO):**  
**On completion of the course, students should be able to**

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	To remember the anatomical and morphological structure of animals and microorganisms	<b>K1</b>
<b>CO2</b>	To understand the ecological and biological importance of vertebrates and Invertebrates	<b>K2</b>
<b>CO3</b>	To validate the practical efficiency in the animal kingdom structure and function	<b>K3</b>
<b>CO4</b>	To interpret the significance of specific structure and function	<b>K3</b>
<b>CO5</b>	Analyse inheritance of Mendelian traits by direct observation for the students	<b>K4</b>

**Recall, K-2 Understand, K-3 Apply, K-4 Analyse**

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

**Course Title : DEVELOPMENTAL BIOLOGY**

**Course Code : 22UZOC5**

**Hours/Week:5**

**Semester : V**

**Course Credit:5**

**Course Objective:**

- To make an awareness to the students about the theories, concepts and basics of Developmental Biology.
- To provide students about the idea of sex cells, fertilization, cleavage, differentiation and development of organs.
- To make an awareness of the induction, organizers and development of extra embryonic structures.
- To provide adequate explanation to students about the late embryonic developments and post embryonic development and ageing.
- To give an idea about teratogenesis, *invitro* fertilization, stem cells and amniocentesis to the students.

**Unit I Gametes & Fertilization**

Basic concepts of developmental biology. Structure & types of Spermatozoa, Mammalian egg - Egg membranes. Patterns of egg - Spermatogenesis – Oogenesis. Fertilization – mechanism, theories and significance – Parthenogenesis.

**Unit II Blastulation & Gastrulation**

Cleavage - Planes & Patterns, Factors controlling cleavage - Fate map & its construction. Blastulation – Morphogenetic movements - Gastrulation of frog & chick.

**Unit III Organogenesis**

Development of Brain, Eye and Heart in frog. Development of Nervous system in chick & Foetal membranes in chick. Placentation in Mammals. Development of Pro, Meso & Metanephric kidneys.

#### **Unit IV Applied Embryology**

Organizer concept –Structure – mechanism of induction and competence. Nuclear transplantation - teratogenesis – Regeneration: types - events and factors. Embryonic stem cells & significance. Methods to culture embryo.

#### **Unit V Embryological Techniques**

Estrous, Menstrual cycle and menopause - Pregnancy – trimesters – development. *Erythroblastosis foetalis* -Twins – types. Infertility – causes - Test tube baby and Assisted Reproductive Technology – Embryo transfer – Amniocentesis.

#### **Books for reference**

1. Arumugam NA Text Book of Embryology, Biotechnology Saras Publication Nagercoil.
2. Balnisky BI An Introduction to Embryology, W.B. Saunders and Co.
3. Berril NJ, Kars G(1986). Developmental biology, McGrawHills
4. Gilbert SF (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
5. Majumdar NN Vetebrate embryology; Tata McGraw-Hill, New Delhi.
6. Verma PS & Agarwal VK Chordate Embryology, S. Chand Publishers, New Delhi.

### Course Outcomes (CO)

**On completion of the course, students should be able to**

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	The learner will be able to understand methodological approaches to the study of embryonic development and the characteristics of the principal experimental models.	<b>K1</b>
<b>CO2</b>	The students will be able to develop an idea, how to identify and arrange embryonic sequences in developmental processes in order.	<b>K2</b>
<b>CO3</b>	The learner will be able to understand the derivatives of embryonic structures.	<b>K2</b>
<b>CO4</b>	The students will be attain a basic conceptual knowledge of the principal cellular mechanisms of development and identify the genetic and molecular elements that are involved.	<b>K3</b>
<b>CO5</b>	The students will be able to apply the principles of the development in applied sciences like Biotechnology, Genetic engineering and Molecular Biology.	<b>K4</b>

**K1- Recall, K2 - Understand , K3- Apply, K4- Analyse**

### Mapping of COs with POs:

<div style="display: inline-block; transform: rotate(-45deg);">PO CO</div>	PO				
	PO1	PO2	PO3	PO4	PO5
<b>CO1</b>	S	S	S	S	S
<b>CO2</b>	S	S	S	S	S
<b>CO3</b>	S	S	S	S	M
<b>CO4</b>	S	S	S	S	M
<b>CO5</b>	S	S	S	S	M

**S- Strong,**

**M-Medium,**

**L-Low**

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

**Course Title : ECOLOGY**

**Course Code : 22UZOC6**

**Hours/Week: 4**

**Semester : V**

**Course Credit:4**

**Course Objectives:**

- To develop awareness about the environment and the interaction of various components.
- To understand about various ecosystems.
- To make an awareness about various effects of pollution and its management.
- To create an awareness about the biodiversity and need for its conservation.

**Unit I Ecological concepts**

Concept of Ecosystem structure & function. Abiotic factors and its ecological role –Soil, Light, Temperature, Water. Limiting factors. Concept of Species, Population dynamics and Growth curves - Population Ecology – Community Ecology.

**Unit II Nutrient cycles & Interactions**

Biogeochemical cycles: Carbon, Sulphur, Nitrogen and Phosphorous. Food chain & web, Pyramids & Trophic levels -Energy flow. Animal relationships: - Mutualism, commensalism, parasitism, competition, predation.

**Unit III Habitat Ecology**

Ecosystem: characteristic features, types and faunal adaptations in Freshwater (Lotic & lentic), Marine, estuarine, mangrove, tundra, Savanna, cave, forest and desert ecosystems. Ecotone & edge effect. Significance & Conservation of wetlands. Ecological succession, Ecological effects of dams, hydroelectric projects & Aquaculture.



#### **Unit IV Pollution:**

Types, causes, effects (with examples) & management of Land, Water, Air, Thermal & Pesticide pollution. Nuclear Hazards – Management of Solid waste, Plastic waste, Medical waste and e-waste.

#### **Unit V Conservation**

Biodiversity – definition, loss & cause. IUCN, CITES & Brief out lines of Indian laws of conservation. Biodiversity hot spots in India. Indian Endangered species & conservation, Community reserves, Sanctuaries, National parks and Tiger reserves in Tamilnadu. Afforestation & Deforestation. Human animal conflicts.

#### **Books for references**

1. Arumugam N *Concepts of Ecology*, Saras Publication, Nagercoil.
2. Gupta PK, Cytology, Genetics & Evolution, Rastogi Publications, Meerut.
3. Verma PS, & Agarwal VK, *Environmental Biology: Principles of Ecology*, S Chand Publishers, NewDelhi.
4. Sharma PD, *Elements of Ecology*, Rastogi Publications, Meerut.
5. Chapman JL & Reiss MJ, *Ecology: Principles and Applications*, Cambridge University Press, New Delhi.
6. Odum EP, *Fundamentals of Ecology*, W.B Saunders College Publishing, Philadelphia.
7. Arumugam N *Organic Evolution*, Saras Publication, Nagercoil.
8. Caughley G, Sinclair AR. Wildlife ecology and management. Blackwell Science.
9. Divan S, Rosencranz A. Environmental law and policy in India: Cases, materials and statutes. New Delhi: Oxford University Press.

**Course outcome:**

**On completion of the course, students should be able to**

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	The students will be able to present an overview of diversity of life forms in an ecosystem, will be able to differ between Qualitative & Quantitative study.	<b>K1</b>
<b>CO2</b>	The learner can correlate choice of habitat for organisms to Abiotic Factors, aspects of energy transfer and will be able to explain the necessity for and adaptations, providing examples.	<b>K2</b>
<b>CO3</b>	The learner can understand the reasons and capable of managing pollution and after effects.	<b>K3</b>
<b>CO4</b>	The learner will be able to understand the value & need of Biodiversity conservation	<b>K1</b>

**K1- Recall, K2- Understand, K3- Apply, K4- Analyse**

**Mapping of COs with POs:**

<b>CO \ PO</b>	<b>PO</b>				
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	S	S	S	S	S
<b>CO2</b>	S	S	S	S	M
<b>CO3</b>	S	S	S	S	M
<b>CO4</b>	S	S	S	S	S

**S-Strong, M- Medium, L-Low**

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

**Course Title : EVOLUTION**

**Course Code : 22UZOC7**

**Hours/Week: 4**

**Semester : V**

**Course Credit:4**

### **Course Objectives**

1. To develop an idea of the adaptations and its significance in relation to evolution.
2. To make the students aware of how organic evolution occurred and how the various life forms come into existence.
3. To make the students aware of the historical periods during the evolution of earth and status of fauna during the particular age.
4. To develop an idea of the distribution of the various faunal components.
5. To develop an idea regarding the evolution of various vertebrate forms

### **Unit I Evidences of Evolution**

Origin of life: Abiogenesis, Biogenesis, Cosmic theory, Biochemical origin of life, Urey-Miller experiment. Evidences of evolution: Morphological & Anatomical, Embryological, Physiological & Biochemical and paleontological.

