**ANNAMALAI** **UNIVERSITY**

(Affiliated Colleges)

208 - B.Sc. ZOOLOGY

Programme Structure and Scheme of Examination (under CBCS)

(Applicable to the candidates admitted from the academic year 2023 -2024 onwards)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Part** | **Course Code** | **Study Components & Course Title** | **Credit** | **Hours/ Week** | **Maximum Marks** | | |
| **CIA** | **ESE** | **Total** |
|  |  | **SEMESTER - I** |  |  |  |  |  |
| I | 23UTAMC11/  23UHINL11/  23UFREL11 | Language - I –  **பொதுதமிழ்- I**  Hindi-I/  French-I | 3 | 6 | 25 | 75 | 100 |
| II | 23UENGC12 | General English – I | 3 | 6 | 25 | 75 | 100 |
| III | 23UZOOC13 | Core - I:Invertebrata | 5 | 5 | 25 | 75 | 100 |
| 23UZOOP14 | Core - II: Practical – I: Invertebrata Practical  (Covering 23UZOOC 13) | 5 | 4 | 25 | 75 | 100 |
| 23UBOTE15  23UBOTEP1 | Elective - I:  (General/Discipline Specific)  Botany - I  Botany Practical - 1 | 2  1 | 3  2 | 25  25 | 75  75 | 100  100 |
| IV | 23UTAMB16  23UTAMA16 | Skill Enhancement Course -1 (NME-I)/\*  Basic Tamil – I /  Advanced Tamil - I | 2 | 2 | 25 | 75 | 100 |
| 23UZOOF17 | Foundation Course:  Ornamental Fish Farming and Management | 2 | 2 | 25 | 75 | 100 |
|  |  | **Total** | **23** | **30** |  |  | **800** |
|  |  | **Semester – II** |  |  |  |  |  |
| I | 23UTAMC21/  23UHINL21/  23UFREL21 | Language – II:  **பொதுதமிழ்- II**  Hindi-II/  French-II | 3 | 6 | 25 | 75 | 100 |
| II | 23UENGC22 | General English – II | 3 | 6 | 25 | 75 | 100 |
| III | 23UZOOC23 | Core - III: Chordata | 5 | 5 | 25 | 75 | 100 |
| 23UZOOP24 | Core - IV: Practical – II: Chordata Practical  (Covering 23UZOOC 23) | 5 | 4 | 25 | 75 | 100 |
| 23UBOTE25  23UBOTEP2 | Elective - II:  (General/Discipline Specific)  Botany - II  Botany Practical – 1I | 2  1 | 3  2 | 25  25 | 75  75 | 100  100 |
| IV | 23UTAMB26  23UTAMA26 | Skill Enhancement Course -II (NME-II)/\*  Basic Tamil – II /  Advanced Tamil - II | 2 | 2 | 25 | 75 | 100 |
| 23USECG27 | Skill Enhancement Course – III:  Internet and its Applications  (Common Paper) | 2 | 2 | 25 | 75 | 100 |
|  |  | **Total** | **23** | **30** |  |  | **800** |

**Non-Major Elective Courses (NME)to other Departments)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| IV | 23UZOON16 | Economic Zoology | 2 | 2 | 25 | 75 | 100 |
| 23UZOON26 | Ornamental Fish Farming & Management | 2 | 2 | 25 | 75 | 100 |

\* PART-IV: NME / Basic Tamil / Advanced Tamil (Any one)

Students who have not studied Tamil upto 12th Standard and have taken any Language other than Tamil in Part-I, must choose Basic Tamil-I in First Semester & Basic Tamil-II in Second Semester.

Students who have studied Tamil upto 10th & 12th Standard and have taken any Language other than Tamil in Part-I, must choose Advanced Tamil-I in First Semester and Advanced Tamil-II in Second Semester.

**Elective Courses offered to other Science Department in I and II Semesters**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| III | 23UZOOE15  23UZOOEP1 | Elective - I:  (General/Discipline Specific)  Zoology - I  Zoology Practical - 1 | 2  1 | 3  2 | 25  25 | 75  75 | 100  100 |
| 23UZOOE25  23UZOOEP2 | Elective - II:  (General/Discipline Specific)  Zoology - II  Zoology Practical - II | 2  1 | 3  2 | 25  25 | 75  75 | 100  100 |

###### **FIRST YEAR**

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **CORE – I**  **Course Code: 23UZOOC13**  **Course Title: Invertebrata** | **H/W** | **C** |
| **I** | **5** | **5** |

**Course Objective :**

|  |  |
| --- | --- |
| **1** | To understand the basic concepts of invertebrates and observe the structure and functions. |
| **2** | To illustrate and examine the systemic and functional morphology of various group of invertebrates. |
| **3** | To differentiate and classify the various groups of animals, modes of life and to estimate the biodiversity. |
| **4** | To compare and distinguish the general and specific characteristics of reproduction in invertebrates. |
| **5** | To infer and integrate the parasitic and economic importance of invertebrates |

**Unit – 1: Protozoa and Porifera**

**Protozoa:** Introduction to Classification, taxonomy and nomenclature. General characters and classification of Phylum Protozoa up to classes.Type study - *Paramecium* and *Plasmodium* - Parasitic protozoans (*Entamoeba*, *Trypanasoma*&*Leishmania*) - Economic importance. - Host-parasitic interactions in *Entamoeba* and *Plasmodium*- Nutrition and Locomotion in protozoa

**Porifera:** General characters and classification up to Classes. Type study -Ascon&Sycon - Canal system in sponges - Skeleton in sponges, Reproduction in sponges Economic importance of sponges.

**Unit – 2: Coelenterata and Platyhelminths**

**Coelenterata :** General characters and classification up to classes – Type study –*Obelia*and *Aurelia* - Corals and coral reefs - Polymorphism - Mesenteries in Anthozoa - Polymorphism in Hydrozoa. Economic importance of corals and coral reefs.

**Platyhelminths:** General characters and classification of up to classes. Type study – *Fasciola hepatica*.Nemathelminthes: *Taeniasolium*– Parasitic adaptations. Host-parasitic interactions of Helminth parasites.Nematode Parasites and diseases –*Wuchereriabancrofti*, *Enterobiusvermicularis*, *Ancylostomaduodenale*.Aschelminthes : General characters and classification of up to classes - Type study –*Ascarislumbricoides*

**Unit–3:Annelida and Arthropoda**

**Annelida:** General characters and classification up to Classes. Type study –*Nereis*and *Hirudinaria granulosa*.Metamerism - Nephridium and coelomoducts - Modes of life in Annelids. Reproduction in polychaetes

**Arthropoda:** General characters and classification of Phylum Arthropoda up to Classes. Detailed study: *Penaeusindicus*. Affinities of *Peripatus* – Larval forms in Crustacea – Organization of Centipede and Millipede

**Unit – 4: Mollusca**

**Mollusca:** General characters and classification of Phylum Mollusca up to Classes. Detailed study: *Pila globosa*. Foot and torsion in Mollusca, Economic importance of Molluscs – Cephalopoda as the most advanced invertebrate.

**Unit – 5: Echinodermata**

**Echinodermata:** General characters and classification of Phylum Echinodermata up to Classes. Detailed study: *Asterias.* Water vascular system in Echinodermata – Larval forms of Echinoderms.

**Expected Course Outcomes (CO)**

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

|  |  |
| --- | --- |
| **1** | Understand the basic concepts of invertebrate animals and recall its structure and functions. |
| **2** | Illustrate and examine the systemic and functional morphology of various groups of invertebrata. |
| **3** | Differentiate and classify the animal’s mode of life in various taxa and estimate the biodiversity. |
| **4** | To compare and distinguish the various physiological processes and organ systems in lower animals. |
| **5** | Infer and integrate the parasitic and economic importance of invertebrate animals. |

**TEXT BOOKS**

1. Arumugam, N., T. Murugan, B. Ramanathan and M.G Ragunathan. (2019). *A Text Book of Invertebrates,* Saras Publications, Nagercoil, Tamil Nadu.
2. EkambaranathaAyyar .M., (1973). *A Manual of Zoology – Part I, Invertebrata.* S. Viswanathan Printers and Publishers Pvt., Ltd., Madras.
3. Jordon, E.L. and P.S Verma, (2014). *Invertebrate Zoology*. S. Chand and Co. Ltd., New Delhi.
4. Adam Sedgwick, (1960). *A student’s text book of Zoology, Vol. I & III*, General Book Depot, Allahabad.
5. Hyman, L.H. (1951). *The Invertebrates,. Vol. I,* McGraw Hill Book Co., New York.
6. Kotpal.R.L., (2017). *Modern Text book of Zoology-Invertebrata, (Animal Diversity- I).* Rastogi Publications, New Delhi.

