M. Sc. Zoology

Syllabi

UNIVERSITY DEPARTMENT

Program Code: ***

2025 - 2026 onwards



BHARATHIAR UNIVERSITY

(A State University, Accredited with "A" Grade by NAAC, Ranked 13th among Indian Universities by MHRD-NIRF, World Ranking: Times - 801-1000, Shanghai - 901-1000, URAP - 982)

Coimbatore - 641046, Tamil Nadu, India

BHARATHIAR UNIVERSITY COIMBATORE – 641046

M. Sc. ZOOLOGY Curriculum (University Department) (For the students admitted during the academic year 2025 – 26 onwards)

Scheme of Examination syllabi

| | | | Hot | irs | Max | imum N | Iarks |
|----------------------|--|---------|--------|-----------|-----|--------|-----------------|
| Course Code | Title of the Course | Credits | Theory | Practical | ESE | CIA | Total |
| | SEMESTER - I | | | | | | |
| Core (Theory) | | | | | | | |
| 25ZOO-13A | Structure and Functions of Invertebrates and Vertebrates | 4 | 4 | - | 75 | 25 | 100 |
| 25ZOO-13B | Molecular Cell Biology | 4 | 4 | - | 75 | 25 | 100 |
| 25ZOO-13C | Animal Physiology & Endocrinology | 4 | 4 | - | 75 | 25 | 100 |
| 25ZOO-13D | Medical Laboratory Techniques | 4 | 4 | - | 75 | 25 | 100 |
| Core Practical - I | [| | | | | | |
| 25ZOO-13P | Structure and Functions of Invertebrates & Vertebrates, Molecular Cell Biology, Animal Physiology & Endocrinology, and Medical Laboratory Techniques | 1 | - | 8 | 75 | 25 | 100 |
| Elective - I (Option | onal) | | | | | | |
| 25ZOO-1EA | Marine Biology | 4 | 4 | _ | 75 | 25 | 100 |
| 25ZOO-1EB | Applied Entomology | | | | | 23 | |
| | Offered by other Departments) | 2 | 2 | - | 38 | 12 | 50 |
| 25ZOO-131 | 'Anti-Drug' - 30 hours - Volunteering Programme (2 hrs. every Saturday except Government holiday) | | - | - | - | - | Completion only |
| | Total credits/hours/mark | 26 | 22 | 8 | 488 | 162 | 650 |
| | SEMESTER - II | | | | | | |
| Core (Theory) | | | | | | | |
| 25ZOO-23A | Experimental Embryology | 4 | 4 | - | 75 | 25 | 100 |
| 25ZOO-23B | Immunology & Microbiology | 4 | 4 | - | 75 | 25 | 100 |
| 25ZOO-23C | Molecular Genetics | 4 | 4 | - | 75 | 25 | 100 |
| 25ZOO-23D | Research Methodology and Biostatistics | 4 | 4 | - | 75 | 25 | 100 |
| Core Practical - I | | | | | | | |
| 25ZOO-23P | Experimental Embryology, Immunology & Microbiology, Molecular Genetics, and Research Methodology & Biostatistics | 4 | | 8 | 75 | 25 | 100 |
| Elective - II (Opti | onal) | | | | | | |
| 25ZOO-2EA | Molecular Taxonomy | 4 | 1 | | 75 | 25 | 100 |
| 25ZOO-2EB | Stem Cell Biology | 4 | 4 | - | 75 | 25 | 100 |
| Supportive –II* (| 2 | 2 | - | 38 | 12 | 50 | |
| Job Oriented Cor | urse - I** | | | | | | |
| 25ZOO2JA | Fish Processing Technology | 4 | 4 | - | - | 100 | 100 |
| Value Added Cou | | | | | | | |
| 25ZOO2VA | Bioinstrumentation | 4 | 4 | - | | 100 | 100 |
| | Total credits/hours/mark | 26 | 22 | 8 | 488 | 162 | 650 |

| | SEMESTER - III | | | | | | |
|---------------------|---|---------------------|---------------|---|------|------------------------|-------------------|
| Core (Theory) | | | | | | | |
| 25ZOO-33A | Animal Phylogeny and Evolution | 4 | 4 | - | 75 | 25 | 100 |
| 25ZOO-33B | Environmental Biology and Toxicology | 4 | 4 | - | 75 | 25 | 100 |
| 25ZOO-33C | Biophysics and Biochemistry | 4 | 4 | - | 75 | 25 | 100 |
| 25ZOO-33D | Conservation Biology | 4 | 4 | - | 75 | 25 | 100 |
| Core Practical - | III | | | | | | |
| 25ZOO-33P | Animal Phylogeny & Evolution, Environmental Biology &Toxicology, Biophysics & Biochemistry, and Conservation Biology | 4 | - | 8 | 75 | 25 | 100 |
| Elective - III (opt | / | | | | | | |
| 25ZOO-3EA | Fisheries and Aquaculture | 4 | 4 | _ | 75 | 25 | 100 |
| 25ZOO-3EB | Medical Zoology | 4 | 4 | _ | /3 | 23 | 100 |
| Supportive - III* | (Offered by other Departments) | 2 | 2 | - | 38 | 12 | 50 |
| 25ZOO-333 | Health and Wellness (one extra credit | 1 | - | - | - | - | Completio only |
| | hour on every Saturday except | | | | | | |
| | Government holiday) | | | | | | |
| | Total credits/hours/mark | 26 | 22 | 8 | 488 | 162 | 650 |
| | SEMESTER - IV | | | | | | |
| Field Trip & Ski | ll Development | | | | | | |
| | Field Trip (Institutional, Research Laboratories, Industrial visits etc., for I & II years). Skill Development (Summer school/ Training/ Internship etc., at the end of the II semester)*. Health and Wellness# (III Semester). | 4 (2+1+1) | - | - | - | 100 (50+25+25) | 100 |
| Project Work & | | | | | | | |
| 25ZOO-47V | Project Work & Viva-Voce Examination | 4 | 26 | _ | 50 | 50 | 100 |
| Elective - IV (opt | | | | | | | |
| 25ZOO-4EA | Bioethics and Intellectual Property Rights | _ | | | | | 400 |
| 25ZOO-4EB | Global Warming and Climate Change | 4 | 4 | - | 75 | 25 | 100 |
| Job Oriented Co | | | | | | | |
| 25ZOO-4JA | | 4 | 4 | _ | _ | 100 | 100 |
| | Conservation | | | | | | |
| Value Added Co | I . | | | | | | |
| 25ZOO-4VA | Fish Culture | 4 | 4 | - | - | 100 | 100 |
| Professional Cer | tification Course*** | | | | | | |
| 25ZOO-4NS | SWAYAM – MOOC (Study Webs of Active-Learning for Young Aspiring Minds (National Programme on Technology Enhanced Learning) – Massive Open Online Course). | 2 | - | - | - | - | Completic |
| | Total credits/hours/mark | 12 | 30 | - | 125 | 175 | 300 |
| | Grand Total credits/hours/mark | 90 (26x3+12) | 120 (30x4) | - | 1589 | 661 (162x3+175) | 2250 |

^{*}Offered by other Departments.

NOTE: 75% attendance is compulsory in each subject. For the final grading and ranking, only the core course credits mark will be taken into account. However, it is compulsory to completion of all the extra credits for the award of the degree.

^{**}These courses are mandatory. They shall not be taken for the calculation of grade point average.

^{***}This course should have been for the duration of at least 4 weeks with 2 credits at least. The course is mandatory and should have been completed within third semester, i.e., before the beginning of the 4th semester. This also shall not be taken for the calculation of grade point average (GPA).

[#]Classes conducted on Saturday except Government holiday.

Question Paper Pattern for Core and Elective Theory Examination: Maximum: 100 Mark

1. End Semester Examination: 75 Mark

Section A - 10x1=10 Mark (Question No. 1 to 10)

Multiple choice question, Choose the correct Answer, Answer all questions, All questions Carry equal mark.

Section B – 5x5 = 25 Mark (Either or type – Question No. 11 to 15)

Answer all questions, Each and every question carries equal mark, Each and every answer should not be exceeded 2 pages.

Section C – 5x8 = 40 Mark (Either or type – Question No. 16 to 20)

Answer all questions, Each and every question carries equal mark, Each and every answer should not be exceeded 4 pages.

2. Continuous Internal Assessment: 25 Mark

(Internal Test, 15 Mark (Test-I, 30 mark; Test-II, 30 mark; Model Exam, 50 mark); Assignment, 5 Mark; Seminar, 5 Mark)

Question Paper Pattern for Core Practical Examination: Maximum: 100 Mark

1. End Semester Examination: 75 Mark

Major Practical: 25 Mark
Minor Practical: 15 Mark
Spotters (A, B, C, D & E) 5x5: 25 Mark
Record: 10 Mark

2. Continuous Internal Assessment: 25 Mark

Major Practical: 10 Mark
Minor Practical: 5 Mark
Spotters: 10 Mark

Question Paper Pattern for Supportive Examination: Maximum: 50 Mark

1. End Semester Examination: 38 Mark

Section A – 5x1=5 Mark (Question No. 1 to 5)

Multiple choice question, Choose the correct answer, Answer all questions, All questions carry equal mark.

Section B -3x3 = 9 **Mark** (Either or type – Question No. 6 to 10)

Answer all questions, Each and every question carries equal mark

Section C – 4x6 = 24 Mark (Either or type – Question No. 11 to 13)

Answer all questions, Each and every question carries equal mark

2. Continuous Internal Assessment: 12 Mark

(Internal Test, 6 Mark; Assignment, 3 Mark; Seminar, 3 Mark)

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POST-GRADUATION IN ZOOLOGY

Programme Specific Outcomes (PSOs) for M.Sc., Zoology

PSO1 – Placement

To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, belief, and apply diverse frames of reference to decisions and actions.

PSO 2 - Entrepreneur

To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate start-ups and high potential organizations.

PSO3 – Research and Development

Design and implement HR systems and practices grounded in research that complies with employment laws, leading the organization towards growth and development.

PSO4 – Contribution to Business World

To produce employable, ethical and innovative professionals to sustain in the dynamic business world.

PSO 5 – Contribution to the Society

To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

Programme Outcomes (POs) for each subject

PO1: Problem Solving Skill

Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.

PO2: Decision Making Skill

Foster analytical and critical thinking abilities for data-based decision-making.

PO3: Ethical Value

Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.

PO4: Communication Skill

Ability to develop communication, managerial and interpersonal skills.

PO5: Individual and Team Leadership Skill

Capability to lead themselves and the team to achieve organizational goals.

PO6: Employability Skill

Inculcate contemporary business practices to enhance employability skills in the competitive environment.

PO7: Entrepreneurial Skill

Equip with skills and competencies to become an entrepreneur.

PO8: Contribution to Society

Succeed in career endeavours and contribute significantly to society.

PO9: Multicultural competence

Possess knowledge of the values and beliefs of multiple cultures and a global perspective.

PO10: Moral and ethical awareness/reasoning

Ability to embrace moral/ethical values in conducting one's life.

First Semester

| Students should know various hicrarchical positions in the taxonomical classification of the sub-divisions invertebrates and vertebrates. Course Objectives | Core Course-I | 25ZOO-13A | STRUCTURE AND FUNCTIONS OF INVERTEBRATES AND VERTEBRATES | Credits | 4/ Week |
|---|---|--|--|--|---|
| classification of major groups of invertebrates and vertebrates 2. To understand various physiological systems and their mode of functions in invertebrates and vertebrates. Expected Course Outcome On the successful completion of the course, students will be able to: Recognize the origin of different invertebrate and vertebrate animals, structures and their functions, and understanding their classifications. K1 & K2 2. Understand the evolutionary significance of each invertebrate and vertebrate groups. K3 & K4 3. Culture and conservation of different invertebrate and vertebrate animals for economic development and creation of assets. K5 & K6 K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create Unit: 1 PRINCIPLES OF ANIMAL TAXONOMY | Pre-requisite | | taxonomical classification of the sub-division | | |
| On the successful completion of the course, students will be able to: 1. Recognize the origin of different invertebrate and vertebrate animals, structures and their functions, and understanding their classifications. K1 & K2 2. Understand the evolutionary significance of each invertebrate and vertebrate groups. K3 & K4 3. Culture and conservation of different invertebrate and vertebrate animals for economic development and creation of assets. K5 & K6 K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create Unit: 1 Unit: 1 PRINCIPLES OF ANIMAL TAXONOMY I4 hours General characteristics of animal phyla-Classification of animal phyla upto order levels. Species Concept-Habitats of living Invertebrates in Global levels- Organization of coclom: Acoclomates Pseudococlomates—Coclomate groups (Schizococ), Enterococl and Mesenchyme). 3D data visualization in invertebrates—Invertebrate monitoring. Unit: 2 LOCOMOTION AND FEEDING HABITS OF INVERTEBRATES 14 hours Locomotion and adaptive mechanism in invertebrates - Flagellar, ciliary movements in Protozoa—Hydrostatic movement in Coelenterata, Annelida, and Echinodermata. Feeding habits: Nutrition and feeding mechanism in invertebrates—Nutrition in protozoa, Types and mode of feeding - Feeding diversity in insects- Filter feeding in Lower metazoans, Crustacean, Mollusca and Echinodermata—functional mechanism. Unit: 3 ORGAN SYSTEMS OF INVERTEBRATES 14 hours Digestive Systems - Over view of the Circulatory systems, Respiratory systems, Exerctorysystems, Nervous and sensory system and Reproductive systems of animals. Unit: 4 ORGAN SYSTEMS OF VERTEBRATES 14 hours Respiratory Organs - Ventilatory Mechanisms—Form and Function—ExcretorySystems: Urinary Systems, Respiratory Organs - Ventilatory Mechanisms—Form and Function—ExcretorySystems: Urinary System and function of the Kidney- Nervous system: Peripheral Nervous Systems and Centra Nervous Systems—Sensory Organs: Components of sensory organs- General sensory organs. Unit: 5 INTEGUMENT | Course Object | ives | classification of major groups of invertebrates 2. To understand various physiological system | and verte | brates |
| K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create Unit: 1 | Expected Cour | rse Outcome | On the successful completion of the course, studer 1. Recognize the origin of different inverte animals, structures and their functions, and classifications. K1 & K2 2. Understand the evolutionary significance of vertebrate groups. K3 & K4 3. Culture and conservation of different invertanimals for economic development and creaters. | ebrate and understate each investebrate and | vertebrate and vertebrate |
| Unit: 1 | IZ1 Damanla | IZA II. danata | | Casata | |
| General characteristics of animal phyla- Classification of animal phyla upto order levels. Species Concept- Habitats of living Invertebrates in Global levels- Organization of coelom: Acoelomates - Pseudocoelomates - Coelomate groups (Schizocoel, Enterocoel and Mesenchyme). 3D data visualization in invertebrates-Invertebrate monitoring. Unit: 2 LOCOMOTION AND FEEDING HABITS OF INVERTEBRATES 14 hours Locomotion and adaptive mechanism in invertebrates - Flagellar, ciliary movements in Protozoa - Hydrostatic movement in Coelenterata, Annelida, and Echinodermata. Feeding habits: Nutrition and feeding mechanism in invertebrates-Nutrition in protozoa, Types and mode of feeding - Feeding diversity in insects- Filter feeding in Lower metazoans, Crustacean, Mollusca and Echinodermata - functional mechanism. Unit: 3 ORGAN SYSTEMS OF INVERTEBRATES 14 hours Nervous and sensory system and Reproductive systems of animals. Unit: 4 ORGAN SYSTEMS OF VERTEBRATES 14 hours Respiratory Organs - Ventilatory Mechanisms- Form and Function- ExcretorySystems: Urinary Systems. Structure and function of the Kidney- Nervous system: Peripheral Nervous System and Centra Nervous Systems- Sensory Organs: Components of sensory organs- General sensory organs. Unit: 5 INTEGUMENT AND SKELETAL SYSTEMS OF VERTEBRATES 14 hours General features of the Integument (Dermis and Epidermis); Phylogeny-Specialization of the Integument; Skeletal System: Overview of Skull Morphology, Design and Function. Contemporary Issues: Expert lectures, Seminars, Webinars 2 hours Text Book(s) 1 Comparative anatomy of vertebrates- S.K. Kulshrestha- Anmol Publications PVT.LTD, New Delhi. 1999 2 Invertebrate Zoology - Barnes (Robert.D) 3 A Textbook Of Invertebrate Zoology - Prasad (S N) 4 Vertebrate History - Stahl(Barbara.J) - Megraw Hill 1974 5 Textbook Of Vertebrate Zoology - Prasad(S N) - Wiley Eastern 1991 | | | | | harres |
| General features of the Integument (Dermis and Epidermis); Phylogeny-Specialization of the Integument; Skeletal System: Overview of Skull Morphology, Design and Function. Contemporary Issues: Expert lectures, Seminars, Webinars Total Lecture hours 72 hours Text Book(s) Comparative anatomy of vertebrates- S.K. Kulshrestha- Anmol Publications PVT.LTD, New Delhi. 1999 Invertebrate Zoology - Barnes (Robert.D) A Textbook Of Invertebrate Zoology - Prasad (S N) Vertebrate History - Stahl(Barbara.J) - Mcgraw Hill 1974 Textbook Of Vertebrate Zoology - Prasad(S N) - Wiley Eastern 1991 | Concept- Habi Pseudocoeloma in invertebrates Unit: 2 Locomotion ar Hydrostatic me feeding mecha diversity in in functional mecha Unit: 3 Digestive Syst Nervous and se Unit: 4 Respiratory Or Structure and Nervous System | tats of living In tates – Coelomate s-Invertebrate mode. LOCOMOTIO and adaptive meanism in inverte sects- Filter fee thanism. Ottomark – Over vice sensory system and gans - Ventilator function of the ms- Sensory Org | nvertebrates in Global levels- Organization of congroups (Schizocoel, Enterocoel and Mesenchyme). Nand FEEDING HABITS OF INVERTEBRATE Chanism in invertebrates - Flagellar, ciliary moved lenterata, Annelida, and Echinodermata. Feeding ebrates-Nutrition in protozoa, Types and mode ding in Lower metazoans, Crustacean, Mollusca RGAN SYSTEMS OF INVERTEBRATES away of the Circulatory systems, Respiratory systems deproductive systems of animals. DRGAN SYSTEMS OF VERTEBRATES by Mechanisms- Form and Function- ExcretorySystems of Systems of S | TES 14 ements in habits: N of feedin and Echin and Echin 14 ems: Urin System ary organs. | hours Protozoa - utrition and g - Feeding nodermata - hours orysystems, hours ary System- and Central |
| Integument; Skeletal System: Overview of Skull Morphology, Design and Function. Contemporary Issues: Expert lectures, Seminars, Webinars Total Lecture hours 72 hours Text Book(s) 1 Comparative anatomy of vertebrates- S.K. Kulshrestha- Anmol Publications PVT.LTD, New Delhi. 1999 2 Invertebrate Zoology - Barnes (Robert.D) 3 A Textbook Of Invertebrate Zoology - Prasad (S N) 4 Vertebrate History - Stahl(Barbara.J) - Mcgraw Hill 1974 5 Textbook Of Vertebrate Zoology - Prasad(S N) - Wiley Eastern 1991 | | | | | |
| Text Book(s) 1 Comparative anatomy of vertebrates- S.K. Kulshrestha- Anmol Publications PVT.LTD, New Delhi. 1999 2 Invertebrate Zoology - Barnes (Robert.D) 3 A Textbook Of Invertebrate Zoology - Prasad (S N) 4 Vertebrate History - Stahl(Barbara.J) - Mcgraw Hill 1974 5 Textbook Of Vertebrate Zoology - Prasad(S N) - Wiley Eastern 1991 | | | | | ion of the |
| Text Book(s) 1 Comparative anatomy of vertebrates- S.K. Kulshrestha- Anmol Publications PVT.LTD, New Delhi. 1999 2 Invertebrate Zoology - Barnes (Robert.D) 3 A Textbook Of Invertebrate Zoology - Prasad (S N) 4 Vertebrate History - Stahl(Barbara.J) - Mcgraw Hill 1974 5 Textbook Of Vertebrate Zoology - Prasad(S N) - Wiley Eastern 1991 | Contemporar | y Issues: Expert | | 2 | hours |
| Comparative anatomy of vertebrates- S.K. Kulshrestha- Anmol Publications PVT.LTD, New Delhi. 1999 Invertebrate Zoology - Barnes (Robert.D) A Textbook Of Invertebrate Zoology - Prasad (S N) Vertebrate History - Stahl(Barbara.J) - Mcgraw Hill 1974 Textbook Of Vertebrate Zoology - Prasad(S N) - Wiley Eastern 1991 | | | Total Lecture hours | 72 | hours |
| 3 A Textbook Of Invertebrate Zoology – Prasad (S N) 4 Vertebrate History - Stahl(Barbara.J) - Mcgraw Hill 1974 5 Textbook Of Vertebrate Zoology - Prasad(S N) - Wiley Eastern 1991 | 1 Comparati 1999 | | | VT.LTD, | New Delhi. |
| 4 Vertebrate History - Stahl(Barbara.J) - Mcgraw Hill 1974 5 Textbook Of Vertebrate Zoology - Prasad(S N) - Wiley Eastern 1991 | | | | | |
| 5 Textbook Of Vertebrate Zoology - Prasad(S N) - Wiley Eastern 1991 | | | | | |
| Reference Books | | | | | |
| | Reference Boo | oks | | | |