### **Unit II Theories of Organic Evolution**

Lamarckism, Neo Lamarckism, Darwinism, Neo Darwinism, Mutation theory & New version of mutation theory. Modern Synthetic theory of evolution. Natural selection. Convergent & Divergent evolution.

### **Unit III: Adaptation & Isolation**

Adaptation –Colouration and Mimicry (types and significance) – Non adaptive traits – Neotony & Significance. Isolation - Mechanism & Speciation. Hardy Weinberg Equilibrium - Genetic drift. Basic outlines of Molecular evolution.

## **Unit V Animal Distribution**

Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions - their Climatic and faunal peculiarities. Wallace line, Discontinuous distribution - Continental Drift. Geological time scale (Up to periods for Paleozoic & Mesozoic era; up to epoch for Cenozoic era) .

## **Unit IV Evolution of Higher forms**

Evolutionary significance of Dipnoi – Origin of Amphibia – Golden age of Reptiles - Major types of Dinosaurs and reason for extinction, Affinities of Archaeopteryx, Outlines of evolution of Man and Horse.

## **Books for references**

1. Verma PS, & Agarwal VK *Cell Biology, Genetics, Evolution and Ecology*, S Chand Publishers, NewDelhi.
2. Gupta PK, Cytology, Genetics & Evolution, Rastogi Publications, Meerut.
3. Arumugam N *Organic Evolution*, Saras Publication, Nagercoil.
4. Barton NH, Briggs DEG, Eisen JA, Goldstein DB and Patel NH, *Evolution*. Cold Spring, Harbour Laboratory Press.
5. Hall BK & Hallgrimsson B, *Evolution*, Jones and Bartlett Publishers.

**Course outcome:**

**On completion of the course, students should be able to**

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	Students will be able to describe the history and development of evolutionary thought, list and describe the evidence for evolution and its required corollaries & mechanisms by which evolution occurs.	<b>K1</b>
<b>CO2</b>	Students will be able to describe the history of life on earth.	<b>K2</b>
<b>CO3</b>	Students will be able to explain how speciation occur and reasons for extinction.	<b>K3</b>
<b>CO4</b>	Students can make knowledge of how major vertebrate forms evolved in the earth.	<b>K1</b>

**K1- Recall, K2- Understand, K3- Apply, K4- Analyse**

**Mapping of COs with POs:**

<div>PO</div> <div>CO</div>	PO				
	PO1	PO2	PO3	PO4	PO5
<b>CO1</b>	S	S	M	M	L
<b>CO2</b>	S	S	M	M	L
<b>CO3</b>	S	S	M	M	L
<b>CO4</b>	S	S	M	M	L

**S-Strong, M- Medium, L-Low**

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

**Course Title : MICROBIOLOGY AND IMMUNOLOGY**

**Course Code : 22UZOC8**

**Hours/Week: 4**

**Semester : V**

**Course Credit:4**

### **Objectives**

- The course is intended to make an awareness of the students about the classification, diversity, organization, application and pathogenicity of the microorganisms existing the ecosystem.
- The course will help the students to learn about the various microbial culture techniques and its handling.
- The course will give an idea that how microbes are used in various industries for generation of various products related to day to day life.
- The course will give an insight to the cellular components involved in the immunity.
- The course will give an awareness of the mechanism, types and concepts regarding immune response.

### **Unit I Introductory Microbiology**

Characters and basic classification of Kingdom Monera and Fungi. Scope of Microbiology. Systematic position of Virus – classification - Structure of bacteriophage. Viroids and Prions. Ultra structure of *E. coli*. General structure of fungi.

### **Unit II Bacterial culture**

Sterilisation- Types of Culture medium – Culture of Bacteria –Bacterial growth and growth curve – factors influencing bacterial growth. Maintenance & Characteristics of colonies. Staining of bacteria, Bio-fermenters and its role in mass culture.

### **Unit III Applied Microbiology**

Control of Microbes. Preservation of Milk –Microbes in Food Spoilage. Culture of Yeast & economic importance. Microbial Nitrogen fixation - Stages – types and methods of fermentation& products. Basic concepts of Probiotics. Bacterial (Cholera, Typhoid), Viral (Rabies, HIV) & Fungal (Candidiasis, Dandruff) diseases in man.

### **Unit IV Immunity**

Lymphoid organs & Cells of immune system - Types of Immunity – immune response – immunoglobulin – Structure of IgG. Epitopes, Paratopes, Haptens& Adjuvants. Antigen- antibody reactions - T-Cell and B-Cell activation - Monoclonal antibodies.

### **Unit IV**

Basic concepts of major histocompatibility complex. - Basic properties and functions of Cytokines, Interferons and complement proteins. Types of hyper sensitivity. Concepts of autoimmunity and immunodeficiency – Vaccines & Immunisation.

### **TEXT BOOKS**

1. Riotts Essential Immunology, 2006. Wiley. Blackwell publications.
2. C.Powar, 2010. General microbiology by Himalaya Publishing house.

### **REFERENCE BOOKS**

1. [Dubey](#) RC & [Maheshwari](#) DK, 2015 A Textbook of Microbiology, S. Chand Publishers, New Delhi.
2. Mani A, Selvaraj A.M , Narayanan L.M , Arumugam A, 2017. Microbiology, Saras Publication, Nagercoil.
3. Ronald M. Atlas(2010) Microbiological Media, CRC Press , 4 th Edition

4. Sastry S Apurba (2020)Essentials of Medical Microbiology, Jaypee Brothers Medical
5. Pelczar MJ, Chan EC, Pelczar MF.2002 Elements of microbiology. McGraw-Hill International Book Company.
6. Ryan KJ, Ray CG, 2004 editors. Sherris medical microbiology. McGraw-Hill Education.
7. Willey JM, Sherwood L, Woolverton CJ. 2013 Prescott's microbiology. Singapore: McGraw- Hill.
8. Abul Abbas Andrew H. Lichtman. 2021 Basic Immunology, Saunders.
9. Ramesh SR, 2017 Immunology, Mcgraw HigherEd.
10. Abul Abbas and Andrew H Lichtman and Shiv Pillai (2019) Basic Immunology, Elsivier Publications.



**Course Outcomes (CO):****On completion of the course, students should be able to**

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	The students will be able to explain the taxonomy, diversity and general structure of micro-organisms.	<b>K1</b>
<b>CO2</b>	They will develop knowledge about the culture, sterilization, handling, identification and assessing growth characters of microorganisms.	<b>K2</b>
<b>CO3</b>	The students will develop knowledge about the general microbial techniques for isolation of pure cultures of bacteria, fungi and algae and will master the aseptic techniques to perform routine culture handling tasks safely and effectively.	<b>K3</b>
<b>CO4</b>	The students will get idea about immunity.	<b>K4</b>
<b>CO5</b>	The students will develop an awareness about the various immunological reactions and diseases.	<b>K3</b>

**Recall, K-2 Understand, K-3 Apply, K-4 Analyse****Mapping of COs with POs:**

<div>PO</div> <div>CO</div>	PO				
	PO1	PO2	PO3	PO4	PO5
<b>CO1</b>	S	M	M	M	L
<b>CO2</b>	S	M	M	M	L
<b>CO3</b>	S	M	M	M	L
<b>CO4</b>	S	M	M	M	L
<b>CO5</b>	S	M	M	M	L

**S - Strong      M - Medium      L - Low**

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

**Course Title : MAJOR ELECTIVE II - SERICULTURE**

**Course Code : 22UZOEC2**

**Hours/Week: 4**

**Semester : V**

**Course Credit:4**

### **COURSE OBJECTIVES:**

- To know the history and socio-economical aspects of Sericulture.
- To understand the classification and morphology of silkworm
- To obtain the knowledge about the description of Mulberry cultivation and pest management.
- To attain the knowledge about the disease management in sericulture.
- To understand the methodology followed for the reeling and rearing of sericulture

### **UNIT I: Sericulture History & economics**

Origin and History of sericulture-environmental impacts of sericulture-Advantages and characteristics of sericulture-current status of sericulture in India-income and employment generation –National Sericulture Project (NSP)-overview-Future scope of sericulture.