**REFERENCE BOOKS**

1. Arumugam, N. (2014). *Animal diversity Volume -1 – Invertebrata*. SarasPublication, Nagercoil, Tamil Nadu.
2. FatikBaran. (2012). *Invertebrate Zoology*. P**rentice Hall of India** Pvt Ltd., New Delhi.
3. Barrington E.J.W. (2012). *Invertebrate structure and function*. Affiliated East West Press Pvt. Ltd., New Delhi.
4. Richard C. Brusca, Wendy Moore and Stephen M. Shuster. ( 2016). *Invertebrates.* Oxford University Press, USA.
5. Clarkson E.N.K. (2011). *Invertebrate Palaeontology and Evolution*. Wiley India Pvt. Ltd., New Delhi.

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |  |  |
| **CO 4** |  |  |  | S | S | M |  |  |
| **CO 5** |  |  | S |  |  |  |  | S |

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **CORE – II: Practical- I**  **Course Code: 23UZOOP14:**  **Course Title: Invertebrata** | **H/W** | **C** |
| **I** | **4** | **5** |

**Course Objective :**

|  |  |
| --- | --- |
| **1** | To identify the different groups of invertebrate animals by observing their external characteristics. |
| **2** | To understand the organs, organ system and their functions in lower animals. |
| **3** | To get knowledge about the different modes of life and their adaptation based on the environment. |
| **4** | Able to dissect and display the internal organs and mount the mouthparts and scales of invertebrates. |

**Unit - 1: Major Dissection :** Cockroach: Circulatory system, Nervous system, Reproductive system. Earthworm: Nervous System, Reproductive system. *Pila globosa*: Nervous system. Prawn: Nervous system (including Appendages).

**Unit – 2: Minor Dissection:** Cockroach: Digestive system. Earthworm: Viscera, Lateral hearts.

*Pila globosa*: Digestive system (Including radula).

**Unit – 3: Mounting:** Earthworm: Body setae; Pineal setae. *Pila globosa*: Radula.

**Unit - 4:Mounting :** Cockroach: Salivary apparatus, Mouth parts - Honey Bee, House fly and Mosquito mouth parts.

**Unit - 5: Spotters (i). Protozoa:** Amoeba, Paramoecium, Paramoecium Binary fission and Conjugation, Vorticella, *Entamoeba histolytica*, *Plasmodium vivax***(ii). Porifera:**Sycon, Spongilla, Euspongia, Sycon - T.S & L.S, Spicules, Gemmule**(iii). Coelenterata:**Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula**(iv). Platyhelminthes:**Planaria, Fasciola hepatica, Fasciolalarval forms – Miracidium, Redia, Cercaria, Echinococcusgranulosus, Taeniasolium, Schistosoma haematobium**(v). Nemathelminthes:** Ascaris(Male & Female), Drancunculus, Ancylostoma, Wuchereria**(vi). Annelida:**Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva **(vii). Arthropoda:** Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male & female Anopheles and Culex, Mouthparts of Housefly and Butterfly. **(viii). Mollusca:** Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva **(ix). Echinodermata:**Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon, Bipinnaria larva

**Expected Course Outcomes (CO)**

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

|  |  |
| --- | --- |
| **1** | Identify and label the external features of different groups of invertebrate animals. |
| **2** | Illustrate and examine the circulatory system, nervous system and reproductive system of invertebrate animals. |
| **3** | Differentiate and compare the structure, function and mode of life of various groups of animals. |
| **4** | To compare and distinguish the dissected internal organs of lower animals. |
| **5** | Prepare and develop the mounting procedure of economically important invertebrates. |

**Text Books**

**(Latest Editions)**

1. EkambaranathaIyyar and T. N. Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1, 2) S. Viswanathan, Chennai.
2. Ganguly, Sinha an d A dhikari , 2 0 11 . Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.
3. Sinha, Chatterjee and Chattopadhyay, 2 0 1 4. Advanced Practical Zoology, Books & Allied Ltd; 3rd Revised edition, 1 07 0 pp.
4. Lal ,S. S, 2016 . Practical Zoology Invertebrate, Rastogi Publications.
5. Verma, P. S. 2010. A Manual of Practical Zoology: Invertebates, S Chand, 4 97pp.

**References Books**

**(Latest editions, and the style as given below must be strictly adhered to)**

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science.
2. Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition. Holt Saunders International Edition.
3. Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson .
4. Boradale, L.A. and Potts, E.A. (1961). *Invertebrates: A Manual for the use of Students*. Asia Publishing Home.
5. Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |  |  |
| **CO 4** |  |  |  | S | S | M |  |  |
| **CO 5** |  |  | S |  |  |  |  | S |

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

**ELECTIVE I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **elective - i**  **Course Code : 23UBOTE15**  **Course Title: Botany – I** | **H/W** | **C** |
| **I** | **3** | **2** |

**Course Objective**

|  |  |
| --- | --- |
| **1** | To study morphological and anatomical adaptations of plants of various habitats. |
| **2** | To demonstrate techniques of plant tissue culture. |
| **3** | To familiarize with the structure of DNA, RNA. |
| **4** | To carryout experiments related with plant physiology. |
| **5** | To perform biochemistry experiments. |

**Unit – 1: Algae:**

General characters of algae - Structure, reproduction and life cycle of the following genera - *Anabaena* and*Sargassum* and economic importance of algae.

**Unit – 2 : Fungi, Bacteria and Virus:**

General characters of fungi, structure, reproduction and life cycle of the following genera –*Penicillium*and*Agaricus* and economic importance of fungi.

Bacteria - general characters, structure and reproduction of *Escherichia coli* and economic importance of bacteria. Virus - general characters, structure of TMV, structure of bacteriophage.

**Unit – 3 : Bryophytes, Pteridophytes and Gymnosperms:**

General characters of Bryophytes, Structure and life cycle of *Funaria*.

General characters of Pteridophytes, Structure and life cycle of *Lycopodium*.

General characters of Gymnosperms, Structure and life cycle of *Cycas*.

**Unit – 4: Cell Biology:**

Prokaryotic and Eukaryotic cell-structure/organization.Cell organelles - ultra structure and function of chloroplast, mitochondria and nucleus.Cell division - mitosis and meiosis.

**Unit – 5: Genetics and Plant Biotechnology:**

Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law of independent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - *In vitro* culture methods.Plant tissue culture and its application in biotechnology.

**Expected Course Outcomes (CO)**

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

|  |  |
| --- | --- |
| **1** | Increase the awareness and appreciation of human friendly  algae and their economic importance. |
| **2** | Develop an understanding of microbes and fungi and  appreciate their adaptive strategies. |
| **3** | Develop critical understanding on morphology, anatomy and  reproduction of Bryophytes, Pteridophytes and Gymnosperms. |
| **4** | Compare the structure and function of cells and explain the  development of cells. |
| **5** | Understand the core concepts and fundamentals of plant  biotechnology and genetic engineering. |

**Recommended Texts**

1. Singh,V.,Pande,P.CandJain,D.K. 2021. ATextBookofBotany.RastogiPublications,Meerut.
2. Bhatnagar, S.P and AlokMoitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
3. Sharma,O.P.2017. Bryophyta, MacMillanIndiaLtd.Delhi.
4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
5. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany,S.

Viswanathan Pvt. Ltd., Madras.

**Reference books:**

1. Parihar, N.S. 2012. An introduction to Bryophyta –Pteridophytes- Surjeet Publications, Delhi.
2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.
3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand & Company Ltd, Delhi.
4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.
5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand & Company Ltd, Delhi.
6. Parihar, N.S. 2013. An introduction to Bbryophyta –Bryophytes -, Surjeet Publications, Delhi.

7. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I &II,

S.Chand and Co. New Delhi.

**Web Resources**

1. <https://www.kobo.com/us/en/ebook/the-algae-world>
2. <http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html>
3. <http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm>
4. <https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/>
5. <https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf>
6. <https://www.us.elsevierhealth.com/medicine/cell-biology>
7. <https://www.us.elsevierhealth.com/medicine/genetics>
8. <https://www.kobo.com/us/en/ebook/plant-biotechnology-1>

**MappingwithProgrammeOutcomes:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | S | S | S | S | S | S | S | S | S | S |
| **CO2** | S | S | S | S | S | S | S | S | S | S |
| **CO3** | M | S | S | S | S | L | S | S | S | S |
| **CO4** | S | S | M | S | S | S | M | S | M | S |
| **CO5** | S | M | M | M | M | M | M | L | M | L |

**S – Strong; M – Medium; L-Low**

**SKILL ENHANCEMENT COURSES**

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **Foundation Course**  **COURSE CODE: 23UZOOF17**  **Ornamental Fish Farmingand Management** | **H/W** | **C** |
| **I** | **2** | **2** |

**Course Objective (LO):**

|  |  |
| --- | --- |
| 1 | To highlight the importance of ornamental fish culture in relation to entrepreneurship development. |
| 2 | To enable the identification, culture and maintenance of commercially important ornamental fishes. |
| 3 | To provide the knowledge on the techniques of ornamental fish breeding, rearing, disease control and economics of ornamental fish farming. |

**Unit I:**

Introduction to ornamental fish keeping.Scope and importance of ornamental fish culture.Domestic and global scenario of ornamental fish trade and export potential.

Commercially important ornamental fishes - Indigenous and exotic varieties.

**Unit II:**

Biology of egg layers and live bearers.Food and feeding in ornamental fishes. Formulated feed and Live feed; Live feed culture.Breeding, hatchery and nursery management of egg layers (eg. Goldfish) and live bearers (eg.Guppy).

**Unit III:**

Aquarium design and construction; Accessories - aerators, filters and lighting.

Aquarium plants and their propagation.Maintenance of aquarium and water quality management.

**Unit IV:**

Disease management of Ornamental fishes(symptoms, Life cycle, and their prevention, control and treatment methods.Protozoan diseases,Bacterial diseases,crustacean diseases,Fungal diseases and Helminth diseases

**Unit V:**

Conditioning, packing, transport and quarantine methods.

Economics, trade regulations, domestic and export marketing strategies.

**References:**

1. Swain SK., Sarangi N. and Ayyappan S. 2010. Ornamental fish farming. ICAR, New Delhi.

2. Living Jewels – A handbook on freshwater ornamental fish, MPEDA, Kochi.

3. Dey V.K.A. 1997. A handbook on aquafarming ornamental fishes. MPEDA, Kochi.

4. Ahilan, B., Felix N. and Santhanam R. 2008. Text book of aquariculture. Daya Publishing House, New Delhi.

# Web links:

# 1. <http://ecoursesonline.iasri.res.in/course/view.php?id=297>

# 2. <https://www.ofish.org/>

# 3. <https://krishijagran.com/agripedia/income-generation-by-ornamental-fish-culture/>

**4.** <https://99businessideas.com/ornamental-fish-farming/>

**Expected Course Outcomes (COs)**

|  |  |
| --- | --- |
| **1** | The students will be able to identify, culture, maintain and market the commercially important ornamental fishes. |
| **2** | The knowledge and skills gained on the different aspects of ornamental fish keeping will enable the students to develop entrepreneurship potential and help in self employment. |

**Outcome Maping**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  |  | M |  |  | S |
| **CO 2** | M | S |  |  |  |  | S |  |
| **CO 3** |  |  |  | S |  | S |  |  |
| **CO 4** | M |  |  | S | S | M |  |  |
| **CO 5** |  |  | S |  |  |  | M | S |

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **elective – i**  **Course Code : 23UBOTEP1**  **Course Title: Botany Practical – I** | **H/W** | **C** |
| **I** | **2** | **1** |

**Course Objectives**

1. To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, and fungi
2. To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.
3. To be familiar with the basic concepts and principles of cell biology.
4. Understandingoflawsofinheritance,geneticbasisoflociand alleles.
5. To learn about the principles and applications of Biotechnology

**EXPERIMENTS**

1. Make suitable micro preparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
2. Micro photographs of the cell organelles ultra structure.
3. Simple genetic problems.
4. Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms Cell biology and Biotechnology.

**Bonafide record of practical work done should be submitted for the practical examination**

**Course outcomes:**

On completion of this course, the students will be able to:

1. To study the internal organization of algae .
2. To study the structure and organization of fungi, bacteria and viruses
3. Develop critical understanding on morphology, anatomy and reproduction of

Bryophytes,Pteridophytes and Gymnosperms.

1. To study the cell structure and function.
2. Understand the fundamental concepts of genetics and Biotechnology

**Recommended texts**

1. Sharma,O.P.2017. Bryophyta,MacMillanIndia Ltd,NewDelhi.

2. Sharma,O.P.2012. Pteridophyta,Tata McGraw-Hills Ltd,NewDelhi.

3. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.

4. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.

5.Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

**Reference books**

1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manualto algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual forBryophytes and Pteridophytes. Lambert Academic Publishing.
4. AlerGingauz.2001. MedicinalChemistry.OxfordUniversityPress&WileyPublications.
5. Steward, F.C. 2012. Plant Physiology Academic Press, US

**Web Resources**

1. https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883
2. <https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover>
3. <https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4>

OUTCOME MAPPING

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

**BOTANY PRACTICAL I**

Time : 3 Hours Max. Marks : 75

**PRACTICAL QUESTION PAPER**

1. Make suitable micro preparations of the given specimens A, B and C.

Submit the slides for valuation. Identify the specimens, draw diagrams and give reasons.

(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (7 X 3) (21)

2. Make suitable micro preparations of the given specimens D.

Submit the slides for valuation. Identify the specimens, draw diagrams and give reasons.

(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (08)

3. Identify the given electron micrograph –E, describe and draw diagrams

(Identification – 2, Diagram – 3, description – 3) (08)

4. Spotters – F, G, H, I, J, K and L.

(Identification – 1, diagram – 1, Reasons – 2) (7 X 4) (28)

Total = 65

Record = 10

\_\_\_\_\_\_\_\_\_\_\_\_

Grand Total = 75

\_\_\_\_\_\_\_\_\_\_\_\_

**BOTANY PRACTICAL I**

**KEY & SCHEME OF VALUATION**

1. A – Algae / Fungi :*Sargassum/Agaricus*

B – Bryophytes :*Funaria*

C – Pteridophytes :*Lycopodium*

(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (7 X 3) (21)

2. Gymnopserms - D :*Cycas* – rachis and leaflet

(Identification – 1, diagram – 2, Reasons – 2, Slide -3) (08)

3. Cell biology - E – Electron Micrograph of organelles- Chloroplast, Mitochondria, Nucleus, Mitosis, Giant Chromosomes

– (Identification – 2, Diagram – 3, description – 3) (08)

4. Spotters – F, G, H, I, J and L(any seven of the following)

(Algae, Fungi, Bacteria, Virus, Bryophytes, Pteridophytes and Gymnosperms –permanent slides, book diagrams or wet preserved jar specimens, mentioned in the syllabus)

Cytology – photographs of cell organelles

Genetics – simple genetics problems

Plant biotechnology – tissue culture techniques : explants, callus, hardening

(Identification – 1, diagram – 1, Reasons – 2) (7 X 4) (28)

Total = 65

Record = 10

\_\_\_\_\_\_\_\_\_\_\_\_

Grand Total = 75

\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **CORE – III**  **Course Code: 23UZOOC23**  **Course Title: Chordata** | **H/W** | **C** |
| **II** | **5** | **5** |

**Course Objective**

|  |  |
| --- | --- |
| **1** | To understand the structures and distinct features of Phylum Chordata. |
| **2** | To understand and able to distinguish the characteristic features of each subphylum and class. |
| **3** | To understand the economic importance of vertebrates |
| **4** | To know about the adaptations of vertebrates |
| **5** | To understand the evolutionary position of different groups of vertebrates |

**Unit – 1: General Characters and Classification of Phylum Chordata**: Origin of Chordata, Differences between non-chordates and chordates, General characters, Affinities and Systematic position of Hemichordata (*Balanoglossus*), Urochordata (*Ascidia*), Cephalochordata (*Amphioxus*).