| 1 | The Invertebrata- Borradile, L.A Cambridge University Press. |
|------|--|
| 2 | • |
| 2 | Life of Vertebrates - Young, J.F Clarendon Press. Oxford. |
| 3 | Evolution of the Vertebrates - Colbert, E.H John Wiley and Sons Inc. New York. |
| 4 | Invertebrate Zoology - Hegner (Robert.W); Engemann (Joseph.G)- Macmilan Publishing Company |
| | 1968 |
| 5 | Comparative Vertebrate Anatomy - Hyman (Libbie. Henrietta) - The University Of Chicago Press |
| | 1942 |
| 6 | Vertebrate Biology - Orr(Robert.T) - W.B.Saunders Co 1971 |
| 7 | Vertebrate Adaptations - Readings From Scientific American |
| 8 | The Vertebrate Brain - Pearson(Ronald And Lindsay) - Academic Press |
| 9 | Comparative Correlative Neuro Anatomy Of The Vertebrate Telencephalon - Crosby(Elizabeth.C); |
| | Schnitzliein(H.N) Ed., - Macmilan Publishing Company 1982 |
| Re | elated Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] |
| 1 | Systems Biology (NPTEL) web https://nptel.ac.in/courses/102/106/102106035/ |
| Cour | rse Teacher: Dr. N. ARUL |

| | Mapping with Programme Outcomes* | | | | | | | | | |
|-----|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | M | S | S | S | S | S | S | S | M | M |
| CO2 | M | M | S | M | S | S | M | M | S | M |

PO1, Problem Solving Skill; PO2, Decision Making Skill; PO3, Ethical Value; PO4, Communication Skill; PO5, Individual and Team Leadership Skill; PO6, Employability Skill; PO7, Entrepreneurial Skill; PO8, Contribution to Society; PO9, Multicultural competence; PO10, Moral and ethical awareness/reasoning.

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

| | 25ZOO-13B | MOLECULAR CELL BIOLOGY C | redits | 4/ Week |
|--|--|---|---------------------------------------|---|
| Dro roquisito | | Knowledge on what are cells and their molecules. | | |
| Pre-requisite Course Objective | | 1. To understand the concept of characterization, ic | lentific | eation and |
| Course Objectiv | CS | classification of major groups of invertebrates. | | ation and |
| | | 2. To understand various physiological systems an | d their | mode of |
| | | functions in invertebrates. | | |
| Expected Cours | e Outcome | On the successful completion of the course, students v | | |
| | | 1. Understanding the structures and functions of | prokar | yotic and |
| | | eukaryotic cells. K1 & K2 2. Realize the importance each cellular and sub-cellular | ılar co | mnonents |
| | | involvement in accomplishing function of a cell | | |
| | | organism. K3 & K4 | i, organ | ii diid tiic |
| | | 3. Study the ill-effects of a cancer, the mechanism | of its f | ormation, |
| | | and how to prevent/ delay its occurrence. K5 & I | | |
| K1 - Remember | ; K2 - Understa | and; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - C | reate | |
| Unit:1 | | BASIC CONCEPTS | 14 h | ours |
| Structure of ato | ms, molecules, | chemical bonds and interactions. Composition, struc | ture an | d function |
| of carbohydrate | es, lipids, pro | teins, nucleic acids and vitamins. Cell organization | n, Sul | b- cellular |
| structures of p | orokaryotic an | nd eukaryotic cells. Synthesis and sorting of pla | asma 1 | membrane. |
| Functions of pla | ısma membrane | e and cell organelles. | | |
| Unit:2 | DNA A | AND RNA REGULATORY MECHANISMS | 14 h | ours |
| Evidence of b | pasic targets, | enzymes, mechanisms of DNA replication in e | ukaryo | tes. Extra |
| | _ | damage and repair mechanisms. Mechanisms of | - | |
| | = | -RNA and hn-RNA structures and folding. Conformat | | |
| nucleic acids, an | | _ | | |
| Unit:3 | | PROTEIN SYNTHESIS | 14 h | ours |
| Ribosomes, Go | enetic code, | General control of DNA, RNA and protein | synthe | esis, Post- |
| | | d confirmations of proteins. Protein targeting, Dornucleic acids structure. | nains, | Motif and |
| Unit:4 | CEL | L COMMUNICATION, SIGNALLING AND | 14 h | ours |
| | | MOLECULE TRANSPORT | | |
| | | General principles of cell communication and adhesion | Signs | 1' , 1 |
| Regulation of he | ematopoiesis. (| deficial principles of cell communication and adiresion | i. Digiic | aling at the |
| _ | - | | _ | _ |
| cell surface rece | eptors, Types of | of signaling pathways that control gene activity, Integration and its regulation. Movement of proteins into | gration | of signals |
| cell surface rece and gene contro | eptors, Types ols. Neurotransi | of signaling pathways that control gene activity, Integnission and its regulation. Movement of proteins into | gration memb | of signals oranes and |
| cell surface rece and gene contro organelles, Ves | eptors, Types ols. Neurotransricular traffic, s | of signaling pathways that control gene activity, Integnission and its regulation. Movement of proteins into secretion and endocytosis. Intra and inter cell | gration membular | of signals oranes and |
| cell surface rece and gene contro organelles, Ves | eptors, Types ols. Neurotransricular traffic, s | of signaling pathways that control gene activity, Integnission and its regulation. Movement of proteins into | gration membular | of signals branes and movement |
| cell surface rece and gene contro organelles, Ves of lipid molecule Unit:5 | eptors, Types of ls. Neurotransr icular traffic, s es. Mechanism | of signaling pathways that control gene activity, Integration and its regulation. Movement of proteins into secretion and endocytosis. Intra and inter cell of spike protein and mammalian cell receptor interaction. CELL CULTURE | gration o membular on. | of signals branes and movement |
| cell surface reco and gene contro organelles, Ves of lipid molecule Unit:5 | eptors, Types of ls. Neurotransicular traffic, ses. Mechanism | of signaling pathways that control gene activity, Integration and its regulation. Movement of proteins into secretion and endocytosis. Intra and inter cell of spike protein and mammalian cell receptor interaction. CELL CULTURE cell cycle, Cell birth, Lineage and cell death. Cellular | gration o membrate ular on. 14 ho | of signals branes and movement ours |
| cell surface rece and gene contro organelles, Ves of lipid molecule Unit:5 | eptors, Types of ls. Neurotransricular traffic, ses. Mechanism e Eukaryotic of y and establish | of signaling pathways that control gene activity, Integration and its regulation. Movement of proteins into secretion and endocytosis. Intra and inter cell of spike protein and mammalian cell receptor interaction. CELL CULTURE cell cycle, Cell birth, Lineage and cell death. Cellular and cell lines, Kinetics of cell growth, Genetics of cultures. | gration o member ular on. 14 ho morph | of signals branes and movement ours |
| cell surface rece and gene contro organelles, Ves of lipid molecule Unit:5 Regulation of the markers, Primar cell culture, er | eptors, Types on the color of t | of signaling pathways that control gene activity, Integnission and its regulation. Movement of proteins into secretion and endocytosis. Intra and inter cell of spike protein and mammalian cell receptor interactive CELL CULTURE cell cycle, Cell birth, Lineage and cell death. Cellular and cell lines, Kinetics of cell growth, Genetics of culture decells and their applications. Cell culture based very constant of the control of the control of the cells and their applications. | gration o member ular on. 14 ho morph | of signals branes and movement ours |
| cell surface rece and gene contro organelles, Vest of lipid molecule Unit:5 Regulation of the markers, Primare cell culture, er oncogenes, Virus | eptors, Types of ls. Neurotransicular traffic, ses. Mechanism e Eukaryotic ory and establish mbryonic stem is induced cancer. | of signaling pathways that control gene activity, Integration and its regulation. Movement of proteins into secretion and endocytosis. Intra and inter cell of spike protein and mammalian cell receptor interactive. CELL CULTURE cell cycle, Cell birth, Lineage and cell death. Cellular and cell lines, Kinetics of cell growth, Genetics of culture decells and their applications. Cell culture based were and therapies. | gration o member ular on. 14 ho morph | of signals branes and movement ours nology and cells, Stem s. Cancer/ |
| cell surface rece and gene contro organelles, Vest of lipid molecule Unit:5 Regulation of the markers, Primare cell culture, er oncogenes, Virus | eptors, Types of ls. Neurotransicular traffic, ses. Mechanism e Eukaryotic ory and establish mbryonic stem is induced cancer. | of signaling pathways that control gene activity, Integnission and its regulation. Movement of proteins into secretion and endocytosis. Intra and inter cell of spike protein and mammalian cell receptor interaction. CELL CULTURE cell cycle, Cell birth, Lineage and cell death. Cellular and cell lines, Kinetics of cell growth, Genetics of culture decells and their applications. Cell culture based were and therapies. t lectures, Seminars, Webinars | gration o member ular on. 14 ho morph | of signals branes and movement ours nology and cells, Stem s. Cancer/ |
| cell surface rece and gene contro organelles, Vest of lipid molecule Unit:5 Regulation of the markers, Primare cell culture, er oncogenes, Virus | eptors, Types of ls. Neurotransicular traffic, ses. Mechanism e Eukaryotic ory and establish mbryonic stem is induced cancer. | of signaling pathways that control gene activity, Integration and its regulation. Movement of proteins into secretion and endocytosis. Intra and inter cell of spike protein and mammalian cell receptor interactive. CELL CULTURE cell cycle, Cell birth, Lineage and cell death. Cellular and cell lines, Kinetics of cell growth, Genetics of culture decells and their applications. Cell culture based were and therapies. | gration o member ular on. 14 ho morph | of signals branes and movement ours nology and cells, Stem s. Cancer/ |
| cell surface rece and gene contro organelles, Vest of lipid molecule Unit:5 Regulation of the markers, Primare cell culture, er oncogenes, Virus | eptors, Types of ls. Neurotransicular traffic, ses. Mechanism e Eukaryotic ory and establish mbryonic stem is induced cancer. | of signaling pathways that control gene activity, Integnission and its regulation. Movement of proteins into secretion and endocytosis. Intra and inter cell of spike protein and mammalian cell receptor interaction. CELL CULTURE cell cycle, Cell birth, Lineage and cell death. Cellular and cell lines, Kinetics of cell growth, Genetics of culture decells and their applications. Cell culture based were and therapies. t lectures, Seminars, Webinars | gration o member ular on. 14 ho morph | of signals branes and movement ours nology and cells, Stem s. Cancer/ |

| 2 | Cell Biology, De Robertis (Edp) & Others, 5 th Edition |
|-----------|--|
| 3 | Cell Biology, Genetics, Evolution and Ecology, Edn.3 Part Ii Verma (P.S), Aul. H) Ed. Nch |
| | (James); Agarwal (V.K.) |
| 4 | Cell and Molecular Biology: Concepts and Experiments. Carp Gerald, 1996. John Wiley & |
| | Sons Publishers. |
| 5 | Concept of Cell Biology, Verma (PS); Agarwal (VK), S. Chand & Co Publishers. |
| Referen | nce Books |
| 1 | Cell Biology, Power (C.B), 3 rd Edition, Himalaya Publishers. |
| 2 | Cell Biology, Gupta (M L); Jangir (M L), 1 st Edition. |
| 3 | Cell Biology, Rastogi (S C), 1 st Edition, New Age International Limited Publishers. |
| 4 | A Textbook of Cell Biology, Shukla (R M), 1 st Edition, Dominant Publishers. |
| 5 | Cytogenetics, Swanson (Carl. P) Etc. Prentice Hall Publishers. |
| Related | Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] |
| 1 | NOC: Cell Culture Technologies : |
| | https://nptel.ac.in/courses/102/104/102104059/ |
| 2 | Molecular Cell Biology: https://nptel.ac.in/courses/102/106/102106025/ |
| 3 | Cell Biology: https://nptel.ac.in/courses/102/103/102103012/ |
| 4 | Molecular Cell Biology: https://nptel.ac.in/courses/102/106/102106025/ |
| 6 | Molecular Biology: https://swayam.gov.in/nd2_cec20_ma13/preview |
| 7 | Cell biology: https://swayam.gov.in/nd2_ |
| Course Te | eacher: Dr. P. SARAVANA BHAVAN |

| | Mapping with Programme Outcomes* | | | | | | | | | | |
|-----|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|--|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | |
| CO1 | S | S | S | M | M | M | M | M | M | M | |
| CO2 | S | S | M | M | M | S | S | M | M | M | |
| CO3 | M | M | M | S | S | S | S | S | M | M | |

PO1, Problem Solving Skill; PO2, Decision Making Skill; PO3, Ethical Value; PO4, Communication Skill; PO5, Individual and Team Leadership Skill; PO6, Employability Skill; PO7, Entrepreneurial Skill; PO8, Contribution to Society; PO9, Multicultural competence; PO10, Moral and ethical awareness/reasoning.