### **UNIT II: Biology of Mulberry and Planting**

Biology of Mulberry- Selection of land and cultivation of mulberry – Mulberry varieties- Different methods of planting –Organic and in organic manure application-Mulberry pest Management- (Mealy bug - *Maconellicoccushirsutus*), (hairy caterpillar- *Spilosomaobliqua*)-(Stem griddler-*Stheniasgrisator*) : their preventive and control Measures.

### **UNIT III: Silk worm Taxonomy and Classification**

Silkworm taxonomy, Classification of silk worms based on number of larval Moults, Moultnism and Voltinism – Tasar, Muga, and Eri. Morphology and life cycle of silk worm (*Bombyx mori*) and organization of larvae, Pupae and Moth- Structure of the silk gland and importance.

#### **UNIT IV: Farming and Disease Management:**

Silkworm rearing house models-Disinfection of rearing houses and appliances- Egg transportation and incubation –Egg handling – Hatching –Brushing. Silk worm Pests- Uzi fly, Ants. Diseases- Bacterial (Flacherie)- fungal (Muscardine) and viral (Grasserie) diseases of silk worm and its preventive measures.

#### **UNIT V: Reeling and Rearing Technologies:**

Reeling methods – Reeling and Re-reeling –Silk examination, cleaning, lacing, bookmaking and grading of silk. Rearing of silkworm-Chawki rearing or young age worm rearing- Harvesting of cocoon (stifling, storage and sorting) and quality assessment.

#### **REFERENCES:**

1. G.Ganga and Sulochanachetty (2018-19,Reprint )An Introduction to sericulture (II<sup>nd</sup> edition),Oxford & IBH Publishing Co.Pvt.Ltd, New Delhi, India.
2. Charsley, s.r. (1982). Culture And Sericulture. Academic Press Inc., New York, U.S.A
3. Rangaswamy .g. (1987) .Manual On Sericulture Fao, Vol –Iv, Agriculture Service Bulletin ,Csb , Bangalore , India.
4. Dandan.s.b.(2004), Hand Book Of New Sericulture Technologies, Central Silk Board Bangalore, Pp 287.
5. <http://www.csrtimys.res.in/sites/default/files/ebooks/2019-1.pdf>
6. Mahadeveppa, D., Halliyal, V.G., Shankar, A.G. and Bhandiwad, R. (2000), Mulberry Silk Reeling Technology, Oxford and IBH Publishing Co. PVT. Ltd. New Delhi.

### Course Outcomes (CO):

On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	Describe the economic impacts and income generation by sericulture.	K1
CO2	Educate the students about the basic biology of Mulberry culture.	K2
CO3	Expertise in the taxonomy, morphology and life cycle of the silkworm.	K3
CO4	Relate the strategies involved in the sericulture management system.	K3
CO5	Acquired the knowledge about the technologies in sericulture.	K4

Recall, K-2 Understand, K-3 Apply, K-4 Analyse

### Mapping of COs with POs:

CO \ PO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	M	M	M	S
CO3	S	M	M	S	S
CO4	S	M	M	M	S
CO5	S	S	S	S	S

S - Strong M - Medium L - Low

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

**Course Title : MAJOR ELECTIVE II – HUMAN NUTRITION**

**Course Code : 22UZOESC2**

**Hours/Week: 5**

**Semester : V**

**Course Credit:5**

**Course Objective:**

- To create general health and dietary awareness

### **UNIT – I**

Introduction and scope. Carbohydrates, proteins and lipids – Classification – Sources – Digestion and absorption – Daily requirements – Essential amino acids – Essential fatty acids. Probiotics and prebiotics.

### **UNIT – II**

Vitamins and Minerals – Sources and functions – Deficiency status. Water as a nutrient – Regulation of water balance.

### **UNIT – III**

Calorific values of food – Based metabolic rate – Energy requirements of man, woman, infants and children.

### **UNIT – IV**

Nutritional value of foods : Cereals, fruits, milk, egg, meat, fish. Balanced diet. Nutritional requirements : Infants, school children, pregnant and lactating mothers and the aged – Health education – Malnutrition.

### **UNIT – V**

Nutritional anemia – Obesity and under weight – Diabetes mellitus – Food allergy – A brief summary of therapeutic diets.

### **REFERENCE BOOKS :**

1. Gopalan, C., B.S.Ramasastri and S.C.Balasubramanian. (1971) Nutritive value of Indian foods, National Institute of Nutrition, Hyderabad.
2. Gopalan, D and K.Vijayaragavan, (1971) Nutrition atlas of India. ICMR., New Delhi.
3. Ghosh, S. (1981) The feeding care of infants and young children. UNICEF, New Delhi.
4. Srilakshmi, B., (2002) Dietetics, New Age International (P) Ltd. New Delhi.
5. Swaminathan, M. (1989) Handbook of food and nutrition Bappco., Bangalore.
6. Swaminathan, M., (1974) Essentials of food and nutrition. Vol. I and II. Ganesh and company, Madras.

**Course Outcomes (CO):**

On completion of the course, students should be able to

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	To recollect the concept of nutritive foods.	<b>K2</b>
<b>CO2</b>	To understand the concepts of vitamins and minerals	<b>K2</b>
<b>CO3</b>	To understand the energy values of various foods	<b>K3</b>
<b>CO4</b>	To study the nutritive value of foods	<b>K2</b>
<b>CO5</b>	To analyze the food deficiency diseases	<b>K2</b>

**K-1 Recall, K-2 Understand, K-3 Apply, K-4 Analyse**

**Mapping of COs with POs:**

<div>PO</div> <div>CO</div>	PO				
	PO1	PO2	PO3	PO4	PO5
<b>CO1</b>	S	M	L	M	S
<b>CO2</b>	S	L	S	L	M
<b>CO3</b>	S	L	M	S	M
<b>CO4</b>	S	M	L	L	M
<b>CO5</b>	S	M	S	M	S

**S – Strong    M – Medium   L - Low**

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

**Course Title : NON MAJOR SKILL BASED-I  
PUBLIC HEALTH AND HYGIENE**

**Course Code : 22UZONSC1**

**Hours/Week: 2**

**Semester : V**

**Course Credit:2**

**Course Objectives:**

- Describe the components of personal hygiene
- Explains the elements and activities that are needed for planning personal hygiene
- Promotes basic standard of living for healthy life
- Enrich the students on healthy psychological development
- Provides life oriented knowledge for a balanced family

#### **UNIT – I: Concepts of health**

Scope-Concepts of health and well being– Physical – Mental – Social - Positive health – Quality of Life Index. Nutrition and Health -Balanced diet – vitamin deficiencies-Food Hygiene – Food intoxicants.

#### **UNIT – II: Environment and Health**

Water quality standards – Basic health needs – Water borne Diseases – Cholera, Dysentery - Ascariasis ; Standards of Housing – Ventilation – Human requirements – Standards.

#### **UNIT – III: Mental Health**

Types – Crucial points in the life of human beings and its causes – prevention of mental illness. Smoking, alcoholism, drug abuse and dead diction- occupational health hazards.

#### **UNIT – IV: Health Education**

Health planning in India–Practice of Health Education-WHO-non-governmental voluntary health organization- Sex Education, Methods of family planning.

#### **UNIT – IV: Health Programmes in India**

Health Problems – Primary Healthcare in India – PHC National Programmes –National AIDS Control–National Malariaeradication –National Tuberculosis eradication Programme.

## TEXT BOOK

1. Sorna Raj, R and Kumaresan, V. (2009). Public Health and Hygiene. Saras Publication, Kanyakumari.

## REFERENCES

1. Park, J.E. and Park, K. (1990). Text Book of Preventive and Social medicine. 13th edition, Banarsidas. Bhanot. Jabalpur.
2. Swaminathan, M. (1989). Handbook of Food and Nutrition. Bappco, Bangalore.
3. Swaminathan, M. (1974). Essentials of Food and Nutrition, Vol I and II, Ganesh and Company, Madras.
4. Verma. S 1998 , Medical Zoology , Rastogi publications, New Delhi.