**Unit - 2: Prochordates and Agnatha**: Characteristics of subphylum vertebrata, Classification of Vertebrata upto Class level, Agnatha (*Petromyzon*), - Pisces (*Scoliodonsorrakowah*) General characters and classification, Origin of fishes, Affinities of Dipnoi - Types of scales and fins - Accessory respiratory organs - Air bladder - Parental care - Migration - Economic importance.

**Unit - 3: Amphibia** : General characters and classification - Origin of Amphibia - Type study - *Rana hexadactyla* - Adaptive features of Anura, Urodela and Apoda - Neoteny in Urodela - Parental care in Amphibia.

**Unit - 4: Reptilia** : General characters and classification - Type study – (*Calotes versicolor (endoskeleton of Varanus*) - Origin of reptiles and effects of terrestrialisation, Extinct reptiles. Snakes of India. Poison apparatus and biting mechanism of poisonous snakes - Skull in reptiles as basis of classification

**Unit - 5: Aves and Mammalia :** Aves: General characters and classification – Type study - *Columba livia* - Origin of birds, Flight adaptations, Migration. Mammalia: General characters and classification - Type study - Rabbit - Adaptive radiation in mammals - Egg laying mammals, Marsupials, Flying mammals, Aquatic mammals, Dentition in mammals.

**Expected Course Outcomes (CO)**

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

|  |  |
| --- | --- |
| **1** | Classify, Identify and recall the name and distinct features of different subphylum belonging to phylum Chordata. |
| **2** | Explain, and relate the origin, structural organization and evolutionary aspects of vertebrates. |
| **3** | Analyze, compare and distinguish the developmental stages and describe the important biological process. |
| **4** | Correlate the different modes of life and parental care among different vertebrates. |
| **5** | Summarise the morphology and ecological adaptations in vertebrates and list out the economic importance. |

**Text Books**

**(Latest Editions)**

* + - 1. Ayyar, E.K. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p.
      2. Jordan, E.K. and P.S. Verma, 1995. Chordate Zoology and Elements of Animal Physiology, 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp.
      3. Nigam, H.C., 1983. Zoology of Chordates, Vishal Publications, Jalandhar - 144008, 942.
      4. Ganguly, Sinha,.BharatiGoswami and Adhikari, 2004. Biology of animals Vol.II - New central book Agency (p) Ltd.
      5. Kotpal. R.L. A, Modern text book of Zoology Vertebrates- Rastogi publications. 2009

**References Books**

**(Latest editions, and the style as given below must be strictly adhered to)**

* + - 1. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub. Co.
      2. Hall B.K. and Hallgrimsson B. (2008). Strickberger’s Evolution. IV Edition. Jones and Bartlett Publishers Inc.
      3. Hickman, C.P. Jr., F.M.Hickman and L.S. Roberts, 1984. Integrated Principles of Zoology, 7th Edition, Times Merror/Mosby College Publication. St. Louis. 1065 pp.
      4. Newman, H.H., 1981. The Phylum Chordata, Satish Book Enterprise, Agra – 282 003, 477 pp.
      5. Parker and Haswell, 1964. Text Book of Zoology, Vol II (Chordata), A.Z.T,B.S. Publishers and Distributors, New Delhi - 110 051, 952 pp.
      6. Pough H. Vertebrate life, VIII Edition, Pearson International.
      7. Waterman, Allyn J. et al., 1971. Chordate Structure and Function, Mac Millan & Co., New York, 587 pp.
      8. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.

**Web Resources**

<http://tolweb.org/Chordata/2499>

<https://www.nhm.ac.uk/>

<https://bit.ly/3Av1Ejg>

<https://bit.ly/3kqTfYz>

<https://biologyeducare.com/aves/>

https://www.vedantu.com/biology/mammalia

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |  |  |
| **CO 3** |  | S | S | S | S | S |  | S |
| **CO 4** |  |  | S | S | S | M |  |  |
| **CO 5** |  |  | S |  | S |  |  | S |

**S – Strong; M – Medium; L - Low**

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **CORE – IV: Practical- II**  **Course Code: 23UZOOP24**  **Course Title: Chordata** | **H/W** | **C** |
| **II** | **4** | **5** |

**Course Objective**

|  |  |
| --- | --- |
| **1** | To understand the structures and distinct features of phylum chordata. |
| **2** | To understand and able to distinguish the characteristic features of each subphylum and class. |
| **3** | To understand and compare the structure of various internal organs in different classes of vertebrates. |
| **4** | To know about the classification, adaptations and affinities of chordate animals. |

**Unit - 1: Dissections**:Frog (Demo)/Fish:Externalfeatures,Digestivesystem, Arterialsystem,Venoussystem,5thCranialnerve,9thand10thcranial nerves, Male and female urinogenital system.

**Unit – 2: Mounting**: Fish: Placoidand Ctenoid scales, Frog: Hyoid apparatus and Brain (Demo).

**Unit – 3:Osteology**:Frog:Skullandlowerjaw,Vertebralcolumn,Pectoral girdle,Pelvicgirdle,Forelimb,Hindlimb.Chelonia-Anapsidskull,Pigeon - skull and lower jaw, synsacrum

**Unit - 4:Specimenand Slides**:**(i) Hemichordata:**Balanoglossus, Tornaria larva **(ii). Protochordata:** Amphioxus, Amphioxus T.S. through pharynx, **(iii). Urochordata; Asidian, (iv) Cyclostomata:** AsidianPetromyzon, Myxine, Ammocoetus larva **(v). Pisces:** Sphyrna Pristis, Torpedo, Channa, Pleuronectes, Hippocampus, Exocoetus, Echieneis, Labeo, Catla, Clarius, Auguilla, Protopterus, Scales: Placoid, Cycloid, Ctenoid**(vi). Amphibia:**Ichthyophis, Amblystoma, Siren, Hyla, Rachophous,Bufo,Rana, Axolotal larva **(vii). Reptilia :** Draco, Chemaeleon, Gecko, Uromastix, Viperarusselli, Naja, Bungarus, Enhydrina, Typhlops, Testudo, Trionyx, Crocodilus, Ptyas. **(viii). Aves:** Archaeopteryx, Passer,Psittacula, Bubo, Alcedo, Columba, Corvus, Pavo; Collection and study of different types of feathers: Quill, Contour, Filoplume, Down**(ix). Mammalia:**Ornithorhynchus, Tachyglossus, Pteropus, Funambulus, Manis, Loris, Hedgehog

**Unit - 5: Embryology**: Stages in the development of Amphioxus ,Frog and Chick- Placenta in shark and mammals.

**Expected Course Outcomes (CO)**

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

|  |  |
| --- | --- |
| **1** | Identify and recall the name and distinct external and internal features of animals belonging to phylum Chordata. |
| **2** | Explain the structural organization of various organs and systems in different classes of vertebrates. |
| **3** | Analyse, compare and distinguish the morphological features and developmental stages of chordates |
| **4** | Dissect and explain various organs and internal systems in different vertebrates and correlate its function. |
| **5** | Summarise the morphology and ecological adaptations in vertebrates and list out the economic importance. |

**Text Books**

**(Latest Editions)**

1. [Lal S S,](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Lal+S+S%22&source=gbs_metadata_r&cad=2) 2009. Practical Zoology Vertebrate, Rajpal and Sons Publishing, 484pp.
2. VermaP.S,2000.AManualofPracticalZoology:Chordates,S.ChandLimited, 627pp.

**References Books**

**(Latest editions, and the style as given below must be strictly adhered to)**

1. [Robert William Hegner,](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Robert+William+Hegner%22&source=gbs_metadata_r&cad=3) 2015. Practical Zoology, BiblioLife, 522pp.
2. Young, J,Z., 1972. The life of vertebrates. OxfordUni. London.