^{*}S, Strong; M, Medium; L, Low

| Core Course -l | II 25ZOO-13C | ANIMAL PHYSIOLOGY & ENDOCRINOLOGY | Credits | 4/ Week | | | | |
|---|--|---|---|----------------------------------|--|--|--|--|
| Pre-requisit | <u> </u> | Knowledge on different organ systems of anima | ıls and hu | ıman. | | | | |
| Course Obje | | To make the students to understand the in functioning of different organ systems in anima in human. | - | • | | | | |
| - | urse Outcome | On the successful completion of the course, studed Recognize how the digestive, excretory, recirculatory systems are functioning in animal K2 Know the role of brain, spinal cord and associand hormones are supporting/ regulating valued K3 & K4 Give respect to the heart, mind and soul of every to sustain healthy life style. K5 & K6 | productivels and hus and here rious bookers | vous system, dy functions. | | | | |
| | | tand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K | | | | | | |
| Unit: 1 | | DIGESTION AND EXCRETION | | hours | | | | |
| Mammalian k | idney - Urine fo | Role of salivary glands, Pancreas and intestinal glands remation - waste elimination - regulation of water and control of gastrointestinal hormones. | | | | | | |
| Unit: 2 | | CIRCULATION AND RESPIRATION | 1 | 4 hours | | | | |
| of respiration Unit: 3 Neurons - C | NERVO | OUS SYSTEM AND SENSE ORGANS theral Nervous system - Nerve impulse transmontrol of muscle tone and posture; Photo, Phono a | 1 nission | 4 hours - Synapse – e responses | | | | |
| Unit: 4 | | ENDOCRINE GLANDS | 1 | 4 hours | | | | |
| | | nd functions, role of hormone secretions – Struc, Pineal and Thymus glands. | ture and | functions of | | | | |
| Unit: 5 | | RMONES AND REPRODUCTION | 1 | 4 hours | | | | |
| HormonalGonadal steregland grow | regulation of condition of condition on specific and functions. | oroductive organs – Gametogenesis - Reproductive ovarian cycles in mammals- Hormones in pregrantogenesis and spermatogenesis – Role of hormonesis – Role of | gnancy and an anones in s | nd lactation. ex accessory | | | | |
| Co | ontemporary 188 | ues: Expert lectures, Seminars, Webinars | | nours | | | | |
| Text Book | | Total Lecture hours | | nours | | | | |
| | nal Physiology F | dn.5 Part Ii, Verma (P.S) Etc, Aul. H Ed.Nch (Jar | nes) Him | alava 2000 | | | | |
| | date Zoology an | d Animal Physiology, Jordan(El); Verma(P.S), S (| | | | | | |
| 3 Intro | duction to Anim | al Physiology, Kay(Ian), Bios Scientific Publisher | | | | | | |
| | | Physiology and Endocrinology, Berry (Ak), Emke | - | | | | | |
| Stud | ents OfZoology | Physiology With Related Biochemistry For B.S of All Indian Universities, Berry (Ak), Emkey Pub 2002 | olications | , | | | | |
| | nal Physiology A ersityPress, 1994 | Adaptation and Environment, Nielson (Knut Schrift 4 | nidt), Ca | mbridge | | | | |
| 7 Yad | v, Text book of | Endocrinology, 2009, Sonali Publications, New D | | | | | | |
| | 8 Williams, R H. 1981. Text book of Endocrinology, Ed. 6 th W. B. Saunders Company, Philadelphia, London. | | | | | | | |

| 9 | George Griffing, Endocrinology, 2015, Stat Pearls Publishing, USA |
|----------|--|
| 10 | De Groot. 1979. Endocrinology, Vol. 1-3, Grune and Stratton, New York |
| Refere | ence Books |
| 1 | Essentials of Animal Physiology, Rastogi(S C), The New Age International 2008 |
| 2 | Animal Physilogy Mechanisms and Adaptions, Randall, W.H. Freeman & Co. Ltd, 2002 |
| 3 | Animal Physiology, Schmidt-Nielsen(Knut), Cambridge, 1997 |
| 4 | Animal Physiology, Stewart (Michael) Ed, Hodder And Stougton, 1991 |
| 5 | Mac E. Hadley, Endocrinology. 1996, Prentice Hall |
| 6 | M.P. Goswami, Endocrinology and Molecular Cell Biology, 2013. Gaurav book centre Pvt Ltd,Delhi |
| 7 | Stephen Nussey and Saffron Whitehead. 2001. Endocrinology - An Integrated Approach, Oxford:BIOS Scientific Publishers; 2001. |
| 8 | Bondy P. K. and Rosenberg L.E. 1974. Duncan"s disease of Metabolism – Genetics, Metabolismand Endocrinology. W.B. Saunders Co., Philadelphia, London. |
| Relate | ed Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] |
| 1 | Animal Physiology: https://swayam.gov.in/nd1_noc20_bt42/preview |
| 2 | Physiology and Biochemistry: https://swayam.gov.in/nd2_cec20_bt19/preview |
| 4 | Animal Physiology: https://www.classcentral.com/course/swayam-animal-physiology-12894 |
| 5 | Respiration in the Human Body: https://www.classcentral.com/course/edx-respiration-in-the-human-body-3050 |
| 6 | Introduction to Brain & Behaviour: https://swayam.gov.in/nd1 noc20 hs33/preview |
| 7 | Endocrinology: https://www.classcentral.com/course/swayam-endocrinology-19855 |
| Course T | eacher: Dr. V. RAMASUBRAMANIAN |

| | Mapping with Programme Outcomes* | | | | | | | | | | |
|-----|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|--|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | |
| CO1 | S | S | S | S | M | M | S | M | M | M | |
| CO2 | S | S | M | S | S | S | S | M | S | S | |
| CO3 | S | S | S | S | S | M | M | M | M | M | |

PO1, Problem Solving Skill; PO2, Decision Making Skill; PO3, Ethical Value; PO4, Communication Skill; PO5, Individual and Team Leadership Skill; PO6, Employability Skill; PO7, Entrepreneurial Skill; PO8, Contribution to Society; PO9, Multicultural competence; PO10, Moral and ethical awareness/reasoning.*S, Strong; M, Medium; L, Low.

| Core Course-IV | 25ZOO-13D | MEDICAL LABORATORY TECHNIQUES | Credits | 4/ Week | |
|--|------------------------|--|-------------|----------------|--|
| Pre-requisite | | Knowledge on the physiology and Biochemistry of different | cells | | |
| Course Objecti | ves | To make the students familiar in conducting some basic m with clear cut protocol and procedures. | nedical lal | boratory tests | |
| Expected Course Outcome On the successful completion of the course, students will be able to: 1. Know how to maintain a clinical lab and its components such a aseptic, instrument handling as per protocol and procedure? K1 & K2 2. Conduct some basic hematological, serological, biochemical, phy histopathological and microbiological tests on different human samp K4 3. Prepare a report on the obtained results for interpretation with the K5 & K6 | | | | | |
| K1 - Remember; | K2 - Understand | ; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create | | | |
| Unit-I | | BIO-SAFETY AND HEALTH ISSUES | 1 | 4 hours | |

Laboratory safety: Toxic chemicals and biohazards waste – bio-safety level - good laboratory practice - hygiene and health issue - Biomedical waste management.

Unit-II BLOOD PROFILE 14 hours

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 haemoglobin - erythrocyte sedimentation 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 PARASITOLOGY AND IMAGING 14 hours

Definition and scope of microbiology: Parasites – *Entamoeba – Plasmodium - Leishmania* and *Trypanosome* - Computer tomography (CT scan) - Magnetic resonance imaging (MRI) – PET- Flow cytometry – Sputum, Semen, Urine and Stool analyses.

Unit-IV MONITORING OF HEART FUNCTION 14 hours

Cardiovascular system: Blood pressure - Pulse - regulation of heart rate - cardiac shock - Heart sounds - Electrocardiogram (ECG) - Ultra sonography - Electroencephalography (EEG). Treadmill test -.

Unit-V HISTOPATHOLOGY 14 hours

Handling and labeling 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.

Contemporary Issues: Expert lectures, Seminars, Webinars

Total Lecture hours

72 hours

Reading list

- 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, 10th 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.

Recommended texts

- 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.

Course Teachers: Dr. P. SARAVANA BHAVAN; Dr. V. RAMASUBRAMANIAN;
Dr. C. GUNASEKARAN; Dr. N. ARUL; Dr. T. MURALISANKAR

| | Mapping with Programme Outcomes* | | | | | | | | | |
|-----------------|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | S | S | S | S | S | S | M | S | M | M |
| CO2 | S | S | S | M | M | S | S | S | M | M |
| CO ₃ | S | S | S | S | S | S | S | S | M | M |

PO1, Problem Solving Skill; PO2, Decision Making Skill; PO3, Ethical Value; PO4, Communication Skill; PO5, Individual and Team Leadership Skill; PO6, Employability Skill; PO7, Entrepreneurial Skill; PO8, Contribution to Society; PO9, Multicultural competence; PO10, Moral and ethical awareness/reasoning.
*S, Strong; M, Medium; L, Low.

| Core Practical –I | 25ZOO-13P | STRUCTURE AND FUNCTIONS | Credits | 4/ Week |
|-------------------|-----------|-------------------------------|---------|---------|
| | | OF INVERTEBRATES & | | |
| | | VERTEBRATES, MOLECULAR | | |
| | | CELL BIOLOGY, ANIMAL | | |
| | | PHYSIOLOGY & | | |
| | | ENDOCRINOLOGY, AND | | |
| | | MEDICAL LABORATORY | | |
| | | TECHNIQUES | | |
| ELINGTIONAL | MODDIIOI | OCV OF INVENTEDDATE ANDVENTED | DATEC | 26 1 |

FUNCTIONAL MORPHOLOGY OF INVERTEBRATE ANDVERTEBRATES

36 hours

- 1. Protozoans and Helminthes of medical importance: Amoeba proteus, Entamoeba histolytica, Trypanosoma, Leishmania donovani, Liver fluke, Schistosoma, Tapeworm, Ascaris, Filaria.
- 2. Significance of differnent larval forms of Invertebrate phyla.
- 3. Types of insect mouth parts: Honey bee, Housefly, Mosquito, Bed bug and Butterfly.
- 4. Affinities of following animals:;
 - a). Amphioxus b). Balanoglossus c). Ascidian d). Peteromyzon
- 5. Adaptive features following animals with reference to their modes of life:
 - a). Echeneis b). Ichthyophis / Uraeotphlus c). Hyla d). Draco e). Pigeon f). Bat
- 6. Types of skulls with reference to jaw suspensions:a). Fish b). Frog c)

b). Frog c). Calotes d). Pigeon;

e) Rabbit; f) Human

MOLECULAR CELL BIOLOGY

36 hours

- 1. Demonstration of different types of microscope optical, phase contrast and fluorescence.
- 2. Squash preparation of polytene chromosome from the salivary gland of *Chironomous* larva.
- 3. Squash preparation of onion root tip to identify mitotic stages.
- 4. Squash preparation of grasshopper testis to identify meiotic stages.
- 5. Measurements of cells using stage and ocular micrometers.
- 6. Determination of nucleo-cytoplasmic index (insect and fish oocytes).
- 7. Extraction, isolation and detection of DNA and its amplification to a specific gene using PCR (Demonstration only).
- 8. Profiling of protein through SDS-PAGE (Demonstration only).

ANIMAL PHYSIOLOGY & ENDOCRINOLOGY

36 hours

- 1. Determination of the effect of temperature and substrate concentration on salivary amylase activity.
- 2. Effect of Temperature on the Opercular activity in fish
- 3. Effect of different saline water medium on the Oxygen consumption by fish
- 4. Oualitative analysis of Ammonia, Urea and Uric acid in the Urine sample of an animal.
- 5. Estimation of blood urea using DAM method
- 6. Oral Glucose Tolerance Test (OGTT).
- 7. View on the T.S. of prepared slide: Pituitary gland; Thyroid gland; Pancreas; Adrenal gland; Thymus; Testis; Ovary.

MEDICAL LABORATORY TECHNIQUES

36 hours

- 1. Preparation of swabs/sterile tubes and bottles.
- 2. Blood collection in human types
- 3. Preparation of blood smear and differential leucocytes count.
- 5. Preparation of haemin crystal.
- 6. Determination of bleeding time and clotting time in human.
- 7. Enumeration of total red blood cells (RBC).
- 8. Enumeration of total white blood cells (WBC).
- 09. Estimation of haemoglobin level using Sahli's apparatus.
- 10. Calculations for mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC)

| Contemporary Issues: Expert lectures, Seminars, Webinars | 2 hours |
|--|---------------------------------|
| | Total practical hours 146 hours |
| Text Book(s) | |

| 1 | Advanced Practical Zoology by Sinha, J., Chatterjeee A.K., Chattopadhyay P. 2011. Arunabha |
|-------|--|
| | Sen Publishers. |
| 2 | Practical Zoology Invertebrate by H.S. Bhamrah. 2003. Dominant Publishers. |
| 3 | Lal, S.S. 2009. Practical Zoology, Rastogi Publications, pp |
| 4 | Iuliis G. D. and D. Pulerà, 2007. The Dissection of Vertebrates: A Laboratory Manual. |
| | Academic Press, Imprint of Elsevier Publication, pp |
| 5 | Verma, P.S. 2000. Manual of Practical Zoology: Chordates, S. Chand Publishing Company, |
| | pp |
| 6 | Text Book of Invertebrate and Vertebrate Zoology – Agarwal, Dalela, Jai Prakash Nath Meerut 1982 |
| 7 | Animal Physiology And Biochemistry - Agarwal, R A, S Chand New Delhi 2007 |
| Refe | erence Books |
| 1 | Fundamentals of Biochemistry by Jain J.L, Sunjay Jain, Nitin Jain. 2007. |
| 2 | Modern Experimental Zoology by Preeti Guptha and Mridula Chaturvedi. 2000 |
| 3 | Manual of Practical Zoology: Chordates by Verma. (2000. S. Chand Publishing |
| 4 | Cell and Molecular Biology: A Lab Manual by Chaitanya K.V. 2013. Prentice Hall India |
| | Learning Private Limited |
| 5 | Manual of Practical Physiology and Endocrinology by Harsh Vardhan Bhask. 2009. Campus |
| | Books International |
| 6 | Preeti, G., and C. Mridula, 2000. Modern Experimental Zoology, Indus International |
| | Publication. |
| 7 | Sinha, J., A. K. Chatterjeee, P. Chattopadhya. 2011. Advanced Practical Zoology, Arunabha |
| | Sen Publishers, pp-1070. |
| 8 | Practical Invertebrate and Vertebrate Zoology, Agarwal, V P, Jai Meerut 1978 |
| Cours | se Teachers: Dr. P. SARAVANA BHAVAN; Dr. V. RAMASUBRAMANIAN; |
| | Dr. C. GUNASEKARAN; Dr. N. ARUL; Dr. T. MURALISANKAR |