### Course Outcomes (CO):

On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	To remember spectrum of health and health awareness.	K1
CO2	To understand the concepts of health and balanced diet	K2
CO3	To acquire knowledge on environment and health	K2
CO4	To analyse the mental health and self control	K1
CO5	To compare health education and health situation in India	K2

K-1 Recall, K-2 Understand

### Mapping of COs with POs:

CO \ PO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	S	L	L	M	M
CO2	S	L	S	L	L
CO3	S	L	M	S	L
CO4	S	L	L	L	L
CO5	S	M	L	M	L

S – Strong    M – Medium    L - Low



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

**Course Title : CORE PRACTICAL III (DEVELOPMENTAL BIOLOGY, ECOLOGY AND EVOLUTION, MICROBIOLOGY AND IMMUNOLOGY)**

**Course Code : 22UZOQC3**

**Hours/Week: 3**

**Semester : V & VI**

**Course Credit:3**

**Course Objective**

- To obtain practical knowledge in Developmental Biology, Ecology and Evolution, Microbiology, and Immunology

**ECOLOGY AND EVOLUTION**

1. Estimation of dissolved Oxygen in water samples by Winkler's method
2. Estimation of Salinity of water samples
3. Estimation of Alkalinity of water samples
4. Estimation of Free Carbondioxide
5. Plankton Analysis: Marine/Fresh water plankton.

**SPOTTERS**

1. Sacculina on Crab
2. Rainfall gauge
3. Maximum and minimum thermometer
4. Hygrometer – Dial type
5. Barometer – Dial Type
6. Homologous organs
7. Analogous organs
8. Vestigial organs
9. Fossils

**DEVELOPMENTAL BIOLOGY**

1. Sperm of mammal
2. Blastula of frog
3. Chick Embryo – 24 hrs
4. Chick Embryo – 48 hrs
5. Chick Embryo – 72 hrs
6. Chick Embryo – 96 hrs

7. Yolk sac placenta of shark
8. Placenta of sheep
9. Placenta of mammals

## **MICROBIOLOGY AND IMMUNOLOGY**

1. Hanging Drop Technique to observe the motility of Bacteria.
2. Gram Staining and identification of types of bacteria
3. Preparation and identification of Fungal smear (Bread mould)
4. Preparation and identification of Yeast.
5. Isolation of T lymphocyte
6. Isolation of B lymphocyte
7. Human Leucocyte Culture technique
8. Single Immuno diffusion technique
9. Double Immuno diffusion technique
10. Haeme agglutination using micro titre plate and estimation of antibody titre

## **SPOTTERS**

1. *Mycobacterium leprae*
2. *Clostridium tetani*
3. Inoculation needle
4. Colony Counter
5. Thymus
6. Lymphnode
7. Bone marrow
8. Spleen.

Certified and Bonafide Practical record should be submitted at the time of practical examination

### Course Outcomes (CO)

On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	Preparation, direct observation and appreciation of different stages of chick embryo development.	K3
CO2	Comprehend the physico- chemical nature of water through estimation of its chemical compounds.	K4
CO3	Comprehend the concept of “ontogeny” repeats “phylogeny” through observations.	K3
CO4	Basic understanding of the operative system and working knowledge of software commonly used.	K1
CO5	Apply the knowledge to collect various biological data.	K3

**K-1 Recall, K-2 Understand, K-3 Apply, K-4 Analyse**

### Mapping of COs with POs:

CO \ PO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	S	M	L	M	S
CO2	S	S	S	M	M
CO3	S	S	M	S	M
CO4	S	M	M	M	M
CO5	S	M	M	M	S

**S-Strong, M-Medium, L-Low**

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

**Course Title : CORE PRACTICAL IV (ANIMAL  
PHYSIOLOGY, BIOCHEMISTRY, AND  
BIOTECHNOLOGY)**

**Course Code : 22UZOQC4**

**Hours/Week: 3**

**Semester : V & VI**

**Course Credit:3**

**Course Objectives:**

- The student will be able to develop analytical skills to observe the working mechanism and application of instruments
- To analyse the presence of major organic compound in samples
- To estimate the presence of elements in water samples and evaluate quality of the samples
- To enhance hands on practical practices and observations

**ANIMAL PHYSIOLOGY**

1. Survey of digestive enzymes in cockroach
2. Action of salivary amylase in relation to temperature.
3. Detection of nitrogenous waste products – Ammonia, Urea and Uric acid.
4. Rate of Oxygen consumption in a fish with reference to body weight.

**BIOCHEMISTRY**

1. Qualitative analysis of carbohydrates proteins and fats
2. Estimation of pH (using pH paper and pH meter)

**BIOTECHNOLOGY**

1. Isolation of DNA from chicken liver
2. Separation of DNA from chicken liver and separation using Agarose Gel electrophoresis
3. Isolation of proteins from chicken muscle and separation based on molecular weight using SDS – PAGE

**SPOTTERS**

1. Sphygmomanometer
2. Stethoscope
3. Spectrophotometer
4. Autoclave
5. Colorimeter
6. Electrophoresis

7. Distillation Apparatus
8. Micropipette
10. Digital Balance
11. Horizontal Gel Electrophoresis
12. Vertical Slab Gel Electrophoresis
13. Immunoelectrophoresis
14. UV Transilluminator
15. Magnetic Stirrer with Hot plate
16. Micropipette

II. Visit to a Central research institute/ industry and study tour report.

III. Certified and Bonafide Practical record should be submitted at the time of practical examination.

**Course Outcomes (CO): On completion of the course, students should be able to**

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	Differentiate the processes and functions of the macromolecules namely the proteins and nucleic acids.	<b>K3</b>
<b>CO2</b>	Acquire analytical skills in comparing and contrasting the biochemical results with reference to its clinical relevance.	<b>K2</b>
<b>CO3</b>	Develop synthetic ability to design and derive new innovative experimental methodologies in immunology and microbiology	<b>K3</b>
<b>CO4</b>	Increase the knowledge on principle, procedures of handling and maintenance of biological instruments and their applications	<b>K3</b>
<b>CO5</b>	To handle biological materials, maintenance of samples, chemicals and lab equipments	<b>K2</b>

**K-1 Recall, K-2 Understand, K-3 Apply**

### Mapping of COs with POs:

<div> <div>PO</div> <div>CO</div> </div>	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	S	L	L	M	S
CO2	S	L	S	L	M
CO3	S	L	M	S	S
CO4	S	M	L	L	M
CO5	S	L	L	M	S

**S-Strong, M-Medium, L-Low**

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

**Course Title : ANIMAL PHYSIOLOGY**

**Course Code : 22UZOC9**

**Hours/Week: 6**

**Semester : VI**

**Course Credit: 5**

**Course objectives:**

1. To familiarise students with the principles and basic facts of Animal Physiology.
2. To give students an insight about the molecular and cellular basis of physiological functions in animals.
3. To give an idea about the regulation of organ system functions in a whole animal using a conceptual model of feedback to explain homeostasis.
4. To make an awareness to the students about how the structure-function relationships synchronise along with the molecular signals.

### **Unit I Nutrition & Respiration**

Nutrition: Digestion and absorption of carbohydrates proteins and lipids. Minerals& Vitamins – their deficiency. Hormonal control of digestion. Respiratory pigments- structure of haemoglobin, Transportation of gases - Bohr effect - Regulation of respiration - bronchitis, asthma - Physiological effects of smoking.

### **Unit II Circulation & Excretion**

Blood- composition and functions, Mechanism of clotting. Types of Hearts – Heartbeat & pace maker – Cardiac cycle – ECG - Pulse and blood pressure. Nephron structure & mechanism of urine formation, -. Excretory products, Osmo-regulation in fishes.

### **Unit III Muscle & Nerve Physiology**

Types of muscles - Ultra structure of striated muscle, Muscle contraction & properties. Neurons – structure & types - Impulse propagation, synaptic transmission, neuro transmitters - Reflex action, Nerve disorders – epilepsy, Alzheimer's disease, Parkinson's disease.