**Web Resources**

1. <https://www.youtube.com/watch?v=b04hc_kOY10>
2. <https://bit.ly/3CzTEy8>
3. <http://tolweb.org/Chordata/2499>
4. <https://www.nhm.ac.uk/>
5. <https://bit.ly/3Av1Ejg>

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |  |  |
| **CO 4** |  |  |  | S | S | M |  |  |
| **CO 5** |  |  | S |  |  |  |  | S |

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

**ELECTIVE II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **elective - ii**  **Course Code: 23UBOTE25**  **course title: Botany- II** | **H/W** | **C** |
| **II** | **3** | **2** |

**Course Objective (LO):**

|  |  |
| --- | --- |
| **1** | To be familiar with the basic concepts and principles of plant systematics. |
| **2** | Learn the importance of plant anatomy in plant production systems. |
| **3** | Understand the mechanism underling the shift from vegetative to reproductive phase. |
| **4** | To learn about the physiological processes that underlie plant metabolism. |
| **5** | To know the energy production and its utilization in plants. |

**Unit – 1: MORPHOLOGY OF FLOWERING PLANTS**

Plant and its parts.Structure and function of root and stem.Leaf and its parts.Leaf types- simple and compound.Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special types. Terminology with reference to flower description.

**Unit – 2 :TAXONOMY**

Study of the range of characters and plants of economic importance in the following families: Rutaceae, Caesalpiniaceae, Asclepiadaceae, Euphorbiaceae and Cannaceae

**Unit – 3: ANATOMY**

Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.

**Unit – 4: EMBRYOLOGY**

Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination -double fertilization, structure of dicotyledonous and monocotyledonous seeds.

**Unit – 5: PLANT PHYSIOLOGY**

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

**Expected Course Outcomes (CO)**

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

|  |  |
| --- | --- |
| **1** | Understand the fundamental concepts of plant anatomy and  embryology. |
| **2** | Analyze and recognize the different organs of plants and secondary  growth. |
| **3** | Understand water relation of plants with respect to various  physiological processes |
| **4** | Classify aerobic and anaerobic respiration. |
| **5** | Classify plant systematics and recognize the importance of  herbarium and virtual herbarium. |

**Recommended Texts**

1. Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.
2. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms

(6th revised and enlarged edition).Vikas Publishing House, New Delhi.

1. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc.

Plant Morphologists, New Delhi.

1. Salisbury, F. B.C.W. Ross.1991. Plant Physiology. Wassworth Pub. Co. Belmont.
2. Ting, I.P. 1982. Plant Physiology. Addison Wesley Pb. Philippines.

**Reference books**

1. Lawrence.G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and

enlarged edition). Vikas Publishing House, New Delhi.

1. Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.
2. Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd.
3. [Rajni Gupta](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Rajni+Gupta&search-alias=stripbooks). 2012. Plant Taxonomy: Past, Present and Future.  [Vedams (P) Ltd. New Delhi.](https://www.abebooks.com/vedams-ebooks-p-ltd-new-delhi/573945/sf" \o "Vedams eBooks (P) Ltd)
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.

**Web Resources**

1. <https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&redir_esc=y>
2. <https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFnUC&redir_esc=y>

##### [https://archive.org/EXPERIMENTS/plantanatomy031773mbp](https://archive.org/details/plantanatomy031773mbp)

1. <https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG>
2. <https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692>

**MappingwithProgrammeOutcomes:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Cos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | S | S | S | S | S | S | S | S | S | S |
| **CO2** | S | S | S | S | S | S | S | S | S | S |
| **CO3** | M | S | S | S | S | L | S | S | S | S |
| **CO4** | S | S | M | S | S | S | S | M | S | M |
| **CO5** | S | M | M | M | M | M | M | L | M | M |

**S – Strong; M – Medium; L – Low**

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **elective - ii**  **Course Code: 23UBOTEP2**  **course title: Botany Practical -II** | **H/W** | **C** |
| **II** | **2** | **1** |

**Course Objectives**

1. To enhance information on the identification of taxonomical plant
2. To be familiar with the basic concepts and principles of plant systematics.
3. Understandingof reproduction and development of angiosperms
4. To understand the internal organization of Angiopserms
5. To learn about the physiological processes that underlie plant metabolism.

**EXPERIMENTS**

1. To identify Angiosperm root, stem, leaf, flowers and fruits based on morphology
2. To describe in technical terms, plants belonging to any of the family prescribes and to identify the family.
3. To dissect a flower, construct floral diagram and write floral formula.
4. Demonstration experiments
   1. Ganong’s Light screen
   2. Ganong’srespiroscope
5. To make suitable micro preparations of anatomy materials prescribed in the syllabus.
6. Spotters - Angiosperm morphology, anatomy, Embryology and Physiology

**Bonafide record of practical work done should be submitted for the practical examination**

**Course outcomes:**

On completion of this course, the students will be able to:

1. Understand external structure of angiosperms
2. To study the classical taxonomy with reference to different parameters.
3. Understand the fundamental concepts of plant anatomy and embryology
4. To study the effect of various physical factors on photosynthesis.
5. Understand simple experiments in plant Physiology

**Recommended texts**

1. Sharma,O.P.2017. Bryophyta,MacMillanIndia Ltd,NewDelhi.

2. Sharma,O.P.2012. Pteridophyta,Tata McGraw-Hills Ltd,NewDelhi.

3. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.

4. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.

5.Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

**Reference books**

1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.
4. AlerGingauz.2001. MedicinalChemistry.OxfordUniversityPress&WileyPublications.
5. Steward, F.C. 2012. Plant Physiology Academic Press, US

**Web Resources**

1. https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883
2. <https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover>
3. <https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4>

OUTCOME MAPPING

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

**BOTANY PRACTICAL II**

Time : 3 Hours Max. Marks : 75

**PRACTICAL QUESTION PAPER**

1. Identify the given specimens –A to its respective family, draw MLS of the flower and describe it in technical terms.

(Identification of family – 2, MLS diagram – 3, technical description – 4) (09)

2. Identify the given specimen –B, to its respective family, construct the floral diagram and write the floral formula.

(Identification of family – 2, floral diagram – 3, floral formula – 2) (07)

3. Make suitable micro preparations of the given specimens C.

Submit the slides for valuation. Identify the specimens, draw diagrams and give reasons.(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (07)

4. Comment on the Physiology setup – D Write the aim, materials required , Procedure, Results and Inference

( Aim-1, Materials required -1, Procedure -2 , Results and Inference -3) (07)

4. Spotters – E, F, G, H, I, J, K and L.

(Identification – 1, diagram – 2, Reasons – 2) (7 X 5) (35) \_\_\_\_\_\_\_\_\_\_\_\_

Total = 65

Record = 10

\_\_\_\_\_\_\_\_\_\_\_\_

Grand Total = 75

\_\_\_\_\_\_\_\_\_\_\_\_

BOTANY PRACTICAL II

KEY & SCHEME OF VALUATION

1. Taxonomy - A – MLS of the flower (from any one family mentioned in the syllabus)

(Identification of family – 2, MLS diagram – 3, technical description – 4) (09)

2. Taxonomy - B – Floral diagram and floral formula (from any one family mentioned in the syllabus)(Identification of family – 2, floral diagram – 3, floral formula – 2) (07)

3.. Anatomy - C : Dicot and monocot – stem, root and leaf.

(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (07)

4. Physiology Set up D - Osmosis – thistle funnel experiment, Photosynthesis – Beaker and Funnel experiment, Ganong’s light screen and Ganong’srespire scope

( Aim-1, Materials required -1, Procedure -2 , Results and Inference -3) (07)

5. Spotters –E, F, G, H, I, J , and K (any seven of the following) (08)

Morphology – vegetative and reproductive morphological parts

Anatomy – simple and complex tissues, dicot, monocot root and leaf

Embryology – ovules, anther T.S.

Physiology - Osmosis – thistle funnel experiment, Photosynthesis – Beaker and Funnel experiment, Ganong’s light screen and Ganong’srespire scope experimental setup.