| Elective Course - I (Optional) | 25ZOO-1EA | MARINE BIOLOGY | Credits | 4/ Week | | | | |
|--|--|--|--|--|--|--|--|--|
| Pre-requisite | | Basic understand on organisms living inthe marine environment. | | | | | | |
| Course Objectives | s: | The main objectives of this course are to: | | | | | | |
| 3 | | 1. Acquire basic knowledge on Oceanography | | | | | | |
| | | 2. Study the ecological and economic importance of | marine flora | and fauna | | | | |
| | | 3. Understand biodiversity and its conservation strategies. | | | | | | |
| | | 4. Know the pharmacological importance of marine | - | 6 | | | | |
| | | 5. Understand the various threats for marine life | 918 | | | | | |
| Expected Course | Outcomes: | On the successful completion of the course, student w | rill be able to: | | | | | |
| Expected Course | outcomes. | 1. Define about oceanography. K1 | | | | | | |
| | | 2. Assess the ecological and economic importance of | marine organi | isms. K2 | | | | |
| | | 3. Explain the significance of marine biodiversity and | | | | | | |
| | | 4. Identify the pharmacological significance of marin | | | | | | |
| | | 5. Classify marine pollution and its effects on the man | rine life.K5 | | | | | |
| K1 - Remember: K2 - | Understand: k | K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create | | | | | | |
| Unit: 1 | Jia | OCEANOGRAPHY | | 14 hours | | | | |
| | nt- Physical oc | ceanography: waves, tides and currents- Chemical o | ceanography: | | | | | |
| | • | ological oceanography: phytoplankton and zoopla | C 1 2 | • | | | | |
| Unit: 2 | | MARINE BIODIVERSITY | | 14 hours | | | | |
| Marine flora: microalgae, salt marshes, seaweeds, sea grasses and mangroves and their ecological importance; Marine | | | | | | | | |
| Marine flora: micro | algae, salt mar | shes, seaweeds, sea grasses and mangroves and their e | ecological imp | ortance; Marine | | | | |
| fauna- Zooplankton | | shes, seaweeds, sea grasses and mangroves and their emolluses, Pisces, birds and mammals-Role of artifici | | | | | | |
| | | | | e in marine | | | | |
| fauna- Zooplankton diversity. Unit: 3 | - crustaceans, | molluses, Pisces, birds and mammals- Role of artifici | al intelligence | in marine 14 hours | | | | |
| fauna- Zooplankton diversity. Unit: 3 Conservation of n | narine life – | molluses, Pisces, birds and mammals- Role of artifici | al intelligence | in marine 14 hours | | | | |
| fauna- Zooplankton diversity. Unit: 3 Conservation of n importance- Sea ran Unit: 4 | narine life – nching- Marine | CONSERVATION OF MARINE ANIMALS In-situ and Ex-situ conservation- Conservation of biosphere reserves of India- Island Biodiversity-Invas | al intelligence coral reefs- sive species. | 14 hours IUCN and its | | | | |
| fauna- Zooplankton diversity. Unit: 3 Conservation of n importance- Sea ran Unit: 4 Bioactive compoun | narine life — nching- Marine ds- Bioactive of | CONSERVATION OF MARINE ANIMALS In-situ and Ex-situ conservation- Conservation of biosphere reserves of India- Island Biodiversity-Invastant Marine Pharmacology compounds from bacteria, microalgae, seaweeds, sea general conservation and the compounds from bacteria, microalgae, seaweeds, sea general conservation. | coral reefssive species. | 14 hours IUCN and its 14 hours tebrates and | | | | |
| fauna- Zooplankton diversity. Unit: 3 Conservation of n importance- Sea ran Unit: 4 Bioactive compoun | narine life — nching- Marine ds- Bioactive of | CONSERVATION OF MARINE ANIMALS In-situ and Ex-situ conservation- Conservation of biosphere reserves of India- Island Biodiversity-Invas | coral reefssive species. | 14 hours IUCN and its 14 hours tebrates and | | | | |
| fauna- Zooplankton diversity. Unit: 3 Conservation of n importance- Sea ran Unit: 4 Bioactive compoun vertebrates- Bioacti | narine life — nching- Marine ds- Bioactive of | CONSERVATION OF MARINE ANIMALS In-situ and Ex-situ conservation- Conservation of biosphere reserves of India- Island Biodiversity-Invastrum MARINE PHARMACOLOGY compounds from bacteria, microalgae, seaweeds, sea get for antibacterial, antifungal, antiviral, anti- inflammatical marines of the conservation o | coral reefssive species. | 14 hours IUCN and its 14 hours tebrates and ancer activities. | | | | |
| fauna- Zooplankton diversity. Unit: 3 Conservation of n importance- Sea ran Unit: 4 Bioactive compoun vertebrates- Bioacti | narine life — nching- Marine ds- Bioactive core compounds | CONSERVATION OF MARINE ANIMALS In-situ and Ex-situ conservation- Conservation of biosphere reserves of India- Island Biodiversity-Invastry MARINE PHARMACOLOGY compounds from bacteria, microalgae, seaweeds, sea go for antibacterial, antifungal, antiviral, anti- inflammate MARINE POLLUTION | coral reefssive species. | 14 hours | | | | |
| fauna- Zooplankton diversity. Unit: 3 Conservation of n importance- Sea ran Unit: 4 Bioactive compoun vertebrates- Bioacti Unit: 5 Marine pollution- | narine life — nching- Marine ds- Bioactive core compounds Types and sou | CONSERVATION OF MARINE ANIMALS In-situ and Ex-situ conservation- Conservation of biosphere reserves of India- Island Biodiversity-Invastrum MARINE PHARMACOLOGY compounds from bacteria, microalgae, seaweeds, sea get for antibacterial, antifungal, antiviral, anti- inflammatical marines of the conservation o | coral reefssive species. | 14 hours IUCN and its 14 hours tebrates and ancer activities. 14 hours metal pollution- | | | | |
| fauna- Zooplankton diversity. Unit: 3 Conservation of n importance- Sea ran Unit: 4 Bioactive compoun vertebrates- Bioacti Unit: 5 Marine pollution- Microplastics pollu | narine life — nching- Marine ds- Bioactive cove compounds Types and soution- Oil pollut | CONSERVATION OF MARINE ANIMALS In-situ and Ex-situ conservation- Conservation of biosphere reserves of India- Island Biodiversity-Invastry MARINE PHARMACOLOGY compounds from bacteria, microalgae, seaweeds, sea get for antibacterial, antifungal, antiviral, anti- inflammate mariness of pollutions- Eutrophication- Ocean Acidification- | coral reefssive species. | 14 hours IUCN and its 14 hours tebrates and ancer activities. 14 hours metal pollution- | | | | |
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| 7 | Bal (D.V); Rao(K.V). 1984. Maine fisheries. TATA - Mcgraw Hill Publishers |
|------|---|
| 8 | Vernberg (Winona.B) ED. Marine pollution. Academic Press. |
| 9 | Steidinger (Karen. A); Walker (Linda.M) ED. Marine plankton life cycle strategies.CRC Press. |
| 10 | Axelrod (Herbert. R). Exotic marine fishes. |
| Rela | ted Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] |
| 1 | Marine biology: https://www.mooc-list.com/course/marine-biology-saylororg |
| 2 | Marine and Antarctic Science: https://www.classcentral.com/course/open2study-marine-and-antarctic-science-1641 |
| 3 | Oceanography: a key to better understand our world: https://www.mooclist.com/course/oceanography-key-better-understand-our-world-coursera |
| 4 | Marine megafauna: An introduction to marine science and conservation: https://www.my-mooc.com/en/mooc/megafauna/ |
| 5 | Ecology and environment: https://swayam.gov.in/nd1_noc20_ge16/preview |
| Cou | rse Teacher: Dr. T. MURALISANKAR |

| Mappir | Mapping with Programme Outcomes | | | | | | | | | |
|--------|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | L | M | S | M | M | S | M | M | S | S |
| CO2 | S | S | M | S | S | S | M | S | S | S |
| CO3 | S | M | M | S | L | S | M | S | S | S |
| CO4 | M | M | S | M | S | M | L | M | S | S |
| CO5 | L | M | S | M | S | S | S | S | S | S |

PO1, Problem Solving Skill; PO2, Decision Making Skill; PO3, Ethical Value; PO4, Communication Skill; PO5, Individual and Team Leadership Skill; PO6, Employability Skill; PO7, Entrepreneurial Skill; PO8, Contribution to Society; PO9, Multicultural competence; PO10, Moral and ethical awareness/reasoning.

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

| Elective Course -I (Optional) | 25ZOO-1EB | APPLIED ENTOMOLOGY | Credits | 4/ Week |
|--|---|--|--|---|
| Pre-requisite | | Knowledge on insect, vector and pest, and culture | sericulture, apicu | lture and lac |
| Course Objective | | Define applied entomology and classify ins Understand insect pest management technic Understand the pest of various crops such food grains, fruits andpulses. Understand insect migration, population veterinary importance | ques h as cotton, sugar | |
| Expected Course | | On the successful completion of the course, stude | ent will be able to: | |
| | 2 3 4 | Classify insects up to order Explain general insect pest management technic Understand key pest insects of the major hortic Explain migration, population and their medica Students should acquire knowledge on sericultu Techniques. | cultural crops and the and veterinary in | nportance |
| K1 - Remember; K | C2 - Understand; | K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - G | Create | |
| Unit:1 | | INSECTS CLASSIFICATION | 1 | 4 hours |
| | | amilies - Classification of following insect orde | | |
| | otera (d) Hymer | noptera (e) Lepidoptera (f) Coleopteran - Collec | | |
| Unit:2 | dybird bootlo | BENEFICIAL INSECTS damsel fly, mealy bug destroyer, soldier bed | | 14 hours |
| fly, tachinid fly, i | ichneumon wasi | o and trichogramma wasp. | elle, green lacew | ing, syrpina |
| Unit:3 | | PRODUCTIVE INSECTS | 1 | 14 hours |
| Unit.3 | | | 4 | |
| Mulberry and non- food for future. | | ture – Economics of sericulture - Apiculture - I | Lac culture - Insec | cts as human |
| Mulberry and non- food for future. Unit:4 | HARMFUL I | NSECTS, INSECTS MIGRATION AND PO | DPULATION 1 | cts as human |
| Mulberry and non- food for future. Unit:4 Insects of medica beetle, boll week science. Insects n | HARMFUL I and veterinary | | OPULATION 1 ory locust, Colo | ets as human 14 hours 14 rado potato 15 to forensic |
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| Mappir | Mapping with Programme Outcomes | | | | | | | | | |
|--------|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | S | S | M | M | M | S | S | S | M | S |
| CO2 | L | M | M | M | S | S | S | M | S | S |
| CO3 | M | M | L | M | M | S | S | S | S | S |
| CO4 | S | S | M | S | S | S | S | S | S | S |
| CO5 | M | M | M | M | S | S | S | S | S | S |

PO1, Problem Solving Skill; **PO2**, Decision Making Skill; **PO3**, Ethical Value; **PO4**, Communication Skill; **PO5**, Individual and Team Leadership Skill; **PO6**, Employability Skill; **PO7**, Entrepreneurial Skill; **PO8**, Contribution to Society; **PO9**, Multicultural competence; **PO10**, Moral and ethical awareness/reasoning.

^{*}S, Strong; M, Medium; L, Low

| Volunteering | 25ZOO-131 | ANTI-DRUG | 2 / Week | | | | |
|---|----------------------------|--|----------|--|--|--|--|
| Programme | | | | | | | |
| Pre-requisite | | Knowledge on the ill-effects of drug. | | | | | |
| Course Object | ctives: | To make awareness on drug addiction and its effects. | | | | | |
| Expected Cor | arse Outcomes: | On the successful completion of the course, student will be able | e to: | | | | |
| | | 1. Awareness on drug addiction and its ill effects. | | | | | |
| | | 2 Handle different difficult situations like stress, depress | sion, | | | | |
| | | emotion etc., | | | | | |
| K1 - Remem | ber; K2 - Understar | nd; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create | | | | | |
| Unit: 1 | | BREAKING BAD HABITS | 2 hours | | | | |
| Open a discu | ssion on bad habi | ts and their harmful effects. | | | | | |
| Provide a wo | rksheet to the stud | dents to identify their personal bad habits. | | | | | |
| Discuss the t | | | | | | | |
| Guide them to replace the bad habits with good ones through worksheets. | | | | | | | |
| Unit: 2 | | | | | | | |

Plan this session around:

- Identifying the environmental cues, triggers that lead to picking up this habit.
- Knowing the impact of substance abuse Adverse health conditions, social isolation, ruined future, hidden financial loss and damaging the family reputation. Seeking help to get out of this addiction.

Suggested Activities (sample): Approaching administration.

- > Providing worksheets to self-reflect on how the environment affects their life, and the ways to initiate a change.
- ➤ Dedicate a bulletin board or wall space (or chart work) in the classroom for students to share their ideas for improving environmental well-being.
- reating a volunteers' club in the college and carrying out monthly activities like campus cleaning, awareness campaigns against noise pollution, (loud speakers in public places), addressing anti-social behaviour on the campus or in their locality.

Unit: 3 | SITUATIONAL AWARENESS (DEVELOPING LIFE SKILLS) | 4 hours

Being street smart

Discuss:

- Who are street smarts?
- Why is it important to be street smart?
- Characteristics of a street smart person: Importance of acquiring life skills to become street smart (General First-aid procedure, CPR Procedure, Handling emergency situations like fire, flood etc).

Digital Awareness Discuss:

- Cyber Security
- Information Literacy
- Digital Privacy
- Fraud Detection

Suggested Activities (sample):

Inviting professionals to demonstrate the CPR Procedure Conducting a quiz on Emergency Numbers

| <u> </u> | | | <u> </u> | | |
|----------|-------------------------|------|----------|---------|--|
| Unit: 4 | ENVIRONMENTAL WELLBEING | | | 4 hours | |

The Importance of initiating a change in the environment.

The session could be around:

Defining Environmental wellbeing (physical, chemical, biological, social, and psychosocial factors) - People's behaviour, crime, pollution, political activities, infra-structure, family situation etc. Suggesting different ways of initiating changes in the environment (taking responsibility, creating awareness, volunteering, Indulging in writing poems, stories, music making/listening, creating visual arts to connect with inner selves).

Suggested Activities (Sample): Mindfulness and Meditation

Conducting guided meditation every day for 10 minutes and directing the students to record the changes they observe.

Unit:5 MINDFULNESS AND MEDITATION PRACTICES 4 hours

Benefits of practicing mindful habits and meditation for overall well-being.

Connecting with nature: Practising to be in the present moment - Nature walk, feeling the sun, listening to the natural sounds. Exploring with intention - Hiking, gardening to observe the nature. Reflecting on the emotions, and feeling kindled by nature.

Serving people: Identifying the needs of others. Helping others. Volunteering your time, skills and listening ear. Finding joy in giving.

Creative Expressions: Provide worksheets to check the students' level of understanding about substance addiction and their impacts. Share case studies with students from real-life. Play/share awareness videos on addiction/de-addiction, experts talk.

*Conduct awareness programmes on Drugs and its ill-effects. Arrange Experts from the concerned government departments and NGOS working in drug addiction issues and maintain the documents of the program.

| Contemporary Issues: Expert lectures, Seminars, Webinars. | 2 hours |
|---|----------|
| Total Lecture hours | 20 hours |

Online Resources

United Nations Sustainable Development Goals - Goal 3 - Good Health & Development Being: https://www.un.org/sustainable development/health/

Mindfulness and Meditation: Stanford Health Library offers mindfulness and meditation resources:

https://healthlibrary.stanford.edu/books-resources/mindfulness-

meditation.html

Breaking Bad Habits: James Clear provides a guide on how to build good habitsand break bad ones: https://jamesclear.com/habits

6 Ways to Keep Your Brain Sharp

https://www.lorman.com/blog/post/how-to-keep-your-brain-sharp

What Is Social Wellbeing? 12+ Activities for Social Wellness

https://positivepsychology.com/social-wellbeing/

How Does Your Environment Affect Your Mental Health?

https://www.verywellmind.com/how-your-environment-affects-your-mental-health-5093687

How to say no to others (and why you shouldn't feel guilty)

https://www.betterup.com/blog/how-to-say-no

Course Teacher: From Psychology Department.

