

Programme Structure and Scheme of Examination (under CBCS) (Applicable to the candidates admitted in Affiliated Colleges in the academic year 2022 -2023 ONLY)

|                    |      |   | Hours/<br>Week | Credit | Maximum Marks |     |       |
|--------------------|------|---|----------------|--------|---------------|-----|-------|
| <b>Course Code</b> | Part | Study Components & Course Title                             | vveek          |        | CIA           | ESE | Total |
|                    |      | SEMESTER – I  |                |        |               |     |       |
| 22UTAML11          | I    | Language Course - I : Tamil-I                               | 5              | 3      | 25            | 75  | 100   |
| 22UENGL12          | II   | English Course - I : Communicative English I                | 5              | 3      | 25            | 75  | 100   |
| 22UZOOC13          |      | Core Course - I :Invertebrata I                             | 4              | 4      | 25            | 75  | 100   |
| 22UZOOC14          |      | Core Course - II : Invertebrata II                          | 4              | 4      | 25            | 75  | 100   |
| 22UBOTA01          | III  | Core Practical – I : Invertebrata & Chordata                | 3              | -      | -             | -   | -     |
|                    |      | Allied - I : Paper – 1 : Botany I                           | 4              | 4      | 25            | 75  | 100   |
|                    |      | Allied Practical – I: Botany Practicals                     | 3              | -      | -             | -   | -     |
| 22UENVS18          | IV   | Environmental Studies                                       | 2              | 2      | 25            | 75  | 100   |
|                    |      | Total   | 30             | 20     |               |     | 600   |
|                    |      | SEMESTER – II   |                |        |               |     |       |
| 22UTAML21          | I    | Language Course - II : Tamil-II                             | 5              | 3      | 25            | 75  | 100   |
| 22UENGL22          | II   | English Course - II : Communicative English II              | 5              | 3      | 25            | 75  | 100   |
| 22UZOOC23          |      | Core Course – III : Chordata                                | 4              | 4      | 25            | 75  | 100   |
| 22UZOOP24          |      | Core Practical – I : Invertebrata & Chordata                | 3              | 3      | 40            | 60  | 100   |
| 22UBOTA02          | III  | Allied – I : Paper -2 : Botany II                           | 3              | 3      | 25            | 75  | 100   |
| 22UBOTP01          |      | Allied Practical – I: Botany Practicals                     | 3              | 3      | 40            | 60  | 100   |
| 22UZOOE26          |      | Internal Elective – I : Select one out of three             | 3              | 3      | 25            | 75  | 100   |
| 22UVALE27          |      | Value Education   | 2              | 1      | 25            | 75  | 100   |
| 22USOFS28          | IV   | Soft Skill  | 2              | 1      | 25            | 75  | 100   |
| 22UNMSD01          |      | Effective English   | -              | 2      | 25            | 75  | 100   |
|                    |      | Total   | 30             | 26     |               |     | 900   |
|                    |      | SEMESTER – III  |                |        |               |     |       |
| 22UTAML31          | I    | Language Course – III : Tamil-III                           | 5              | 3      | 25            | 75  | 100   |
| 22UENGL32          | I    | English Course – III : English Through<br>Literature-I      | 5              | 3      | 25            | 75  | 100   |
| 22UZOOC33          |      | Core Course – IV :Cell & Molecular Biology                  | 4              | 4      | 25            | 75  | 100   |
| 22UZOOP34          |      | Core Practical – II : Cell & Molecular Biology<br>&Genetics | 3              | -      | -             | -   | -     |
| 22UCHEA01          | III  | Allied - II : Paper -1 Chemistry I                          | 4              | 3      | 25            | 75  | 100   |
|                    |      | Allied Practical – II: Chemistry Practicals                 | 2              | -      | -             | -   | =     |
| 22UZOOE36          | 1    | Internal Elective – II : Select one out of three            | 3              | 3      | 25            | 75  | 100   |
| 22UZOON37          |      | Non-Major Elective – I : Economic Zoology                   | 2              | 2      | 25            | 75  | 100   |
| 22UZOOS38          | IV   | Skill Based Subject – I : Vermiculture                      | 2              | 2      | 25            | 75  | 100   |
|                    |      | Total   | 30             | 20     |               |     | 700   |

| 1         |     | SEMESTER – IV  |    |    |     |    |      |
|-----------|-----|--|----|----|-----|----|------|
| 22UTAML41 | I   | Language Course - IV: Tamil-IV   | 5  | 3  | 25  | 75 | 100  |
| 22UENGL42 | Ι   | English Course – IV : English Through<br>Literature-II   | 5  | 3  | 25  | 75 | 100  |
| 22UZOOC43 |     | Core Course – V : Genetics   | 5  | 4  | 25  | 75 | 100  |
| 22UZOOP44 | III | Core Practical – II : Cell & Molecular Biology<br>&Genetics  | 3  | 4  | 40  | 60 | 100  |
| 22UCHEA02 |     | Allied – II : Paper – 2 Chemistry II   | 3  | 3  | 25  | 75 | 100  |
| 22UCHEP01 |     | Allied Practical – II : Chemistry Practicals   | 3  | 3  | 40  | 60 | 100  |
| 22UZOON47 | 137 | Non-Major Elective – II : Ornamental Fish Culture  | 2  | 2  | 25  | 75 | 100  |
| 22UZOOS48 | IV  | Skill Based Subject – II : Apiculture  | 2  | 2  | 25  | 75 | 100  |
| 22UNMSD02 |     | MS-Office Essentials   | 2  | 2  | 25  | 75 | 100  |
|           |     |  | 30 | 26 |     |    | 900  |
|           |     | SEMESTER – V   |    |    |     |    |      |
| 22UZOOC51 |     | Core Course – VI : Developmental Biology   | 4  | 4  | 25  | 75 | 100  |
| 22UZOOC52 |     | Core Course – VII : Animal Physiology  | 4  | 4  | 25  | 75 | 100  |
| 22UZOOC53 |     | Core Course – VIII : Biochemistry  | 4  | 4  | 25  | 75 | 100  |
| 22UZOOC54 | TIT | Core Course – IX : Bio-Technology & Bio-<br>Informatics  | 4  | 4  | 25  | 75 | 100  |
| 22UZOOP55 | III | Core Practical – III : Developmental Biology&<br>Animal Physiology& Biochemistry& Bio-<br>Technology & Bio-Informatics | 3  | -  | -   | -  | -    |
| 22UZOOP56 |     | Core Practical – IV :  | 3  | -  | -   | -  | -    |
| 22UZOOE58 |     | Internal Elective – III : Select one out of three  | 4  | 3  | 25  | 75 | 100  |
| 22UZOOS59 | *** | Skill Based Subject – III : Mushroom culture   | 2  | 2  | 25  | 75 | 100  |
| 22UGENS57 | .IV | Gender Studies   | 2  | 1  | 25  | 75 | 100  |
|           |     | Total  | 30 | 22 |     |    | 700  |
|           |     | SEMESTER – VI  |    |    |     |    |      |
| 22UZOOC61 |     | Core Course – X : Ecology  | 6  | 4  | 25  | 75 | 100  |
| 22UZOOC62 |     | Core Course – XI : Evolution   | 5  | 4  | 25  | 75 | 100  |
| 22UZOOC63 |     | Core Course – XII : Micro-Biology& Immunology  | 5  | 4  | 25  | 75 | 100  |
| 22UZOOP64 | III | Core Practical – III : Developmental Biology,<br>Animal Physiology, Biochemistry, Bio-Technology<br>& Bio-Informatics  | 4  | 4  | 40  | 60 | 100  |
| 22UZOOP65 |     | Core Practical – IV: Ecology & Evolution & Micro-Biology & Immunology  | 4  | 4  | 40  | 60 | 100  |
| 22UZOOE66 | 1   | Internal Elective – IV : Select one out of three   | 4  | 3  | 25  | 75 | 100  |
| 22UZOOS68 | IV  | Skill Based Subject – IV : Aquarium Fish Keeping   | 2  | 2  | 25  | 75 | 100  |
| 22UEXTA67 | V   | Extension Activities   | -  | 1  | 100 | -  | 100  |
| 22UNMSD03 |     | Employability Readiness  | -  | 0  | 25  | 75 | 100  |
|           |     | I(NAANDI/UNNATI/SKILLS BUILD)  |    |    |     |    |      |
|           |     | (NAANDI/UNNATI/SKILLS BUILD)  Total  | 30 | 26 |     |    | 1000 |

#### **Internal Elective Courses**

| 22UZOOE26-1 | Internal Elective - I:    | Biodiversity conservation       |
|-------------|---------------------------|---------------------------------|
| 22UZOOE26-2 |                           | Vector biology                  |
| 22UZOOE26-3 |                           | Aquaculture                     |
| 22UZOOE36-1 | Internal Elective - II :  | Public Health & Hygiene         |
| 22UZOOE36-2 |                           | Applied Microbiology            |
| 22UZOOE36-3 |                           | Animal Behaviour                |
| 22UZOOE58-1 | Internal Elective - III : | Poultry Farming                 |
| 22UZOOE58-2 |                           | Applied Entomology              |
| 22UZOOE58-3 |                           | Nano-Technology in Life Science |
| 22UZOOE66-1 | Internal Elective - IV:   | Bio-Fertilizer Production       |
| 22UZOOE66-2 |                           | Human Endocrinology             |
| 22UZOOE66-3 |                           | Medical Laboratory Techniques   |

#### Non-Major Elective Courses (NME)

(Department of Zoology offers the following NME to other Departments)

| 22UZOON37 | Economic Zoology        |
|-----------|-------------------------|
| 22UZOON47 | Ornamental Fish Culture |

#### **Credit Distribution**

| Part     | Study Components                | Papers | Credits | <b>Total Credits</b> | Marks | Total Marks |
|----------|---------------------------------|--------|---------|----------------------|-------|-------------|
| Part I   | Languages                       | 4      | 3       | 12                   | 100   | 400         |
| Part II  | Communicative English & English | 4      | 3       | 12                   | 100   | 400         |
| Part III | Core Courses                    | 12     | 4       | 48                   | 100   | 1200        |
|          | Core Practical                  | 4      | 4       | 16                   | 100   | 400         |
|          | Allied Courses                  | 4      | 4       | 16                   | 100   | 400         |
|          | Allied Practical                | 2      | 3       | 6                    | 100   | 200         |
|          | Internal Electives              | 4      | 3       | 12                   | 100   | 400         |
| Part IV  | Environmental Studies           | 1      | 2       | 2                    | 100   | 100         |
|          | Value Education                 | 1      | 1       | 1                    | 100   | 100         |
|          | Soft Skill                      | 1      | 1       | 1                    | 100   | 100         |
|          | Gender Studies                  | 1      | 1       | 1                    | 100   | 100         |
|          | Non Major Electives             | 2      | 2       | 4                    | 100   | 200         |
|          | Skill Based Courses             | 4      | 2       | 8                    | 100   | 400         |
| Part V   | Extension Activities            | 1      | 1       | 1                    | 100   | 100         |
|          |                                 | 45     |         | 140                  |       | 4500        |

#### **Tamilnadu State Council for Higher Education**

| I         | SECTION A – MANDATORY AREAS (CORE PAPERS) |
|-----------|---|
| COREI:    | INVERTEBRATA                              |
| COREII:   | CHORDATA                                  |
| COREIII:  | CELLBIOLOGY&BIOCHEMISTRY                  |
| COREIV:   | GENETICS                                  |
| COREV:    | DEVELOPMENTALBIOLOGY                      |
| COREVI:   | MICROBIOLOGY&IMMUNOLOGY                   |
| COREVII:  | ANIMALPHYSIOLOGY                          |
| COREVIII: | ECOLOGY                                   |
| COREIX:   | EVOLUTION                                 |
| COREX:    | BIOTECHNOLOGY.                            |
| II        | SECTION B – NON-MANDATORY AREAS (ELECTIVE |
|           | PAPERS)                                   |
|           |   |

| SEMESTER: I |                             | CREDIT:4   |
|-------------|-----------------------------|------------|
| PART:III    | 22UZOOC13: INVERTEBRATA - I |            |
| CORE: I     |                             | HOURS :4/W |

- 1) To obtainbroad knowledge about different kinds of animal species of invertebrates.
- 2) To understand the systematic and functional morphology of various groups of invertebrates
- 3) To study their economic importance, affinities and adaptations.
- 4) To understand the role of invertebrates in biological communities, ecological interactions and conservation problems
- 5) To assess the diversity of animals in a phylogenetic conditions.

#### Unit I:

**Principles of taxonomy -** Binominal nomenclature and outline classification of Animal Kingdom.

#### Unit II:

**Protozoa:** General characters and classification up to classes with examples. **Type Study:Entamoeba-** General structure, Life cycle and Entamoeba **Gneneral Topic:** Locomotion, Nutrition, Reproduction and Osmoregulation in Protozoa-Parasitic Protozoa of Man

#### Unit III:

**PORIFERA:** General characters and classification up to classes with examples. **Type study** - **sycon, Gneneral Topic -C**anal system, Reproductio, Skeleton in sponges. **Unit IV:** 

**COELENTERATA:** General characters and classification up to classes with examples.

**Type study** – **Obelia,** Life history of Obelia.**Gneneral Topic:**Nematocysts,polymorphism in coelenterates – Corals and Coral reefs. **Unit V:** 

**PLATYHELMINTHES**: General characters and classification up to classes with examples.

**Type study – Fasciola hepatica. Gneneral Topic: P**arasitic adaptations of Platyhelminth parasites (Taenia solium, Sachistosoma).

#### **COURSE OUTCOMES**

- 1) To understand the principle of taxonomy animals
- 2) To identify the general characters, classification, phylum of Invertebrates
- 3) To understand the morphology and their systems of various groups of Invertebrates.
- 4) To study the economic importance of invertebrates and important parasites
- 5) To study the affinities and adaptations of Invertebrates

#### **Text Books**

- 1) Ekambaranatha Ayyar.M. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol.1 [Invertebrata], Viswanathan [Printers and Publishers] Pvt. Ltd.; Madras
- 2) Ekambaranatha Ayyar.M. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol.1 [Invertebrata], Viswanathan [Printers and Publishers] Pvt. Ltd.; Madras.
- 3) Kotpal, R.L. 1988-1992 Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
- 4) Parker and Haswell, 1964. Test Book of Zoology. Vol.1 [Invertebrata]. A.Z.T; B.S. Publishersand distributors, New Delhi.

#### **Supplementary Readings**

- 1) N.C. Nayar., S.Leelavathy, N.Soundrapandian., T.Murugan and N.Arumugam, 2013. A text book of Invertebrates, Saras Publications Tamilnadu.
- 2) Dr. N.Arumugam and Dr. N.Sivakumar. 2020. Invertebrata in Tamil version. Tamilnadu.
- 3) Barrington E.J.W.(2012) Invertebrate structure and function. Affiliated East West Press Pvt. Ltd., New Delhi.

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 3   | 3   | 3   | 1   |

| ſ | SEMESTER: I |                              | CREDIT:4   |
|---|-------------|------------------------------|------------|
|   | PART:III    | 22UZOOC14: INVERTEBRATA - II | HOURS :4/W |
|   | CORE: II    |                              | HOURS :4/W |

- 1) To obtain broad knowledge about different kinds of animal species of invertebrates.
- 2) To understand the systematic and functional morphology of various groups of invertebrates
- 3) To study their economic importance, affinities and adaptations.
- 4) To understand the role of invertebrates in biological communities, ecological interactions and conservation problems
- 5) To assess the diversity of animals in a phylogenetic conditions.

#### Unit I:

**ASCHELMINTHES**: General characters and classification up to classes with examples.

**Type study – Wuchereria bancrofti. Gneneral Topic: P**arasitic adaptations of Aschelminth parasites (Ancylostoma duodenale and Ascaris lumbricoides).

#### Unit II:

**ANNELIDA**: General characters and classification up to classes with examples.

**Type study: Megascolex mauritii, Gneneral Topic:**Metamerism in Annelids, Excretion and Economic importance of Annelids.

#### Unit III:

**ARTHROPODA:** General characters and classification up to classes with examples.

**Type study** – **Prawn, Gneneral Topic:**Larval forms of Crustacea, Respiration,Excretion in Arthropods,Peripatus and its affinities, Mouth parts of insect, Beneficial Insects

#### **Unit IV:**

**MOLLUSCA:** General characters and classification up to classes with examples.

**Type study – Lamellidens marginalis, Gneneral Topic:**Respiration. Foot and Torsion in Mollusca, Economic importance of Mollusca.

#### Unit V:

**ECHINODERMATA**: General characters and classification up to classes with examples.

**Type Study- Asterias rubens, Gneneral Topic:** Larval forms of Echinidermata, Water Vascular System and Phylogeny of Echinidermata.

#### **COURSE OUTCOMES**

- 1) To understand the principle of taxonomy animals.
- 2) To identify the general characters, classification, phylum of Invertebrates.
- 3) To understand the morphology and their systems of various groups of Invertebrates.
- 4) To study the economic importance of invertebrates and important parasites.
- 5) To study the affinities and adaptations of Invertebrates.

#### **Text Books**

- 1) Ekambaranatha Ayyar.M. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol.1
  - a. [Invertebrata], Viswanathan [Printers and Publishers] Pvt. Ltd.; Madras
- 2) Ekambaranatha Ayyar.M. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol.1
  - a. [Invertebrata], Viswanathan [Printers and Publishers] Pvt. Ltd.; Madras.
- 3) Kotpal, R.L. 1988-1992 Protozoa, Porifera, Coelenterata, Helminthes, Annelida, a. Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
- 4) Parker and Haswell, 1964. Test Book of Zoology. Vol.1 [Invertebrata]. A.Z.T; B.S.Publishersand distributors, New Delhi. Supplementary Readings

#### **Supplementary Readings**

- 1) N.C. Nayar., S.Leelavathy, N.Soundrapandian., T.Murugan and N.Arumugam, 2013. A text book of Invertebrates, Saras Publications Tamilnadu.
- 2) Dr. N.Arumugam and Dr,N.Sivakumar. 2020. Invertebrata in Tamil version. Tamilnadu.
- 3) Barrington E.J.W.(2012) Invertebrate structure and function. Affiliated East West Press Pvt. Ltd., New Delhi.

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 3   | 3   | 3   | 1   |

SEMESTER - I PART - III

## 22UBOTA01: ALLIED BOTANY – I : PLANT DIVERSITY, ANATOMY, EMBRYOLOGY (OFFERED TO B.SC. ZOOLOGY/ CHEMISTRY/ MICROBIOLOGY)

CREDITS: 4 HOURS: 4/W

#### **COURSE OBJECTIVES**

- 1. To understand the major groups of plants and their characteristics.
- 2. To render the structural and reproductive stages of major groups of plants with appropriate type study.
- 3. To impart the knowledge on the life cycle patterns of major groups of plants.
- 4. To Gain knowledge about anatomy of stem, root and leaf and their secondary growth.
- 5. To Grasp the idea of double fertilization, types of endosperms, and dicot embryo development.