(Identification – 1, diagram – 2, Reasons – 2) (7 X 5) (35) \_\_\_\_\_\_\_\_\_\_

Total = 65

Record = 10

\_\_\_\_\_\_\_\_\_

Grand Total = 75

\_\_\_\_\_\_\_\_\_

**Elective Courses offered to other Science Department in I and II Semesters**

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **Elective - I**  **COURSE CODE: 23UZOOE15**  **Course Title : Zoology – I** | **H/W** | **C** |
| **I** | **3** | **2** |

**Course Objectives**

The main objectives of this course are:

|  |  |
| --- | --- |
| 1 | To acquire a basic knowledge of diversity and organization of Protozoa, Coelenterata, Helminthes and Annelida |
| 2 | To acquire a basic knowledge of diversity and organization of Arthropoda, Mollusca and Echinodermata |
| 3 | To comprehend the taxonomic position and diversity among Protochordata, Pisces and Amphibia |
| 4 | To comprehend the taxonomic position and diversity among Reptilia, Aves and Mammalia |
| 5 | To acquire detailed knowledge of selected invertebrate and chordate forms |

**Unit - I: Diversity of Invertebrates–**I

Principles of taxonomy.Criteria for classification–Symmetry and Coelom–Binomial nomenclature. Classification of Protozoa, Porifera, Coelenterata, Helminthes and Annelida upto classes with two examples.

**Unit – II: Diversity of Invertebrates–II**

Classification of Arthropoda, Mollusca and Echinodermata upto class level with examples.

**Unit – III: Diversity of Chordates–I**

Classification of Prochordata, Pisces and Amphibia upto orders giving two examples.

**Unit – IV: Diversity of Chordates–II**

Classification of Reptilia, Aves and Mammalia upto orders giving two examples.

**Unit –V :Animal organization**

Structure and organization of (i) Earthworm, (ii) Rabbit/Rat, (iii) Prawn/Fish

**Expected Course Outcomes**

On completion of this course, students will:

|  |  |
| --- | --- |
| **1** | Recall the characteristic features invertebrates and chordates. |
| **2** | Classify invertebrates up to class level and chordates up to order level |
| **3** | Explain and discuss the structural and functional organisation of some invertebrates and chordates |
| **4** | Relate the adaptations and habits of animals to their habitat |
| **5** | Analyse the taxonomic position of animals. |

**Text Books (Latest Editions)**

* + - 1. EkambaranathaIyer, - Outlines of Zoology, Viswanathan Publication.

**References Books**

**(Latest editions, and the style as given below must be strictly adhered to)**

Ekambaranatha Iyar and T.N.Ananthakrishnian - A Manual of Zoology Invertebrata–VoI. I: Viswanathan Publishers.

Ekambaranatha Iyar and T.N. Ananthakrishnan, - A Manual of Zoology -Invertebrata–Vol. II: Viswanathan Publishers.

Ekambaranatha Iyar and T.N.Ananthakrishnan, - A Manual of Zoology: Chordata Viswanathan Publishers.

Jordan E.L. and P.S. Verma-Invertebrate Zoology, S. Chand & Co.

**Web Resources**

1. [www.sanctuaryasia.com](http://www.sanctuaryasia.com/)

2. [www.iaszoology.com](http://www.iaszoology.com/)

**Outcome Maping**

|  |  |  |  |  |  |  |  |  |
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|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  |  |  |  |  |  |
| **CO 2** | M | S |  |  |  |  |  |  |
| **CO 3** |  |  |  | S |  | S |  |  |
| **CO 4** |  |  |  | S | S | M |  |  |
| **CO 5** |  |  | S |  |  |  |  | S |

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

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| --- | --- | --- | --- |
| **Semester** | **Elective - I**  **COURSE CODE: 23UZOOEP1**  **Course Title : ZoologyPractical – I** | **H/W** | **C** |
| **I** | **2** | **1** |

**Course Objectives**

|  |  |
| --- | --- |
| 1 | To identify the different groups of invertebrate animals by observing their external characteristics. |
| 2 | To understand the organs, organ system and their functions in lower animals. |
| 3 | To get knowledge about the different modes of life and their adaptation based on the environment. |
| 4 | Able to dissect and display the internal organs and mount the mouthparts and scales of invertebrates. |

**UNIT – I :Major Dissection :**

Cockroach: Digestive system. Earthworm: Nervous System, *Pila globosa*: Digestive system. Prawn: Appendages. Digestive system Reproductive of fish.

**UNIT – II: Minor Dissection:**

Earthworm: Body setae; Pineal setae. *Pila globosa*: Radula. - Honey Bee and Mosquito mouth parts

**UNIT – III: Mounting:**

Fish : Placoid and Ctenoid scales

**UNIT - IV: Spotters :(i).**

**Protozoa:** Amoeba, Paramoecium, Paramoecium Binary fission and Conjugation, *Entamoeba histolytica, Plasmodium vivax* **(ii). Porifera:**Sycon, Spongilla, Euspongia, **(iii). Coelenterata:** Obelia – Colony & Medusa, Aurelia, Physalia, Pennatula

**(iv). Platyhelminthes:** Planaria, *Fasciola hepatica*,*Taenia solium*, **Nemathelminthes:** Ascaris (Male & Female), *Wuchereria* **(vi). Annelida:** Nereis, Chaetopteurs, Hirudinaria, **(vii). Arthropoda:** Palaemon, Limulus, Peripatus, **(viii). Mollusca:** Chiton, Pila, Unio, Sepia, Loligo, Nautilus, **(ix). Echinodermata:** Asterias, Echinus, Cucumaria, Antedon,

**UNIT - V: Spotters :(ii).**

**(i) Hemichordata:** Balanoglossus, **(ii). Cephalochordata:** Amphioxus,**(iii). Urochordata:** Asidian, **(iv)Cyclostomata:** Petromyzon, Myxine, **(v). Pisces:** Pristis, Torpedo, Channa, Hippocampus, Exocoetus, Echieneis, Labeo, Catla, Clarius, Anguilla, Protopterus, **(vi). Amphibia:** Ichthyophis, Hyla, Rachophous, Bufo, Rana, **(vii). Reptilia :** Draco, Chemaeleon, Gecko, Viperarusselli, Naja, Bungarus, **(viii). Aves:** Archaeopteryx, Alcedo, Columba, Corvus, **(ix). Mammalia:**  Pteropus, and , Rabbit/ Rat/ squirrel

**Expected Course Outcomes**

On completion of this course, students will;

|  |  |
| --- | --- |
| **1** | Identify and label the external features of different groups of invertebrate animals. |
| **2** | Illustrate and examine the circulatory system, nervous system and reproductive system of invertebrate animals. |
| **3** | Differentiate and compare the structure, function and mode of life of various groups of animals. |
| **4** | To compare and distinguish the dissected internal organs of lower animals. |
| **5** | Prepare and develop the mounting procedure of economically important invertebrates. |

**Text Books**

**(Latest Editions)**

1. EkambaranathaIyyar and T. N. Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1, 2) S. Viswanathan, Chennai.
2. Ganguly, Sinha an d A dhikari , 2 0 11 . Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.
3. Sinha, Chatterjee and Chattopadhyay, 2 0 1 4. Advanced Practical Zoology, Books & Allied Ltd; 3rd Revised edition, 1 07 0 pp.
4. Lal ,S. S, 2016 . Practical Zoology Invertebrate, Rastogi Publications.
5. Verma, P. S. 2010. A Manual of Practical Zoology: Invertebates, S Chand, 4 97pp.