Second Semester

| Core Course-V | 25ZOO-23A | EXPERIMENTAL EMBRYOLOGY | Credits | 4/ Week | | |
|--|--|--|--|----------------------------|--|--|
| Pre-requisite | | Various life states of Animal forms, monoecious and | dioecious | | | |
| Course Objectives: | | To make the students to become familiar in developmental stages of different invertebrate and vertebrate animals including mammals. To make the students familiar about the importance male and female sexes in perpetuation of their races. | | | | |
| Expected Course Ou | | On the successful completion of the course, student will. Understand the events of gametogenesis, gastrulation, organogenesis and up to the birth of a K1 & K2 2. Understand embryonic organizer, inductions and different tissues and organs. K2 & K3 3. Understand the importance of metamorphose embryonic membrane and placenta of different ani 4. Knowledge on cryo-preservation techniques and sperm banking in day to day life, and other extechniques in research. K4, K5 & K6 | fertilization, an individual differential is, regenerate mals. K3 & K the require the requiremental serimental differential serimental seriment | tion in to | | |
| | 2 - Understand; | K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Cr | | | | |
| Unit:1 | | GAMETOGENESIS | 14 ho | | | |
| Origin of Primordial | germ cells - I | nd forms of asexual reproduction. Sexual reproduction Differentiation of spermatozoa – Structure and motility ags – Biochemical changes during Oogenesis. | | | | |
| Unit:2 | | FERTILIZATION | 14 ho | urs | | |
| | es. Post–fertiliza | erm and egg— Interaction of sperm and egg — Sequence ation changes: changes in the organisation of the egg CLEAVAGE AND BLASTRULATION | | caused by | | |
| | | ces in the egg – role of egg cortex - morphogenet eal changes during cleavage – pattern of cleavage – | | | | |
| | Principles and pa | ASTRULATION AND ORGANOGENESIS atterns – Fate map. Speman's primary organizer: Na steraction – Differentiation. | ture and mec | | | |
| Unit:5 | EMRDVONI | C AND POST EMBRYONIC DEVELOPMENT | 14 ho | urc | | |
| Embryonic adaptation and physiology. Meta preservation of game control and regulati | n: Extra embryo amorphosis (Insectes and embryo on – Role of artif | onicmembrane structure in Reptiles and Birds. Placenta: ects and amphibians); Regeneration in v s – in-vitro fertilization and embryo transfer – spe ficial intelligence in embryo selection. | Classification various anima | n, structure als. Cryo- | | |
| Contemporary Is | sues: Expert le | ctures, Seminars, Webinars | 2 hou | | | |
| | | Total Lecture hours | 72 hou | irs | | |
| Text Book(s) | | | | _ | | |
| Massach | nusetts, USA | evelopmental Biology, 8th edition, Sinauer Associates, l | | | | |
| Pvt Ltd., | , | n Introduction to Embryology, 5th edition, Thomson | | | | |
| | rma & V K Agarwal. 2012. Chordate Embryology, 1st edition, S. Chand Publishing, India. | | | | | |
| | anna, Advanced | Embryology, Discovery Publishing House DPH, India | | | | |
| Reference Books | | | . ~ . | | | |
| | noniam, 2011, N onal Ltd, UK | Molecular Developmental Biology, Second Edition, Alp | oha Science | | | |

| 2 | Julian S. Huxley and G. R. de Beer, 2015. The Elements of Experimental Embryology, Cambridge |
|-----------|---|
| | University Press, UK. |
| 3 | T.H. Morgan, 2010. Embryology and Genetics, 1st edition, Agrobios India publishers, Jodhpur, |
| | India |
| 4 | Bruce Carlson, Human Embryology and Developmental Biology, 2 nd Edition, SPRINGER- |
| | VERLAG |
| 5 | Rm Twyman, 2003, Instant Notes Developmental Biology, Viva Books Private Limited, India |
| 6 | Müller, Werner, 1997. Developmental Biology, 1 st edition, SPRINGER-VERLAG |
| 7 | Robert S. McEWEN, Vertebrate Embryology, 4 th edition, Oxford & IBH Publication |
| Related (| Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] |
| 1 | NOC: Introduction to Developmental Biology, Prof. Subramaniam K, IIT Madras, |
| | https://nptel.ac.in/courses/102/106/102106084/] |
| Course D | esigned By: Dr. T. MURALISANKAR |

| Mappi | ng with P | rogramm | e Outcon | ies | | | | | | |
|-------|-----------|---------|----------|-----|-----|-----|-----|-----|-----|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | L | M | S | L | M | L | M | S | L | S |
| CO2 | L | M | S | L | M | L | M | S | L | S |
| CO3 | L | M | S | L | M | L | M | M | L | S |
| CO4 | L | M | S | L | M | L | M | M | L | S |

PO1, Problem Solving Skill; PO2, Decision Making Skill; PO3, Ethical Value; PO4, Communication Skill; PO5, Individual and Team Leadership Skill; PO6, Employability Skill; PO7, Entrepreneurial Skill; PO8, Contribution to Society; PO9, Multicultural competence; PO10, Moral and ethical awareness/reasoning.

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

| Core Course - VI | 25ZOO-23B | IMMUNOLOGY & MICROBIOLOGY | Credits | 4/ Week | | | |
|--|-----------|--|---------|---------|--|--|--|
| Pre-requisite Course Objectives: | | Knowledge on different organs of immune system, and innate and acquired immunity against microbial diseases, and rejection of self and non-self. To understand the functional organization of immune system in general health and its competence/ responsiveness to diseases. | | | | | |
| Con the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the course, student will be able to the successful completion of the successful comp | | | | | | | |

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit: I INTRODUCTION TO IMMUNOLOGY

Scope of immunology- Innate and acquired immunity - B and T cells - Cellular and humoral immune responses - Host defense systems: first line defense system - second line immune system - Third line host defense system - Primary and secondary immune responses.

Unit: II ANTIGENS, IMMUNOGLOBULINS AND HYPERSENSITIVITY

14 hours

14 hours

Definition, characteristic features and classification - Antigenicity versus immunogenicity - Adjuvants: definition, types and applications. Immunoglobulin structure, function and types of immunoglobulin classes-hypersensitivity-types of hypersensitivity- major histocompatibility complex and its significance- complement system

Unit: III IMMUNOTECHNOLOGY

Vaccines-active immunization and passive immunization-immunological techniques – RIA and ELISA-transplantation immunology-types of graft-mechanism of allograft rejection.

Unit: IV INTRODUCTION TO MICROBIOLOGY

14 hours

14 hours

General characters, Classification of Bacteria, Bacterial morphology and staining; Nutrition – Nutrient media and types; Culture methods – Pour plate, Spread plate and Streak plate; Microbes in Agriculture – Microbe symbiosis, Plant-microbe symbiosis, Legume- Rhizobium interaction; Animal-microbe symbiosis; Bioinsecticide – *Bacillus thuringensis*; Medical microbiology – Pathogenesis and Control of Tuberculosis, Typhoid, Tetanus, Syphilis, Candidiasis, SARS (CoV2) and AIDS.

Unit: V MICROBIAL GENETICS 14 hours

Genetic recombination in viruses: Conjugation, Transformation and Transduction – Transposons – Bacterial transposons – Human normal microbial flora and microbiane-Microbial infections-Diagnostic methods in microbial infections- Genomics and Proteomics of microbes.

| Contemporary Issues: Expert lectures, | Seminars, | Webinars | 2 hours |
|---------------------------------------|-----------|----------------------------|----------|
| | | Total Lecture hours | 72 hours |

Reading list

- 1. Kuby, J. 1997. Immunology. W. H. Freeman & Co., New York, pp-670.
- 2. Male, D. J. Brostoff, D. B. Roth and I. Roitt. 2006. Immunology (7th edition), Mosby / Elsevier, Philadelphia, pp-472
- 3. Abbas, A. K and A. H. Lichtman. 2007. Cellular and Molecular Immunology (6th edition), W. B. Saunders, Philadelphia, pp-564
- 4. Coica, R. Sunshine, G. 2015. Immunology (Seventh Edition), Wiley Blackwell, UK, pp-406.
- 5. Hans G. Sclegl, General Microbiology, 7th Edition, UK Cambridge University Press 1995
- 6. Ananthanarayanan, Jayaram Panicker, Text book of Microbiology, 5th Edition, New Delhi Orient Longman 1997.

Recommended texts

- 1. Weir, D. M and J. Stewart. 1997. Immunology, Churchill Livingstone, London, pp-362
- 2. Janeway, C. A and P. Travers. 1997. Immunology, Garland Publ. Inc., London, pp-904
- 3. Peakman, M and D. Vergani. 1997. Basic and Clinical Immunology, Churchill Livingstone, London, pp-366
- 4. Parham, P. 2009. The Immune System (Third Edition), Garland Science, USA, pp-506
- 5. Pelczar M.J, Chan ECS, Kreig NR, Microbiology, 6th Edition, New Delhi, Tata McGraw Hill Pub. CO. Ltd. 2007
- 6. Stainer RY, Doudroff M, Addberg EA, General Microbiology, 3rd Edition, MacMillan India 1970.

Course Designed By: Dr. V. RAMASUBRAMANIAN

| | Mapping with Programme Outcomes* | | | | | | | | | |
|-----|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | S | S | S | M | M | S | S | S | M | M |
| CO2 | S | S | S | S | S | S | S | S | M | M |
| CO3 | M | M | S | M | M | S | S | S | M | M |

PO1, Problem Solving Skill; **PO2**, Decision Making Skill; **PO3**, Ethical Value; **PO4**, Communication Skill; **PO5**, Individual and Team Leadership Skill; **PO6**, Employability Skill; **PO7**, Entrepreneurial Skill; **PO8**, Contribution to Society; **PO9**, Multicultural competence; **PO10**, Moral and ethical awareness/reasoning. *S, Strong; M, Medium; L, Low.

| Core Course -VII | 25ZOO-23C | MOLECULAR GENETICS | Credits | 4/ Week | | | |
|--------------------------|---|--|---------|---------|--|--|--|
| Pre-requisite | | Knowledge on different characters within a species, and between different species. | | | | | |
| Course Objectives | | 1. To understand the role of genetic materials (DNA and RNA) in maintain and control of traits of organisms. | | | | | |
| | | 2. To understand the molecular mechanisms of living cells through modern techniques. | | | | | |
| | | 3. To study DNA interaction with chemical agents, cancer therapies and immune-modulation. | | | | | |
| Expected Course C | Outcome | On the successful completion of the course, students will be able to: 1. Know, how the genes control traits, their inheritance, and flow in a population? K1 & K2 | | | | | |
| | | 2. Know the techniques for obtaining genetically modified organisms. K3 & K4 | | | | | |
| | 3. Understand the role of genetics in disease management an differentiation between normal and pathological conditions. K5 & | | | | | | |
| K1 - Remember: K2. | Understand: K3 | 3 - Annly: K4 - Analyze: K5 - Evaluate: K6 - Create | | | | | |

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit:1 GENETIC MATERIALS 14 hours

Chromatin structure and nucleosome concept, Organization and function of genetic material, Structures of DNA and RNA, Gene paradox, Repetitive DNA, Satellite DNA, Overlapping genes, Split genes, Pseudogenes. Chromatin, nuclear and mitochondrial genome organization, Stereochemistry of bases and secondary structures. Eukaryotic genome organization.

Unit:2 GENETIC ENGINEERING 14 hours

Recombinant DNA technology, Isolation and purification of DNA/ genes, DNA sequencing. Concept of restriction and modification - Restriction endonucleases, DNA modifying enzymes, Ligases. Host-vector system - Cloning vectors for *E. coli*, cloning vectors for Eukaryotes.

Genomic libraries, cDNA libraries, Genome project, Gene tagging. DNA forensics, DNA finger printing and paternity decisions. CRISPR/CAS9 technology in genome editing.

Unit:3 GENE EXPRESSION 14 hours

Gene regulation in eukaryotes, Gene clustering, Mechanism of positive and negative control ofgene expression. Translational and transcriptional control of regulatory mechanism of expression, Environmental effects on gene regulation. Gene silencing, and Epigenetics.

Unit:4 CLASSICAL GENETICS, AND GENETIC DISORDERS AND SYNDROMES 14 hours

Mendelian principles - Linkage and crossing over - Chromosome mapping - Gene mapping - Sexlinked, limited and influenced characters - Ploidy. Genetic disorders (gout, hypercholesterolemia, cystic fibrosis, phenylketonuria, hemophilia, and muscular dystrophy), syndromes (Down's, Klinfelter's, and Turner's), and congenital anomalies. Pedigree analysis; Karyotypes. Somatic cell genetics: Extrachromosomal inheritance - maternal inheritance.

Unit:5 MUTATION 14 hours

Mutagens-mutagenesis, types of mutation, mutator genes, sickle-cell anemia, forward and reverse mutation, frame shift mutation, site directed mutagenesis, transposable elements and transposition, and evolutionary significance.

| Contemporary Issues: Expert lectures, Seminars, Webinars 2 hou | | | | | |
|--|--|----------|--|--|--|
| | Total Lecture hours | 72 hours | | | |
| Text Book(| s) | | | | |
| 1 | Molecular genetics, Shukla 2001 ,Dominant publishers | | | | |
| 2 | Principles of genetics fifth edition 1985. Published by Tata McGraw-Hill Ltd., New | Delhi | | | |
| 3 | From Genes to Cells, Bolsover (Stephen R); Hyaams (Jeremy S). | | | | |
| 4 | Genetics, Gupta (P.K). | | | | |
| 5 | Concept of Molecular Biology, Verma (PS); Agarwal (VK), S. Chand & Co Publi | ishers. | | | |
| 6 | Genetics, Jain (H K), Oxford Ibh Publishers. | | | | |
| Reference I | Books | | | | |

| 1 | Molecular Cell Biology, Lodish (Harvey); Berk (Arnold), 5 th Edition, W H Freeman andCo. Ltd Publishers. |
|------------|--|
| 2 | Genetics, Verma (P S); Aggarwal (V K), 1 st Edition, S. Chand & Co Publishers. |
| 3 | Genetics: A Conceptual Approach, Pierce Benjamin A., 3 rd Edition. W.H. Freeman and Company Publishers. |
| 4 | Biochemistry & Molecular Biology, Elliott William (H) |
| 5 | Principles of Genetics, Sinnott (Edmund. W), 5 th Edition, Tata - McGraw Hill Publishers. |
| 6 | Cell and Molecular Biology, Robertis (De E.D.P); Robertis (De E.M.F), 8 th Edition. |
| Related On | line Contents [MOOC, SWAYAM, NPTEL, Websites etc.] |
| 1 | NOC: Human Molecular Genetics: https://nptel.ac.in/courses/102/104/102104052/ |
| 2 | Human gene: https://swayam.gov.in/nd2_cec20_bt17/preview |
| 3 | Tissue engineering: https://swayam.gov.in/nd1_noc19_bt33/preview |
| 4 | Genetic Engineering: Theory and Application: https://swayam.gov.in/nd1_noc19_bt15/previe |
| 5 | Genes and the Human Condition (From Behavior to Biotechnology): https://www.coursera.or |
| 6 | Introduction to Human Behavioral Genetics: https://www.coursera.org |
| Course Des | signed By: Dr. P. SARAVANA BHAVAN |

| | Mapping with Programme Outcomes* | | | | | | | | | |
|-----|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | S | S | M | M | S | S | S | M | M | M |
| CO2 | S | S | M | M | S | M | M | M | M | M |
| CO3 | S | S | S | S | M | M | M | S | S | S |

PO1, Problem Solving Skill; PO2, Decision Making Skill; PO3, Ethical Value; PO4, Communication Skill; PO5, Individual and Team Leadership Skill; PO6, Employability Skill; PO7, Entrepreneurial Skill; PO8, Contribution to Society; PO9, Multicultural competence; PO10, Moral and ethical awareness/reasoning.

| Core Course- VIII | 25ZOO-23D | RESEARCH METHODOLOGY AND BIOSTATISTICS | Credits | 4/ W | eek |
|--|---|---|---------------------------------|----------------------------|--------------------|
| Pre-requisite | | Knowledge on applications of various | | nents | in |
| | | conducting experiments and inferring the resu | ılts. | | |
| Course Objectives: | | To create scientific temperament amon do research activities. | g the stu | ıdents | to |
| | | 2. To make the students familiar in application basic statistical tools in biology. | cations o | f certa | ain |
| | | 3. To make the students judiciously equipments for data generation. | | | |
| Expected Course Out | tcomes: | On the successful completion of the course | , student | wıll | be |
| | | able to: 1. Understand the importance statistical to day life. K1 & K2 2. Apply the right statistical tool to | | | |
| | | experimental results. K3 & K4 3. Derive a meaningful conclusion while | | | |
| | | group of data, and suggestion for furtl | • | _ | _ |
| | | K4 &K5 4. Utilize various equipments for acquiring | scientifi | c data | in |
| | | their research and report writing for p | | | |
| | | K6 | | | |
| | Understand; K | 3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - | | | |
| Unit:1 | | BIOINSTRUMENTATION | | 14 ho | |
| | | t microscope, SEM – TEM - PAGE (1D & 2) | | | |
| DNA sequencer- NG HPLC - FTIR – MAL | | Centrifuge - UV-visible spectrophotometer - | - AAS - (| GCMS | 3 – |
| Unit:2 | | RESEARCH TOOLS | | 14 ho | |
| collection and review database: Web of scand tools, Motif and | w of literatures- ience- Scopus - d Folds. Disse nesis writing- In | entification of research problems and research – Planning and implementation of Research PubMed-Google scholar. Bioinformatics da rtation writing – Preparation of research pact factor of journals- Articles citations, hon. | work – tabases, papers- S | Journ softwa Scienti | als are ific |
| Unit:3 | | TA COLLECTION AND PROCESSING | | 14 ho | urs |
| Primary and secondata - Types and Construction of freq curve; Diagrammatic Unit:4 | ary data - Source applications; Valuency distribute representation | ce and implications; Classification and tabula variables - Definition and types; Frequence ion table for grouped data, Frequency poly-Histogram, bar diagram, pictogram and pie c DESCRIPTIVE STATISTICS | tion of bey distri | iologi bution d O-gi | cal 1 - ive |
| Measurement of Central Tendency: Mean, median and mode for continuous and discontinuous variables. Measures of dispersion: Range, variation, standard deviation, standard error and coefficient of variation. Probability: Properties and application of Normal, Binomial and Poisson distributions. | | | | | |
| Unit:5 | | NFERENTIAL STATISTICS | | 14 ho | |
| correlation, Significan | nce test for corr | I mean difference 't' tests. Karl Pearson's C elation coefficients. Computation of biological representation and prediction. One-way and tw | l data, ca | lculati | ion |
| _ | | atistical software using SPSS. | , o way r | 11 10 V | 11. |
| Contemporary Issues: | • | | | 2 hou | rs |
| | - | Total Lecture hours | 72 | 2 hou | rs |
| Text Book(s) | | | | | |
| ` , | odology for bio | logical sciences by Gurumani (N). 2011. MJP | Publishe | rs | |
| Tested in ended of grant selections by Garaniam (17). 2011. 1101 Tablished | | | | | |