## Unit IV Sense Organs

Structure of eye, physiology of vision, visual elements and pigments, photo chemistry of vision - Eye defects – myopia, hyperopia, presbyopia, astigmatism, cataract - Structure of ear and mechanism of hearing - Hearing impairments – deafness, labyrinthine disease - Olfactory, gustatory and tactile sense organs.

## Unit V Reproductive Physiology

Endocrine glands in man - Hormones, action and disorders - Feed-back mechanism, Outlines of mechanism of hormonal activity. Puberty, adolescence, pregnancy, parturition, lactation and birth control.

### Books for reference

1. Arumugam N & Mariakuttikan A Animal Physiology Saras Publications, Nagercoil.
2. Bhagavan NV, Medical biochemistry, fourth edition Academic Press.
3. Guyton AC, Hall JE, Text Book of Medical Physiology, Elsevier
4. Jain AK Textbook of Physiology. Avichal Publishing Company.
5. Lehninger AL, Michael Cox, Nelson DL, Biochemistry. Macmillan.
6. Tyagi BS, Agarwal VK & Verma PS Animal Physiology S. Chand Publishers, New Delhi.

### Course Outcomes (CO):

**On completion of the course, students should be able to**

CO Number	CO Statement	Knowledge Level
CO1	The students will be able to explain how the various organ systems are coordinated and controlled.	K1
CO2	The students will be able to list the functions of various organs in relation to physiological process.	K2
CO3	The students will develop the idea of multilevel controlling and feedback mechanism in relation to various physiological functions.	K3
CO4	The students will be able to understand the basic physiological process related to adaptation, metabolism and major requirements.	K4

**K1- Recall, K2- Understand, K3- Apply, K4- Analyse**



### Mapping of COs with POs:

<div> <div>PO</div> <div>CO</div> </div>	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	L
CO2	S	S	M	S	M
CO3	S	L	M	S	M
CO4	S	M	L	S	M
CO5	S	M	L	M	S
<div> <div>S-Strong,</div> <div>M-Medium,</div> <div>L-Low</div> </div>					

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

**Course Title : BIOCHEMISTRY**

**Course Code : 22UZOC10**

**Hours/Week: 5**

**Semester : VI**

**Course Credit:5**

**Course Outcomes:**

- The aim of the course to develop basic knowledge on chemical nature of biological systems.
- To understand the structure and functions of carbohydrates, Aminoacids, Proteins and Lipids.
- To inculcate metabolism of macro components and their significance in life

### **UNIT I**

**Biomolecules:** Structure Of atom-chemical bonds: primary bonds: covalent bond- ionic bond-secondary bonds: hydrogen bond- Vander walls interactions- hydrophilic and hydrophobic molecules. Structure, water as a solvent, ionization reaction - pH: Hydrogen ion concentrations- buffer system – (Bicarbonates and Phosphates) – Acids – Bases and salts: Biological functions

### **UNIT -II**

**Amino acids:** General structure- classification based on structure and functions

**Proteins:** General structure- classification- biological functions and metabolism: Oxidative deamination – Transamination –Transdeamination

### **UNIT III**

**Carbohydrates:** General structure and classification of Monosaccharides, Disaccharides, Polysaccharides- biological functions and metabolism: Glycogenesis – Glycogenolysis – Gluconeogenesis – Glycolysis – Krebs cycle - Electron transport system and Oxidative phosphorylation.

### **UNIT IV**

**Lipids:** General structure- classification- biological functions and metabolism: Oxidation of fatty acids – Ketogenesis Urea and ornithine cycle- metabolism and biological significance.

## UNIT V

**Enzymes:** Definition – nomenclature – classification – characteristic features – mechanism of action: Induced fit and Lock and key Model - factors affecting enzyme activity – specificity – enzyme inhibition – co-enzyme – isoenzymes - anti enzymes. Enzyme Kinetics: Michaelis Menten equilibrium.

**Vitamins:** Water soluble and Fat soluble: sources, biological functions and deficiency diseases.

### TEXT BOOK:

1. J.L Jain, Nithin Jain and Sanjay Jain (2005) Fundamentals of Biochemistry 6th edition, Chand Publications

### REFERENCE BOOKS

1. Stryer, Biochemistry (2001) 5th edition, W.H. Freeman and company , USA
2. Harpers illustrated biochemistry, a Lange medical book 26th edition (2001). The McGraw Hill company USA
3. Nelson and Cox Principles of Biochemistry( IV edition ) (2001) Leninger Book publications
4. Vasantha Pattabhi & Goutham, Biophysics (2005) Narosa Publishing House Pvt Ltd New Delhi
5. P.K. Srivastava, Elementary Biophysics (2011) Narosa Publishing House Pvt Ltd New Delhi
6. Mohan P Arora, Biophysics (2007) Himalays Publishing House, Mumbai
7. Well J.H (1990) General Biochemistry, Willey Eastern Hall, Madras
8. David Nelson Michael Cox (2005) Leninger's Principles of Biochemistry 4th edition , W.H. Freeman & Co New York.
9. Lehninger Principles of Biochemistry 6<sup>TH</sup> Edition, by David L.Nelson and Michael M.Cox.

**Course Outcomes (CO):**

On completion of the course, students should be able to

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	Understand the importance and scope of biochemistry and describe the basic principles of chemistry that govern complex biological Systems	<b>K2</b>
<b>CO2</b>	Understand the structure and biological significance of carbohydrates, aminoacids, Proteins, lipids and nucleic acids and recall catabolism of protein, carbohydrates and Proteins	<b>K2</b>
<b>CO3</b>	Understand fundamental enzymatic principles and mechanism of action and regulation	<b>K2</b>
<b>CO4</b>	Understand the process of DNA replication, transcription and translation and describe the Anabolism of glucose, aminoacids and other biologically significant metabolisms	<b>K2</b>
<b>CO5</b>	Learn measurement of enzyme activity and its kinetics and identify the class, function and deficiency of vitamins	<b>K3</b>

Recall, K-2 Understand, K-3 Apply

**Mapping of COs with POs:**

<div>PO</div> <div>CO</div>	PO				
	PO1	PO2	PO3	PO4	PO5
<b>CO1</b>	S	S	M	M	L
<b>CO2</b>	S	S	M	M	L
<b>CO3</b>	S	S	M	M	L
<b>CO4</b>	S	S	M	M	L
<b>CO5</b>	S	S	M	M	L

S - Strong M-Medium, L-Low

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

**Course Title : BIOTECHNOLOGY**

**Course Code : 22UZOC11**

**Hours/Week: 5**

**Semester : VI**

**Course Credit:5**

**Objectives**

- The objective of this course is to give a firm foundation in the fundamentals of modern Molecular techniques.
- The course will give an insight to the mechanism of Gene Expression and Regulation.
- The course will give a nut shell idea of various protocols followed in Biotechnology in relation to animal science.

**Unit I Recombinant DNA technology**

Scope of Biotechnology, Restriction endonuclease – sequence recognition. DNA Ligase. Identification & isolation of gene - Cloning vectors and recombination –. Screening of recombinant DNA. Application of recombinant DNA technology. Commercial production of Insulin. Human Genome Project.

**Unit II Molecular Techniques**

Methods to isolate DNA – PCR types, Principle & applications. Electrophoresis – types and Principle. Blotting – types & applications. DNA finger printing and its applications – RAPD – FISH- RFLP. DNA probes & diagnosis – Super bugs (Oil pollution).

**Unit III Animal tissue culture**

Applications – Primary culture. Steps involved in mammalian cell culture- *He la* & *WI38* cell lines – Maintenance of cell lines – Techniques and Application of organ culture. Animal cloning –Dolly.

**Unit IV Applications**

Genetically modified Animals - Single cell Protein from microbes – Biofuels – Solid waste management – Liquid Waste Management – Biogas production - Biopesticides. Transgenic Animals (Fish, Mice, Sheep & Cow)& its significance – Mushroom Culture.

## **Unit V Enzyme Biotechnology**

Microbial production & application of enzymes – Ribozymes- Artificial enzymes - Immobilization of enzymes methods and its application. Biosensors - Cryobiology – Methods of cryo-preservation.