#### UNIT - I: Algae and Fungi

(15 hours)

Structure, reproduction and life cycle of the following: Algae: *Chlamydomonas, Sargassum and Gracillaria*; Fungi: *Penicillium* and *Agaricus*.

#### UNIT – II : Bryophytes and Pteridophytes

(15 hours)

Study of the Structure, reproduction and life cycle of the following : Bryophytes : *Marchantia* and *Funaria* ; Pteridophyta: *Lycopodium* and *Adiantum*.

#### **UNIT - III: Gymnosperms and Palaeobotany**

(10 hours)

Gymnosperms: Structure, reproduction and life cycle of *Pinus*; Palaeobotany: Fossils, Types (compressions, impressions, petrifactions, coal ball Detailed study of morphology and reproduction in *Rhynia* 

#### **UNIT – IV : Plant Anatomy**

(10 hours)

Anatomy: Tissues - Classification of plant tissues - Simple and Complex tissues; Anatomy of Dicot and Monocot root, stem and leaf, Secondary growth in Dicot stem and root.

#### **UNIT - V: Plant Embryology**

(10 hours)

Embryology: Mature anther Megasporangium- Types of Ovule and Female gametophyte (Polygonum type), Double fertilization, Types of endosperm, Structure and development of dicot embryo.

#### **COURSE OUTCOMES**

On the successful completion of the course, the student will be able to

- 1. Get knowledge in plant groups and their features
- 2. Understand the organizational characters and reproductive features of plant groups
- 3. Identify and have a sound knowledge of the life cycles of different plant groups
- 4. Possess high understanding on the anatomy of plants
- 5. Familiar with fundamental knowledge on embryology and its applications.

#### **Text Books**

- 1. Pandey, B.P. (2001). College Botany Vol. I: Algae, Fungi, Lichens, Bacteria.
- 2. Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd., New Delhi.
- 3. Gangulee&Khar, 1980. College Botany Vol. I &II Tata McGraw Hill, New Delhi.
- 4. Vashishta , P.C , Sinha and Anilkumar (2010). Pteridophytes, S.Chand & company Ltd, New Delhi.
- 5. Kirkaldy, J.E. (1963). The study of Fossils. Hutchinson Educational, London.
- 6. Pandey, S.N., Misra, S.P and Trivedi, P.S. 1970. A text book of Botany (Vol II). Vikas Publishing House Pvt. Ltd. Delhi.
- 7. Vashista P.C (1984). Plant Anatomy Pradeep publication, Jalandhar
- 8. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, 5th Edition, Vikas Publishing House. Delhi.

|     | PO1 | PO2 | PO3 | PO4 | PO5 |
|-----|-----|-----|-----|-----|-----|
| CO1 | 2   | 3   | 1   | 1   | 2   |
| CO2 | 2   | 3   | 2   | 2   | 3   |
| CO3 | 2   | 1   | 3   | 2   | 2   |
| CO4 | 1   | 3   | 3   | 2   | 1   |
| CO5 | 2   | 2   | 3   | 3   | 3   |

| SEMESTER: I<br>PART: IV | 22UENVS 18: ENVIRONMENTAL STUDIES | CREDIT: 2<br>HOURS: 2/W |
|-------------------------|-----------------------------------|-------------------------|
|-------------------------|-----------------------------------|-------------------------|

- 1) To gain knowledge about the importance of environmental sciences and natural resources.
- 2) To learn the concept, structure and function of ecosystem and the importance of biodiversity.
- 3) To understand and gain knowledge about environmental pollution and management.
- 4) To impart knowledge about social issues and human population.
- 5) To acquire the skills for identifying and solving pollution problem.

### UNIT - I: INTRODUCTION TO ENVIRONMENTAL SCIENCES: NATURAL RESOURCES:

Environmental Sciences – Relevance – Significance – Public awareness – Forest resources – Water resources – Mineral resources – Food resources – conflicts over resource sharing - Exploitation - Land use pattern - Environmental impact - fertilizer -PesticideProblems-casestudies.

#### UNIT - II:ECOSYSTEM, BIODIVERSITY AND ITS CONSERVATION:

Ecosystem – concept – structure and function producers, consumers and decomposers - Food chain - Food web - Ecological pyramids - Energy flow - Forest, Grassland, desert and aquaticeco system.

Biodiversity - Definition - genetic, species and ecosystem diversity - Values and uses ofbiodiversity - biodiversity at global, national (India) and local levels - Hotspots, threatstobiodiversity-conservationofbiodiversity-Insitu &Exsitu.

#### UNIT - III: ENVIRONMENTAL POLLUTION AND MANAGEMENT

Environmental Pollution – Causes – Effects and control measures of Air, Water, Marine, soil, solidwaste, Thermal, Nuclear pollution and Disaster Management - Floods, Earth quake, Cyclone and Land slides. Role of individuals in prevention of pollution-pollution cases tudies.

#### **UNIT - IV:SOCIALISSUES-HUMANPOPULATION**

Urban issues - Energy - water conservation - Environmental Ethics - Global warming -Resettlement and Rehabilitation issues - Environmental legislations - Environmentalproduction Act. 1986 - Air, Water, Wildlife and forest conservation Act - Population growth and Explosion - Human rights and Value Education - Environmental Health- HIV/AIDS - Role of IT in Environment and Human Health - Women and child welfare - Public awareness - Case studies.

#### **UNIT-V:FIELDWORK**

Visittoalocalarea/localpollutedsite/localsimpleecosystem-Reportsubmission

#### **COURSE OUTCOMES**

After completion of this course, students will be able to gain knowledge in

- 1) The scope and importance of environmental science and natural resources.
- 2) The structure and functions of Ecosystem and biodiversity and its conservation.
- 3) The problem of environmental pollution and its management.
- 4) The social issues and human population.
- 5) They will identify and solve the pollution problem.

#### **Text Books**

- 1) Agarwal, K.C. (2008). Environmental Biology, NidiPubl. Ltd. Bikaner.
- 2) Bharucha Erach, (2004). Textbook for Environmental Studies, UGC.
- 3) Odum, E.P., Odum, H.T. & Andrews, J. (1971). *Fundamentals of Ecology*. Philadelphia: Saunders.
- 4) Brusseau, M.L., Pepper, I.L., and Gerba, C. (2019). *Environmental and Pollution Science*. Academic Press, USA.
- 5) Primack R.B. (2014). Essentials of Conservation Biology, Oxford University Press, USA.
- 6) Raven, P.H, Hassenzahl, D.M., Hager M.C, Gift N.Y, and Berg L.R. (2015). *Environment*, (9th Ed.), Wiley Publishing, USA.
- 7) Rosencranz, A., Divan, S., and Noble M.L. 2002. Environmental Law and Policy in India: Cases, Material & Statutes. Oxford University Press.
- 8) Schmidtz, D., Shahar, D.C. 2018. Environmental Ethics: What Really Matters, What Really Works 3rd Edition, Oxford University Press, USA.
- 9) Sengupta,R.(Ed.) 2013. Ecological Limits and Economic Development. Oxford University Press, New Delhi, India.
- 10) Singh, J.S., Singh, S.P. and Gupta, S.R. 2017. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
- 11) Stuetz R.M., and Stephenson T. (Eds.) (2009). *Principles of Water and Wastewater Treatment Processes (Water and Wastewater Process Technologies)*. IWA Publishing, London, UK.
- 12) Sodhi, N.S., Gibson, L. and Raven, P.H. (Eds). (2013). *Conservation Biology: Voices from the Tropics*. John Wiley & Sons.
- 13) Thapar, V. (1998). Land of the Tiger: A Natural History of the Indian Subcontinent. University of California Press, USA.
- 14) Warren, C.E. (1971). Biology and Water Pollution Control. WB Saunders.
- 15) Wilson, E.O. (2006). *The Creation: An Appeal to Save Life on Earth.* W.W. Norton & Company, NewYork, USA.

16) World Commission on Environment and Development. (1987). *Our Common Future*. Oxford University Press, USA.

#### **Supplementary Readings**

- 1) Kumarasamy, K., A. Alagappa Moses and M. Vasanthy, (2004). *Environmental Studies*, Bharathidsan University Pub, 1, Trichy.
- 2) Rajamannar, (2004). Environemntal Studies, EVR College Pub, Trichy.
- 3) Kalavathy,S. (ED.) (2004). *Environmental Studies*, Bishop Heber College Pub., Trichy.

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 3   |
| CO2   | 3   | 2   | 3   | 3   | 3   |
| CO3   | 2   | 3   | 3   | 2   | 3   |
| CO4   | 3   | 3   | 3   | 3   | 3   |
| CO5   | 3   | 3   | 2   | 3   | 3   |

| SEMESTER: II |                     | CREDIT: 4  |
|--------------|---------------------|------------|
| PART:III     | 22UZOOC23: CHORDATA |            |
| CORE: III    |                     | HOURS: 4/W |

- 1 To understand the taxonomy and relationship and evolution of animals.
- 2 To understand the systematic and functional morphology of various groups of Chordates
- 3 To study their economic importance, affinities and adaptations.
- 1. To understand the role of vertebrates in biological communities, ecological interactions and conservation problems
- 5 To assess the diversity of animals in a phylogenetic conditions.

#### UNIT I:

1. **General charecters of Chordata**, classification of Chordata upto upto orders Vertebrata. **Prochordata**: General Characters, Classification of Prochordata. **Type Study:** Ascidian, Amphioxus and Balanoglossus, **General Topic**:Affinities of Hemichordata, Cephalochordata & Urochordata

#### **Unit II: PISCES**

- 4) General characters and classification up to upto orders
- 5) Type study: **Labeo rohita**. **General Topic**: Fins of fishes, Migration of fishes, Parental care in fishes.

#### **AMPHIBIA**

6) General characters and classification up to upto orders

**Type study :Frog,General Topic-**Adaptive features of Apoda, Origin of Amphibia, Parental care in Amphibia

#### **Unit III: REPTILIA**

1. General characters and classification up to upto orders

**Type study-Calotes.General Topic:** Origin and Evolution of Reptilia, Identification of poisonous and non-poisonous snakes of South India, Poison apparatus and biting mechanism, Venom and Antivenom.

#### Unit IV: AVES

1. General characters and classification upto orders

Type study-**Pigeon.General Topic:** Characters of Archaeopteryx, Ratitae, Origin of Birds, Flight adaptation, Migration of Birds.

#### **Unit V: MAMMALIA**

General characters and classification upto orders.

**Type study-Rabbit.General Topic:** Origin of Mammals, Dentition in mammals, Flying Mammals, Aquatic mammals.

#### **COURSE OUTCOMES**

- 1) To understand the diversity of chordates and their classification.
- 2) To identify the general characters, classification, phylum of Chordates.
- 3) To understand the morphology and their systems of various groups of Vertebrates.
- 4) Familiarize with gradual development of habit and habitat.
- 5) To study the affinities and adaptations of Invertebrates.

#### **Text Books**

- 1) Hyman. L.H. Comparative vertebrate Zoology. McGraw Hill Co., New York. B.Sc. Zoology: Syllabus (CBCS) 11.
- 2) Waterman, Allyn J.et al.1971, Chordate Structure and functions. Mac.Millan and Co., New York.
- 3) Kotpal, R.L. 1988-1992 Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
- 4) Parker and Haswell, 1964. Test Book of Zoology. Vol.1 [Invertebrata]. A.Z.T; B.S.Publishersand distributors, New Delhi.
- 5) Nigam.H.C. 1983 Zoology of chordates, Vishal publications, Jalandhar.

#### **Supplementary Readings**

- 1) A.Thangamani., S.Prasannakumar., L.M. Narayanan and N.Arumugam,2013. A text book of Invertebrates, Saras Publications Tamilnadu.
- 2) Kent, G.C. (2015). Comparative anatomy of the vertebrates. McGraw Hill, UK.
- 3) Kenneth Kardong. 2018. VertebratesL compatrative anatomy, Function, Evolution. McGraw Hill. UK.

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 3   | 3   | 3   | 1   |

| SEMESTER: I&II |                                      | CDEDIT:2   |
|----------------|--------------------------------------|------------|
| PART:III       | 22UZOOP24: INVERTEBRATA AND CHORDATA | CREDIT:3   |
| PRACTICAL - I  |                                      | HOURS: 3/W |

- 1) To understand the taxonomy and relationship and evolution of animals.
- 2) To understand the systematic and functional morphology of various groups of Chordates.
- 3) To study their economic importance, affinities and adaptations.
- 4) To understand the role of vertebrates in biological communities, ecological interactions and conservation problems
- 5) To assess the diversity of animals in a phylogenetic conditions.

#### DISSECTIONS

cockroach /Earth worm - Digestive and Nervous systemPrawn - Nervous system, Fish - Digestive system

#### MINOR PARCTICAL

MOUNTING - **Setae**:Mounting of Body setae and Penial setae of Earthworm, **Insect Mouth parts**: Mounting of mouth parts of Honey bee, House Fly and Mosquito **Prawn** - Appendages, **Shark** - Placoid scales,

#### **SPOTTERS**

#### Study of the following specimens

#### 1.Classify by giving reasons

Paramecium, Euglena, Sycon, Obelia, Taenia solium, Neries, Prawn, Fresh water mussel, Seastar, Amphioxus, Shark, Hyla, Rhacophorus, Calotes, Pigeon, Rabbit.

#### 2.Adaptations to their respective modes of life

Entamoeba, Trypanosoma, Plasmodium, Corals [any 2], Ascaris, Wuchereria bancrofti, Cheatopterus, Leech, Limulus, Nauplius, Mysis, Zoea, Balanoglossus, Ascidian, Ichthyophis, Draco, sea snake and Bat.

#### 3.Biological significance:

Paramecium conjugation and binary fission, Fasciola hepatica, physalia, Trochophore Larva, Peripatus, Sacculina On Crab, Sea Anemone on Hermit Crab, Pearl Oyster, Bipinnaria Larva, Anabas, Hippocampus, Narcine, Echeneis, Arius, Exocoetus, Eel, Amblystoma, Axolotl Larva, Bufo, Cobra, Krait, Russels Viper, Echis Carinata, Turtle, Parrot, Woodpecker, King Fisher.

#### 4. Relate structure and function:

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

#### 5.Draw labeled sketches:

T.S. Fasciola, T.S. of Leech, Obelia medusa, T.S. of Amphioxus through Pharynx, T.S. through arm of Sea star. **Skeleton** - Pectoral girdles of Frog and Pigeon., Pelvic Girdles of Frog and Pigeon. Fore and Hind limbs of Frog and Pigeon., Synsacrum of Pigeon. **Dentition** - Rabbit

#### Record of Laboratory work shall be submitted at the time of practical examination

#### **COURSE OUTCOMES**

- 1) To Understand the diversity of chordates and their classification.
- 2) To identify the general characters, classification, phylum of Chordates.
- 3) To understand the morphology and their systems of various groups of Vertebrates.
- 4) Familiarize with gradual development of habit and habita.
- 5) To study the affinities and adaptations of Invertebrates.

#### **Text Books**

- 1) Verma, P.S. 2013. A Manual of Practical Zoology of Invertebrates, S. Chand & Company Ltd., New Delhi.
- 2) Verma. P.S. 2011 A Manual of Practical Zoology INVERTEBRATES Chand & Co, Ltd, Ram Nagar -New Delhi.
- 3) Vijayaraman. K and palanivel.K, 1997 Cheimurai Vilangial, chimeera Publications.
- 4) Amsath, A. 2013. Practical manual in Zoology. MMA Publications, Adirampattinam.
- 5) Jayanpa Sinha . 2010 Advanced Practical Zoology, Books & Allied (p) Ltd. No.1. SubhamPlaza IFloor, Calcutta.

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 3   | 3   | 3   | 1   |

SEMESTER - II PART-III

# 22UBOTA02: ALLIED BOTANY - II: MORPHOLOGY, TAXONOMY, PHYSIOLOGY, ECOLOGY AND BIOTECHNOLOGY (OFFERED TO B.Sc. ZOOLOGY/ CHEMISTRY/ MICROBIOLOGY)

CREDITS: 3 HOURS: 3/W

#### **COURSE OBJECTIVES**

- 1. To understand external features of plants
- 2. To familiarize range of characters and economic importance of some families.
- 3. To know structure of mature anther and types of ovules.
- 4. To understand physiology mechanisms of plant.
- 5. To acquire knowledge of ecosystem and environmental pollution..

#### **UNIT - I: Morphology of flowering plants**

(10 hours)

Plant and its parts. Structure and function of root and stem. Leaf and its parts. Inflorescence - Racemose, Cymose, Classification of fruits.

#### **UNIT – II : Taxonomy**

(15 hours)

General outline of Bentham and Hooker's system of classification. Study of the range of characters and plants of economic importance in the following families: Cucurbitaceae, Apocynaceae, Euphorbiaceae and Liliaceae.

#### **UNIT – III : Plant Physiology**

(15 hours)

Absorption of water, photosynthesis - light reaction - Calvin cycle; respiration - Glycolysis - Krebs cycle - electron transport system. Growth hormones - auxins and cytokinins and their applications.

#### UNIT – IV : Ecology

(10 hours)

Ecosystem - fresh water ecosystem. Structure and components. Ecological groups of plants : Hydrophytes - *Nymphaea*, Xerophytes - *Nerium*, Mesophytes-*Mangifera* .

#### UNIT - V: Plant Biotechnology

(10 hours)

Plant Tissue culture techniques - Basic Principles- aseptic conditions, media preparation, callus induction,. Genetic engineering- Basic principles, tools, techniques and applications, transgenic plants- Bt- brinjal.