| 2 | Textbook of laboratory techniques by Chinmoy Goswami. 2011. Wisdom Press |
|-------|--|
| 3 | Arora, P. N. and P. K. Malhan. 1996. Biostatistics, Himalaya Publishing House, Mumbai. |
| 4 | Gurumani, N. 2005. Introduction to Biostatistics, M.J.P. Publishers, Delhi. |
| 5. | Das, D. and A. Das. 2004. Academic Statistics in Biology and Psychology, Academic Publisher, Kolkata. |
| 6. | Palanichamy, S. and Manoharan, M. 1990. Statistical Methods for Biologists, Palani Paramount Publications, Tamil |
| Refe | rence Books |
| 1 | Research techniques in biological sciences by Sandhu (G S). 1991. Anmol Publishing |
| 2 | Biological techniques by Knudsen(Jens. W). Harper and Row Publishers. 1966 |
| 3 | Notes on Microscopical Technique for zoologists by Pantin(C.F.A). 1960. Cambridge Publishing |
| 4 | Guidebook to Microscopical Methods by Grimstone(A.V.), Skaer(R.J.). 1972.Cambridge Publishing |
| 5 | Bailey, N. T. J. 1959. Statistical in Biology, English Universities Press, London. |
| 6 | Sokal, R. R. and F. J. Rohlf, 1973. Introduction to Biostatistics, W.H. Freeman, London. |
| 7 | Sokal, R.R. and F.J. Rohlf. 1981. Biometry: The principles and practice of statistics in biological research, San Francisco: W.H. Freeman, London. |
| 8 | Zar, J.H. 1998. Biostatistical Analysis, Pearson Education (Singapore) Pvt. Ltd., Delhi, India. |
| 9 | Bailey, N. T. J. 1994. Statistical Methods in Biology (Third Edition), Cambridge University Press, Cambridge. |
| 10 | Wayne W. Daniel. Biostatistics: A Foundation for Analysis in the Health Sciences, John Wiley & Sons Inc, USA. |
| 11 | Snedecor, G. W. and W. G. Cochran. 1967. Statistical Methods (Sixth Edition), Oxford & IBH Publishing Co., New Delhi. |
| 12 | Pagano, M. and K. Gauvreau. 2008. Principles of Biostatistics (Second Edition), Cengage Learning, New Delhi. |
| Rela | ted Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] |
| 1 | Research Methodology: https://swayam.gov.in/nd2_cec20_hs17/preview |
| 2 | Understanding Research Methods: https://www.mooc-list.com/course/understanding-research-methods-coursera |
| Cours | be Teachers: Dr. P. SARAVANA BHAVAN; Dr. V. RAMASUBRAMANIAN; Dr. C. GUNASEKARAN; Dr. N. ARUL; Dr. T. MURALISANKAR |

| Mappii | Mapping with Programme Outcomes | | | | | | | | | |
|--------|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | M | M | M | M | M | M | M | M | M | M |
| CO2 | M | M | M | M | M | M | M | M | M | M |
| CO3 | L | L | M | L | M | M | M | M | S | S |
| CO4 | L | L | L | L | L | L | L | L | M | M |

PO1, Problem Solving Skill; PO2, Decision Making Skill; PO3, Ethical Value; PO4, Communication Skill; PO5, Individual and Team Leadership Skill; PO6, Employability Skill; PO7, Entrepreneurial Skill; PO8, Contribution to Society; PO9, Multicultural competence; PO10, Moral and ethical awareness/reasoning.

^{*}S, Strong; M, Medium; L, Low

| Core Practical -II | 25ZOO-23P | EXPERIMENTAL EMBRYOLOGY, | Credits | 4/ Week | | |
|--------------------|----------------------------------|---------------------------|---------|---------|--|--|
| | | IMMUNOLOGY & MCROBIOLOGY, | | | | |
| | | MOLECULAR GENETICS, AND | | | | |
| | | RESEARCH METHODOLOGY & | | | | |
| | | BIOSTATISTICS | | | | |
| | EXPERIMENTAL EMBRYOLOGY 36 hours | | | | | |

- 1. Permanent slides of spermatogenesis and Oogenesis.
- 2. Microscopic observation of live sperm.
- 3. Developmental stages of frog: Egg WM and TS of the following, Early cleavage, Late cleavage, Blastula, Gastrula, Neural folds stage and Yolk plugs stage.
- 4. Developmental stages of Chick embryo: Whole egg and TS of 24hr, 33hr, 48h, 58hr, 72hr and 96hr old developmental stages.
- 5. Incubation and removal of chick blastoderm.

IMMUNOLOGY

18 hours

- 1. Microscopic observation of prepared permanent slides on the TS of Lymph gland, Lymph node, Spleen, Bone marrow and Bursa Fabricius.
- 2. Determination of ABO blood group in human.
- 3. Determination of Rh factor in human.
- 4. Precipitation reaction between antigen and antibody by simple diffusion (Double immune-diffusion).
- 5. Separation of protein factions in serum samples using immune-electrophoresis.

MICROBIOLOGY

18 hours

- 1. Cleaning and Sterilization
- 2. Preparation of culture media and sterilization.
- 3. Pure culture of bacteria
- 4. Estimation of bacterial count using haemocytometer.
- 5. Bacterial staining Grams stain

MOLECULAR GENETICS

36 hours

- 1. Diagrammatic representation of Pedigree analysis.
- 2. Observation of simple Mendalian traits (ear lobe, tongue, cheek, thumb, eye, hair etc) in man.
- 3. Identification of Barr body in human buccal epithelium.
- 4. Identification of drumstick chromosome in human Leucocyte (Neutrophil)
- 5. Identification of syndromes (Down, Klinefelter and Turner) using idiograms.
- 6. Experiment to demonstrate the Hardy- Wienberg law

RESEARCH METHODOLOGY

18 hours

Hands on training on possible Bioinformatics databases, software and tools:

- 1. Databases NCBI-GenBank, EMBL, DDBJ, PDB, PIR, PROSITE, Pfam, KEGG, and OMIM.
- 2. Software FlyBase, swissport, MEGA, and CLUSTAL.
- 3. Sequence analysis tools BLAST, ClustalW, T-Coffee, MEME, MEGA, PHYLIP.
- 4. Structure analysis tools CN3D, PyMOL, RasMOL, and ODELLER.
- 5. Functional analysis tools GEO, InterProScan, COBRA Toolbox, and Pathway tools.

BIOSTATISTICS

18 hours

- 1. Measurement of central tendencies Find out of Mean, Median and Mode.
- 2. Measurement of dispersion Find out of Standard deviation and Coefficient of variation.
- 3. Test to find out simple and rank correlation coefficient.
- 4. Student 't' test paired sample and mean difference 't' tests to find out significance.
- 5. Chi-square test to find out significance.
- 6. One-way ANOVA and two-way ANOVA to find out significance

| Contemporary Issues: Expert | ectures, Seminars, Webinars | | 2 hours |
|------------------------------------|-----------------------------|------------------------------|-----------|
| | | Total Practical hours | 146 hours |

| Text | Book(s) | | | | | |
|------|---|--|--|--|--|--|
| 1 | Advanced Practical Zoology by Sinha, J., Chatterjeee A.K., Chattopadhyay P. 2011.Arunabha Sen Publishers. | | | | | |
| 2 | Fundamentals of Biochemistry by Jain J.L, Sunjay Jain, Nitin Jain. 2007. | | | | | |
| 3 | Medical Laboratory Technology, Methods and Interpretations by Ramnik Sood. 2006. Jaypee publishers. | | | | | |
| 4 | Chordate Embryology, Agarwal, V K, Chand New Delhi 1978 | | | | | |
| Refe | erence Books | | | | | |
| 1 | Clinical Embryology: A Practical Guide by 1.Zsolt Peter Nagy, Alex C. Varghese, Ashok Agarwal. 2013. Springer-Verlag New York Inc | | | | | |
| 2 | Modern Experimental Zoology by Preeti Guptha and Mridula Chaturvedi. 2000 | | | | | |
| 3 | Richard L. Myers Immunology: A Laboratory Manual. 1994. McGraw-Hill Inc., US; 2ndRevised edition. | | | | | |
| 4 | Cell and Molecular Biology: A Lab Manual by Chaitanya K.V. 2013. Prentice Hall IndiaLearning Private Limited | | | | | |
| 5 | Manual of Practical Physiology and Endocrinology by Harsh Vardhan Bhask. 2009. Campus Books International | | | | | |
| Cou | Course Teachers: Dr. P. SARAVANA BHAVAN; Dr. V. RAMASUBRAMANIAN; Dr. C. GUNASEKARAN; Dr. N. ARUL; Dr. T. MURALISANKAR | | | | | |

| Elective Course -II (Optional) | 25ZOO-2EA | MOLECULAR TAXONOMY Cred | its 4/ Week | | | | |
|---|---|---|---|--|--|--|--|
| Pre-requisite | | Different morphological traits of various animal including structure, smell and taste. | | | | | |
| Course Objectives: | • | To make the students know about the need of coup | ling both classical | | | | |
| · · | | taxonomy and molecular taxonomy of animals | in order to give a | | | | |
| | | complete | | | | | |
| | | view on it. | | | | | |
| Expected Course C | Outcomes: | On the successful completion of the course, student 1. Understand the concept of taxonomy and it classification of animals. | s importance in the | | | | |
| | | 2. Get trained into few taxonomical/ bioinfor | matics methods for | | | | |
| | | sequence annotation.Extracts information from various databases interpretation of biodiversity of animals. | for the analysis and | | | | |
| K1 - Remember; K2 | 2 - Understand | ; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Cr | eate | | | | |
| Unit:1 | | BASIC CONCEPTS | 14 hours | | | | |
| | sic concepts | of biosystematics taxonomy and classification | | | | | |
| speciation and taxo biosystematics, Ch Taxonomic proced classification - taxon | onomic charac nemotaxonom lure Internati nomic ranks – | eters, Species concepts: Species category, Substy, Neotaxonomy, Cytotaxonomy and Moleonal code of Zoological Nomenclature (IC. hierarchy - nomenclature codes: binomial nome key to the species - Linnaean taxonomy and classic | pecies, Trends in cular taxonomy, ZN). Theories of nclature, trinomial | | | | |
| of taxonomy. | ioimear keys. i | tey to the species - Elimacan taxonomy and classic | artaxonomy - icver | | | | |
| Unit:2 | | MODERN CONCEPTS | 14 hours | | | | |
| in modern taxonomy features of DNA base | y: COI, cytb, | als - DNA and RNA based taxonomy in plants - Re 16s, 18s, 28s rRNA, matK, ITS1, ITS2, rDNA, | and trnL-F - Key | | | | |
| Unit:3 | | PHYLOGENETIC ANALYSIS | 14 hours | | | | |
| phylogenetic recons Bootstrapping and n | etic va struction, man eighbor joinin alar divergence | - Evolutionary taxonomy -Phylogenetic nomenceriations -Phylogenetic analysis ximum parsimony, maximum likelihood, Bay g -Problems and errors in phylogenetic reconstructe and molecular clocks and molecular drive; | : methods in esian probability, ction. Molecular | | | | |
| Unit:4 | | GENOMIC DATA BASES | 14 hours | | | | |
| BOLDs. Genome Da | ıtabase: Bioinf | rimary nucleotide sequence databases: GenBank, I ormatic Harvester, SNPedia, Corn, National Microl etwork, RGD Rat Genome Database, and Vector Ba | oial Pathogen Data | | | | |
| Unit:5 | | TOOLS AND SOFTWARE | 14 hours | | | | |
| sequence analysis - S | oftware: MEG | BLAST, ORF finder, PHYLIP, pair-wise analy A, DNA SP, BIO EDIT, PAUP, and Chromas Lite. | sis and multiple | | | | |
| Contemporary I | ssues: Expert | lectures, Seminars, Webinars | 2 hours | | | | |
| | | Total Lecture hours | 72 hours | | | | |
| Text Book(s) | | 1 | | | | | |
| | | and Rastogi, P. 2006. Bioinformatics – Concepts, sl nn. CBS Publishers and Distributors Pvt. Ltd. ISBN: | | | | | |
| | | 08. Bioinformatics — Principles and Applications, puess. ISBN: 13-978-0-19-569230-3. | blished in | | | | |

Evolution (Second Edition) by, Monroe W. Strickberger, 1990. Museum of vertebrate zoology, University of California, Berkeley. ISBN: 0-867820-20-892-9.
 An Introduction to Genetic Analysis (7th Edn.)., A.J.F. Griffths et al., 2000. W.H. Freeman & Co. 12. Molecular Biotechnology, S. Maulik and S.D. Patel, 1997, Wiley. Liss

Reference Books

- Darwin, C. 1859. On the Origin of Species. London: John Murray (always seeks outthe first edition, facsimile version, and avoid later editions).
- Dobzhansky, T. 1937. Genetics and the Origin of Species. New York: ColumbiaUniv. Press (there are several later editions, and the title changed in the last).
- Fisher, R. A. 1930. The Genetical Theory of Natural Selection. Oxford: OxfordUniv. Press (there is a later edition).
- Hennig, W. 1966. Phylogenetic Systematics. Urbana: Univ. Illinois Press (an English translation of a book published earlier in German). Hall, B. J. (ed.). 1994.
 Homology, the Hierarchical Basis of Comparative Biology. San Diego: AcademicPress (a collection of essays by many authors).

Sober, E. 1984. The Nature of Selection, Evolutionary Theory in PhilosophicalFocus. Cambridge, MA: MIT Press.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

- 1 <u>https://nptel.ac.in/courses/102/104/102104068/</u>
- 2 https://swayam.gov.in/nd1 noc20 bt39/preview
- 3 https://swayam.gov.in/nd1 noc20 bt38/preview
- 4 https://www.coursera.org
- 5 https://nptel.ac.in/courses/102/106/102106025/
- 6 https://nptel.ac.in/courses/102/103/102103017/
- 7 https://nptel.ac.in/courses/102/106/102106035/
- 8 https://swayam.gov.in/nd1 noc19 ge23/preview

Course Teacher: Dr. C. GUNASEKARAN.

| Mappir | Mapping with Programme Outcomes | | | | | | | | | |
|--------|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | S | S | M | M | S | M | S | S | M | S |
| CO2 | S | M | M | S | M | S | S | M | S | S |
| CO3 | M | S | S | S | M | S | M | S | M | S |

PO1, Problem Solving Skill; PO2, Decision Making Skill; PO3, Ethical Value; PO4, Communication Skill; PO5, Individual and Team Leadership Skill; PO6, Employability Skill; PO7, Entrepreneurial Skill; PO8, Contribution to Society; PO9, Multicultural competence; PO10, Moral and ethical awareness/reasoning.

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

| | 25ZOO-2EB | STEM CELL BIOLOGY | Credits | 4/ Week |
|-------------------------|------------------|---|-------------|--------------------------|
| (Optional) | | | | |
| Pre-requisite | | Knowledge on the physiology of different cells | | |
| 1 16-16quisite | | | | |
| Course Objectives | | To make the students familiar with the importance of | f different | stem cells |
| Expected Course Outcome | | On the successful completion of the course, students Understand the basic knowledge of different origin. K1 & K2 Get knowledge on how different organs can be cells. K2, K3 & K4 Understand how vaccine, hormone, enzymes et therapeutic purposes. K3, K4, K5 & K6 | stem cel | ls and their d from stem |

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit: I INTRODUCTION TO STEM CELL BIOLOGY 14 hours

Stem cell definition, origin and hierarchy, stem cell properties, identification and characterization, potency and differentiation, niche of stem cell, overview of different stem cell types (embryonic stem cells, adult stem cells and induced pluripotent stem cells).

Unit: II EMBRYONIC STEM CELLS 14 hours

Characterization and properties of ES cells, pluripotency and self-renewal of ES cells; molecular mechanisms regulating pluripotency and maintenance of the stem state, progressive differentiation of ES cells into ectoderm lineage organs (skin, brain and nerve), mesoderm lineage organs (heart, kidney, muscle, bone and blood), and endoderm lineage organs (lung, liver, stomach, pancreas and intestine).