### **TEXT BOOK**

1. R.C. Dubey (2005) A text book of Biotechnology S. Chand and Company Ltd., Ram Nagar, New Delhi – 110055.

### **REFERENCES**

1. Brown TA. Gene cloning. London: Chapman & Hall;1995.
2. Desmond S.T. Nicholl (2004) – An Introduction to Genetic Engineering Second Edition. Published by Manas Saikia for Foundation Books Pvt.Ltd., Mayapuri., phase– II, New Delhi – 110 064.
3. Gupta P.K (2001) Elements of Biotechnology, Rastogi publication, Meerut.
4. Kumaresan V.2015. Biotechnology Saras PublicationNagercoil
5. Primrose SB, Twyman R. 1994 Principles of gene manipulation and genomics. John Wiley & Sons; 2013 May28.
6. Robertis D. 1987. Cell and molecular biology. Lea & Febiger, U.S
7. Verma PS & Agarwal VK 2005. Genetic Engineering, S. Chand Publishers, NewDelhi

### Course Outcomes (CO)

On completion of the course, students should be able to

CO Number	CO Statement	Knowledge Level
CO1	The course will give an idea about the various techniques used in modern biotechnology.	K1
CO2	The course will give an insight to the current applications of biotechnology and advances in the different areas like medical, microbial, environmental, bioremediation, agricultural, animal and forensics.	K2
CO3	The learner will be able to understand how microbes is used engineer various genes.	K3
CO4	The students will be able to explain the general principles of generating genetically modified organisms and modern artificial methods in biotechnology.	K1

### Mapping of COs with POs:

CO \ PO	PO				
	PO1	PO2	PO3	PO4	PO5
CO1	S	S	L	M	S
CO2	S	S	S	L	M
CO3	S	S	M	S	M
CO4	S	S	S	L	M
CO5	S	S	S	M	S

S - Strong    M - Medium    L - Low

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

**Course Title : NON MAJOR SKILL BASED-II:APPLIED ZOOLOGY**

**Course Code : 22UZONSC2**

**Hours/Week: 2**

**Semester : VI**

**Course Credit:2**

**Course Objectives:**

- Create an interest on the Entrepreneurial opportunities in the field of Zoology.
- Deal with rearing methods of silkworm, earthworm, honeybee
- To develop skills in rearing methods of fish and poultry
- To gain knowledge on the diseases, pests and their control
- To comprehend management and economics of domestic animal and its byproducts

#### **UNIT - I: Vermiculture and vermicomposting**

Ecological classification of earthworm-advantages of vermiculture- Methods of vermiculture-Vermicomposting and applications of vermiculture.

#### **UNIT - II: Apiculture**

Species of honey bee – Social organisation of honey bee – Life history – Selection of bees for apiculture – Bee keeping appliances (Newton's hive) with accessories – Products of bee keeping – Economic importance of honey and Bees wax.

#### **UNIT - III: Fresh water Fish Culture:**

Major carps: Fish seed – Types of hatching pits – Transport of fish fry to Nursery ponds – Rearing ponds – Stocking ponds – Harvesting – Diseases. Preservation of fish - By-products of fishing industries

#### **UNIT - III: Poultry**

Fowl house – Food and feeding of Fowls – Breeding in Fowls – Selection of eggs – Treatment of eggs – Rearing of chickens – Diseases – Poultry products (Egg and Poultry meat).



## **UNIT - V: Dairy Farming**

Breeds of Dairy animals – Food and feeding – Diseases – Processing of milk – Milk products.

### **TEXT BOOK**

1. Shukla, G.S. and Upadhyay (2009), Economic Zoology, Rashtogi Publications, Shivaji Road, Meerut – 250 002.

### **REFERENCES**

1. Bhatnagar R.K and R.K Palta (1996) Earthworm vermiculture and vermi composting Kalyan publications, Ludiana, North Delhi.
2. Fexemore – P.G. & Alka Prakash (1995). Applied Entomology, Wiley Eastern Ltd., New age International, New Delhi.
3. Metcalf C.L. Flint, W.P. and Metcalf R.L. (1973) Destructive and useful insects – Their habits and control, (fourth edition) Tata Mc. Graw Hill Publishing Company Ltd., New Delhi.
4. Nayar, K.K. Ananthakrishnan, T.N. and David, B.V. General and Applied Entomology, Tata Mc. Graw Hill.
5. Vasantharaj David, B. Muralinarayan, M C., and Meera Muralinarayan (1992), Applied Entomology, Popular book Depot, Madras – 15.
6. Vasantharaj David, B. & Kumaraswami. T. (1988) Elements of Economic Entomology) IV Edition Popular Book Report Madras.
7. Vishwapremi, K.K.C (1991) Economic Zoology Akashdeep Publishing House Pvt. Ltd., New Delhi.
8. Arumugam N, Murugan T, Ramprabhu R, Johnson Rajeshwar J (2015) saras publications

**Course Outcomes (CO):****On completion of the course, students should be able to**

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
<b>CO1</b>	Understand the culture techniques of Prawn, Pearl and Fish	<b>K2</b>
<b>CO2</b>	Understand silkworm rearing and equipments, Products and learn various concepts of lac cultivation	<b>K2</b>
<b>CO3</b>	Understand the bee keeping equipments and apiary management	<b>K2</b>
<b>CO4</b>	Understand dairy animal management, the breeds and diseases of goats and learn the testing of egg and milk quality	<b>K2</b>
<b>CO5</b>	Be aware of a broad array of career options and activities in human medicine, biomedical research and allied health professions	<b>K2</b>

**K-1 Recall, K-2 Understand****Mapping of COs with POs:**

<div>PO</div> <div>CO</div>	PO				
	PO1	PO2	PO3	PO4	PO5
<b>CO1</b>	S	M	L	M	M
<b>CO2</b>	M	L	S	L	L
<b>CO3</b>	S	L	M	S	L
<b>CO4</b>	M	M	L	L	L
<b>CO5</b>	S	M	L	M	M

**S - Strong      M - Medium      L - Low**

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

**Course Title : LIFE SKILLS-PAPER I COMMUNICATION SKILLS**

**Hours/Week: 2**

**Semester : III**

**Course Credit:2**

**Course Objectives:**

This course has been developed with the following objectives:

1. Identify common communication problems that may be holding learners back
2. Identify what their non-verbal messages are communicating to others
3. Understand role of communication in teaching-learning process
4. Learning to communicate through the digital media
5. Understand the importance of empathetic listening
6. Explore communication beyond language

**Module 1: Listening**

**4 Hours**

Techniques of effective listening-Listening and comprehension-Probing questions-Barriers to listening

**Module 2: Speaking**

**6 Hours**

Pronunciation-Enunciation-Vocabulary-Fluency-Common Errors

**Module 3: Reading**

**3 Hours**

Techniques of effective reading-Gathering ideas and information from a given text: Identify the main claim of the text-Identify the purpose of the text-Identify the context of the text-Identify the concepts mentioned-Evaluating these ideas and information-Identify the arguments employed in the text-Identify the theories employed or assumed in the text-Interpret the text: To understand what a text says-To understand what a text does-To understand what a text means.

**Module 4: Writing and different modes of writing**

**4 Hours**

Clearly state the claims-Avoid ambiguity, vagueness, unwanted generalisations and oversimplification of Issues-Provide background information-Effectively argue the claim-Provide evidence for the claims-Use examples to explain concepts- Follow convention-Be properly sequenced-Use proper signposting

techniques-Be well structured: Well-knit logical sequence-Narrative sequence- Category groupings.

Different modes of Writings: E-mails-Proposal writing for Higher Studies- Recording the proceedings of meetings-Any other mode of writing relevant for learners.

#### **Module 5: Digital Literacy**

**4 Hours**

Role of Digital literacy in professional life-Trends and opportunities in using digital technology in workplace-Internet Basics-Introduction to MS Office tools: Paint-Office-Excel-Powerpoint

#### **Module 6: Effective use of Social Media**

**4 Hours**

Introduction to social media websites-Advantages of social media-Ethics and etiquettes of social media-How to use Google search better-Effective ways of using Social Media-Introduction to Digital Marketing

#### **Module 7: Non-verbal communication**

**5 Hours**

Meaning of non-verbal communication-Introduction to modes of non-verbal communication-Breaking the misbeliefs

-Open and Closed Body language-Eye Contact and Facial Expression-Hand Gestures-Do's and Don'ts-Learning from experts-Activities-Based Learning

#### **REFERENCES:**

1. Sethi, J & et al. A Practice Course in English Pronunciation, Prentice Hall of India, New Delhi.
2. Sen, Leena. Communication Skills, Prentice Hall of India, New Delhi.
3. Prasad, P. Communication Skills, S.K. Kataria & Sons.
4. Bansal, R.K. and J.B. Harrison. Spoken English, Orient Language.
5. Roach Peter. English Phonetics and Phonology.
6. A.S. Hornby's. Oxford Advanced Learners Dictionary of Current English, 7th Edition.