#### **COURSE OUTCOMES**

On the successful completion of the course, the student will be able to

- 1. Identify and describe external features of plants
- 2. Understand range of characters and economic importance of some families.
- 3. Explain structure of mature anther and types of ovules.
- 4. Understand functioning of the plant.
- 5. Analyse functioning of ecosystems and plant adaptations

#### **Text Books**

- 1. Lawrence.G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
- 2. Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd.
- 3. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.
- 4. Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand and Company Ltd., New Delhi.
- 5. Verma, S.K. 2006. A Textbook of Plant Physiology, S.K.Chand& Co., New Delhi.

|     | PO1 | PO2 | PO3 | PO4 | PO5 |
|-----|-----|-----|-----|-----|-----|
| CO1 | 2   | 3   | 1   | 3   | 2   |
| CO2 | 2   | 3   | 2   | 2   | 3   |
| CO3 | 2   | 1   | 3   | 2   | 1   |
| CO4 | 2   | 3   | 3   | 2   | 3   |
| CO5 | 2   | 1   | 3   | 1   | 3   |

|               | 22UBOTP02: ALLIED BOTANY PRACTICAL I: |            |
|---------------|---------------------------------------|------------|
| SEMESTER - II | COVERING ALLIED BOTANY - I & II       | CREDITS: 3 |
| PART - III    | (OFFERED TO B.Sc. ZOOLOGY/ CHEMISTRY/ | HOURS: 3/W |
|               | MICROBIOLOGY)                         |            |

- 1. To make suitable micro preparations of Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms (mentioned in the theory syllabus) and to describe and identify the same.
- 2. To make suitable micro preparations and detailed microscopic analysis of Dicot and Monocot Stem, root and leaf and to identify the same giving reasons.
- 3. To study the normal secondary thickening in dicot stem and root.
- 4. To study the internal structure of a mature anther.
- 5. To study the different types of ovules and endosperms.
- 6. To describe in technical terms, plants belonging to any of the families prescribed and to identify the family.
- 7. To dissect a flower, construct floral diagram and write floral formula.
- 8. Demonstration experiments 1. Ganong's Light screen 2. Ganong's respiroscope.
- 9. To identify Spotters- Morphology of flowering plants, Taxonomy, Plant Physiology, Plant Biotechnology and Ecology.
- 10. To maintain observation and record note book.

|     | PO1 | PO2 | PO3 | PO4 | PO5 |
|-----|-----|-----|-----|-----|-----|
| CO1 | 2   | 3   | 1   | 1   | 2   |
| CO2 | 3   | 3   | 2   | 2   | 3   |
| CO3 | 2   | 1   | 3   | 2   | 1   |
| CO4 | 2   | 3   | 3   | 2   | 2   |
| CO5 | 2   | 2   | 3   | 3   | 3   |

| SEMESTER: II | 22UZOGE27 4. DIODIVEDCITY CONCEDVATION | CREDIT: 3  |
|--------------|--|------------|
| PART: III    | 22UZOOE27-1: BIODIVERSITY CONSERVATION | HOURS: 2/W |

- 1) To give the student insight of scientific developments in Conservation of Biodiversity.
- 2) To understand the distribution of species and threats to concerning biodiversity.
- 3) To study the climate change and its problems in conservation of biodiversity.
- 4) To study the various conservation measures adopted in India.
- 5) To make the student get aware with various legislations related to wildlife and conservation.

#### Unit I: Biodiversity and their values

**Biodiversity:** definition – Biodiversity conservation strategies - types of diversity – genetic, species and ecosystem.

**Value of Biodiversity:** Biodiversity and environmental services - Consumptive, Productive, Social, Ethical and moral values, Aesthetic value.

#### **Unit II: Biodiversity Hot spot and Threats**

**Hot spot:** Mega diversity centers – Global 200 - India's Biogeographic Zones - Biodiversity Hot spot - North-East, the Western Ghats, Andaman and Nicobar Islands.

**Threats to biodiversity:** Habitat loss, poaching of wildlife, man-wildlife conflicts, invasive species; consequences of biodiversity loss; Endangered faunal species of India.

#### **Unit III: Global warming and Biodiversity**

**Global warming:** Greenhouse gases and sources – CO<sub>2</sub> –Methane –and Chloro-flouro-carbon (CFCs) –Aerosols in the atmosphere – Sea level rise– Ozone depletion–Irregular monsoon – Droughts – Cyclones & Cloudburst –Tsunami – Acid rain – Impact of climate change on biodiversity.

#### Unit IV: Conservation of biodiversity

**Conservation Methods:** *In situ* conservation (Biosphere Reserves, National Parks, Wildlife Sanctuaries); *Ex-situ* conservation (botanical gardens, zoological gardens, gene banks, seed and seedling banks, pollen culture, tissue culture and DNA banks),

**Integrated Protected Area System (IPAS):** Community Reserves or Community Conserved Areas - Sacred Grooves - Corridors.

#### Unit V: People participation, Environmental legislation & Authority

People participation in Conservation: Chipko Movement – **Navdanya Movement** and**Ecotourism.** 

**Environmental legislation & Authorities:** Wildlife Protection Act (1972) - Biological diversity Act 2002– The National Green Tribunal Act 2010 – National biodiversity authority (NBA) and State Biodiversity Boards.

#### **COURSE OUTCOMES**

- 1) Able to understand the types and values of Biodiversity.
- 2) Able to understand the distribution and threats.
- 3) Analyse and interpret the problems in conservation of biodiversity.
- 4) Explain the various strategies adopted in conservation of various species.
- 5) Able to follow and interpret various rules and regulations related to biodiversity.

#### **Text Books**

- 1) Lawmann, J. (2017). Wildlife Protection Act 1972. Kamal Publishers, New Delhi.
- 2) Majumdar, A.B., Nandy, D, and Mukherjee, S. (2013). Environment and Wildlife Laws in India. LexisNexis Publishers.
- 3) Saha, T. K. (2007). Ecology and environmental Biology. Books and allied(P) Ltd. Kolkata, India.
- 4) Mitra, A.P., Sharma, S., Bhattacharya, S., Garg, A., Devotta, S. and Sen, K. (2004). Climate Change and India. Universities Press, India.
- 5) Khitoliya, R. K. (2004). Environmental pollution: Managment and control for sustainable developments. S. Chand & company (p) Ltd., New Delhi, India.

#### Supplementary Readings

- 1) Sodhi, N.S., Gibson, L. and Raven, P.H. (2013). Conservation Biology: Voices from the Tropics. Wiley-Blackwell, Oxford, UK.
- 2) Philander, S.G. (2012). Encyclopedia of Global Warming and Climate Change (2<sup>nd</sup> edition). Sage Publications.
- 3) Hardy, J.T. (2003). Climate Change: Causes, Effects and Solutions. John Wiley & Sons.
- 4) Primack, R.B. (2002). Essentials of Conservation Biology (3rd edition). Sinauer Associates, Sunderland, USA.
- 5) Divan, S. and Rosencranz, A. (2001). Environmental Law and Policy in India. Oxford University Press.

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 2   | 3   | 2   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 3   | 2   | 3   | 1   |

| SEMESTER: II | 22UZOOE27-2: VECTOR BIOLOGY | CREDIT: 3  |
|--------------|-----------------------------|------------|
| PART: III    | 220200E27-2: VECTOR BIOLOGY | HOURS: 3/W |

- 1) To acquire Knowledge of the types of vectors, host, parasite and their control.
- 2) To study the types of metamorphosis and disease transmission cycle of Vector.
- 3) To learn morphology, life cycle, diseases transmission and control measures of Housefly and Sandfly.
- 4) To learn morphology, life cycle, diseases transmission and control measures of Fleas, Lice and Ticks.
- 5) To learn morphology, life cycle, diseases transmission and control measures of Cyclopes and freshwater snail and to emphasis the National and International programmes and Agencies in vector control.

#### Unit I: Concept of Vector, Host, Parasite

**Vectors:** Definition - characteristics - types - mechanical - direct - indirect, biological - **propagative- cyclo-propagative - cyclo-developmental -** transovarial.

**Host& Parasite:** Definition - characteristics - types.

**Vector control:** Integrated vector management - chemical - larvicides, adulticides and Insect growth regulators(IGRs), biological - bio-larvicides, larvivorous fish, other predators, pathogens.

#### **Unit II: General Features of Vectors**

General Features of Medical and Public Health import vectors: Breeding habitats; metamorphosis – Complete and Incomplete.

**Mosquito:** Morphology and Life cycle –identification characters of different stages of Anopheles, Ades and Culex; Disease transmission cycle - role of mosquito in disease transmission of Malaria, Filariasis, Dengue.

#### **Unit III: Housefly and Sandfly**

**Housefly:** Morphology - life cycle - disease transmission (Amoebic Dysentery) – control measures.

**Sand fly:** Morphology –life cycle - disease transmission (Leishmaniasis) - control measures.

#### Unit IV: Flea, Louse and Ticks

**Fleas:** Morphology - life cycle - disease transmission (Plague) control measures.

**Louse:** Morphology –life cycle - disease transmission (relapsing fever and secondary dermatitis) - lice control.

**Ticks:** Morphology - difference between Hard and Soft ticks - disease transmission (typhus, 'Q' fever) - control measures.

#### Unit V: Cyclopes, Freshwater snail, Disease control programmes

**Cyclops** (water-flea): Morphology – disease transmission (Dracunculiasis) – prevention and control measures.

**Freshwater snails - D**isease transmission (Schistosomiasis), Control measures.

Role of International and National disease control programmes & Agencies: WHO; NMCP; ICMR.

#### **COURSE OUTCOMES**

After completing the class, students will be

- 1) acquire basic knowledge on types of vectors, host and parasites & take up integrated vector management activities.
- 2) acquire basic knowledge on the general characters of vectors, types of disease transmission.
- 3) acquire basic knowledge on the biology, epidemiology and control of these three vectors (Housefly and Sandfly).
- 4) acquire basic knowledge on the biology, epidemiology and control of these three vectors (Fleas, Lice and Ticks).
- 5) acquire basic knowledge on the biology, life cycle and control methods of Cyclopes and freshwater snail, understand the rationale of a global strategy to control these diseases by National and International Agencies and take up jobs in vector control and public health departments.

#### **Text Books**

- 1) Park, K. (2021). Park's Text book of preventive and social medicine. 26th Edition. Banarsidas Bhanot Publisher, USA.
- 2) Jayaram Panikar, C.K.(2018). Textbook of Medical Parasitology. Jaypee Brothers Medical publishers Pvt. Ltd, New Delhi.
- 3) Tembhare, D.B. (2012). Modern Emtomology. Himalaya Publishing House, New Delhi.
- 4) Tyagi, B.K. (2012). Medical Entomology. Scientific publishers, Chennai.
- 5) Parthiban, M. and B. Vasantharaj David, (2007). Manual of Household & Public Health pests and their control. Namrutha Publications, Chennai.

#### **Supplementary Readings**

- 1) Sudhir R. Wagh and Vishnu K. Deshmukh. (2015). Medical Entomology. Success Publications.
- 2) Rathanswamy, G.K, (2010). A Hand book of Medical Entomology. S.Viswanatham Printers & Private & Ltd., Chennai.
- 3) Arthropods of Medical importance (1981) Edited by Nicholas R.H.Burgess, Published by Noble Books Ltd, Hampshire.
- 4) Rao, T. R. (1981). The Anophelines of India. Indian Council of Medical Research, New Delhi.

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 2   | 3   | 3   | 1   |

| SEMESTER: II | 2211700527 2: AQUACUI TUDE | CREDIT: 3  |
|--------------|----------------------------|------------|
| PART: III    | 22UZOOE27-3: AQUACULTURE   | HOURS: 3/W |

- 1) To acquire knowledge about the importants of aquaculture.
- 2) To know the different types of culture and pond management.
- 3) To obtain knowledge about cultivable species and aquarium keeping.
- 4) To gather information about poly culture
- 5) To learn the role of organizations and funding agencies involved in aquaculture.

#### Unit I: Importance of aquaculture

Definition - Scope and importance - status of aquaculture in India, Role of aquaculture on economic development. Types of aquaculture - Freshwater, coastal and marine water aquaculture.

#### **Unit II: Fish ponds and Management**

Definition, breeding ponds, nursery ponds, rearing ponds, culture ponds (stocking ponds). Preparation of pond for fish culture, management of fish ponds, water quality management of fish ponds. Importance and composition of feeds; types of feed, wet and dry feeds, Artificial and live feeds.

#### **Unit III: Cultivable species**

Cultivable species of fish, crustaceans, molluscs and algae; Different types of cultures, Monoculture, Poly culture, composite fish culture, cageculture, penculture, race wayculture- extensive, intensive and semi intensive culture; Common species for ornamental fish farming.

#### Unit IV: Fish disease management

Common bacterial, viral, fungal, protozoan and crustacean diseases, their symptoms and treatment. Aquatic pollution –Definition, causes, ecological effects and control ofwater pollution.

#### Unit V: Marketing the products

Marketing the fish to local markets and for export - Harvesting and transport of fish and its products -Fish preservationand fish processing technology; Organizations involved and their role of aquaculture - ICAR, CMFRI, CIFRI, CIFRI, CIFA, CIBA, CIFT &MPEDA.

#### **COURSE OUTCOMES**

At the end of the course, the student will be able to

- 1) Students will be able to describe the history and development of aquatic life.
- 2) Students will be able to theoretical and practical aspects of fisheries across different species.
- 3) Students will be able to explain how the management of aquatic ponds and to analyze biological samples of Aquaculture ponds.
- 4) Students can make knowledge of how the difference of cultivable forms evolved in the earth.
- 5) To take up jobs in Aquaculture farms.

#### **Text Books**

- 1) Pillay, T.V.R. 1995. Aquaculture principles and practices. Fishing New Books, Blackwell Science Ltd.,Oxford.
- 2) Shanmugam, K. 1990. Fishery biology and Aquaculture. Leo Pathipagam, Madras.
- 3) Santhanam, Sugumaran and Natarajan, P. 1997. *A Manual of freshwater aquaculture*.OxfordandIBHPub.Co.Ltd.,NewDelhi.

#### **Supplementary Readings**

- 1) Arumugam.N. 2008. Aquaculture. Saras Publications, Nagercoil.
- 2) Baradach, JE, JH Ryther and WO McLarney (1972) Aquaculture. The farming and Husbandry of Freshwater and Marine Organisms. Wiley Interscience, NewYork.
- 3) Chadar, S.L. 1980. *Hypophysation of Indian major carps*. Satish Book Enterprise, Agra, PP. 146
- 4) ExportersmanualandDocumentation.1999.JainBookAgency.NewDelhi.
- 5) Jhingran.V.C. 1991. Fish and fisheries of India, Hindustan Pub. Cord. New Delhi.
- 6) Kurian, C.V and Sebastin. 1992. *Prawn and prawn fisheries of India*, Hindustan Pub. Cord. NewDelhi.
- 7) Rath, R.K. (2000) *Freshwater Aquaculture*. Scientific Publishers, (India), PO.Box.91, Jodhpur.

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |

| SEMESTER : III | COURSE CODE:22UZOOC33 COURSE TITLE:CELL AND MOLECULAR | CREDITS:4 |
|----------------|---|-----------|
| PART:III       | BIOLOGY   | HOURS:4/W |

#### Learning Objective:

- 1) Have an enhanced knowledge on microscopes, cytological techniques.
- 2) To provide a basic information on structure and functions of cell and cell organelles.
- 3) To gain an understanding of chemical and molecular processes that occur in and between cells.
- 4) To provide the basic knowledge on biochemical and cell culture techniques.
- 5) To give in-depth knowledge of biological and medicinal processes through the investigation of the underlying molecular mechanisms.

#### UNIT - I

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

#### UNIT - II

**Cell** – Cell theory, Ultra structure of animal cell – structure, composition and functions – cell components – Plasma Membrane – Endoplasmic reticulum, Ribosomes, Golgi Complex, Lysomes, Glyoxisomes, peroxisomes, centrioles and Mitochondria.

#### UNIT – III

**Cytoplasm** – Physical, chemical and biological properties. **Nucleus** – Ultrastructure, Composition and Function – **Chromosomes** – Giant chromosomes (Polytene and Lamp brush chromosomes).

#### UNIT - IV

**Cell cycle and cell division** – Amitosis, Mitosis and meiosis and their significance. **Cancer biology** – structure of cancer cell, carcinogenesis. **Aging** – Cell death and apoptosis.

#### UNIT - V

**Structure and functions of DNA & types of RNA** [mRNA, tRNA, rRNA]. Semi conservative replication, mechanism and enzymology of DNA replication, **Protein synthesis.** 

#### **Course Outcomes:**

 ${f 1}.$  To understand the Principles of microscopes , Cytological techniques and to describe the

Cell theory, Ultra structure of animal cell.

- **2**. To recognize the properties of cytoplasm ,cell cycle , cell division, Ultra structure and functions cell organelles.
- 3. To get knowledge on biochemical and cell culture techniques
- **4.** To understand the structure and function of chromosomes, giant chromosomes, DNA and

types of RNA.

**5**. To describe the mechanism of DNA replication and Protein synthesis.

#### Text Book

- 1. Powar, C.B., 1989. Essentials of Cytology, Himalaya Publishing House, Bombay.
- 2. Verma, P.S., and V.K. Agarwal, 1995. Cell and Molecular Biology, 8th Edition, S. Chand & Co., NewDelhi.

3. Rastogi. S.C. 2008 Cell and Molecular Biology, 2nd Edition, New Age International (p) Ltd., New Delhi.

#### **Supplementary Readings:**

- 1. Cohn, N.S., 1979, Elements of Cytology, Freeman Book co., New Delhi.
- 2. De Robertis, E.D.P. and E.M.F. De Robertis, 1988. Cell and molecular Biology, 8th Edition, International edition Informes Hongkong. 734p.
- 3. Gies, A.C., 1979. Cell Physiology, Saunders co., Philadelphia, London, Toronto.

#### **COURSE MAPPING**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 2   | 3   | 3   | 3   | 2   |
| CO2   | 3   | 2   | 2   | 3   | 2   |
| CO3   | 3   | 2   | 3   | 2   | 2   |
| CO4   | 3   | 3   | 2   | 3   | 2   |
| CO5   | 2   | 2   | 3   | 2   | 2   |

| SEMESTER: III | 22UCHEA35: ALLIED CHEMISTRY-I | CREDIT: 3  |
|---------------|-------------------------------|------------|
| PART: III     |                               | HOURS: 4/W |

- 1) To impart wide knowledge about Metallurgy.
- 2) To invoke the knowledge in basic concepts of chemistry.
- 3) To provide a knowledge on chemical kinetics.
- 4) To Familiarize the students about Industrial Chemistry.
- 5) To inculcate interest in Nuclear chemistry.

#### Unit – I: METALURGY HOURS: 9

Metallurgy – Introduction – Metals – Occurrence of Metals – Minerals and Ores – Difference between Minerals and Ores – Minerals of Iron, Aluminium and Copper – Concentration of Ores – Froth Floatation process, Magnetic separation, Calcination, Roasting, Smelting, Flux.

Reduction of Mineral to Metal – Aluminothermic process – Refining of Metals – Electrolysis, Van Arkel and Zone refining.

#### **UNIT - II: FUNDAMENTAL CONCEPTS**

HOURS: 9

HOURS: 9

Fundamental concepts – Bonding – Nature of bounds – Ionic, Covalent, Coordinate and Hydrogen bonds – Cleavage bonds – Homolytic and Heterolytic Fission – Electrophiles, Nucleophiles and Free Radicals. Types of Organic Reactions – Substitution, Addition Elimination, Rearrangement - Definition & Examples.

Isomerism – Optical Isomerism – Lactic and Tartaric acid – Geometrical Isomerism – Maleic and Fumaric Acid.