Unit: III ADULT STEM CELLS 14 hours

Mesenchymal stem cells (MSCs) – sources, properties (plasticity, homing and engraftment), potency and characterization; Haematopoietic stem cells (HSCs) – sources, properties, potency and characterization; Steps involved in production of induced pluripotent stem cells (iPSCs), role of Yamanaka factor in iPSCs.

Unit: IV STEM CELL AND AGING 14 hours

Aging theory; cell cycle; telomere and telomerase; senescence of stem cell; role of stem cell in aging; tissue repair and regeneration of adult stem cell.

Unit: V STEM CELL THERAPIES 14 hours

Advantages and disadvantages of ES cells and adult stem cells (MSCs and HSCs) therapy; Ethical concern on stem cell therapy; current stem cell therapy for various diseases; clinical outcome of stem cell therapy; state of clinical trials in adult stem cells for various diseases.

| Contemporary Issues: Expert lectures, Semin | nars, Webinars | 2 hours |
|---|---------------------|----------|
| | Total Lecture hours | 72 hours |

Reading list

- 1. Kiessling, A.A. 2006. Human Embryonic Stem Cells (Second Ed.), Jones & Barlett Publishers.
- 2. Lanza, R. and A. Atala. 2005. Essentials of Stem Cell Biology. Academic Press, pp-712.
- 3. Turksen, K. 2004. Adult Stem Cells. Humana Press, Inc, pp-429.
- 4. Lanza, R. *et al.* 2004. Handbook of Stem Cells: Embryonic/Adult and Fetal Stem Cells (Vol. 1 & 2). Academic Press, pp-1626.
- 5. Institute of Medicine, 2002. Stem cells and the future of regenerative medicine. National Academy Press, pp-112.
- 6. Marshak, D., R.L. Gardener and D. Gottlieb. 2001. Stem Cell Biology, Cold Spring Harbour Monograph Series, 40, pp-550.
- 7. Booth, C. 2003. Stem Cell Biology and Gene Therapy, Cell Biology International, Academic Press.

Recommended texts

- 1. Quesenberry, P.J., G.S. Stein, B. Forget and S. Weissman. 2001. Stem Cell Biology and Gene Therapy, Wiley Publishers, pp-584.
- 2. Sell, S. and Totowa, N.J. 2004. Stem Cells Handbook, Humana Press, pp-534.
- 3. Sullivan, S., C. A. Cowan and K. Eggan. 2007. Human Embryonic Stem Cells: The Practical Handbook, Wiley Publishers, pp-424.
- 4. Battler, A., and Leo, J. 2007. Stem Cell and Gene-Based Therapy: Frontiers in Regenerative Medicine, Springer Publication, pp-422.

Course Teachers: Dr. P. SARAVANA BHAVAN; Dr. V. RAMASUBRAMANIAN; Dr. C. GUNASEKARAN; Dr. N. ARUL; Dr. T. MURALISANKAR

| | Mapping with Programme Outcomes* | | | | | | | | | |
|-----|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | S | S | S | M | M | S | S | S | M | M |
| CO2 | M | M | M | M | M | S | S | S | M | M |
| CO3 | S | S | S | M | M | S | S | S | M | M |

JOB ORIENTED COURSE - I

| 25Z(| OO-2JA | FISH | PROCESSING TECHNOLOGY | |
|-------|-----------------------------------|--|--|-----------------|
| Na | me of the Dep | artment | ZOOLOGY | |
| | 0.41 | | Dr. T. MURALISANKAR | |
| | | ulty Member i/c With | Assistant Professor, Department of Zool | |
| ma | - | ss with Phoneand e- | Bharathiar University, Coimbatore- 641 Phone: 0422 2422610. Email: | U46 . |
| Ша | .11 | | tsmuralisankar@buc.edu.in | |
| Int | er / Intra Dep | artment Course | Intra Department Course | |
| Du | ration of the C | Course | 30 hrs. | |
| Eli | gibility | | B.Sc., Zoology | |
| Nu | mber of Cand | idates to be Admitted | 40 | |
| Re | gistration Pro | cedure | Offline/Online | |
| Job | Opportunitie | es: | | |
| Qua | ality Analysist | and quality control officer in | fish processing industry, Fishery technician, | |
| sup | ervisor and tec | hnician food processing plant | s etc. | |
| | | | | |
| | | the Course are: | | |
| The | e main objectiv | es of this course are to: | | |
| 1 | Know the im | portance of fish processing tea | chniques | |
| 2 | Understand t | he fish storage techniques | | |
| 3 | Learn the fish | h processing the packing proce | ess | |
| 4 | Comprehend | the importance of valued fish | products | |
| 5 | Gain knowle | dge on importance of fishery b | pyproducts | |
| Exp | pected Course | Outcomes: | | |
| 1 | Explain the i | mportance if fisheries resource | es (K5) | |
| 2 | Summarize f | reezing and storing techniques | s of fishery products (K2) | |
| 3 | Define the fi | sh processing and packing tecl | hniques (K1) | |
| 4 | Classify the | significance of valued fishery | products (K5) | |
| 5 | Assess the ty | pes and importance of fisherie | es waste (K5) | |
| Co | urse Content | Lecture | | |
| Mo | dule 1 | | d its importance- Nutrient compositionof | 3 hours |
| | | fish and shellfish-fish- fish | <u> </u> | |
| Mo | dule 2 | Assessing of freshness | | 3 hours |
| N/I ~ | dulo 2 | - | on and processing. g offish, prawns, crabs and Lobsters | 2 house |
| | odule 3 odule 4 | · · · · · · · · · · · · · · · · · · · | ng freezing of finfish and shell fishes | 3 hours 3 hours |
| | dule 5 | | ples- Canning process - Irradiation | 3 hours |
| | | preservation | | |
| | Module 6 Types of packing and lab | | | 3 hours |
| | dule 7 | _ | rawn pickles-sauces- fish surimi- | 3 hours |
| | dule 8 | _ | sh wafer. Fish salads- Fish cakes. | 3 hours |
| Mo | odule 9 | Fish and shellfish silage - fish waste | Fish meal and its importance- oils from | 3 hours |
| Mo | dule 10 | Fish protein hydrolysis-chi | tin and chitosan- fishery fertilizers. | 3 hours |
| Boo | ok(s) for Stud | • | | |
| 1 | | | ology of Fish and Fishery Products, Daya | |
| | Publishing H | ouse, New Delhi. | | |

| 2 | Gopakumar, K., 2020. Textbook of Fish Processing Technology. Directorate of Information and | | | | | | |
|----|---|--|--|--|--|--|--|
| | Publications of Agriculture, Indian Council of Agricultural Research. | | | | | | |
| | Hall, G.M. 1997. Fish Processing Technology (2nd edition). Springer US. Link: | | | | | | |
| | file:///C:/Users/User/Downloads/productFlyer_978-0-7514-0273-5.pdf | | | | | | |
| Bo | ok(s) for reference | | | | | | |
| 1 | Boziaris, I.S., 2013. Seafood Processing: Technology, Quality and Safety. Wiley Blackwel publisher. | | | | | | |
| 2 | Ward, A., Beyens, Y., Fish Handling, Quality and Processing: Training and | | | | | | |
| | Community Trainers Manual, FAO. Avaliable link: http://www.fao.org/3/a-az083e.pdf | | | | | | |
| 3 | Clucas, J and A.R. Ward., 1996. Post Harvest Fisheries Development; A guide to | | | | | | |
| | Handling preservation, processing and Quality. Publishing Manager Natural | | | | | | |
| | Resources Institute, Central Avenue, United Kingdom | | | | | | |
| 4 | Oliveira, F.A.R. and J.C Oliveira, 1999. Processing Foods: Quality Optimization and | | | | | | |
| | Process Assessment, CRC Press. | | | | | | |
| Re | lated Online Contents | | | | | | |
| 1 | Food Science & Processing: https://onlinecourses.swayam2.ac.in/cec19_ag05/preview | | | | | | |
| 2 | Dairy and Food process and products technology: | | | | | | |
| | https://onlinecourses.nptel.ac.in/noc20_ag02/preview | | | | | | |
| 3 | Food Science & Processing: https://www.classcentral.com/course/swayam-food-science-processing-14065 | | | | | | |
| 4 | Food Preservation Technology: https://www.classcentral.com/course/swayam-food-preservation-technology-14064 | | | | | | |

Course Teacher: Dr. T. MURALISANKAR.

VALUE ADDED COURSE – I

| 25ZOO-2VA | BIOINSTRUMENTATION |
|---|--|
| Name of the Department | ZOOLOGY |
| Name of the Faculty Member i/c With Complete Address with Phoneand e- mail | Dr. N. ARUL Assistant Professor, Department of Zoology, Bharathiar University, Coimbatore- 641046. Phone: 0422 2422610. E.mail:swamyarul@gmail.com; swamyarul@buc.edu.in |
| Inter / Intra Department Course | Intra Department Course |
| Duration of the Course | 30hrs |
| Eligibility | B.Sc. Zoology |
| Number of Candidates to be Admitted | 40 |
| Mode of the Course | Regular / Online / Both Regular and Online |
| Collaboration if any with Companies (if Yes, Full Address of the Company Address, | Dr. Sivakumar Neelamegam |
| Name of the Contact Person, Phone, e-mail | Founder and managing director, Biomerits. |
| etc.) | E-mail: sivaport@gmail.com |
| Registration Procedure | |
| Job Opportunities: | |
| Clinical Engineers Bio-instrumentation Engineer Research Scientists Business Managers Technical Writers Bio-mechanics Engineers Patent Analyst Professors/Teachers Biomaterials Engineers | |
| The objectives of the Course are: | |
| The main objectives of this course are to: | <u> </u> |
| 1 Know the basic techniques of bioinstrume | |
| 2 Learn the techniques of chemical analytics | al. |
| 3 Understand the techniques of biosensor | |
| 4 Study the techniques of immune-clinical a | assays |
| 5 Learn the cell culture techniques. | |
| Expected Outcome | |
| 1 Understand the basic techniques of bioins | trumentation. (K2) |
| 2 Describe the techniques of Chemical analy | ytical. (K2) |
| 3 Explain the techniques of biosensor. (K2) | |
| | |

Illustrate the techniques of immune-clinical assays. (K3)

Lecture / Practical / Internship

Summarize the cell culture techniques. (K5)

5

Course Content

| Module | 1 | Basic theory- instrumentation, laboratory techniques, Autoclave – principle & applications and type, | 3 hours |
|----------|--|--|----------------|
| Module | 2 | pH-Sorenson"s pH scale, pH meter-principle and applications. Manometry, | 3 hours |
| Module | principles & types (clinical, ultra centrifuges) | | 3 hours |
| Module | 4 | Chromatography: Adsorption, ion-exchange and HPLC. | 3 hours |
| Module | 5 | Biosensors, principle, - types (Enzyme, Bacterial electrodes) & applications) | 3 hours |
| Module | 6 | PCR & qPCR- principle & application. | 3 hours |
| Module | 7 | ELISA – Principle and application, antibody affinity, antibodyavidity. | 3 hours |
| Module | 8 | Immuno-electrophoretic techniques. | 3 hours |
| Module | 9 | Cell culture techniques and its applications | 3 hours |
| Module | 10 | Binocular Inverted light Microscope, Fluorescent microscope | 3 hours |
| Book(s) | for Study | | |
| 1 | • | Chemistry: an Introduction (7th Ed), Skoog, West, and Harris Saunders, ablishing.2016 | |
| 2 | Contempo | orary Instrumental Analysis by Kenneh A. Rubinson, Culinary and Hospita ons Services. 2008 | ılity Industry |
| 3 | Veerakun publ.Cher | nari L., 2006. Protein sequencing in Bio informatics Bioinstrumentation, Manai. | IJP |
| Book(s) | for reference | ee | |
| 1 | Larry R.F | emical Methods: Fundamentals and Applications, 2nd Edition by Allen Jaulkner ISBN: 0-471-04372-9, December 2000. | |
| 2 | Technique | iyaya, K. Upathyaya and N. Nath, (2003) Biophysical chemistry, Princes, 3rd Ed, Himalaya publishing house. | |
| 3 | Hand-boo | k of Biomedical Instrumentation – by R.S. Khandpur, McGraw-Hill, 2003 | |
| 4 | Guruman Chennai. | i.N. 2006. Reasearch methodology for Biological sciences MJP publ. | |
| 5 | Culture of | f Animal cells- R.Freshney. Fifth edition, Wiley. 2006 | |
| Related | Online Con | tents | |
| 1 | | ure Technologies (NPTEL) video https://nptel.ac.in/courses/102/104/1021 | .04059/ |
| 2 | Tissue en | gineering (SWAYAM) https://swayam.gov.in/nd1_noc19_bt33/preview | |
| 3 | | al nanotechnology (SWAYAM) https://swayam.gov.in/nd1_noc19_bt28/p | review |
| 4 | Industrial | Biotechnology (SWAYAM) https://swayam.gov.in/nd1_noc19_bt20/prev | view |
| Course T | eacher: Dr. | N. ARUL. | |

Third Semester

| Core Course-IX | 25ZOO-33A | ANIMAL PHYLOGENY AND EVOLUTION | Credits 4/ Week | | | | |
|--|--|--|---|--|--|--|--|
| Pre-requisite | | Knowledge on species living in different environment and their descendents, and structural and functional relationship of various organs. | | | | | |
| Course Objectives: | | To identify key features for classificatio interpret phylogenetic tree of the metazoar the evolutionary history and relationsh members of animal kingdom. | n in order to know | | | | |
| | | 2. To know how the evolutionary forces as speciation. | nd factors lead to | | | | |
| Expected Course Ou | tcomes: | On the successful completion of the course, studer 1. Gain demonstrable and measurable kr phylogeny, origin and evolution of a significance. K1 & K2 | nowledge on the | | | | |
| | | 2. Analyze the origin of amphibians, reptiles evolutionary significance of Australopithec | - | | | | |
| | | 3. Know the theories, concepts and process social and ecological evolution. K5 & K6 | | | | | |
| K1 - Remember; K | | d; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - G | Create | | | | |
| Unit:1 | PH | IYLOGENY OF INVERTEBRATES | 14 hours | | | | |
| Coelomata - definiti evolution. Minor ph and Chaetognatha. A | on, origin of cyla: general commonites and | evolution. Metazoa-origin and theories. Bilateria-ocoelom. Trilobites- structure and significance. M haracters, morphology, anatomy and affinities of their significance. HYLOGENY OF VERTEBRATES | ollusca- origin and rotifers, Phoronida | | | | |
| Unit:2 | | features of lampreys. Characteristic features an | 14 hours | | | | |
| Cephalaspida, Ana Primitive jawed ver reptilian features of | psida, Cyclos rtebrates-origin of Seymouria. | stomata, and Coelolepis. Evolutionary position of jaws. Origin of Placoderms. Origin of Reptile Mammal like reptiles. Aquatic reptiles. Flying d monkeys, Old world monkeys and apes. | of Ostracoderms. es: Amphibian and | | | | |
| Unit:3 |] | MECHANISMS OF EVOLUTION | 14 hours | | | | |
| Lamarck; Darwin- | concepts of | variation, adaptation, fitness and natural selec | tion; Mendelism; | | | | |
| frequency; Hardy-W selection, migration | Veinberg Law n and rando | es evolution; Mass extinction, evolutionary tree. ; concepts and rate of change in gene frequency om genetic drift; Adaptive radiation; Isola | through natural ting mechanisms; | | | | |
| | icity and Symp | patricity; Convergent and divergent evolution; Co- | | | | | |
| Unit:4 | in4auc -4: | COMMUNITY EVOLUTION | 14 hours | | | | |
| Red queen hypothes | sis, Kin select | d Cooperation; Sexual selection, Group selection, ion, Parent – offspring conflict. Evolutionary pat attern of Birds; Cladogenesis and anagenesis. | | | | | |
| Unit:5 | <i>J</i> 1 | ECOLOGICAL EVOLUTION | 14 hours | | | | |
| Population: structu | re and growt | h: Density dependent and independent, Survivor | ship, life history | | | | |
| strategies (R and K | selection), Co d coloration, l | mpetitions among species: Lotka-Volterra interspectation communities and colonization. Application | ecific competition | | | | |
| <u> </u> | | etures, Seminars, Webinars | 2 hours | | | | |
| | | Total Lecture hours | 72 hours | | | | |
| Text Book(s) | | | 1 | | | | |
| 1 Agarwal | l (V K); Verma S Chand Repr | a (P S). 2006. Cell Biology Genetics Evolution and | Ecology, 3 rd | | | | |