#### **Course Outcome**

By the end of this program participants should have a clear understanding of what good communication skills are and what they can do to improve their abilities.

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

**Course Title : LIFE SKILL PAPER-II-PROFESSIONAL SKILLS**

**Hours/Week: 2**

**Semester : IV**

**Course Credit:2**

**Course Objectives:**

1. Acquire career skills and fully pursue to partake in a successful career path
2. Prepare good resume, prepare for interviews and group discussions
3. Explore desired career opportunities in the employment market in consideration of an individual SWOT.
4. Understand the significance of Team Skills and help them in acquiring them
5. To help them design, develop and adapt to situations as an individual and as a team.

**CAREER SKILLS**

**Module1: Resume Skills**

**(3 Hours)**

Resume Skills: Preparation and Presentation • Introduction of resume and its importance  
• Difference between a CV, Resume and Bio data • Essential components of a good resume  
ii. Resume skills: common errors • Common errors people generally make in preparing their resume • Prepare a good resume of her/his considering all essential components

**Module 2: Interview Skills**

**(5 Hours)**

- i. Interview Skills : Preparation and Presentation • Meaning and types of interview (F2F, telephonic, video, etc.) • Dress Code, Background Research, Do's and Don'ts • Situation, Task, Approach and Response (STAR Approach) for facing an interview • Interview procedure (opening, listening skills, closure, etc.) • Important questions generally asked in a job interview (open and closed ended questions)
- ii. Interview Skills : Simulation • Observation of exemplary interviews • Comment critically on simulated interviews

- iii. Interview Skills : Common Errors • Discuss the common errors generally candidates make in interview • Demonstrate an ideal interview

**Module 3: Group Discussion Skills (4 Hours)**

Meaning and methods of Group Discussion • Procedure of Group Discussion  
Group Discussion- Simulation • Group Discussion - Common Errors

**Module 4: Exploring Career Opportunities (3 Hours)**

Knowing yourself – personal characteristics • Knowledge about the world of work, requirements of jobs including self-employment. • Sources of career information • Preparing for a career based on their potentials and availability of opportunities

**TEAM SKILLS**

**Module 1: Presentation Skills (5 Hours)**

Types of presentations • Internal and external presentation • Knowing the purpose • Knowing the audience • Opening and closing a presentation • Using presentation tools • Handling questions • Presentation to heterogenic group • Ways to improve presentation skills over time

**Module 2: Trust and Collaboration (2 Hours)**

Explain the importance of trust in creating a collaborative team • Agree to Disagree and Disagree to Agree – Spirit of Team work • Understanding fear of being judged and strategies to overcome fear

**Module 3: Listening as a Team Skill (2 Hours)**

Advantages of Effective Listening • Listening as a team member and team leader. Use of active listening strategies to encourage sharing of ideas (full and undivided attention, no interruptions, no pre-think, use empathy, listen to tone and voice modulation, recapitulate points, etc.).

**Module 4: Brainstorming (2 Hours)**

Use of group and individual brainstorming techniques to promote idea generation. • Learning and showcasing the principles of documentation of team session outcomes.

**Module 5: Social and Cultural Etiquette****(2 Hours)**

Need for etiquette (impression, image, earn respect, appreciation, etc) Aspects of social and cultural/corporate etiquette in promoting teamwork. Importance of time, place, propriety and adaptability to diverse cultures

**Module 6: Internal Communication****(2 Hours)**

Use of various channels of transmitting information including digital and physical, to team members.

**REFERENCES:**

1. Foundation Skills In IT (FSIT) - <https://www.sscnasscom.com/ssc-projects/capacity-building-and-development/training/fsit/> and
2. Global Business Foundation Skills (GBFS) – Refer websites like <https://www.sscnasscom.com/ssc-projects/capacity-building-and-development/training/gbfs/>
3. Generic and the entrepreneurial NOS at NSQF Level 4 -7.

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

**Course Title : LIFE SKILL PAPER-III-LEADERSHIP  
AND MANAGEMENT SKILLS**

**Hours/Week: 2**

**Semester : V**

**Course Credit:2**

**Course Objectives :**

The Module is designed to:

1. Help students to develop essential skills to influence and motivate others
2. Inculcate emotional and social intelligence and integrative thinking for effective Leadership
3. Create and maintain an effective and motivated team to work for the society
4. Nurture a creative and entrepreneurial mindset
5. Make students understand the personal values and apply ethical principles in professional and social contexts.

**MODULE 1- LEADERSHIP SKILLS**

**(6 Hours )**

**a. Understanding Leadership and its Importance**

- What is leadership?
- Why Leadership required?
- Whom do you consider as an ideal leader?

**b. Traits and Models of Leadership**

- Are leaders born or made?
- Key characteristics of an effective leader
- Leadership styles
- Perspectives of different leaders

**c. Basic Leadership Skills**

- Motivation
- Team work
- Negotiation
- Networking



## **MODULE 2 - MANAGERIAL SKILLS**

**(6 Hours )**

### **a. Basic Managerial Skills**

- Planning for effective management
- How to organise teams?
- Recruiting and retaining talent
- Delegation of tasks
- Learn to coordinate
- Conflict management

### **b. Self Management Skills**

- Understanding self concept
- Developing self-awareness
- Self-examination
- Self-regulation

## **MODULE 3 - ENTREPRENEURIAL SKILLS**

**(6 Hours )**

### **a. Basics of Entrepreneurship**

- Meaning of entrepreneurship
- Classification and types of entrepreneurship
- Traits and competencies of entrepreneur

### **b. Creating Business Plan**

- Problem identification and idea generation
- Idea validation
- Pitch making

## **MODULE 4 - INNOVATIVE LEADERSHIP AND DESIGN THINKING**

### **a. Innovative Leadership**

**(6 Hours )**

- Concept of emotional and social intelligence
- Synthesis of human and artificial intelligence
- Why does culture matter for today's global leaders

## **b. Design Thinking**

- What is design thinking?
- Key elements of design thinking:
  - Discovery
  - Interpretation
  - Ideation
  - Experimentation
  - Evolution.
- How to transform challenges into opportunities?
- How to develop human-centric solutions for creating social good?

## **MODULE 5- ETHICS AND INTEGRITY**

**(6 Hours )**

### **a. Learning through Biographies**

- What makes an individual great?
- Understanding the persona of a leader for deriving holistic inspiration
- Drawing insights for leadership
- How leaders sail through difficult situations?

### **b. Ethics and Conduct**

- Importance of ethics
- Ethical decision making
- Personal and professional moral codes of conduct
- Creating a harmonious life

**Assessment :** It can be combination of written evaluation and presentations, including simulations, case studies and business plan.

### **Bibliography and Suggested Readings :**

#### **Books**

- Ashokan, M. S. (2015). Karmayogi: A Biography of E. Sreedharan. Penguin, UK.
- Brown, T. (2012). Change by Design. Harper Business

- Elkington, J., & Hartigan, P. (2008). *The Power of Unreasonable People: How Social Entrepreneurs Create Markets that Change the World*. Harvard Business Press.
- Goleman D. (1995). *Emotional Intelligence*. Bloomsbury Publishing India Private Limited • Kalam A. A. (2003). *Ignited Minds: Unleashing the Power within India*. Penguin Books India
- Kelly T., Kelly D. (2014). *Creative Confidence: Unleashing the Creative Potential Within Us All*. William Collins
- Kurien V., & Salve G. (2012). *I Too Had a Dream*. Roli Books Private Limited
- Livermore D. A. (2010). *Leading with cultural intelligence: The New Secret to Success*. New York: American Management Association
- McCormack M. H. (1986). *What They Don't Teach You at Harvard Business School: Notes From A Street-Smart Executive*. RHUS
- O'Toole J. (2019) *The Enlightened Capitalists: Cautionary Tales of Business Pioneers Who Tried to Do Well by Doing Good*. Harpercollins
- Sinek S. (2009). *Start with Why: How Great Leaders Inspire Everyone to Take Action*. Penguin
- Sternberg R. J., Sternberg R. J., & Baltes P. B. (Eds.). (2004). *International Handbook of Intelligence*. Cambridge University Press.