#### UNIT – III: CHEMICAL KINETICS AND PHOTOCHEMISTRY HOURS: 9

Chemical Kinetics – Rate of a reaction – Order and Molecularity – Definition & Differences – First Order rate equation – Derivation – Half life period – Catalysis – Catalyst – Autocatalyst – Enzyme Catalyst – Promoters – Catalytic poisons – Homogeneous and Heterogenous Catalysis – Differences – Industrial application of Catalysis.

Photochemistry – Grotthus – Draper law – Stark Einstein's law – Quantum yield – Photosynthesis.

UNIT-IV: FUELS HOURS:9

Fuels – Classification of Fuels – Calorific Value of Fuels – Water gas, Semi water gas, Carburetted Water gas and Producer gas – Composition and Uses

Non-Conventional Fuels-Need Of Solar Energy-Bio Fuels-Oil gas, Natural gas and LPG-Uses

#### UNIT – V: NUCLEAR CHEMISTRY

Nuclear Chemistry-Introduction-Fundamental Particle of Nucleus-Isotopes, Isobars, Isotones and Isomers-Definition and Examples-Nuclear Binding Energy, Mass Defect and N/P ratio-Nuclear Fission and Nuclear Fusion(Elementary Idea)-Applications of Radioisotopes in Medicine, Agriculture and Industries-Carbon dating.

Metallic bond-Band theory-Conductors, Insulators and Semiconductors - types.

#### **COURSE OUTCOMES**

- 1) Acquire thorough Knowledge about Metallurgy and Fundamental concepts in Organic chemistry.
- 2) Acquire an idea about Chemical Kinetics.
- 3) Identify the Importance of Nuclear chemistry and Metallic Bond.
- 4) Acquire Knowledge on Photochemistry
- 5) Extensive Knowledge about Fuels.

#### **TEXTBOOKS: (IN API STYLE)**

- 1) ssP.L. Soni, 2014, Text Book of Inorganic Chemistry, Sultan Chand & Sons, 29th edition, New Delhi.
- 2) P.L.Soni, H.M.Chawla, 2014, Text book Of Organic Chemistry, Sultan Chand & Sons, New Delhi.
- 3) Arun Bahl, B.S.Bahl, 2019, A Text Book Of Organic chemistry, Sultan &Sons, 22<sup>nd</sup> Edition, New Delhi.
- 4) M.K. Jain, S.C.Sharma, 2012, Modern Organic Chemistry, Vishal Publishing Company, 4th Edition, New Delhi.

#### Supplementary Readings

- 5) B.R. Puri, L.R.Sharma, K.C.Kailia, 2016, Principles of Inorganic Chemistry, Vishal Publishing Company, 33rd Edition, New Delhi.
- 6) Samuel Glasstone, David Lewis, 1963, Elements Of Physical chemistry, Palgrave Macmillan, New Delhi.

#### **Outcome Mapping**

|     | <u> </u> |     |     |     |     |
|-----|----------|-----|-----|-----|-----|
|     | PO1      | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2        | 3   | 2   | 3   | 3   |
| CO2 | 2        | 3   | 3   | 3   | 3   |
| CO3 | 3        | 2   | 3   | 3   | 2   |
| CO4 | 3        | 3   | 2   | 2   | 3   |
| CO5 | 3        | 3   | 3   | 3   | 2   |

(1-Low, 2-Moderate, 3-High)

| SEMESTER : III | 22UZOOE36-1: PUBLIC HEALTH AND HYGINE | CREDITS:3 |
|----------------|---------------------------------------|-----------|
| PART:III       |                                       | HOURS:3/W |

#### **Learning Objectives**

- 1. To impart awareness on public health, Hygiene and diseases.
- 2. To educate and emphasize on preventive measures of diseases.
- 3. To create knowledge on Health Education.
- 4. To explain why having good personal hygiene is important.
- 5. To list and discuss how to have good personal hygiene.

#### UNIT - I

**Scope of Public Health and Hygiene** - Nutrition and Health - classification of foods - Nutritional deficiencies - Vitamin deficiencies.

#### UNIT - II

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

#### UNIT - III

**Communicable diseases** Measles, Polio, Chikungunya, Rabies, Plauge, Leprosy and AIDS- their control measures.

**UNIT - IV Non-Communicable diseases** Hypertension, Coronary Heart diseases, Stroke, Diabetes, Obesity and Mental ill-health and their preventive measures Alcoholism and drug dependence

#### UNIT - V

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

#### **Course Out Comes**

- 1. To be able to understand Scope of Public Health and Hygiene Nutrition and health classification of foods.
- 2. **To** be able to understand Environment and Health Hazards
- 3. To be able to understand Communicable diseases and their control measures
- 4. To acquire the knowledge about Non communicable diseases and their preventive
- 5. The student will acquire the knowledge about Health Education and Health programmes in India and WHO programmes.

#### **Text Books**

- **1.** Park and Park, 1995: Text book of preventive and social medicine Banarsidas Bhanot ubl. jodhpur- India.
- 2. Verma, S. 1998: Medical zoology, Rastogi Publ.- Meerut- India
- 3. Singh, H.s. and Rastogi, P. 2009: Parasitology, Rastogi Publ. India.

#### Supplementary Readings:

- **1.** Dubey, R.C and Maheswari, D.K. 2007: Text Book of Microbiology S. Chand & co. Publ. New Delhi- India.
- **2.**Park and Park, 1995: Text book of preventive and social medicine Banarsidas Bhanot Publ. jodhpur- India.

3.Lopez AD, et al. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. Lancet. 2006;367:1747–1757. [PubMed]

#### **Outcome Mapping**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 2   | 3   | 3   | 3   | 2   |
| CO2   | 3   | 2   | 2   | 3   | 2   |
| CO3   | 3   | 2   | 3   | 2   | 2   |
| CO4   | 3   | 3   | 2   | 3   | 2   |
| CO5   | 2   | 2   | 3   | 2   | 2   |

| SEMESTER: III | COURSE CODE:22UZOOE36-2: | CREDIT: 3  |  |
|---------------|--------------------------|------------|--|
| PART: III     | APPLIED MICROBIOLOGY     | HOURS: 3/W |  |

#### **Course Objectives**

- 1. The course is intended to make an awareness of the students about the classification, diversity, organization and signification.
- 2. Application and pathogenicity of the microorganisms existing the ecosystem.
- 3. The course will help the students to learn about the various microbial culture techniques and its handling.
- 4. 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.
- 5. To provide students with the latest information in scientific microbiological methods.

#### Unit I: Introductory Microbiology

History and Scope of microbiology - Classification of microbes - Structure of a bacteria - respiration and reproduction - economic importance of bacteria. Classification of viruses - physical and chemical structures of viruses, General structure of fungi.

#### Unit II: Microscopy and staining

Microscopy - Simple, Compound, Dark field, Phase contrast, Fluorescence and Electron microscopy; Staining methods and principles - Simple, Differential (Grams staining) and Special staining techniques (Acid fast staining, Spore staining, Capsule staining, Flagellar staining, Negative staining).

#### Unit III: Concept of sterilization

Control of microbial growth by Sterilization and Disinfection – Definitions, methods; Physical, Chemical methods – Antiseptics; Antimicrobial agents – Antibacterial, antifungal and antiviral agents with examples – Resistance mechanisms. Types of Culture medium – Culture of Bacteria – Bacterial growth and growth curve.

#### Unit IV: 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 V: Aquatic Microbiology

Microbes in fresh and marine environment, Eutrophication – water zonation – test for potablity of water – microbial quality testing of water – water born disease and preventive measures. Water treatment – characteristic of solid and liquid waste – measurement of BOD & COD – primary, secondary and tertiary treatment.

#### **Course Outcomes:**

At the end of the course, the student will be able to

- 1. Understand the scope and relevance of Microbiology as a scientific discipline.
- 2. Decide on the correct type of microscopy and staining.
- 3. Gain knowledge on the various classifications of microorganisms.
- 4. Study the morphology and structure of microorganism.
- 5. Get acquainted with various sterilization techniques.

#### **Text Books:**

- **1.** Lansing M,Prescott, John. P.Harvey, Donold A, Klain. Microbiology second edition –WM.C. BrownPublications
- **2.** R.C. Dubey, D.U. Maheshwari 2005. A Text book of Microbiology., S.Chand and company Ltd, NewDelhi

#### Reference books:

- 1. Burden, K.L. and R.P. Williams (6th Ed.) 1968. Microbiology. The Macmillan Co., London P.818.
- 2. Dawes, E.A. (Ed.) 1986. Energy conservation in bacterial photosynthesis. In: Microbial energetics. Blackie & Son Ltd., Glasgon, 133-144pp.
- 3. Doelle, H.W. (Ed.) 1969. Fermentation acetic acid bacteria and lactic acid bacteria. In: Bacterial metabolism. Academic Press. New York, London. 256 351pp.
- **4.** Gevaral .J, Tortora, Berdell R. Funne Christine L. Cara, 1994. Microbiology an Introduction- fifthedition,
- 5. Hay, J.M. (Ed.) 1986.Modern Food Microbiology. CBS publishers, Delhi. 622pp.
- 6. Kumarasamy, P, A. Maharajan and V. Ganapiriya. 2012. Microbiology. HariKrish Publication, Nagercoil.
- 7. Reed, G. (4th Ed.) 1983. Prescott & Dunn's Industrial Microbiology. AVI Publishing Co., Inc. Connecticut, 883.pp.
- **8.** Roberts, T.A. and F.A. Skinner (Eds.) 1983.Food Microbiology: Advances and Prospects, Academic Press, Inc. London, 393pp.
- 9. Selle, A.J. (Ed.) 1967. Fundamental Principles of Bacteriology. Tata McGraw-HillPublishingCompanyLtd., NewDelhi, 822pp.

#### OutcomeMapping:

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 2   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |

| SEMESTER:III | 22UZOOE36-3: ANIMAL BEHAVIOUR | CREDIT: 3  |
|--------------|-------------------------------|------------|
| PART:III     |                               | HOURS: 3/W |

#### **Learning Objectives**

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

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

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

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

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

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

#### **Course Outcomes**

- 1. Student should be capable of understanding and identify behaviour in a variety of taxa.
- 2. Competently discuss the evolutionary origins of various behaviours.
- 3. Designing and implementing experiment to test hypothesis relating to animal behaviour
- 4. To demonstrate knowledge of key concepts in animal behaviour.
- 5. To exhibit quantitative research skills

#### Text Books (In API Style)

- 1. Animal behavior an evolutionary approach by JOHN ALCOCK Ninth edition.
- 2. Animal behaviour (ETHOLOGY) V.K. Agarwal S. Chand publishers.
- 3. Animal behaviour a very short introduction wyatt Tristram D oxford publishers.

# **Supplementary Readings**

- 1. Lecture 1 Notes: Introduction: class requirements, various approaches to animal behavior and its study (PDF)
- 2. Lecture 2 Notes: Introduction to ethology; three-spined stickleback fish (PDF)

| PO/CO | PO1 | PO2 | РО3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 2   | 3   | 2   | 2   |
| CO3   | 3   | 3   | 2   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 3   | 2   | 3   | 2   |

| SEMESTER:III | 22UZOON37: ECONOMIC ZOOLOGY | CREDIT: 2  |
|--------------|-----------------------------|------------|
| PART: IV     |                             | HOURS: 2/W |
| NME          |                             |            |

# **Learning Objectives**

- 1. To encourage young learners to take up the small scale industries
- 2. To generate motivation for self-employment
- 3. To disseminate information on economic aspects of zoology
- 4. To inculcate knowledge on useful animals to mankind
- 5. To satisfy the learners with modern techniques of animal culture

#### Unit I:

A) Vermiculture and Composting Economic Entomology: Useful Insects of commercial values, B) A piculture - Species of Honeybees - Honey extraction - Economics of Apiculture and management. C) Sericulture - Nature and economic importance of Sericulture in India

#### Unit II:

Economics of aquaculture- A] Pisciculture - Techniques of induced breeding Commercial culture of catla& cat fish By-Products of Fishing and its commercial values.

B] Prawn culture -Culture techniques of fresh water (Macrobrachiumrosembergii) & Marine water (Penaeus monodon) preservation - processing and export techniques adopted in Prawn fishiery. C] Pearl culture: Formation and nature of Pearls - Commercial importance of Pearl Culture in India.

#### Unit III:

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

#### **Unit IV:**

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

B]: Sheep farming: Indigenous and Exotic breeds of Sheep.

#### Unit V:

Future strategies for Livestock Development - Transgenic Animal Technology - Genetic Improvement for best breeds - Economic importance of Dairy, Leather, Wool, Fur and Pharmaceutical Industries in India.

# Course Outcomes at the end of the course

- students can able to understanding the role of worm farming in modern farming, potential of vermicompost, maintaining health of the soil, economic importance of vermiculture and role of vermiculture in protecting the environment.
- they could able to understand techniques of induced breeding, commercial culture of catla& cat fish

- they could understand about area of poultry production including nutrition, health welfare and product quality
- thay can get basic input to students about production, planning and management of diary farms milch breeds. draught breeds, dual purpose breeds and new cross breeds of cows and buffaloes in india.
- the students could able to learn the future strategies for livestock development

# Text Books (In API Style)

- 1. Sukla, g.s. And upadhyay, v.b., 2000 economic zoology isbn 81-7133-137-8 Rastogi publications, meerut, india
- 2. Jawaid ahsan and subhas prasad sinha, 2000 a handbook on economic zoology-isbn-81-219-0876-o s. Chand & co., ltd., new delhi.
- 3. Banerjee, g.c. 1992 poultry iii- edition isbn-81-204-008-4 oxford & ibh publishing co. Pvt. Ltd., new delhi.

# **Supplementary Readings**

- 1. Major hall, c.b. 2005 ponds and fish culture isbn-81-7754-146-3 agrobios (india), jodhpur india.
- 2. Ismail, s.a. 1997. Vermicology the biology of earth worm orient longman, india
- 3. Banerjee, 1988 a text book of animal husbandry-viii-edition-isbn-81-204-1260-5 Oxford & ibh publishing co. Pvt. Ltd., new delhi.

| СО/РО | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 3   |
| CO2   | 3   | 3   | 3   | 3   | 3   |
| CO3   | 3   | 3   | 3   | 3   | 3   |
| CO4   | 3   | 3   | 3   | 3   | 3   |
| CO5   | 3   | 3   | 3   | 3   | 3   |

| SEMESTER:III | 22UZOOS38: VERMICULTURE | CREDIT: 2  |
|--------------|-------------------------|------------|
| PART: IV     |                         | HOURS: 2/W |
| SKILL BASED  |                         |            |

#### **Learning Objectives**

- 1. To acquire knowledge about biofertilizer
- 2. To impart training on Earthworm culture technology
- 3. To create knowledge on Self Employment opportunity
- 4. To understand the potential of vermicompost as an alternative to chemical fertilizer
- 5. To understand the role of vermiculture in protecting the environment and managing the waste

**Unit I :** Eathworm types - Morphological and Anatomical characteristics. Biology of *Lampito maruitti* 

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

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

**Unit IV:** Vermicomposting: General procedure in Homes. Maintenance of vermicomposting beds. Harvesting the worms. Earthworm Predators, parasites and pathogens

**Unit V:** Nutrients availability - Application of Vermicomposting in Agriculture and Horticultural practices. Advantages of Vermicompost and marketing

#### **Course Outcomes**

- 1. Learn about the characteristics and biology of earthworm
- 2. Get an in depth knowledge about the culture techniques
- 3. Understand about the methods of composting
- 4. Learn the factors for proper maintenance of the vermicomposting beds
- 5. Learn about the application and marketing of the compost.

# Text Books (In API Style)

- 1. Edwards, C.A., and Bother, B. 1996: Biology of Earthworms Chapman Hall Publ. Co., London
- 2. Ismail, S.A. 1997: Vermitechnology the Biology of Earthworms Orient Longman Publ. India.
- 3. Ranganathan, L.S. 2006: Vermibiotechnology from soil health to Human health Agrobios India.

#### **Supplementary Readings**

- 1. Talashikar, S.C. 2008: Earthworms in Agriculture Agrobios India
- 2. Gupta, P.K. 2008: Vermicomposting for sustainable agriculture [2nd edition] Agrobios India.
- 3. Rajeev Prathap Singh. 2012: Organic Fertilizers: Types, Production and Environmental Impact Nova Science Inc. New York

| PO/CO | PO1 | PO2 | РО3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 2   | 3   | 3   | 1   |

| SEMESTER:IV | 22UZOOC43: GENETICS | CREDIT:4   |
|-------------|---------------------|------------|
| PART: III   |                     | HOURS: 5/W |

# **Course Objectives**

- 1. To enable the students understand the basic principles of inheritance.
- 2. To learn polygenic inheritance, linkage and crossing over.
- 3. To understand genetics of Sex determination and sex linked inheritance.
- 4. To acquire knowledge of the gene structure and mutation.
- 5. To understand the human genetic characters and disorders.

#### Unit I: Mendelism, Interaction of Genes

**Mendelism:** Mendel's Laws of inheritance - Monohybrid - Dihybrid cross - Back Cross - Test Cross.

**Interaction of genes:Non- allelic gene interactions** - Dominant epistasis - Colouring pattern of plumage in domestic fowls, Complementary genes - Inheritance of flower colour in sweet pea.

**Allelic geneinteractions** - Incomplete dominance - Inheritance of flower colour in 4 O' clock plant, Codominance - Coat colour in short horn cattle; Pleotrophism; Penetrance and Expressivity, Lethality.

# Unit II: Multiple Alleles, Polygene, Linkage and Crossing Over

Multiple Alleles: ABO Blood Group in man- Rh factor.

Polygenic inheritance: Skin Colour in man.

**Linkage & Crossing over:** Principle, types and mechanism with *Drosophila* as example. **Mapping of Chromosomes:** Principles and methods - Construction of chromosome map in *Drosophila* - Three Point Test cross experiment.

# Unit III: Sex Determination, Sex -linked and Cytoplasmic inheritance

**Sex determination:** Chromosomal theory of Sex Determination in man and butterfly, genic balance, environmental and hormonal basis of sex determination.

**Sex - Linked inheritance:** X-linked - Colour blindness, Y-linked - Harry pinna in man. **Sex influenced and Sex limited inheritance:** sex influenced genes - Baldness in man; Sex limited genes - Sickle feathers in chicken.

**Cytoplasmic inheritance:** Shell coiling pattern in snail.

# Unit IV: Gene structure, mutation, Population genetics

Fine Structure of Gene: Cistron – Recon – Muton.

Gene expression and regulation: Operon model- Lac operon.

**Mutation:** Mutagens – physical, chemical; point mutation –chromosomal aberrations – structural – numerical.

**Population genetics:** Hardy-Weinberg Law, Factors affecting Hardy-Weinberg equilibrium;

Inbreeding, Outbreeding and Heterosis.