**References Books**

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science.
2. Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition. Holt Saunders International Edition.
3. Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson
4. Boradale, L.A. and Potts, E.A. (1961). *Invertebrates: A Manual for the use of Students*. Asia Publishing Home.
5. Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut

**Web Resources**

1. <https://nbb.gov.in/>
2. <http://www.agshoney.com/training.htm>
3. <https://icar.org.in/>
4. <http://www.csrtimys.res.in/>
5. <http://csb.gov.in/>
6. <https://iinrg.icar.gov.in/>
7. <https://www.nationalgeographic.com/animals/invertebrates/>

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  | S | S | S | M |  |
| **CO 2** | M | S |  |  | M |  | L |  |
| **CO 3** |  |  | M | S |  | S |  |  |
| **CO 4** | S |  |  | S | S | M | S |  |
| **CO 5** |  |  | S |  |  | S |  | S |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **Elective - II COURSE CODE: 23UZOOE25**  **Course Title: Zoology– II** | **H/W** | **C** |
| **II** | **3** | **2** |

**Course Objectives**

|  |  |
| --- | --- |
| 1 | To enable students to learn basic concepts relating to aspects of respiratory, circulatory, excretory, nervous and sensory physiology. |
| 2 | To enable students to comprehend the processes involved during development |
| 3 | To enable students to learn basic concepts of immunity and the working of immune organs and familiarize them with the recommended vaccination schedule |
| 4 | To enable students to comprehend the basic concepts of human genetics and patterns of inheritance |
| 5 | To enable students to learn about aspects of animal behaviour such as foraging, courtship, nest construction, parental care and learning |

Unit – I: Respiration- Respiratory pigments and transport of gases. Mechanismofbloodclotting.Typesofexcretoryproducts–Ornithinecycle.Structureofneuron–Conductionofnerve impulse, Mechanism of vision andhearing.

Unit – II: Fertilization,Cleavage,GastrulationandOrganogenesisof Frog; Placentation in mammals

Unit – III:Innate and Acquired - Active and Passive; Antigens and Antibodies; Immunologicalorgans–responses inhumans; Vaccination schedule

Unit – IV: Human Genetics: Human Chromosomes – Sex Determination in Humans; Patterns of Inheritance: Autosomal Dominant, Autosomal Recessive, X-linked , Y-linked, Mitochondrial, Multiple Allelic and Polygenic; Genetic Counseling

Unit - V: Animal Behaviour: Foraging, Courtship Behaviour, Shelter and Nest Construction, Parental Care, Learning Behaviour

**Expected Course Outcomes**

On completion of this course, students will be able to:

|  |  |
| --- | --- |
| **1** | Recall the parts and working of body organs and developmental stages, name the patterns of inheritance and list different types of animal behaviour |
| **2** | Analyse the different developmental stages |
| **3** | Analyse the working of body and immune systems |
| **4** | Analyse the different patterns of inheritance |
| **5** | Relate the behaviour of animals to physiology. Analyse the different types of behavior |

**Text Books (Latest Editions)**

* + - 1. Verma P.S. & Agarwal - Developmental Biology, Chordata embryology S. Chand & Co.

**References Books**

**(Latest editions, and the style as given below must be strictly adhered to)**

Owen, J. A., Punt, J. &Stranford, S. A. Kuby Immunology. New York: W.H. Freeman & Company.

Klug, W. S., Cummings, M. R. & Spencer, C - Concepts of Genetics. (12th ed.). New Jersey: Pearson Education.

Mathur, R. Animal Behaviour. Meerut: Rastogi.

VermaP.S. & Agarwal Developmental Biology, Chordata embryology. S.Chand& Co.

**Outcome Maping**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  | S |  | M |  | S | S |
| **CO 2** | M | S |  |  |  |  |  |  |
| **CO 3** |  | S | M | S |  | S | M |  |
| **CO 4** | S |  |  | S | S | M |  |  |
| **CO 5** |  |  | S |  |  |  |  | S |

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Semester** | **Elective - II COURSE CODE: 23UZOOEP2**  **Course Title: Zoology Practical – II** | **H/W** | **C** |
| **II** | **2** | **1** |

Course Objectives:

|  |  |
| --- | --- |
| 1 | To learn basic concepts relating to various physiological aspects of animals. |
| 2 | To comprehend the processes involved during development |
| 3 | To learn basic concepts of immunity and familiarize on immune organs. |
| 4 | To know the basic concepts of human genetics and patterns of inheritance |
| 5 | To learn about aspects of animal behaviour. |

**Practicals:**

**UNIT I: MAJOR**

1. Qualitative detection of excretory products (Ammonia, Urea, Uric acid).
2. Identification of ABO blood groups.
3. Polygenic inheritance with respect to body height in human.

**UNIT II: MINOR**

1. Demonstration of lymphoid organs.
2. Study of behavioural adaptations of animals
3. Vital staining of chick blastoderm.
4. Y – linked inheritance (Hairy Pinna in human)

**UNIT III: Spotters**

1. Construction and identification of pedigree for the X – linked Dominant inheritance (Ricket), X-linked recessive inheritance (Colour blindness),
2. Identification of Human syndrome- Turner’s syndrome, Kleinfelter’s Syndrome and Down’s Syndrome.

**UNIT IV: Spotters**

Frog egg,

Frog Cleavage – 2-cell, 4-cell & 8-cell

Frog – Blastula, Gastrula

Placenta of pig and sheep

**UNIT V: Spotters**

Immunological organs –Lymph node, Spleen, Thymus and Bone marrow

**Expected Course Outcomes**

On completion of this course, students will be able to:

|  |  |
| --- | --- |
| 1 | Recall the parts and working of body organs |
| 2 | Analyse the different developmental stages |
| 3 | Analyse the functioning of body and immune systems |
| 4 | Analyse the different patterns of inheritance |
| 5 | Understand the different types of behaviour |

**Text Book(s)**

1 Arumugam N. (2013). Developmental Zoology, Saras Publication, Nagercoil, Tamilnadu, India.

2 Das S. (2020).Microbiology Practical Manual, CBS Publication, Delhi.

3 Jayasurya, Arumugam N, Dulsy Fatima. (2013). Practical Zoology Vol 3, Saras Publication, Nagercoil, Tamilnadu, India.

4 Singh HR and Neerajkumar. (2014). Animal Physiology and Biochemistry, Vishal Publishing Co. Jalandhar, Delhi.

**Outcome Maping**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S | M |  | M | M | S |  | S |
| **CO 2** | M | S | M |  | S |  | M |  |
| **CO 3** | S | M |  | S |  | S |  | M |
| **CO 4** | S | S |  | S | S | M |  |  |
| **CO 5** | S | S | S |  |  |  | S | S |

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

**SKILL ENHANCEMENT COURSES (NME)**

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| --- | --- | --- | --- |
| **Semester** | **NME – I**  **COURSE CODE: 23UZOON16**  **COURSE TITLE: Economic Zoology** | **H/W** | **C** |
| **I** | **2** | **2** |

**Course Objective**

1. To understand the culturing techniques and production methods of different farm animals.
2. To know the life history of animals and disease control methods used in farming.
3. To understand the concept of breeding, cross breeding and the importance of high yield varieties.
4. To know about the marketing strategies.

**Unit I:Economic Entomology** : Apiculture: Species of honey bees – Social organisation of honey bee – selection of bees and location for apiary – Newton’s bee hive – products of bee keeping – enemies and diseases of honey bees. Sericulture: Species of silkworm – life history of mulberry silkworm – Rearing of silkworm – pests and diseases of silkworm.

Lac Culture: Introduction – Life history – Host plants – cultivation of Lac – Enemies of lac cultivation – Economic importance of Lac.

**Unit II: Vermiculture :** Introduction: Types of earthworms – ecological classifications of earthworms – Physical, chemical and biological changes caused by earthworms in the soil – Natural enemies of earthworms. Vermicomposting: vermicomposting methods – factors affecting vermicomposting –Vemiculture unit. Harvesting of vermicompost – vermicast – advantages of vermicompost – vermiwash and its applications.

**Unit III: Aquaculture :** Fresh water aquaculture: Carp culture – types of ponds – preparation – maintenance – harvesting and management. Integrated and composite culture. Prawn culture. Marine Aquaculture: Edible – pearl oyster culture. Ornamental fish culture: Aquarium fishes– Aquarium maintenance in home.

**Unit IV: Poultry Farming :** Poultry industry in India – Poultry for sustainable food production and livelihood - Commercial poultry farming – Nutritive value of egg and meat- Broiler management (Definition; Housing and equipment; Brooding, feeding and health cover of broilers; Record keeping; Broiler integration) – Layer management (Brooder; Grower and layer management; Culling of layers; Marketing of eggs and meat). Women in backyard poultry farming.