## **E-Resources**

- Fries, K. (2019). 8 Essential Qualities That Define Great Leadership. Forbes. Retrieved 2019-02-15 from <https://www.forbes.com/sites/kimberlyfries/2018/02/08/8-essential-qualities-that-define-great-leadership/#452ecc963b63>.
- How to Build Your Creative Confidence, Ted Talk by David Kelly - [https://www.ted.com/talks/david\\_kelley\\_how\\_to\\_build\\_your\\_creative\\_confidence](https://www.ted.com/talks/david_kelley_how_to_build_your_creative_confidence)

- India's Hidden Hot Beds of Invention Ted Talk by Anil Gupta - [https://www.ted.com/talks/anil\\_gupta\\_india\\_s\\_hidden\\_hotbeds\\_of\\_invention](https://www.ted.com/talks/anil_gupta_india_s_hidden_hotbeds_of_invention)
- Knowledge@Wharton Interviews Former Indian President APJ Abdul Kalam - . "A Leader Should Know How to Manage Failure" <https://www.youtube.com/watch?v=laGZaS4sdeU>
- Martin, R. (2007). How Successful Leaders Think. Harvard Business Review, 85(6): 60. • NPTEL Course on Leadership - <https://nptel.ac.in/courses/122105021/9>

**Programme Title : B.Sc. Zoology****Course Title : LIFE SKILLS PAPER IV - UNIVERSAL HUMAN VALUES****Course Code : Hours/Week: 2****Semester : VI Course Credit:2****Course Objectives:**

The present course deals with meaning, purpose, and relevance of universal human values and how to inculcate and practice them consciously to be a good human being and realize one's potentials.

**Module 1: Love & Compassion (5 Hours)**

Introduction: What is love? Forms of love—for self, parents, family, friend, spouse, community, nation, humanity and other beings, both for living and non-living.

Love and compassion and inter-relatedness - Love, compassion, empathy, sympathy, and non-violence - Individuals who are remembered in history for practicing compassion and love.

Narratives and anecdotes from history, literature including local folklore - Practicing love and compassion: What will learners learn/gain if they practice love and compassion? What will learners lose if they do not practice love and compassion? Sharing learner's individual and/or group experience(s) Simulated Situations Case studies.

**Module 2: Truth (5 Hours)**

Introduction: What is truth? Universal truth, truth as value, truth as fact (veracity, sincerity, honesty among others). Individuals who are remembered in history for practicing this value.

Narratives and anecdotes from history, literature including local folklore.

Practicing Truth: What will learners learn/gain if they practice truth? What will learners lose if they don't practice it?

Learners' individual and/or group experience(s). Simulated situations. Case studies.

**Module 3: Non-Violence (5 Hours)**

Introduction: What is non-violence? Its need. Love, compassion, empathy sympathy for others as pre-requisites for non-violence. Ahimsa as non-violence

and non-killing. Individuals and organisations that are known for their commitment to non-violence.

Narratives and anecdotes about non-violence from history, and literature including local folklore. Practicing non-violence: What will learners learn/gain if they practice non-violence? What will learners lose if they don't practice it?

Sharing learner's individual and/or group experience(s) about non-violence - Simulated situations - Case studies.

#### **Module 4: Righteousness**

**(5 Hours)**

Introduction: What is righteousness? - Righteousness and *dharma*, Righteousness and Propriety - Individuals who are remembered in history for practicing righteousness - Narratives and anecdotes from history, literature including local folklore - Practicing righteousness: What will learners learn/gain if they practice righteousness? What will learners lose if they don't practice it?

Sharing learners' individual and/or group experience(s) - Simulated situations - Case studies.

#### **Module 5: Peace**

**(4 Hours)**

Introduction: What is peace? Its need, relation with harmony and balance  
Individuals and organisations that are known for their commitment to peace  
Narratives and Anecdotes about peace from history, and literature including local folklore - Practicing peace: What will learners learn/gain if they practice peace? What will learners lose if they don't practice it? - Sharing learner's individual and/or group experience(s) about peace - Simulated situations - Case studies.

#### **Module 6: Service**

**(3 Hours)**

Introduction: What is service? Forms of service, for self, parents, family, friend, spouse, community, nation, humanity and other beings—living and non-living, persons in distress or disaster.

Individuals who are remembered in history for practicing this value.  
Narratives and anecdotes dealing with instances of service from history, literature including local folklore.

Practicing service: What will learners learn/gain if they practice service?  
What will learners lose if they don't practice it?

Sharing learners' individual and/or group experience(s) regarding service  
- Simulated situations - Case studies.

### **Module 7: Renunciation (Sacrifice)**

**(3 Hours)**

Introduction: What is renunciation? Renunciation and sacrifice. Self-restrain and Ways of overcoming greed. Renunciation with action as true renunciation - Individuals who are remembered in history for practicing this value. Narratives and anecdotes from history and literature, including local folklore about individuals who are remembered for their sacrifice and renunciation. Practicing renunciation and sacrifice: What will learners learn/gain if they practice Renunciation and sacrifice? What will learners lose if they don't practice it? - Sharing learners' individual and/or group experience(s)  
- Simulated situations - Case studies.

### **Course Outcomes**

By the end of the course the learners will be able to:

1. Know about universal human values and understand the importance of values in individual, social circles, career path, and national life.
2. Learn from case studies of lives of great and successful people who followed and practised human values and achieved self-actualisation.
3. Become conscious practitioners of human values.
4. Realise their potential as human beings and conduct themselves properly in the ways of the world.

**DEPARTMENT OF ZOOLOGY**  
**CORE - THEORY, MAJOR ELECTIVE AND**  
**ALLIED COURSE - QUESTION PAPER**  
**PATTERN**

(For the candidates admitted from the academic year 2022-2023  
onwards under CBCS)

**Time: 3 Hrs.**

**Max. Marks - 70**

**SECTION A**

**Question Number : 1 to 20 20 x 1 = 20**

20 Questions, Four from each unit Each Question carries 1 mark. Multiple choice Questions

**SECTION B**

**Question Number: 21 to 25 5 x 4 = 20**

Internal Choice Two

from each Unit

Type : Either / or type, Medium length answers

**SECTION C**

**Question Number 26 to 30 3 x 10 = 30**

5 Questions, one from each unit

Open Choice : 3 Questions to be answered.

**SKILL BASED, NON-MAJOR**  
**ELECTIVE, NON-MAJOR SKILL**  
**BASED SUBJECT**

**Question Paper Pattern (Computer Based Exam)**

**Time: 3 Hrs.**

**Max. Marks - 70**

**SECTION A**

**Question Number : 1 to 70 70 x 1 = 70**

70 Questions, from all the 5 units .Multiple choice Questions



**SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS),**

**SALEM -16 DEPARTMENT OF ZOOLOGY**

**CORE - PRACTICAL QUESTION PAPER PATTERN**

**(For the candidates admitted from the academic year 2022-2023  
onwards under CBCS)**

**Time: 3 Hrs.**

**Max. Marks- 60**

CLASS :I B.Sc. Core Practical– I

CLASS :II B.Sc. Core Practical II

II B.Sc., Botany - Allied Zoology Practical

	<b>Marks</b>
QUESTION : No. I Major – Dissection/Experiment	25
II Minor – Mounting / Dissection/Experiment	10
III Spotters- Identify and Comment upon (5 x 3)	15
IV Practical Record	10
	<b>60</b>

CLASS: II B.Sc Skill Based IV - Clinical Laboratory Techniques Practical

CLASS: III– B.Sc. Core Practical III

CLASS: III– B.Sc. Core Practical – IV

	<b>Marks</b>
QUESTION : No.	
I Major – Dissection/Experiment	25
II Minor – Mounting / Dissection/Experiment	15
III Spotters- Identify and Comment upon (2 x 5)	10
IV Practical Record	10

**60**