# Unit V: Human Genetics and Genetic counseling

**Human genetics:** Human chromosome - Karyotype, Idiogram; Pedigree analysis. **Chromosomal syndromes in man:** Down's, Turner's and Klinefelter's syndromes. **Inborn errors of metabolism:** Phenylketonuria, Alkaptonuria and Albinism. **Genetic Counseling:** Eugenics- positive and negative, Euthenics and Euphenics.

#### xxCourse Outcomes:

At the end of the course, the student will be able to

- 1. Explain the key concepts in genes and its expression and Interpret phenotypic expressions based on genotype.
- 2. The Basis of genetic variation and heritability.
- 3. Interpret genetics of sex determination and inheritance.
- 4. Understand the gene structure, expression and regulation and understand the alterations of chromosome number arise during mitosis and meiosis.
- 5. Evaluating the principles to describe genetic profiles of populations and understands the importance of Genetic Counseling.

#### **Text Books**

- 1. Veer Bala Rastogi. (2019). *A Text book of Cell Biology and Genetics*. Kedar Nath Ram Nath Publication, Meerut. U.P.
- 2. Snustad, D.P. and M. J. Simmons. (2017). *Principles of Genetics*. John Wiley & Sons Inc., India.
- 3. Verma, P.S. and V.K. Agarwal, (2010). Genetics. S. Chand and Co., New Delhi.
- 4. Gupta P.K. (2009). Genetics. Rastogi Publication Ltd., New Delhi
- 5. Dipak Kumar, K. and Soma Halder. (2009). *Cell Biology, Genetics & Molecular Biology*. New Central Book Agency (P) Ltd. Kolkata.

#### **Reference Books**

- 1. Robert Tamarin. (2017). Principles of Genetics. McGraw Hill, USA.
- 2. James, D. Watson, A. Baker Tania and P. Bell Stephen. (2017). *Molecular Biology of the Gene*. Pearson Education, New Delhi.
- 3. Gangane, S.D. (2017). Human Genetics. Elsevier India.
- 4. William S. Klug, Michael R. Cummings and Chariotte A. Spencer. (2016). Genetics. Pearson Education, New Delhi.
- 5. Gardener, E.J. and M.J. Simmons. (2009). Principles of Genetics. John Wiley & Sons. Inc. New York.

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 2   | 3   | 3   | 1   |

| SEMESTER:IV | 22UZOOP44: PRACTICAL – II (Cell and | CREDIT:4  |
|-------------|-------------------------------------|-----------|
| PART:III    | Molecular Biology & Genetics)       | HOURS:3/W |

# **Course Objectives**

- 1. To impart training on the principles of microscope and their importance in cell study.
- 2. To train the students to prepare the smear and squash of blood and other cells to observe different types of cell structure.
- 3. To impart training on the principles of genetics, the role of genes and their inheritance.
- 4. To emphasize the knowledge about certain phenotypic characters and geneic interactions.
- 5. To inculcate good laboratory practices in students and to train them about to basic patters of inheritance in organisms, emphasize the human genetic characters and disorders and understand the pedigree charts of various characters.

#### **CELL BIOLOGY**

#### **Unit I: Cytometry**

Light and Compound microscope - principles and functions, camera Lucida, Stage and Ocular Micrometers - Determine the nucleo cytoplasmic ratio any cell.

#### Unit II: Smear & Squash Preparation

Identification of drumstick chromosome from human blood smear preparation.

Identification of Barr body from human buccal epithelial smear preparation.

Squash preparation of Onion root tip for identification of different stages of Mitosis.

Squash preparation of Grass hopper testes/ Onion flower bud for identification of different stages of Meiosis.

Squash preparation of Salivary glands of chironomous larva to observe polytene chromosome.

# **Spotters**

Observation of Eukaryotic cell types –Columnar Epithelial cell, Buccal Epithelial cell, Liver, Pancreas and muscle using permanent slides; Observation of meiotic cell division stages using permanent slides; Model of DNA chemical composition, DNA double helical structure, DNA replication, RNA structure.

#### **GENETICS**

#### Unit III: Mendelian's Principle

Monohybrid cross, Test cross and Back cross; Dihybrid cross, Test the hypothesis of law of independent assortment by Chi-square test – Using models (Peas/Beads).

**Unit IV: Gene interaction and Polygene, Multiple allele** - Using models (Peas/Beads) Gene interaction - Non-allelic gene interactions- Complementary genes (9:7), Dominant epistasis (13:3)

Allelic gene interactions - incomplete dominance and Co-dominance

Polygenic / Quantitative genetics – Human height

Multiple alleles - Blood grouping in Man.

#### Unit V: Autotomal and sex linked inheritance and mutation

Study of finger prints and their patterns of inheritance in man

Calculation of gene frequency and genotype frequency for autosomal, Sex linked and sex influenced human traits

Culture of Drosophila and identification of sex and mutants.

#### Spotters

Human karyotype - Male and female, Turner's syndrome, Klinefelter's syndrome, Down's syndrome; Pedigrees charts - Autosomal dominant gene inheritance -

Polydactyly in Man, Autosomal recessive gene inheritance – Sickle cell anemia in man, X - linked Dominant gene inheritance - Ricket in man, X - linked recessive gene inheritance - Colour blindness in man, Y-linked gene inheritance - Hairy pinna in man, Mitochondrial gene inheritance - Leigh syndrome; Cytoplasmic inheritance - Identification of shell coiling pattern in Snail.

#### **Course Outcomes**

At the end of the course, the student will be able to

- 1. Students will learn the practical knowledge about principle and working procedure of microscope.
- 2. Identify various stages of cell divisions and giant chromosome structure.
- 3. Students will learn the practical knowledge about certain phenotypic characters.
- 4. Understand the mechanism of Inheritance of genes in organisms.
- 5. Identify the genetic disorders in man and gain the knowledge to construction of pedigree for the genetic characters.

#### **Text Books**

- 1. Veer Bala Rastogi. (2019). A Text book of Cell Biology and Genetics. Kedar Nath Ram Nath Publication, Meerut. U.P.
- 2. Verma, P.S. and Agarwal, V.K. (2013). *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology.* S. Chand & Company Ltd, New Delhi.
- 3. Powar, C.B., (2012). Cell Biology. Himalaya Publishing house, Mumbai.
- 4. Gupta P.K. (2009). Genetics. Rastogi Publication Ltd., New Delhi
- 5. Singh. H.G, Y.S. Chauhan, and R.P. Katiyar. (1988). *A manual of Practical genetics*. Kalyani Publishers. New Delhi, Ludhiana.

#### Reference Books

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 2   |
| CO2   | 3   | 3   | 3   | 3   | 2   |
| CO3   | 3   | 3   | 3   | 3   | 2   |
| CO4   | 3   | 3   | 3   | 3   | 2   |
| CO5   | 3   | 3   | 3   | 3   | 2   |

| SEMESTER: IV | 22UCHEA02: ALLIED CHEMISTRY-II | CREDIT: 3  |
|--------------|--------------------------------|------------|
| PART - III   |                                | HOURS: 3/W |

#### **COURSE OBJECTIVES**

- 1) Make the students familiar with Coordination Chemistry.
- 2) To acquire thorough knowledge about Carbohydrates and proteins.
- 3) Enable the students to acquire knowledge in Electrochemistry.
- 4) To have an idea about paint and varnishes.
- 5) To create about knowledge in medicinal chemistry.

UNIT - I HOURS: 12

### **COORDINATION CHEMISTRY**

Coordination Chemistry-Introduction-Nomenclature of Coordination Compounds-Ligands, Central Metal Ion, Complex Ion, Coordination Number-Definition and Examples-Werner theory of Coordination Compounds-Biological role of Haemoglobin and Chlorophyll.

Industrial Chemistry- Fertilizers and Manures-Bio fertilizers-Organic Manures and their importance-Role of NPK in Plants-Urea, Potassium Nitrate and Superphosphate of Lime-Preparation and uses.

UNIT – II HOURS: 12

#### CARBOHYDRATES AND AMINOACIDS

Carbohydrates-Classification—Glucose-Preparation and Properties of Glucose-Structure of Glucose (Elucidation Not Necessary)-Starch and Cellulose-Occurrence, Properties and uses.

Amino Acids and Proteins-Classification of Amino Acids-Essential and Non Essential Amino Acids-Preparation of Amino Acid-Gabriel Phthalimide Synthesis – Iso electric Point of Amino Acid-Proteins-Classification of Proteins based on Physical Properties and Biological Functions-Primary and Secondary Structure of Proteins (Elementary treatment only).

UNIT – III HOURS: 12

### **ELECTROCHEMISTRY**

Electrochemistry-Specific and Equivalent Conductance-their determination-Variation of Specific and Equivalent Conductance on Dilution-Ostwald's dilution law-Kohlrausch law-Conductivity Measurement-Conductometric Titrations.

pH and Buffer,Importance of pH and Buffers in living systems-Buffer solution and Buffer action-Buffer-Definition-pH determination by Indicator Method.

UNIT – IV HOURS: 12

# **PAINTS AND GLASS**

Paint-Component of paint- Requisites of a Good Paint-Varnishes-Definition-Types and Composition-Safety Matches-Introduction-Contents in Match sticks and Match Box-Industrial making of Safety Matches.

Glass-Composition, Manufacture, types and uses.

UNIT- V HOURS: 12 DRUG CHEMISTRY

Drugs-Sulpha Drugs-Preparation and Uses of Sulpha pyridine and Sulpha diazine-Mode of action of sulpha Drugs-Antibiotics-Uses of Penicillin, Chloramphenicol and Streptomycin-Drug abuse and their Implication.

Chemotherapy-Definition-Analgesics, Antipyretics, Antiseptics, Tranquilizers and Sedatives-Explanation with two Examples-Anaesthetics-Local and General Anaesthetics.

#### **COURSE OUTCOMES**

- 1) Wide Knowledge about Coordination Chemistry.
- 2) Identify the importance of Carbohydrates, Amino acids and Proteins.
- 3) Acquire Knowledge about the action of drugs.
- 4) Able to understand about Paint and Varnishes.
- 5) Able to understand the concepts of pH and Buffers in living systems.

#### **TEXTBOOKS**

- 1) R.Gopalan, 2012, Text book Of Inorganic Chemistry, Universities Press, 1<sup>st</sup> Edition, Hyderabad.
- 2) P.L.Soni, H.M.Chawla, 2014, Text Book Of Organic Chemistry, Sultan Chand and Sons, 29th Edition, New Delhi.
- 3) Arun Bahl, BS.Bahl, 2019, A Text Book Of organic Chemistry, Sultan Chand and Sons, 22<sup>nd</sup> Edition, New Delhi.
- 4) P.C.Jain, M.Jain, 2019, Engineering Chemistry, Dhanpat Rai& sons, 17th Edition, New Delhi.
- 5) Jayashree Ghosh, 2015, A Text Book Of Pharmacuetical Chemistry, Sultan Chand and Sons, New Delhi.

# Supplementary Readings

- 1) R.Gopalan, P.S.Subramanian, K.Rengarajan, 1991, Elements of Analytical Chemistry, Sultan Chand and Sons, 2<sup>nd</sup> Edition, New Delhi.
- 2) B.R.Puri, L.R.Sharma, K.C.Kailia, 2016, Principles Of Inorganic Chemistry, Vishal Publications, 33<sup>rd</sup> Edition, New Delhi.

# **Outcome Mapping**

|     | PO1 | PO2 | PO3 | PO4 | PO5 |
|-----|-----|-----|-----|-----|-----|
| CO1 | 2   | 3   | 2   | 3   | 3   |
| CO2 | 2   | 3   | 3   | 3   | 3   |
| CO3 | 3   | 2   | 3   | 3   | 2   |
| CO4 | 3   | 3   | 2   | 2   | 3   |
| CO5 | 3   | 3   | 3   | 3   | 2   |

(1-Low, 2-Moderate, 3-High)

| SEMESTER: IV | 22UCHEP01: ALLIED CHEMISTRY PRATICALS | CREDIT:3   |
|--------------|---------------------------------------|------------|
| PART: III    |                                       | HOURS: 3/W |

#### **COURSE OBJECTIVES**

- 1) To help the students to develop the skills in Titrimetric Analysis.
- 2) To learn the basic analytical method.
- 3) To know about various indicators and their significance.
- 4) To impart knowledge about primary standard solution.
- 5) To enhance knowledge about stoichiometric relationship for standardization.

# **VOLUMETRIC ANALYSIS**

- 1) A. Acidimetry and alkalimetry
  - 2) Strong Acid Vs Strong Base.
  - 3) Weak Acid Vs Strong Base.
  - 4) Strong Acid Vs Weak base.
  - 5) Determination of hardness of Water.
- 2) B. Permanganometry
  - 3) Estimation of Oxalic acid.
  - 4) Estimation of Ferrous Sulphate.
- 3) C. Iodometry
  - 4) Estimation of Potassium dichromate.
  - 5) Estimation of Potassium Permanganate.

#### **COURSE OUTCOMES**

- 1) Able to understand the techniques of Titrimetric Analysis.
- 2) Acquire knowledge in Analytical skills.
- 3) Analyse the given unknown solution and assess its normality.
- 4) Evaluate the amount of substance from the normality.
- 5) Predict the hardness of water samples using EDTA.

### **TEXTBOOKS**

- 1) V.Venkateswaran, R.Veeraswamy, A.R.Kulandaivelu, 1997, Basic principles of Practical Chemistry, Sultan Chand and Sons, 2<sup>nd</sup> edition, New Del
- 2) Anbusrinivasan.P, 2021 Allied Chemistry Practicals Volumetry and Organic Analysis, Shri Publications, 1<sup>st</sup> Edition, Chidambaram, Tamil Nadu, India.
- 3) A.O.Thomas, 1999, Practical Chemistry, Scientific book Centre,7th Edition, Cannanore, Kerala

#### Supplementary Readings

- 1) Sundaram, Krishnan, Raghavan, 1999, Practical Chemistry (Part III), S.Viswanathan Co. Pvt Ltd, 2<sup>nd</sup> Edition, Kannur.
- 2) B.S.Furniss, A.J.Hannaford, P.W.G.Smith, A.R.Tatchell, 2005, Vogel's Text Book of Practical Chemistry, 5<sup>th</sup> Edition, Pearson Education, New Delhi.

| <u> </u> |     |     |     |     |     |
|----------|-----|-----|-----|-----|-----|
|          | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1      | 2   | 3   | 2   | 3   | 3   |
| CO2      | 2   | 3   | 3   | 3   | 3   |
| CO3      | 3   | 2   | 3   | 3   | 2   |
| CO4      | 3   | 3   | 2   | 2   | 3   |
| CO5      | 3   | 3   | 3   | 3   | 2   |

(1-Low, 2-Moderate, 3-High)

| SEMESTER:IV | 22UZOON47: ORNAMENTAL FISH CULTURE | CREDIT: 2  |
|-------------|------------------------------------|------------|
| PART: IV    |                                    | HOURS: 2/W |
| NME         |                                    |            |

#### **Learning Objectives**

- 1. To inculcate importance of ornamental fish farming in relation with entrepreneurship development
- 2. To give students knowledge about various techniques of ornamental fish breeding, rearing and its marketing to make them self sustainable after graduation
- 3. To teach techniques of construction of glass aquarium and its maintenance.
- 4. To teach students about fish food production and health related problems with ornamental fish.
- 5. To encourage and promote the science of keeping an aquarium

#### Unit I:

Basics of aquaculture- Definition and Scope. History o/aquaculture - Present global and national scenario- World trade of Ornamental fish and export potential - Different varieties of exotic and indigenous fishes.

#### Unit II:

Introduction to Ornamental fishes - Ornamental fishes of the world —A brief introduction - Indigenous Indian ornamental Fishes - Breeding of ornamental fish with reference to live bearer species - Breeding of Guppies, Mollies; Sword-tail fish and Platy fish -Hatchery management system and Nursery management of live bearers - Rearing or live bearers

#### Unit III:

Fish Breeding and rearing in Egg layers - Breeding of ornamental fish with reference to selected egg layer species - Breeding of Angel fish, Zebra fish and Neon tetras - Hatchery management system and Nursery management of Egg layers Rearing of egg layers

#### **Unit IV:**

Disease management of ornamental fishes (Symptoms, life cycle, and control measures) i. protozon disease ii. Bacterial disease iii. Crustacian disease iv. Fungal disease and v. Helminth disease.

### Unit V:

Setting up and maintenance of an Aquarium -Introduction to some selected Aquarium plants and its propagation techniques - Management of ornamental aquatic plants and its trading - Benefits of an Aquarium

#### **Course Outcomes**

- 1. Fundamental information on ornamental fish industry
- 2. Familiarity on diversity of ornamental fish and other species
- 3. Comprehensive awareness on accessories used in aquarium industry
- 4. proficiency in culture and breeding of fresh and marine ornamental varieties
- 5. Set up and maintain fresh and marine aquariums as hobby and commercial level

#### Text Books (In API Style)

- 1. Ahilan. B, felix. N. & santhanam. R., 2008. Text book of aquariculture. Daya publishing house, new delhi. 157 pp.
- 2. Biju kumar, a. &alappat, h.j., 1996. A complete guide to aquarium keeping. Books for all, delhi, 80 pp.
- 3. Alappat, h.j. & a. Biju kumar 1996. Aquarium fishes (a colourful profile). B.r. Publ., delhi, 106 pp.

# **Supplementary Readings**

- 1. Dholakia, A.D., 2009. Ornamental fish culture & aquarium management. Daya publishing house, delhi, 313 pp.
- 2. Goldstein, RJ., 2012. Betas: a complete pet owners manual (2nd ed). Barron's educational series inc.usa. 112 pp.
- 3. Kurup, M.B., 2008. Ornamental fish farming, breeding and trade. Dept. Fish., govt. Kerala, 280 pp

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 3   |
| CO2   | 3   | 3   | 3   | 3   | 3   |
| CO3   | 3   | 3   | 3   | 3   | 3   |
| CO4   | 3   | 3   | 3   | 3   | 3   |
| CO5   | 3   | 3   | 3   | 3   | 3   |

| SEMESTER: IV | 22UZOOS48: APICULTURE | CREDIT: 2  |
|--------------|-----------------------|------------|
| PART: IV     |                       | HOURS: 2/W |
| SBS          |                       |            |

#### **Course Objectives**

- 1. To acquire knowledge of different species of honey bees and their biology.
- 2. To understand the social organization and behavoiur of bees.
- 3. To gain the knowledge of tools required in Bee Keeping and hive maintenance.
- 4. To obtain the knowledge to protect the bee hives from enemies and diseases.
- 5. To acquire Knowledge of harvesting bee products from the combs and work out business plan and economics of apiculture.