**Unit V: Dairy Farming :**Dairy farming – advantages of dairying – classification of breeds of cattle – Indigenous and exotic breeds – Selection of dairy cattle. Breeding – artificial insemination – Dairy cattle management – housing – water supply – cattle nutrition feeding standards – Common contagious diseases. Milk - Composition of milk – milk spoilage – pasteurization – Role of milk and milk products in human nutrition – Dairying as a source of additional income and employment.

**Text Books**

1. Sastry, N.S.R., C.K.Thomas and R.A.Singh, 2015. Livestock Production Management, 4thEd.Kalyani Publishers, New Delhi.   
   Mary violet Christy, A. 2014. Vermitechnology, MJP Publishers, Chennai.
2. ICAR, 2013. Hand book of Animal Husbandry, 4th Ed., ICAR Publication, Pusa, New Delhi.
3. Awasthi, V.B., 2012. Introduction to General and Applied Entomology, third edition, Scientific publishers, India.
4. Vasanthraj David, B and Ramamurthy, VV., 2012. Elements of Economic Entomology, Seventh edition, Namrutha publications, Chennai.
5. Shukla &Upadhyay, 2014. Economic Zoology, 5th edn. Rastogi Publication, Meerut New Delhi.
6. Gupta, S.M., 2010. Text book of fishery, Ann Backer, Mumbai.
7. ShailendraGhosh, 2009. Fisheries and aquaculture management, Adhyayan, New Delhi.
8. David, B and Ananthakrishnan, T. N., 2006. General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd., New Delhi, India.
9. Jagadish Prasad, 2002. Principles and practices of Dairy Farm Management, 3rd Ed. Kalyani Publishers, Ludhiana.
10. Sukumar, D.E., 2002. Outline of Dairy Technology, Oxford University, New Delhi.
11. Rath, R.K., 2000. Freshwater Aquaculture. Scientific Publishers (India), Jodhpur.
12. Ismail, S.A., 1997. Vermitechnology, The biology of earthworms, Orient Longman, India.
13. Prabakaran, R. 1998. Commercial Chicken production. Published by P. Saranya, Chennai.
14. Hafez, E. S. E., 1962. Reproduction in Farm Animals, Lea &Fabiger Publisher.

**Suggested Readings**

1. Glenn Munroe, 2017. Manual of on-Farm vermicomposting and vermiculture, Holdanca Farms Ltd, Wallace, Nova Scotia.
2. Hanifa, M.A., 2011. Aquatic resources and aquaculture, Dominent, New Delhi.
3. Gupta, P.K., 2008. Vermicomposting for sustainable agriculture, 2nd Edition, Agrobios, India.
4. Talashikar, S.C., 2008. Earthworms in Agriculture, Agrobios, India.
5. Abishek Shukla, D ., 2 0 0 9 . A Hand Book of Economic Entomology, Vedamse Books, New Delhi .
6. Banerjee, G.C., 2006. Text book of Animal Husbandry 8thEd.Oxford and IBH Publishing Company Ltd., New Delhi.
7. Walstra, P. Wouters, J.T.M. and Geurts, T.J. 2006. Dairy Science and Technology. CRC Press, New York.
8. Dunham, R.A., 2004. Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K.
9. Donald.D Bell and William. D. Weaver, 2002. Commercial chicken meat and egg production, Springer, New York.
10. Eckles C.H. and Anthony, E.L., 2001. Dairy Cattle and milk production, Biotech. Tata McGraw Hill Publishing Co.Pvt.Ltd., New Delhi.
11. Edwards, C.A., and Bother, B., 1996. Biology of earthworms, Chapman Hall Publication company.
12. ICAR, 1997. Handbook of Animal Husbandary– The Indian Council of Agricultural

Research, New Delhi.

1. Banerjee G.C., 1992. Poultry, Oxford and IBH, New Delhi.
2. Jhingran, AVG, 1991. Fish and Fisheries of India. Hindustan Publishing Co. New Delhi.
3. James. N. Marner, 1975. Principles of dairy processing, wiley eastern limited, New Delhi.
4. Baradach, JE. Ryther. JH. and, MC larney WO., 1972. Aquaculture. The farming and Husbandry of Freshwater and Marine Organisms. Wiley InterScience, NewYork.

**Web Resources**

1. <https://bit.ly/3tXHjk8>
2. <https://bit.ly/3tUTHBu>
3. <https://bit.ly/3hVv96q>
4. <https://bit.ly/39nztH1>
5. <https://bit.ly/3CzasVO>
6. <https://agritech.tnau.ac.in/org_farm/orgfarm_vermicompost.html>
7. <https://bit.ly/3nYvgSF>
8. <http://caa.gov.in/farms.html>
9. <http://www.csrtimys.res.in/>
10. <http://www.agshoney.com/training.htm>

**Course Outcomes (COs)**

1. To identify the breeds and varieties of poultry, fish, bees, and cattle and understand the basic aspects of farming.
2. To assess and integrate the available tools and techniques to increase the productivity in farms.
3. To analyse the pros and cons of different methods of farming and marketing strategies of products.
4. To evaluate the use of available resources in improving the breeds, vermicomposting, farm products etc..
5. To design new methods to improve farm animals with increased productivity and disease resistance and to construct new methods in vermicomposting.

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| --- | --- | --- | --- |
| **Semester** | **NME - II**  **COURSE CODE:23UZOON26**  **Ornamental Fish Farming& Management** | **H/W** | **C** |
| **II** | **2** | **2** |

**Course Objective (LO):**

|  |  |
| --- | --- |
| **1** | To highlight the importance of ornamental fish culture in relation to entrepreneurship development. |
| **2** | To enable the identification, culture and maintenance of commercially important ornamental fishes. |
| **3** | To provide the knowledge on the techniques of ornamental fish breeding, rearing,disease control and economics of ornamental fish farming. |

**Unit I:**

Introduction to ornamental fish keeping.

Scope and importance of ornamental fish culture.

Domestic and global scenario of ornamental fish trade and export potential.

Commercially important ornamental fishes - Indigenous and exotic varieties.

**Unit II:**

Biology of egg layers and live bearers.

Food and feeding in ornamental fishes. Formulated feed and Live feed; Live feed culture.

Breeding, hatchery and nursery management of egg layers (eg. Goldfish) and live bearers (eg.Guppy).

**Unit III:**

Aquarium design and construction; Accessories - aerators, filters and lighting.

Aquarium plants and their propagation.

Maintenance of aquarium and water quality management.

**Unit IV:**

Disease management of Ornamental fishes(symptoms, Life cycle, and their prevention, control and treatment methods.Protozoan diseases,Bacterial diseases,crustacean diseases,Fungal diseases and Helminth diseases

**Unit IV:**

Conditioning, packing, transport and quarantine methods.

Economics, trade regulations, domestic and export marketing strategies.

**References**:

1. Swain SK., Sarangi N. and Ayyappan S. 2010. Ornamental fish farming. ICAR, New Delhi.

2. Living Jewels – A handbook on freshwater ornamental fish, MPEDA, Kochi.

# 3. Dey V.K.A. 1997. A handbook on aquafarming ornamental fishes. MPEDA, Kochi.

4. Ahilan, B., Felix N. and Santhanam R. 2008. Text book of aquariculture. Daya Publishing House, New Delhi.

# Web links:

# 1. <http://ecoursesonline.iasri.res.in/course/view.php?id=297>

# 2. <https://www.ofish.org/>

# 3. <https://krishijagran.com/agripedia/income-generation-by-ornamental-fish-culture/>

**4.** <https://99businessideas.com/ornamental-fish-farming/>

**Expected Course Outcomes (COs)**

|  |  |
| --- | --- |
| **1** | The students will be able to identify, culture, maintain and market the commercially important ornamental fishes. |
| **2** | The knowledge and skills gained on the different aspects of ornamental fish keeping will enable the students to develop entrepreneurship potential and help in self employment. |

**Outcome Maping**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** |
| **CO 1** | S |  |  |  | M |  |  | S |
| **CO 2** | M | S |  |  |  |  | S |  |
| **CO 3** |  |  |  | S |  | S |  |  |
| **CO 4** | M |  |  | S | S | M |  |  |
| **CO 5** |  |  | S |  |  |  | M | S |

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