# Unit I : Basics of Beekeeping

**History of bee keeping**: History of beekeeping in India; scope and advantages of beekeeping.

**Honey bee species and identification:** Systematics and distribution; Species of honey bees and their identification characters - *Apis dorsata*, *A. florea* and *A. cerana indica*, *A. mellifera*.

**Biology and life history of honeybees:** Egg, larva, pupa and adult - characteristics.

# Unit II: Organization and Behaviour

**Social organization of honeybees:** Social organization of bees; Structural and functional differences – Queen bee – Drone bee – Worker bee.

**Behaviour of honeybees:**Bee dances – types (round and Wag tail) and purposes; nuptial flight and purposes. Role of pheromones in social life.

# Unit III: Basic requirements & Management

**Bee keeping Equipments**: Newton's bee hive, smoker, bee veil, knife, honey extractor, queen excluder, queen gate, comb foundation, feeder.

**Bee Pasturage**: Definition - importance in apiculture.

**Selection of Apiary & Bee Species:** Selection and preparation of Apiary; Selection and Acquiring bees.

**Management of bee hive:** Seasonal management – summer and winter, management during dearth and flow seasons; **artificial feeding-** sugar solution, bee bread preparations; Swarming and colony multiplication.

# Unit IV: Enemies & Diseases

**Natural Enemies:** Wax-moth, wasp, ants, reptiles and amphibians, birds-their control measures.

**Diseases:** Brood diseases - Bacterial (American Foul brood), Virus (Sac brood), Fungal (Chalk brood) - their control measures.

# **Unit V: Bee Products & Economics**

**Bee products**: Honey, bee wax, propolis, royal jelly, bee venom, pollen – methods of collection, processing and uses.

**National Institute and their role:** Central Bee Research and Training institute, National Bee Board.

Economics of apiculture.

#### **Course Outcomes:**

At the end of this course, the students will be able to

- 1. Appreciate the importance of beekeeping and understand the basic biology of honey bees.
- 2. Understand the social life of honey bee and importance of behavior.
- 3. Select suitable area and species of bees for Bee keeping and maintain the Bee hives in a scientific way.
- 4. Maintain the Bee hives in a healthy condition.
- 5. Understand the methodologies of in extracting, preservation of bee products and establish bee keeping unit and run it profitably.

#### **Text Books**

- **1.** ayashree, K.V., C.S. Tharadevi and N. Arumugam. (2018). *Apiculture*. Saras publications, Nagarkoil, India.
- **2.** Tamilselvi, M. and Abdul Ali. (2018). *A text book for Apiculture*. Vijay Nicole publications, Chennai, India.
- **3.** Abrol, D.P. (2013). *Beekeeping: AComprehensive guide to bee and beekeeping.* Scientific Publishers, India.
- **4.** T.V. Sathe (2006). Fundamentals of Beekeeping. Daya publish's house. Delhi.
- 5. Phillips, E.F. (2001). Beekeeping. Agrobios Publication, Jodhpur, India.

#### Reference Books

- **1.** Mahindru. S.N. (2014). *Beekeeping*. APH. Publishing Corporation, New Delhi, India.
- 2. Stuart. F.S. (2010). Beekeeping practice, Axis Books, India.
- **3.** Wheeler, W.M. (2006). *Social Insects their origin and evolution.* Discovery publishing house, New Delhi.
- **4.** George. A, Carter, (2004). *Beekeepinng*. A guide to the better understanding of Bees, their disease and the chemistry of Beekeeping. Biotech Books. Delhi.
- **5.** Mishra, R. C. and R. Garg. (2002). *Perspectives in Indian Apiculture*. Agrobios Publication, India.

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 3   | 3   | 3   | 1   |

| SEMESTER: V | COURSE CODE:22UZOOC51 COURSE TITLE:DEVELOPMENTAL BIOLOGY | CREDITS:4 |
|-------------|--|-----------|
| PART:III    |  | HOURS:4/W |

#### **Learning Objectives:**

- 1. To make aware of the students about the theories, concepts and basics of Developmental Biology.
- 2. To provide students the idea of sex cells, fertilization, cleavage, differentiation and development of organs.
- 3. To make aware of the students about organogenesis.
- 4. To acquire knowledge about Organizer concept, Nuclear transplantation, Regeneration types and Methods to culture embryo.
- 5. To provide knowledge about Placentation and Techniques.

#### Unit:1 GAMETES AND FERTILIZATION

Basic concepts of developmental biology – theories - Structure human Spermatozoa

- Structure of mammalian egg Egg membranes Patterns of egg Spermatogenesis
- Oogenesis. Fertilization mechanism and significance Parthenogenesis.

Introduction- Fundamentals-Need for Artificial Intelligence.

# **Unit:2 BLASTULATION AND GASTRULATION**

Cleavage - Planes and Patterns of cleavage - Factors controlling cleavage - Fate map. Blastulation - Morphogenetic movements - gastrulation Frog and Chick.

# **Unit:3 ORGANOGENESIS**

Development of Brain, Eye and Heart in frog. Development of Nervous system in chick and Foetal membranes in Chick and Mammals.

# **Unit:4 APPLIED EMBRYOLOGY**

Organizer concept –Structure – mechanism of induction and competence. Nuclear transplantation - teratogenesis – Regeneration: types - events and factors. Transgenic mice - Retroviral method – Microinjection method - Embryonic stem cell method. Methods to culture embryo.

# **Unit:5 PLACENTATION AND TECHNIQUES**

Placentation in Mammals –Ostrous - Menstrual cycle and menopause - Pregnancy – trimesters – development. Erythroblastosisfoetalis -Twins – types. Infertility – causes - Test tube baby and Assisted Reproductive Technology – Embryo transfer – Amniocentesis.

#### **Course Outcomes:**

- 1) Understand the concepts of basic developmental biology.
- 2 )Able to know about pattern, plans and morphogenetic techniques of developing egg.
- 3) Gain knowledge about the development of organs in different animals.
- 4) Know and apply the techniques involved in embryology field.
- 5) Familiar with reproductive technology and embryo transfer technology.

#### **Text Books**

- 1 Arumugam N. (2014). A Text Book of Embryology. 15th edition, Saras publication, Nagercoil, Tamilnadu.
- 2 Verma PS and Agarwal VK. (2010). Chordate<br/>Embryology. S Chand and Company Ltd, New

Delhi.

- 3. Developmental Biology (English, Paperback, Dr. K.V. Sastry, Dr. Vineeta Shukla) **Supplementary Readings:**
- 1 .Balinsky BI and Fabian BC. (2012).AnIntroductiontoEmbryology, 5th edition, CBS
  - College Publishers, Cengage Learning India Pvt. Ltd. New Delhi. .
- 2. Madhavan KS. (2017). Developmental Biology, Arjun publishing house, India. 3 Rastogi.
- (2014).ChordateEmbryology, Kedar Nath Ram Nath, Meerut. 4 Sastry KV and Shukla V.
  - Developmental Biology, 2 nd edition, Rastogi publication, Meerut.
- 3. Abu-Shaar M , Mann R S . Generation of multiple antagonistic domains along the proximo distal axis during  ${\it Drosophila}$  leg
- development. Development. 1998;125:3821-

3830. [PubMed]

# **OUTCOME MAPPING**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 2   | 3   | 3   | 3   | 2   |
| CO2   | 3   | 2   | 2   | 3   | 2   |
| CO3   | 3   | 2   | 3   | 2   | 2   |
| CO4   | 3   | 3   | 2   | 3   | 2   |
| CO5   | 2   | 2   | 3   | 2   | 2   |

| SEMESTER:V | 22UZOOC52 - ANIMAL PHYSIOLOGY | CREDIT4   |
|------------|-------------------------------|-----------|
| PART:III   |                               | Hours:4/W |

# **Course Objectives:**

- 1. To emphasize the basic needs of macromolecules of food and their importance
- 2. To study the basic principles of animal Physiology.
- 3. To understand the physiology of various organs and organ systems,

# UNIT-1 Nutrition and Digestion.

Introduction - Food requirements - Carbohydrates, proteins, fats, minerals, and vitamins. Digestive enzymes and their role in digestion - absorption and assimilation. Metabolism - Pathways with reference to carbohydrates.

#### **UNIT-II Respiration and Circulation**

Introdution - Type of respiration- respiratory organ - Respiratory Pigments and functions. Transport of gases [Co2 and 021 Respiratory quotient. Circulation Types, Composition and Function of Blood – Human Cardiac Cycle- Cardiac Rhythm – Origin of heart Beat – Regulation of heart Beat – ECG - Blood Pressure – coronary circulation.

# UNIT-III Excretion and Osmoionoregulation

Introdution - kinds of excretory products -Kidney- structure and Mechanism of urine formation in mammals, hormonal regulation of excretion.

Osmoionoregulation in Crustaceans, fishes and mammals. Mechanism of osmoregulation.

#### **UNIT-IV Neuromuscular Co-ordination**

Nervous tissue-Neuron-Structure, types of neurons. Nerve impulse-Synapse – Synaptic Transmission of impulses – Neurotransmitters. Muscles - Types of muscles – Chemical composition of muscles - Theories of contraction – Physico - chemical changes during muscular contraction.

#### **UNIT-V Receptors and Endocrine system**

Receptors - Chemoreceptor - Photoreceptor- mammalian eye -structure of retina visual pigments - phonoreceptors mammalian ear - Organ of Corti. Endocrine glands-structure, secretions and functions of endocrine glands of vertebrates Pituitary,, Thyroid, Parathyroid, Adrenal, Thymus, Islets of langherhans, Sex organs.

#### **Course Outcomes**

- 1. To describe the process of nutrition and digestion
- 2. To understand the process of respiration and circulation.
- 3. To recognize excretory system and osmo ionoregulation in fishes and mammals
- 4. To evaluate the nervous system and muscular system
- 5. To acknowledge about receptors and structure, secretions and functions of endocrine glands.

#### Text Books (In API Style)

- 1. Verma, P.S,Tyagi B.S.and Agarwal V.K.2000. Animal Physiology. S.Chand Publication
- 2. Sambasivaiah, Kamalakara rao and Augustine chellappa 1990. A Text

- book of Animal physiology and ecology. S. Chand & co., Ltd., New Delhi-110055.
- 3. Prosser, CL Brown, 1985, Comparative Animal Physiology, Satish Book Enterprise, Agra 282003

# **Supplementary Readings**

- 1. Parameswaran, Anantakrishnan and Ananta Subramanyam, 1975. Outlines of Animal Physiology, S. Viswanathan [ printers & Publishers | Pvt. Ltd.
- 2. William S. Hoar, 1976. General and comparative physiology, prentice Hall of India Pvt. Ltd., New Delhi. 110 001.
- 3. Wood D.W, 1983, Principles of Animal Physiology 3rd Ed..

| . mapping |     |     |     |     |     |
|-----------|-----|-----|-----|-----|-----|
| PO/CO     | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1       | 3   | 3   | 3   | 3   | 1   |
| CO2       | 3   | 3   | 3   | 3   | 1   |
| CO3       | 3   | 3   | 3   | 3   | 1   |
| CO4       | 3   | 3   | 3   | 3   | 1   |
| CO5       | 3   | 3   | 3   | 3   | 1   |

| SEMESTER:V | COURSE CODE: COURSE TITLE | CREDIT: 4  |
|------------|---------------------------|------------|
| PART: III  | 22UZOOC53: BIOCHEMISTRY   | HOURS: 4/W |

# **Learning Objectives**

- 1. To study the structure of biomolecules and their importance in the life process.
- 2. To define and explain the basic principles of biochemistry
- 3. be familiar with the enzymes (biocatalysts), and their salient attributes including unique conformation and amazing catalytic properties.
- 4. interpret the structure-function relationships of the proteins, carbohydrates, lipids, and nucleic acids.
- 5. demonstrate basics of enzyme catalyzed reactions and their mechanisms

**Unit I :** Aqueous solutions - properties of water - hydrogen ion concentration, acids bases and their concept - buffers and electrolytes and functions - acidity, alkalinity and pH determination.

**Unit II**: Bioenergetics - energy and its forms - free energy - laws of thermodynamics - enthalpy and entropy - redox coupling and ATP bioenergetics.

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

**Unit IV**: Enzymes: classification and nomenclature - Physico-chemical - properties of enzymes - enzyme kinetics - mechanism of enzyme action - factors affecting enzyme activity.

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

#### **Course Outcomes**

- 1. To learn and understands the various properties of water
- 2. To understand the bioenergetics
- 3. To know about classification, metabolism and biological significance of carbohydrate, protein and lipids
- 4. To learn properties, classification, nomenclature and action of enzymes
- 5. To learn biochemistry of antibiotics

#### Text Books (In API Style)

- 1. L. stryer, 1999 Biochemistry IV Edition. Freeman Company, New York
- 2. Lehninger, 1992 Biochemistry worth publication Inc., CBS Publication New Delhi.
- 3. H.S. Srivastava Elements of Bio Chemistry, Rastogi Publications.

#### Supplementary Readings

- 1. Outline of Biochemistry, Corn & Stump.
- 2. Veerakumari.L, 2004, Bio Chemistry, MJP Publications
- 3. G.P. Talwar & L.M. Srivastava, 2003 Text Book of Bio Chemistry and Human Biology Eastern Economy Edition, Prentice Hall of India. New Delhi.

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 3   | 3   | 3   | 1   |

| SEMESTER: V | 22UZOOC54:                                | CREDIT: 04  |
|-------------|---|-------------|
| PART: III   | <b>BIOTECHNOLOGY &amp; BIOINFORMATICS</b> | HOURS: 04/W |

#### **Course Objectives**

- 1. Revolutionary scientific discipline which will provide platform to understand biology more technically.
- 2. It will pave way for understanding the application of each gene and its specific applications.
- 3. Will enable to do wet laboratory experiments with or without support of dry laboratory techniques.
- 4. To impart an introductory knowledge about the subject of Bioinformatics to the students studying any discipline of science.
- 5. Will enable to work in dry lab & minimize time on wet laboratory experiments.

#### **Unit I: Introduction**

Scope of biotechnology – branches and applications. DNA and RNA – Structure, Composition and Types. Cell cycle – DNA replication, recombination and repair.

#### Unit II: Molecular Techniques

Principles, applications and types of Polymerase Chain Reaction (PCR), Electrophoresis (Agarose gel), Blotting (Northern, Southern), Random Amplified Polymorphic DNA (RAPD), Restriction Fragment Length Polymorphism (RFLP).

**Unit III:Genetic Engineering / Recombinant DNA Technology / Gene cloning**Isolation of DNA – Restriction enzymes – isolation of desired gene – Amplification of gene by PCR. Cloning vectors – types, Probes – types, DNA sequencing. Examples: commercial production of insulin.

#### **Unit IV: Applications**

Cell lines: HeLa and WI-38. Organ culture – Techniques and applications. Transgenic animals – Mice, Dolly, Pigs. Transgenic plants – Resistance to insect pests, microbial diseases. Super bug for oil pollution. Human Genome Project.

#### Unit V: Basics and Alignment

Introduction to Nucleic Acid and Protein sequence Data Banks; Nucleic acid sequence data banks: Genbank, EMBL nucleotide sequence data bank and multiple alignment programs - CLUSTAL, Patterns, NBRF-PIR, SWISSPROT, Signal peptide data bank; Database Similarity Searches - alignment and building data model.

# **Course Outcomes**

- 1. Students will learn molecular techniques of handling DNA and RNA.
- 2. Importance of genes and commercial utilization of molecular techniques.
- 3. Commercial production of medicinal needs for human.
- 4. Vast usage of molecular techniques for various therapies.
- 5. Learn the usage of various Open source software for Bioinformatics applications. Non-biology students will understand the basic concepts of biological structures and functions.

#### Text Books (In API Style)

- 1. Lohar, P.S. 2005. Biotechnology. MJP Publishers, Chennai, India.
- 2. Dubey, S. 2006. Text book of Biotechnology. S. Chand and Co., New Delhi, India.
- 3. Baxevanis A.D. & B.F.F. Ouellettee. 2001. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. Wiley Interscience.
- 4. Mount, D.W. 2001. Bioinformatics: Sequence and Genome Analysis. Spring Harbor, CSHL Press.

- Supplementary Readings
  1. Satyanarayana, U. 2008. Biotechnology. Books and Allied (P) Ltd., Kolkata,
  - 2. Software Manuals and Help Files.

| CO/PO | 1 | 2 | 3 | 4 | 5 |
|-------|---|---|---|---|---|
| CO1   | 3 | 2 | 2 | 3 | 3 |
| CO2   | 3 | 3 | 2 | 2 | 2 |
| CO3   | 3 | 3 | 3 | 2 | 3 |
| CO4   | 3 | 2 | 3 | 3 | 2 |
| CO5   | 3 | 3 | 3 | 3 | 3 |

| SEMESTER:V | COURSE CODE: COURSE TITLE   | CREDIT: 3  |
|------------|-----------------------------|------------|
| PART:III   | 22UZOOE58A: Poultry Farming | HOURS: 4/W |

# **Learning Objectives**

- 1. To understand the poultry industry based on the past, present and emphasis of future growth
- 2. To study the statistical data and various functions involved in poultry industry.
- 3. To identify many types of poultry that exist other than chickens
- 4. To understand the biology, nutritional needs and reproductive traits of poultry
- 5. To understand the equipment utilized in a poultry operation

#### Unit I: PROSPECTS OF POULTRY INDUSTRY

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

# Unit II: POULTRY PRODUCTION SYSTEMS, HOUSING, AUTOMATION AND EQUIPMENTS

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

Unit III: FOOD AND FEEDING OF

# **POULTRY FARMING**

Feed ingredients, processing of feed - forms of feed - mash, pellet and crumble feed preparation and feeding methods. Feeding chicks, growers, layers, broiler and breeders - feeding in different seasons - nutritional and metabolic disorders in poultry. Physical and sensory evaluation of feed ingredients - sampling techniques - proximate analysis - poultry feed formulae. Commonly occurring anti nutrients and toxicants in poultry feed ingredients - Mycotoxins and their prevention.

# Unit IV: INCUBATION AND HATCHERY MANAGEMENT

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

# Unit V: ENVIRONMENT, POULTRY PRODUCTION AND DISEASES

Climatic differentiation for avian production: micro &macro climate - temperature, temperature zones, air - composition, speed and movement, relative humidity and light. Climatic factors affecting poultry production in housed conditions. Definition of disease, Classification of poultry diseases - Viral, Bacterial, Fungal and Parasitic. Nutritional deficiency diseases

#### **Course Outcomes**

- 1. The Students will have a Knowledge about the Prospects Of Poultry Industry
- 2. The Students will have a Knowledge about the poultry production systems, housing, automation and equipments
- 3. The Students will have a Knowledge about the food and feeding of poultry farming
- 4. The Students will have a Knowledge about the incubation and hatchery

- management
- 5. The Students will have a Knowledge about the environment, poultry production and diseases

# Text Books (In API Style)

- 1. Bell D. Donald and Weaver D. William Jr., 2007. Commercial Chicken Meat and Egg Production. 5th Edition. Springer India Pvt. Ltd., Noida
- 2. Colin G. Scanes., 2015. Sturkie's Avian Physiology. 6th Edition. Academic Press, Elsevier Inc., New York.
- 3. Hurd M. Louis, 2003. Modern Poultry Farming. 1st Edition. International Book Distributing Company, Lucknow

# **Supplementary Readings**

- 1. Mountney J. George and Parkhurst R. Carmen, 2001. Poultry Products Technology. 1st Edition. The Harwoth Press Inc., USA
- 2. Reddy Ramasubba V., and Bhosale T. Dinesh, 2004. Handbook of Poultry Nutrition. 1st Edition. International Book Distribution Co., Lucknow, India
- 3. Susan E. Aiello and Michael a. Moses, 2014. Merck Veterinary Manual. 11th Edition. Merck Vet Manual.

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 2   |
| CO2   | 3   | 3   | 3   | 3   | 2   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 2   | 3   | 3   | 1   |

| SEMESTER :V | COURSE CODE:22UZOOE58B           | CREDITS:3 |
|-------------|----------------------------------|-----------|
| PART:III    | COURSE TITTLE:APPLIED ENTOMOLOGY | HOURS:3/W |

# **Learning Objectives**

- 1) 1.To provide extensive knowledge in the field of applied entomology.
- 2) Be able to categorize insects based on basic ecological, behavioral, morphological, physiological or developmental attributes.
- 3) The familiarity between insect and environment was highlighted to various field like agricultural entomology, medical entomology and industrial entomology.
- 4) To understand about productive insects and their biology.
- 5) To acquire knowledge about various pest control methods and approaches to the biological control of insect pests.

#### UNIT – I

#### Introduction to Entomology

Definition – classification up to orders - scope- Agricultural entomology, Forest entomology, Veterinary entomology, Medical entomology, Forensic entomology, Industrial entomology.

#### UNIT - II

# Agricultural entomology

Pest identification marks, nature, symptoms of damage. Any three pests - rice, Maize, pulses, sugar cane, cotton, coconut, ground nut, brinjal, cardamom, tea, coffee.

Pollinators, Destroyers of insect pests, Serve as food, Destroyers of weeds, Improve soil fertility.

#### UNIT – III

#### Medical entomology

Life cycles of arthropod vectors - ticks, mites and fleas. Vector borne diseases: malaria, filariasis, dengue. Vector control- Chemical, Biological, Genetic and Environmental.Insecticide resistance in vectors.Drug resistance in pathogens.Importance of education, awareness and Community participation.

#### UNIT - IV

#### **Industrial Entomology**

Productive Insects (a) Honey bee: Apiculture and its scope; life history, Bee products-Honey and Bee wax, and Uses, Bee diseases. (b) Silk moth: Different types of silkworms, life cycle; Sericulture, uses of silk, silk worm diseases. (c) Lac insect: Different strains of Lac insects, uses of lac.

# UNIT - V

# Pest control methods and application

Cultural, mechanical, biological and chemical methods – classification of pesticides. First Aid & precautions in handling pesticides – pesticide spraying appliances. Residual effects of pesticides on non target organisms. Pesticide industry- production and marketing – Integrated pest management, its importance & applications.

#### **Course Outcomes**

- 1. To obtain knowledge on basic introduction of entomology
- 2. To recognize beneficial and harmful insects in the agricultural entomology
- 3. To describe vector borne diseases, control measures and awareness in medical entomology
- 4. To identify productive insects in industrial entomology
- 5. To understand pest control methods and application

# Text Books:

- 1. Vasantharaj David and T. Kumaraswami 1988. Elements of Economic Entomology Popular Book Depot, Chennai.
- 2. Nayar, K.K., Ananthakrishnan, T.N. and B.V. David 1992 General and Applied Entomology Tata McGraw, New Delhi.
- 3. P.G. Fenemore and AlkaPrakash 1997 Allied Entomology, Wiley Eastern Ltd., New York.

# **Supplementary Readings:**

- 1. Wigglesworth J.B., 1994. Insect Physiology, Chapman and Hall, London.
- 2. A.Upadhyaya, K.Upathyaya and N.Nath, 2003 Biophysical chemistry, Principles and Techniques, 3rd Ed, Himamalaya publishing house.
- 3. Gurumani.N 2006. Research methodology for biological sciences MJP publ. Chennai.

#### COURSE MAPPING

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 2   | 3   | 3   | 3   | 2   |
| CO2   | 3   | 2   | 2   | 3   | 2   |
| CO3   | 3   | 2   | 3   | 2   | 2   |
| CO4   | 3   | 3   | 2   | 3   | 2   |
| CO5   | 2   | 2   | 3   | 2   | 2   |

| SEMESTER: V | 22UZOOE58C: NANOTECHNOLOGY IN LIFE | CREDIT: 03  |
|-------------|------------------------------------|-------------|
| PART: III   | SCIENCES                           | HOURS: 04/W |

#### **Course Objectives**

- 1. To understand the basics and future of nanotechnology.
- 2. To know the physico-chemical properties of the nanomaterial in life sciences.
- 3. To understand its usage at molecular level.
- 4. To know the types / shapes involved in nanomaterial production.
- 5. To understand their applications for mankind.

#### **Unit I: Introduction**

Scope and importance of nanotechnology, Basic concepts and overview of nanotechnology as interdisciplinary field

#### Unit II: Characterization

Structure of the molecules, its properties at macrolevels using microscopy, particle analyser. Detect the functional groups involved

#### Unit III: Utilization

Molecular Nanotechnology, DNA Computing. Optical and Particles used in nanotechnology.

#### Unit IV: Nano materials

Carbon nanotubes, silver, cadmium, copper and titanium nanoparticles.

#### **Unit V: Applications**

Nanotechnology in agriculture (absorption) and medicine (drug delivery)

# **Course Outcomes**

- 1. To synthesize nanoparticles.
- 2. Characterize them.
- 3. Utilize it effectively without affecting the environment.
- 4. Know the types of nanomaterials and its production.
- 5. Effective usage in enhanced food production and disease treatment.

#### Text Books (In API Style)

- 1. Shanmugam, S. 2009. Nanotechnology, MJP Publishers, Chennai, India.
- 2. Kumar, U. 2008. Nanotechnology-A Fundamental Approach, Agrobios, India

#### **Supplementary Readings**

- 1. Christian, P., F. von der Kammer, M. Baalousha & Th. Hofmann. 2008. Nanoparticles: structure, properties, preparation and behavious in environmental media. **Ecotoxicology**, **17**: 326-343.
- 2. Handy, R.D., F. von der Kammer, J.R. Lead, M. Hassellöv, R. Owen & M. Crane. 2008. The ecotoxicology and chemistry of manufactured nanoparticles. **Ecotoxicology, 17:** 287 314.
- 3. De Jong & P.J.A. Borm. 2008. Drug delivery and nanoparticles: Applications and hazards. **Int. J. Nanomed., 3:** 133 149.

| CO/PO | 1 | 2 | 3 | 4 | 5 |
|-------|---|---|---|---|---|
| CO1   | 3 | 3 | 3 | 2 | 3 |
| CO2   | 3 | 3 | 2 | 3 | 3 |
| CO3   | 2 | 3 | 3 | 2 | 2 |
| CO4   | 3 | 3 | 3 | 3 | 3 |

| CO5 | 3 | 3 | 3 | 3 | 3 |
|-----|---|---|---|---|---|

| SEMESTER: V | COURSE CODE: COURSE TITLE   | CREDIT: 2  |
|-------------|-----------------------------|------------|
| PART: IV    | 22UZOOS59: Mushroom culture | HOURS: 2/W |

#### **Learning Objectives**

- 1. To emphasize the importance of integrating new knowledge on food biotechnology
- 2. To update the technological innovations of edible mushrooms and their application in Nutrition
- 3. To study the morphology and types of Mushrooms
- 4. To know the spawn production technique
- 5. To aware the identification of edible and poisonous Mushrooms and To learn the prospects and scope of mushroom cultivation in small scale industry

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

**Unit II:** Structure and key for identification of edible mushrooms - Button mushroom (Agaricus bisporus), Milky mushroom (Calocybe indica), Oyster mushroom (Pleurotus sajorcaju) and paddy straw mushroom (Volvariella volvcea). Structure and key for identification of poisonous mushrooms-Truffles (Tuber elanosporum), Ammanita sp, Galerina marginata, and Chlorophyllum molybdites

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

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

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

# **Course Outcomes**

- 1. Students will understand the principles of mushroom cultivation
- 2. acquire the practical knowledge to grow several species of fungi
- 3. will have the confidence to approach the mushroom industry for potential employment opportunities.
- 4. The Student will be able to procure knowledge about the nutritive values of mushroom.
- 5. The student will be able understand the medicinal values of mushrooms

#### Text Books (In API Style)

- 1. Nita Bhal. (2000). Handbook on Mushrooms. 2nd ed. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- 2. Marimuthu, T. et al. (1991). Oster Mushroom. Department of Plant Pathology. Tamil Nadu Agricultural University, Coimbatore
- 3. Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication, New Delhi

# **Supplementary Readings**

- 1. Kannaiyan,S. Ramasamy,K. (1980). A hand book of edible mushroom, Today & Tomorrows Printers & Publishers, New Delhi.
- 2. Mushroom Cultivation, Tripathi, D.P.(2005) Oxford & IBH Publishing Co. PVT.LTD, New Delhi.
- 3. Mushroom Production and Processing Technology, PathakYadavGour (2010) Published by Agrobios (India).

|       | 0   |     |     |     |     |
|-------|-----|-----|-----|-----|-----|
| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 2   | 3   | 3   | 1   |

| SEMESTER:VI | 22UZOOC61 - ECOLOGY | CREDIT:4   |
|-------------|---------------------|------------|
| PART:III    |                     | HOURS: 6/W |

#### **Course Objectives**

- 1. To learn the scope of environmental biology, importance of protection and conservation of wild life to maintain the ecosystem balance.
- 2. To realize the importance of inter relationship between every organism and environment.
- 3. To study the impact of eco factors on the morphology & distribution of organisms.
- 4. To create the awareness about the environmental problem and motivate the students to participate in environmental production
- 5. To create awareness towards recent changes in the environment and preventive measures.

#### Unit I:

**Scope-concept** Branches in ecology-Autecology, synecology — **Water**: Properties, Forms of water, Soft and hard water, Properties of water. **Air**: Component and Properties **Substratum**: Soil Types, soil formation, soil group of India, soil profile, soil texture.

#### Unit II:

**Type of Environment** - Biosphere -Hydrosphere - Lithosphere - Atmosphere **Temperature**: Distribution of Temperature, thermal stratification - Temperature as a limiting factor, thermal adaptations. - **Light** -source of light - Biological effect of light. Limiting factors.

#### Unit III:

**Ecosystem** – structure of ecosystem, dynamics of ecosystem, pond ecosystem. **Biogeochemical cycles gaseous cycle** [ N2 & O2] sedimentary cycle, [phosphorus] **Animal association** Intra specific and inter specific-colony formation, social organization, predation, parasitism, commensalisms, mutualism, inter specific competition competitive principle or Gause's principle.

#### Unit IV:

**Population:** Definition-characteristics – Natality, Mortality, age distribution of Population growth forms, population fluctuation. Community Ecotone and edge effects – ecological succession. Conservation **Wild life management**, Preservation laws enforced sanctuaries, National parks.

#### Unit V:

**Natural resources management**: renewable and non - renewable. **Environmental degradation**- deforestation, urbanization, population explosion and other environmental hazards Environmental ethics and laws Earth summits role of governmental agencies for environmental monitoring.

#### **Course Outcomes**

- 1. To realize the scope and concept of environmental biology
- 2. To describe structure and function of environment.
- 3. To understand ecosystem biogeochemical cycles and animal association
- 4. To describe population, community of an ecosystem and wild life management.
- 5. To get knowledge on natural resources, environmental degradation and their effects and remedy measures.

#### Text Books (In API Style)

- 1. Kotpal. R.L, and N.P. Bali, 1986. Concepts of Ecology. Vishal Publications, New Delhi-7
- 2. Rastogi V.B, and M.S. Jayaraji, 1988-1989. Animal Ecology and Distribution of animals. Kedarnath, Ram Nath Meerut -250 001.
- 3. Clark, GL, 1954, Elements of Eology, John wiley & Sons Inc., New York, London

# **Supplementary Readings**

- 1. Ananthakrishnan, T.N, and S. Viswanathan, Principles of Animal Ecology.
- 2. Eugene P. Odum, 1971, Fundamentals of ecology, Saunders International Student Edition, W.B. Saunders Company, Philadelphia London, Toronto.
- 3. Verma, P.S and Agarwal 1986, Environmental Biology, S. Chand & Co Ltd.

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 2   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 3   | 3   | 3   | 1   |

| SEMESTER: VI | COURSE CODE: 22UZOOC62 | CREDIT: 4  |
|--------------|------------------------|------------|
| PART: III    | EVOLUTION              | HOURS: 5/W |

# **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 learn the origin of life and geological time scale andtheories of evolution.
- 4. Tolearn aboutmechanismsofevolution.
- 5. Tolearnspeciationandevolution ofman.

#### Unit I: Origin and Evidences of Evolution

Introduction - Origin of life - Abiogenesis, Biogenesis, Cosmic theory, Biochemical origin of life, Urey-Miller experiment. Evidences of evolution - Morphological and Anatomical, Embryological, Physiological and Biochemical, Taxonomic and paleontological evidences. **Unit II: Theories of Organic Evolution** 

Lamarkism, Neo Lamarkism, Darwinism, Neo Darwinism, Mutation theory of De Vries and Modern version of mutation theory. Modern Synthetic theory of evolution. Natural selection. Convergent and Divergent evolution.

#### Unit III:PolymorphismandPopulationgenetics

Polymorphism – Types and origin of polymorphism - Variation – Sources of variations – Hardy-WeinbergLaw-GeneticDrift-Salientfeatures of genetic drift-Evolutionary significance of genetic drift.

# **Unit IV: Animal Distribution**

Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions. Animal distribution – Methods, Classification, Patterns of distribution. Geological time scale (Up to periods for Paleozoic, Mesozoic era; Cenozoic era).

# Unit V: Speciation, Isolation and Evolution of man

Speciation – Types of speciation – Mechanism of speciation – Patterns of speciation – Species

concept–Isolatingmechanisms–Patternsofevolution Evolutionofman– Fossils,typesan dsignificance-Livingfossils–Mimicry and Colouration – Adaptation andadaptiveradiation.

### **Course Outcomes**

At theendofthecourse, the studentwill be ableto

- 1. Analysetheevolutionaryhistoryof biologicalorganisms
- 2. Critically assess the evolutionary relationship among various phyla
- 3. Identifythe roleofnaturalselection in the survival of the species
- 4. Understandthevarious mechanismsinvolvedinevolution.
- 5. Students will be able to explain how speciation occur and reasons for extinction.

# Text Books (In API Style)

- 1. Colbert, E.H.(1969). Evolution of vertebrates, Wiley, New York.
- 2. Arumugam, N. (2016). *Atextbookofevolution*—Saras Publication. Nagercoil, Tamil Nadu.
- 3. Rastogi, V.B. (2018). Organic evolution, Kedar Nath Ram Nath Publishers, Mee rut UP
- 4. Hall, B.K. and B. Hallgrimson. (2014). Strickbergers Evolution, Jones and Bartlett P

- ublishersltd., New Delhi.
- 5. Gupta.P.K., N. (2008). *Cytology, genetics and Evolution*, Rastogi Publications, Meerut, UP.

# Reference Books:

- 1. RichardSwann Lull, (2012). OrganicEvolution, Sagwan Press, UK.
- 2. ReenaMathur, B.S. Tomarand S.P. Singh, (2014). *Evolution and behavior*, Rastogi Publications, Meerut, UP.
- 3. ClarksonE.N.K.(2011). *InvertebratePalaeontologyandEvolution*. WileyIndia Pvt.Ltd.
- 4. EdwinH.Colbert, Michael Morales and EliC. Min Koff. (2011). Colbert" s Evolution of the Vertebrates. Wiley India.
- 5. Kenneth V. Kardong. (2018). *Vertebrates: Comparative Anatomy, Function, Evolution*. McGraw Hill, USA.

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 2   | 3   | 1   |
| CO3   | 2   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |

| SEMESTER: VI | COLUZO COCO. MICEROPIOI COV 9- IMMITMOLOGY | CREDIT: 04  |
|--------------|--|-------------|
| PART: III    | 22UZOOC63: MICROBIOLOGY & IMMUNOLOGY       | HOURS: 05/W |

- 1. To understand classification of microorganisms.
- 2. To know the methodologies of culturing bacteria.
- 3. To distinguish communicable and non-communicable diseases.
- 4. To impart knowledge on the defense system of our body.
- 5. To learn about molecules or cells involved and impact of defective defense system.

#### Unit I: Classification

Scope of microbiology. Classification of bacteria, virus and fungus. Structure of *Escherichia coli*, bacteriophage and fungi.

### Unit II: Culture techniques

Culture of bacteria: Sterilization, types of media, bacterial growth and growth curve – factors influencing growth of bacteria. Maintenance of the colonies.

### Unit III: Applied Microbiology

Microbes in food spoilage – preservation of milk. Nitrogen-fixation. Fermentation products. Diseases in man: Bacterial (cholera, typhoid), Viral (rabies, HIV) and Fungal (candidiasis, dandruff).

### Unit IV: Immune system

Immunity – Humoral and cellular. Lymphoid organs, cells of the immune system. Immunoglobulins – structure and types (IgG, IgA, IgM, IgD IgE). T-cell and B-cell activation.

### Unit V: Immune functions

Antigen-antibody reactions – epitopes, paratopes, haptens, adjuvants. Major Histocompatibility Complex (MHC). Hypersensitivity – types. Immunodeficiency diseases. Vaccines.

### **Course Outcomes**

- 1. Classify microorganisms.
- 2. Culture microorganisms to purity.
- 3. Learn to prevent communicable diseases.
- 4. Components of the immune system.
- 5. Mechanism of immunity.

#### **Text Books**

- 1. Ananthanarayanan, T. & C.K. Jayaram Paniker. 2000. **Text Book of Microbiology**, Sixth Edition, Orient Longman Ltd., Chennai, India
- 2. Roit, I.M. & P.J. Delves. 2001. **Roitt's Essential Immunology**. Blackwell Science Ltd., USA.

### **Supplementary Readings**

- 1. Pelczer, M.J., R.D. Reid, and E.C.S. Chan.1996. **Microbiology**, 5 Edn., Tata McGraw Hill Publishing Company Ltd., New Delhi, India.
- 2. Kuby. J. 2008. Immunology. W.H. Free man and Co. New York, USA.

| CO/PO | 1 | 2 | 3 | 4 | 5 |
|-------|---|---|---|---|---|
| CO1   | 3 | 2 | 3 | 3 | 3 |
| CO2   | 3 | 3 | 3 | 3 | 3 |
| CO3   | 2 | 3 | 2 | 3 | 3 |
| CO4   | 3 | 3 | 2 | 2 | 3 |
| CO5   | 3 | 3 | 3 | 3 | 3 |

| SEMESTER :VI | COURSE CODE:22UZOOP64   | CREDITS:-4 |
|--------------|---|------------|
| PART:III     | CORE PRACTICAL - III COURSE TITLE:DEVELOPMENTAL BIOLOGY, ANIMAL PHYSIOLOGY, BIOCHEMISTRY AND BIOTECHNOLOGY & BIOINFORMATICS | HOURS:4/W  |

- 1. To give students competent lab skills in developmental biology
- 2. To give students competent lab skills in animal physiology
- 3. To give students competent lab skills in Biochemistry
- 4. To give students competent lab skills in Biotechnology
- 5. To give students competent lab skills in Bio-informatics

### **Unit I: DEVELOPMENT BIOLOGY:**

Study of the following prepared slides / museum specimens.

Section of testis and Ovary [ Mammalian].

Slides of Mammalian sperm and ovum.

Study of Egg types - Frog's Egg, Hen's Egg.

Study of cleavage stages 2 Cell, 4Cell, 8Cell - Blastula and gastrula of Frog.

Slides of different stages of chick embryo –24 hours, 48 hours 72 hours and 96 hours. Placenta of Sheep, Pig and Man.

#### **Unit II: ANIMAL PHYSIOLOGY:**

Activity of human salivary amylase in relation to Ph, Enzyme concentrate and Temperature.

Estimation of Oxygen consumption in a fish with reference to body weight.

Detection of nitrogenous waste products in fish tank water, frog tank water, bird excreta and mammalian urine/ Kidney.

Use of Stethoscope, B.P. apparatus and Kymograph Unit.

#### **Unit III: BIOCHEMISTRY**

Analysis of carbohydrates

a. Monosaccharides- Hexoses- Glucose, b. Disaccharides- Sucrose, c. Polysaccharide- Starch. Analysis of Amino acids a. Histidine b. Tyrosine. Characterization of Lipids [Group experiment] 1. Determination of acid number.

### Unit IV: BIOTECHNOLOGY:

Study of prepared slides, Models or specimen. Escherichia coli, Bacteriophage, Plasmid. Demonstration of P.C.R technique: Southern blot, Electrophoresis. and Visit to Biotechnology lab and Report – compulsory.

### **Unit V: BIO INFORMATICS:**

Bioinformatics and its relation with molecular biology. Examples of related tools(FASTA, BLAST, BLAT, RASMOL), databases(GENBANK, Pubmed, PDB) and software(RASMOL, Ligand Explorer). General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary)

#### **Course Outcomes**

- 1. The student will be able to understand experimental Developmental biology
- **2.** The student will be able to understand experimental physiology
- 3. The student will be able to understand experimental Biochemistry
- **4.** The student will be able to understand different biotechnological tools
- **5.** The student will be able to compute various bio-informatics tools

### Text Books (In API Style)

1. Gilbert, Developmental Biology. 3rd ed. Sinauer, 1991

- 2. Pandey B N: B.Sc. Zoology Series-Biochemistry, Physiology, Endocrinology; Tata McGraw Hill Edu Pvt. Ltd. N. Delhi
- 3. Lesk, A.M. 2005, 2nd edition, Introduction to Bioinformatics. Oxford University Press.
- 4. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox,
- 5. Text Book of Biotechnology By H.K. Das (Wiley Publications

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 2   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 3   | 3   | 3   | 1   |

| SEMESTER: VI | Core Practical IV 22UZOOP65 : Ecology, | CREDIT: 04  |
|--------------|--|-------------|
| PART: III    | Evolution, Microbiology & Immunology   | HOURS: 04/W |

- 1. Learn basic sterility techniques in a lab.
- 2. To handle microbial samples.
- 3. To understand the water: quality-portable or not.
- 4. To determine the biological results in numerical value.
- 5. To handle equipments in the laboratory.

### **Experiments**

- 1. Sterilization techniques and preparation of media for bacterial culture.
- 2. Identification of Gram positive and Gram negative bacteria using Gram's stain.
- 3. ABO blood grouping and Rh factor determination.
- 4. To determine total leukocyte count (or) Immunodiffusion using commercial kit.
- 5. Estimation of dissolved oxygen.
- 6. Estimation of salinity.
- 7. Estimation of total hardness.
- 8. Mounting & identification of plankton from the given sample..
- 9. Spotters: Inoculation loop, pH meter, centrifuge, secchi disc,
- 10. Fossils ammonite.
- 11. Living fossils Limulus, sphenodon.
- 12. Conneting link peripatus, archaeopteryx.
- 13. Evolutionary significance exocoetus, draco, hippocampus.
- 14. Mimicry monarch butterfly.
- 15. Camouflage chameleon

#### **Course Outcomes**

- 1. Comparative analysis of blood smear preparations.
- 2. Comparative analysis of Bio-geo chemicals. Laws and types of ecosystem.
- 3. Elaborate the environmental degradations.
- 4. Estimate the quality of water.
- 5. Methodological calculations of biological data.

## Text Books (In API Style)

- 1. Snedecor, G.W. & W.G. Cochram. 1967. Statistical Methods, Oxford & IBH Publishing, New Delhi, India.
- 2. Gallagher, S.R. & E.A. Wiley (Eds.) 2008. Current Protocols Essential Laboratory Techniques, John Wiley & Sons, Inc., New Jersey, USA.

| CO/PO | 1 | 2 | 3 | 4 | 5 |
|-------|---|---|---|---|---|
| )1    | 3 | 3 | 3 | 3 | 3 |
| )2    | 3 | 2 | 3 | 3 | 3 |
| )3    | 3 | 3 | 3 | 3 | 3 |
| )4    | 3 | 2 | 3 | 3 | 3 |

| 5 | 3 | 3 | 3 | 3 | 2 |
|---|---|---|---|---|---|

| SEMESTER:VI | 22UZOOE66A - BIO- FERTILIZER PRODUCTION | CREDIT:3  |
|-------------|---|-----------|
| PART:III    |   | HOURS:4/W |

To impart awareness on bio fertilizer technology
To create knowledge on Environmental degradation.

#### UNIT- I

**Scope and principles of Biofertilizers** – Types of soil – Role of microbes in soil fertility - physical and chemical composition of soil. Types of microorganisms in soil. UNIT-II

**Production of bacterial biofertilizers** – Importance of bio fertilizer, Importance of organic fertilizer -Mass production and utilization of different strains of cyanobacteria. Mass cultivation of Azolla, Azospirillum, Azotobacter and its utilization. UNIT-III

**Isolation and identification** of endophytic nitrogen fixers. Rhizobium and legume root Nodulation and Nitrification process. Cyanobacteria – Vermicomposting. UNIT-IV

**Production of Micorrhizal Biofertilizer**- Phosphate solublising microorganisms – Arbuscular vesicular Mycorrhizal (VAM) fungi as bio fertilizer and its applications – microbial enzymes.

UNIT-V

**Use of composite Biofertilizers** – Fermentation technology Methods for enhancing soil fertility. Renewable properties of biofertilizers. The cost/benefit analysis of production and application of Biofertilizers.

#### **Course Outcomes**

- 1. To understand the soil composition
- 2. To describe bacterial biofertilizer
- 3. To get knowledge about nitrification
- 4. To understand mycorrhiza biofertilizer
- 5. To know application of bio fertilizer

### Text Books (In API Style)

- 1 Singh, T. And Purohit, S.S. 2008: Bio fertilizer Technology. Agrobios-India
- 2 Sharma, A.K. 2007: Bio fertilizer for sustainable agriculture-Agrobios-India
- 3 Pandiyarajan, P.2008: Techniques in Agricultural Microbiology Agrobis Jodhpur India.

### **Supplementary Readings**

- 1. Purohit, S.S. 2005: Microbiology Fundamentals and Application [ $6^{th}$  edition] student Edition-Jodhpur India.
- 2 Dubey,R.C., and Maheswari, D.K. 2007: A text book of microbiology-S. Chand & co. New

Delhi,India.

3 Chandhirasekar P 2009: Biofertilizers T.K Publication Pudukottai.

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 3   | 3   | 3   | 1   |

| SEMESTER:VI | COURSE CODE: 22UZOOE66B | CREDIT: 3  |
|-------------|-------------------------|------------|
| PART: III   | HUMAN ENDOCRINOLOGY     | HOURS: 4/W |

- 1. To understand the objectives of endocrinology.
- 2. Tolearngeneral conceptsofhormones and pituitary gland.
- 3. To study the comparative account and functions of endocrine glands of vertebrates.
- 4. Toacquireknowledgeinthe endocrinologicalbasis ofvertebratereproduction.
- 5. Clinical endocrinology plays a vital role in clinical biochemistry and metabolism.

### **UNIT-I:** General concepts of Hormones

Generalcharacteristicsofhormones-conceptofhormonesecretion-hormones as messengers – classification of hormones - steroid hormones – peptidehormones-mechanismofhormoneaction

## UNIT-II: Hypothalamus and Pituitary gland

Neuro-endocrinology and Disorders of the Neuro-hypophysis - Pituitary gland - structural organization - anterior pituitary, Pars intermediaandneurohypophysis-Hypothalamiccontrolofpituitaryfunction.

### UNIT-III: Thryoidglandandparathyroidgland

Thryoid gland – structural organization – Biosynthesis of thyroid hormones -biologicalfunctionofthyroidhormones.

Parathyroid – structure and functions of parathyroid hormone – hormonalregulationofcalcium and phosphorus metabolism.

### UNIT - IV:Pancreasand adrenalglands

Structure of pancreas – function of insulin – Biosynthesis and regulation of thesecretion of insulin – Biological action of insulin – function of glucagon – Biologicalactionofglucagon.

Adrenals – structural organization - synthesis of adrenocortical hormones – Mineralocorticoids – Glucocorticoids - functions – hormones of adrenal medulla and theirbiological actions.

## UNIT-V:ReproductiveEndocrinology

Structure of mammalian testis and ovary – male, female sex accessoryorgans-hormonesoftestisandovary-estrusandmenstrualcycle-hormonesofpregnancy-parturition-hormonalcontroloflactation.

#### **Course Outcomes:**

At the end of the course, the student will be able to

- 1. To understand the theoretical and practical aspects of endocrinology acrossvarious phyla.
- 2. Apply the endocrinological methods and procedures for higher studies and research.
- 3. Totakeupjobsinclinicallabs.
- 4. Toanalyzebiologicalsamplesofendocrinologicalimportance.
- 5. To learn the role of reproductive hormones.

#### **Text Books**

1. Barington (1979) Hormones and evolution Vol I&II Academic press, New York.

- 2. John F- Laycock and Peter H. Wise, Essential of Endocrinology
- 3. Wiliaimas R.H.(1974). Textbook of Endocrinology V.Ed. Saunders Press, London.
- 4. Endocrinlogy- Hadley
- 5. General endocrinology Bagrara and Tumer, W.B. Saunders.
- 6. *The Physiology of Reproduction*, Vol I& II E.K.Nobil and JU. D.Neil, Raven Press, New York, 1988.
- 7. Benjamin Levin-Gene VII, Oxford University Press.
- 8. Lodish et al Molecular Cell Biology

#### Reference books

- 1. Haris, G.W. and B.T. Donovan. 1968. The Pituitory Gland. S. Chand and Co.,
- 2. Bentley, P.J. 1985. *Comparative vertebrate endocrinology*, Second Edition, Cambridge University Press. Cambridge.
- 3. Mac Hadley. 1992. *Endocrinology*, 3rd Edition. Prentice Hall Inc. A Simon & Schuster

Company, Englewood Cliffs, New Jersey. USA.

- 4. Ingleton, P.M. and J.T. Bangara. 1986. Fundamentals of comparative vertebrate endocrinology, Kluwer Academic Publishers.
- 5. Turner, C.D. and J.T. Bangara. 1986. *General endocrinology*. Saunders International Student

edition. Toppan Company Limited. Tokyo.

6. Barrington, E.J.W. 1985. *An introduction to general and comparative endocrinology*. Claredon Press Oxford.

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 2   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| O5    | 3   | 3   | 3   | 3   | 1   |

| SEMESTER:VI | COURSE CODE: 22UZOOE66-3      | CREDIT: 3  |
|-------------|-------------------------------|------------|
| PART: III   | MEDICAL LABORATORY TECHNIQUES | HOURS: 3/W |

## **Learning Objective (LO):**

| LO1 | Understand protocols and procedures to collect clinical samples for blood analysis and to study human physiology. |  |  |  |  |  |
|-----|---|--|--|--|--|--|
| LO2 | Explain the characteristics of clinical samples and demonstrate skill in handling clinical equipment.             |  |  |  |  |  |
| LO3 | Evaluate the hematological and histological parameters of biological samples.                                     |  |  |  |  |  |

**Unit – I:** Laboratory safety - toxic chemicals and biohazards waste- biosafety levelgood laboratory practice - hygiene and health issue - physiology effect of alcohol, tobacco, smoking & junk food & its treatment - biomedical waste management.

**Unit – II:** Composition of blood and their function- collection of blood & lab procedure-haemopoiesis- types of anaemia- mechanism of blood coagulation-bleeding time- clotting time- determination of hemoglobin-erythrocyte sedimentations rate- packed cell volume- Total count of RBC & WBC- Differential count WBC- blood grouping and typing- haemostasis- bleeding disorder of man - Haemolytic disease of newborn, Platelet count, reticulocytes count, Absolute Eosinophil count.

**Unit – III:** Definition and scope of microbiology- structure and function of cells - parasites - Entamoeba- Plasmodium- Leishmania and Trypanosome-Computer tomography (CT scan) - Magnetic Resonance imaging - flowcytometry - treadmill test - PET.

**Unit – IV:** Cardiovascular system- Blood pressure - Pulse - regulation of heart rate, cardiac shock. Heart sounds, Electrocardiogram (ECG) - significance - ultra sonography- Electroencephalography (EEG).

**Unit – V:** Handling and labelling of histology specimens - Tissue processing - processing of histological tissues for paraffin embedding, block preparation. Microtomes – types of microtome- sectioning, staining - staining methods - vital staining - mounting- problems encountered during section cutting and remedies - Frozen section techniques- freezing microtome.

### **Text Books**

- 1. Godker, P. B. and Darshan, P, Godker, 2011. Text book of medical Laboratory Technology, Mumbai.
- 2. Guyton and Hall, 2000. Text Book of medical Physiology, 10<sup>th</sup> edition, Elseiner, New Delhi.
- 3. Mukerjee, K.L, 1999. Medical Laboratory Technology- Vol, I, II, III. Tata MC GrawHill, New Delhi.
- 4. Sood, R, 2009. Medical Laboratory technology, Methods and interpretation.

### **Reference Books**

- 1. Manoharan, A, and Sethuraman, 2003. Essential of Clinical Heamatology, Jeypee brothers, New Delhi.
- 2. Richard, A, McPherson, Mathew, R, Pincus, 2007. Clinical and management by laboratory methods, Elsevier, Philadelphia. Published by Tata McGraw-Hill Education Pvt. Ltd.,
- 3. Ochei. J., A. Kolhatkar (2000). Medical Laboratory science: Theory and practice, Published by Tata McGraw-Hill Education Pvt. Ltd, First edition.

| Mapping with Programme Outcomes* |     |     |     |     |     |     |     |     |     |      |
|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| COs                              | PO1 | PO2 | PO3 | PO4 | PO5 | P06 | P07 | PO8 | PO9 | PO10 |
| CO1                              | 3   | 2   | 2   | 2   | 1   | 1   | 2   | 2   | 1   | 2    |
| CO2                              | 3   | 3   | 2   | 3   | 3   | 3   | 1   | 2   | 3   | 3    |
| CO3                              | 2   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 3   | 1    |
| CO4                              | 3   | 3   | 2   | 2   | 1   | 2   | 1   | 2   | 2   | 3    |
| CO5                              | 2   | 2   | 3   | 3   | 2   | 3   | 1   | 1   | 3   | 3    |

\*3 - Strong; 2 - Medium; 1-Low

| SEMESTER:VI | COURSE CODE: COURSE TITLE        | CREDIT: 2  |
|-------------|----------------------------------|------------|
| PART: IV    | 22UZOOS68: Aquarium Fish Keeping | HOURS: 2/W |

### **Learning Objectives**

- 1. To impart training on Aquarium fish keeping technology
- 2. To create knowledge on self employment opportunity.
- 3. To inculcate importance of ornamental fish farming in relation with entrepreneurship development.
- 4. To give students knowledge about various techniques of ornamental fish breeding, rearing and its marketing to make them self sustainable after graduation.
- 5. To teach techniques of construction of glass aquarium and its maintenance.

**Unit I**: Fish Aquarium - Introduction - Types of aquarium - Importance of aquarium - Accessories of aquarium - Aquarium fabrication - Setting of aquarium.

**Unit II**: Care and maintenance of aquarium - Aquarium water quality and management - Aquarium plants - Food for Aquarium fishes.

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

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

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

#### **Course Outcomes**

- 1. The student will be able to understand the basic knowledge of Aquarium fish keeping
- 2. The students will be able to know how to maintain an aquarium.
- 3. The student will be able get knowledge about different varieties of ornamental fish
- 4. The student will be able to acquire knowledge about disease management in aquarium fish culture.
- **5.** The students will acquire knowledge about the feeding techniques of aquarium fishes.

### Text Books (In API Style)

- 1. Jingran V.G., 1991: Fish and fisheries in India Hindustan Publ. co New Delhi India.
- 2. Shanmugam K. 1992, Fishery Biology and Aqua Culture Leo Pathipagam Chennai- India.
- 3. Mill Dick, 1993: Aquarium fish, DK Publ.Co,Inc. New York -USA

### **Supplementary Readings**

- 1. Yadav. 1995: Fish and fisheries, Daya publ. co., New Delhi India
- 2. Hall, C.B. 2005: Ponds and Fish culture Agrobios Jodhpur India.
- 3. Day, F. 1978: Fishes of India Vol. I & II, William Danisan & Sons, India.

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 |
|-------|-----|-----|-----|-----|-----|
| CO1   | 3   | 3   | 3   | 3   | 1   |
| CO2   | 3   | 3   | 3   | 3   | 1   |
| CO3   | 3   | 3   | 3   | 3   | 1   |
| CO4   | 3   | 3   | 3   | 3   | 1   |
| CO5   | 3   | 2   | 3   | 3   | 1   |