| 2 | Cain (A.J). 2016. Animal species and their evolution. Princeton University Press. | | | | | | |
|--------|--|--|--|--|--|--|--|
| 3 | Lull (Richard Swann). 2011. Organic evolution, Nabu Press. | | | | | | |
| 4 | Strickberger. 2007. Strickberger's Evolution, Jones & Bartlett; 4th Revised edition. | | | | | | |
| Refere | ence Books | | | | | | |
| 1 | Long, M. 2003. Origin and evolution of new gene functions. Kluwar Academic Pub., | | | | | | |
| 2. | Kapoor, V.C.1995. Theory and Practice of Animal Taxonomy. Oxford & IBH Publishing Co. New Delhi. | | | | | | |
| 2 | Yadav (B.N), Kumar (D). 2000. Vertebrates zoology and evolution. Daya Publishing House. | | | | | | |
| 3 | Sharma, N.S. 2005. Continuity and evolution of animals. International Scientific Publishing Co. | | | | | | |
| 4 | Walker Louis J. 2013. Evolutionary ecology of birds life histories, mating systems and extinction. Random Publications | | | | | | |
| 5 | Colbert Edwin H. 2012. Colbert's Evolution of the vertebrates. 5 th edition. Wiley-India | | | | | | |
| 6 | Banerjee, S., 2006.Evolutionary Biology, Dominant Publishers | | | | | | |
| 7 | Chiarelli (A.B). 1973. Evolution of the primates. Academic Press | | | | | | |
| 8 | Carroll (Robert .L). 1997. Patterns and processes of vertebrate evolution. Cambridge University Press. | | | | | | |
| 9 | Andrew Cockburn. 2001. An introduction to evolutionary ecology, 2end edition, Wiley-Blackwell. | | | | | | |
| Relate | ed Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] | | | | | | |
| 1 | Paleontology: Early Vertebrate Evolution: https://www.classcentral.com/course/early-vertebrate-evolution-5417 | | | | | | |
| 2 | Molecular Evolution: https://www.classcentral.com/course/molecularevolution-3555 | | | | | | |
| 3 | Paleontology: Theropod Dinosaurs and the Origin of Birds: https://www.classcentral.com/course/theropods-birds-5236 | | | | | | |
| 4 | Evolutionary Biology: https://swayam.gov.in/nd2_cec20_bt06/preview | | | | | | |
| 5 | Introduction to Genetics and Evolution: https://www.classcentral.com/course/geneticsevolution-381 | | | | | | |
| Course | e Designed By: Dr. T. MURALISANKAR . | | | | | | |

| Mappii | Mapping with Programme Outcomes | | | | | | | | | | | |
|--------|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|--|--|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | | |
| CO1 | S | S | M | S | L | L | M | S | S | M | | |
| CO2 | S | S | M | S | L | M | M | S | S | M | | |
| CO3 | S | S | M | S | L | M | L | S | S | M | | |
| CO4 | M | S | S | S | L | M | L | S | S | S | | |
| CO5 | M | S | M | S | M | M | M | S | S | M | | |

| Core Course-X | 25ZOO-33B | ENVIRONMENTAL BIOLOGY AND TOXICOLOGY | Credits | 4/ Week |
|------------------------|------------------------|---|----------------------|--------------|
| Pre-requisite | | Knowledge on climate, weather, season, living and their interactions, poisonous materials and day activities. | | |
| Course Objective | es: | 1. To create awareness for sustainable resources available in different ecological | | |
| | | 2. To make the students for judiciously anthropogenic activities in order to reduce the environment. | | |
| Expected Course | Outcomes: | On the successful completion of the course, st | udent will be | e able to: |
| | | 1. Understand the nature of relationships | and interac | tions |
| | | among organisms that comprise | | |
| | | ecosystem. K1, K2 & K3 | 8 | |
| | | 2. Manage/ utilize different natural resoumanner. K3 & K4 | irces in a | sustainable |
| | | 3. Reduce the indiscriminate usage of diffe | erent toxic n | naterials in |
| | | the name of infrastructure, industructure, developments. K5 & K6 | trial and | agriculture |
| K1 - Remember | ; K2 - Understa | nnd; K3 - Apply; K4 - Analyze; K5 - Evaluate | ; K6 - Create |) |
| Unit:1 | | LIMITING FACTORS | 14 hours | |
| | | Liebig's law of the minimum – Shelfor | | |
| | | cology: Natality, Mortality, Growth rate as fa | | |
| | - | on interactions. Types of community - Str | ructure – Co | ommunity |
| Succession, Hor | neostasis. | | | |
| Unit:2 | | HABITAT ECOLOGY | 14 hours | |
| | | ond and Forest as examples of natural eco | | |
| | | w, Trophic level and structure - Food co chemical cycles. Terrestrial, Freshwater, | | |
| habitats. | | • | | |
| Unit:3 | | JRAL RESOURCE MANAGEMENT | 14 hours | |
| | | on-Renewable and Renewable resources- | | |
| Unit:4 | ource and energ | y – Conservation and management – Zoos – Sanct POLLUTION ECOLOGY | | |
| | Water Soil | Noise and Radiation pollution and their co | 14 hours | |
| - | | or rivers of India. | omnor meast | nes. Case |
| Unit:5 | • | PRINCIPLES OF TOXICOLOGY | 14 hours | 1 |
| | | developments, Routes of Entry and | | |
| | | xcretion – Bio-transformation of xenobiotics | | y: Acute |
| _ | | Assessment of safety/risk. SPSS software | - | |
| | | Risk Assessment. | | |
| Contemporary Is | sues: Expert le | ctures, Seminars, Webinars | 2 hou | rs |
| | | Total Lecture | 72 hour | rs |
| | | hours | | |
| Text Book(s) | DID (10=2 = | 1 1 00 1 00 00 | <u> </u> | 110 : |
| | | undamentals of Ecology, Fifth Edition, Cenga | <u> </u> | USA |
| | | gy and Environment, Rastogi Publications, Me | | |
| | | ndamental of Ecology, Tata McGraw-Hill Edu | | |
| Limited, No | ew Delhi | ronmental Impact Assessment, New Age Inter | | rate |
| | | Principles of Toxicology, JOHN WILEY & So | ONS, INC. | |
| Reference Book | KS | | | |

| 1 | Michael Reiss and Jenny Chapman, 2000. Environmental Biology, Cambridge University |
|---|--|
| | Press, UK |

2 Peter J. Russel, 2009. Ecology, Cengage Learning

3 J.L. Chapman, M.J. Reiss, 2001, 2nd edition, Cambridge University Press.

4 G. C. Butler, 1978. Principles of Ecotoxicology, JOHN WILEY & SONS, New York

John C. Dearden, 2006. Computers in Toxicology and Risk Assessment, Computer Applications in Pharmaceutical Research and Development, Edited by Sean Ekins. ISBN 0-471-73779-8 Copyright © 2006 John Wiley & Sons, Inc.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

Ecology and Environment, Prof. Abhijit Deshpande and Prof. R. Ravi Krishna, IIT Madras, https://swayam.gov.in/nd1 noc19 ge23/preview

Course Teacher: Dr. N. ARUL.

| Mappi | Mapping with Programme Outcomes | | | | | | | | | | |
|-------|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|--|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | |
| CO1 | S | S | L | M | M | S | L | L | L | S | |
| CO2 | S | S | L | S | S | S | L | L | L | S | |
| CO3 | S | S | L | M | M | S | L | L | L | S | |
| CO4 | S | M | L | L | L | S | L | L | L | S | |
| CO5 | L | M | L | M | L | L | L | L | S | S | |

| Core Course -XI | 25ZOO-33C | BIOPHYSICS AND BIOCHEMISTRY | Credits | 4/ Week | | | | |
|---|---|--|---------------------------------|-----------------|--|--|--|--|
| Pre-requisite | | Basic knowledge on the constituents of various cell on different life stages of organisms toarrive an average | | • | | | | |
| Course Objectiv | res: | 1. To provide a concise and unifying approach with a strong backgrounds in chemistry, biology, and physics. | | | | | | |
| | | 2. To understand the structure, function and interact how biological processes occur at the molecular le | | nolecules, and | | | | |
| Expected Cours | e Outcomes: | On the successful completion of the course, student v | will be able to | | | | | |
| | | Recognize the biophysical and biochemical princi Understand the chemical structure and functions of biomolecules. | of various | · | | | | |
| | | 3. Relate the body functions with presence macromolecules. | and absence | e of various | | | | |
| K1 - Remember; | K2 - Understand | d; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Crea | te | | | | | |
| Unit:1 | | BIOENERGETICS | 14 | hours | | | | |
| | ounds, ATP cyc | of free energy, oxidation reduction (redox) reactions. le, standard free energy, membrane potentials, and no | | • | | | | |
| Unit:2 | | ICAL TECHNIQUES | 14 | hours | | | | |
| | on), Spectroscop | matography (Paper, thin-layer, column and GLC), Copic techniques (UV, visible spectroscopy, X-ray control. | _ | , | | | | |
| Unit:3 | | ATOMS, MOLECULES AND BONDS | 14 | hours | | | | |
| | | ic bonds, covalent bonds, hydrogen bond, Vander Va capacity in the cell environment. | al's forces, I | ntermolecular | | | | |
| Unit:4 | <u> </u> | RBOHYDRATES, PROTEINS AND LIPIDS | 14 | hours | | | | |
| chemical structure and purification, S | perties, isoelectron, function and so ynthesis of poly | structure and properties of functional groups. ric point and zwitter ions of amino acids. Proteins blubility; properties, primary, secondary and tertiary, H peptides - Structure, classification, properties, isoelectra, properties – saturated and unsaturated fatty acids | : Classifica Ielix, principl | es of isolation | | | | |
| Unit:5 | | CLEIC ACIDS AND ENZYMES | 14 | 14 hours | | | | |
| replication (semi o | ONA structure a conservative and | and properties, DNA as a genetic material, DNA s reverse transcription), nucleotides. Different types of , Co-factors, Enzyme inhibition, Enzyme substrate com | synthesis – if RNA : mRN | nechanism of | | | | |
| · | | ectures, Seminars, Webinars | _ | hours | | | | |
| | | Total Lecture hours | 72 | hours | | | | |
| Text Book(s) | | | • | | | | | |
| W | alker, 7 th Edition | chniques of Biochemistry and Molecular Biology by Keon, Cambridge University Press. | eith Wilson a | nd John | | | | |
| | Biochemistry, by D.Voet and J.G. Voet, 2004. John Wiley & Sons, USA | | | | | | | |
| P | Biochemistry, by R.H. Garrett and C.M. Grisham, 3 rd edition, 2007. Saunders College Publishers. | | | | | | | |
| | | N. Arora and P.K. Malhan. 2004. Himalaya Publishing | | | | | | |
| Н | all of India Pvt.I | Biostatistics by Rao (P.S.Ssundar); Richard (J). 4 rd edittd | ition, 2006.Pr | rentice- | | | | |
| · | · | | | | | | | |
| Reference Book | S | | | | | | | |
| 1. Bi | | eremy M. Berg, John L. Tymoczko, Lubert Stryer. 5 th | Edition. W.H | I. Freeman | | | | |

| | Bonner, 2 nd Edition, Woodhead Publishing. |
|-----------|---|
| 3. | Principles of Instrumental Analysis by Douglas A. Skoog, F. James Holler, and Stanley R. Crouch, 6 th edition. Thompson books/cole. |
| 4 | Lehninger Principles of Biochemistry by A David L. Nelson; Michael M. Cox. 2017. 7 th edition. W H Freeman & Co Publishers |
| 5 | Principles of Biochemistry by Albert L. Lehninger (4th edition) 2004. CBS Publishers & Distributors, New Delhi. |
| 6 | Biochemistry by Lubert stryer. 4 th , edition, 2000. Freeman International Edition |
| 7 | Biochemistry. S. C. Rastogi, 2nd edition. 2003. Tata McGraw Hill Publishing CompanyLtd., N. Delhi. |
| 8 | Zubay's Principles of Biochemistry by Veer Bala Rastogi, Dr. K.R. Aneja. 2019.Medtech Publisher, |
| 9 | Methods of Biostatistics by Bhaskararao (T), 2004. Paras Medical Publisher. |
| 10 | Fundamentals of Biostatistics by Rastogi (Veer Bala). 1st edition, 2009. Anne BooksNew Delhi |
| 11 | Introduction to Biostatistics (a Textbook of Biometry) by Pranab Kumar Banerjee. 3 rdedition, 2007. S Chand Publishers |
| 12 | Statistics for Biologists by Campbell (RC), 3 edition 2008. Cambridge University Press. |
| 13 | Biostatical Analysis by Zar (Jerrold. H). Prentice Hall publication. 5 th edition, 2014 |
| Related (| Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] |
| 1 | Analytical Techniques in Biochemistry: https://onlinecourses.swayam2.ac.in/cec24_bt16/preview |
| 2 | Analytical Techniques in Biochemistry: https://onlinecourses.swayam2.ac.in/cec24_bt16/preview |
| 3 | Analytical Techniques in Biochemistry: https://onlinecourses.swayam2.ac.in/cec24_bt16/preview |
| 4 | Analytical Techniques in Biochemistry: https://onlinecourses.swayam2.ac.in/cec24_bt16/preview |
| Course To | eacher: Dr. N. ARUL |

| Mappir | Mapping with Programme Outcomes | | | | | | | | | | | | |
|--------|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|--|--|--|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | | | |
| CO1 | L | L | S | L | M | L | M | L | M | S | | | |
| CO2 | L | L | S | L | M | L | M | L | M | S | | | |
| CO3 | L | L | L | L | M | M | M | M | S | S | | | |

| Core Course - XII | 25ZOO- 33D | CONSERVATION BIOLOGY | Credits | 4/ Week |
|-----------------------------------|----------------------|---|--|---|
| Pre-requisite | | Knowledge on various fauna and f importance for the socio economic mankind. | | |
| Course Objectives: | | To focus the importance of culture and m plants and animals in order to conserve the loss of Biodiversity. | | |
| Expected Course Ou | | On the successful completion of the cours able to: 1. Get knowledge on terminology, methods, principles, ethics and theoric conservation of biological diversity. K1 2. Understand the causes and consequence environmental changes leads to habitat turn ultimately resulted in human-wild & K3 3. Familiarize with tools and technique conservation of habitat and organism. K4, K5 & K6 | classifies relevance K2 es of recent tat loss with the contract co | fications, and to the nt global which in flict. K2 |
| K1 - Remember; K2 - | Understand; K | 3 - Apply; K4 - Analyze; K5 - Evaluate; K6 | - Create | |

BIODIVERSITY OF ANIMALS 14 hours Unit:1

Components of Biodiversity (Ecosystem, Genetic and Species diversity) - Assigning values to biodiversity - Species concepts - Animal diversity: (Distribution inventory, species richness) -Biodiversity Hotspots (Western Ghats, Indo-Burma region). Biogeography of India - patterns and distribution of ecosystems, ecological succession, biotic and abiotic factors of an ecosystem. Conservation ethics and values of wildlife. India as a mega diversity nation. Catalogue species diversity

Unit:2 **DIVERSITY LOSS AND SPECIES STATUS** | 14 hours

Extinctions: Past rates of Extinctions - Concepts of Island biogeography and extinction rates on Islands - Human induced, Modern and local extinctions - Population reduction - threats to wildlife with examples - Habitat loss, degradation and fragmentation. Threats to animal diversity in India -Status of species: Rare, endemic and threatened species - Measuring status of species in the wild -IUCN Red list (Assessments and methodologies) - Status of Indian animals.

Unit:3 **CONSERVATION TOOLS** 14 hours

In situ conservation of Indian animals (Case studies). Ex situ: Captive breeding programme people participation in conservation - Successes and failures of conservation actions in India (Case study) - Tools in Conservation: GIS - remote sensing - Landscape model - PVA - VORTEX. Red listing process: categories and criteria, SIS. Wildlife conservation in India importance of conservation - methods of wildlife conservation.

ANIMAL LAWS AND POLICIES IN INDIA 14 hours Unit:4

Economics of biodiversity conservation: Wildlife (Protection) Act of India (1972) - Protected Area network - forest policy - Prevention of cruelty to Animal Act - Convention on Biological diversity, International Trade in endangered species - Zoo policy- Laws and their applications in Zoological parks, wildlife sanctuaries and biosphere reserves - Economics of biodiversity conservation. The world Conservation Union (IUCN) - World wildlife fund (WWF) - Indian Board for Wildlife (IBWL).

Unit:5 CONSERVATION EDUCATION, AWARENESS 14 hours AND IMPLEMENTATIONS

Wildlife / Animal magazines, Journals- How to write popular and Scientific articles - Magazine and Journal information - Wildlife, nature, environment games (examples) - Role of NGO"s and Government organizations in wildlife conservation - Wildlife celebration days in India. Technical writing and reporting of field studies. Public presentation. Field Project/ Report – visit to Zoological parks, wildlife sanctuaries and biosphere reserves.

| C | ontemporary Issues: Expert lectures, Seminars, Webinars | 2 hours |
|-----|---|-------------------|
| | Total Lecture hours | 72 hours |
| Te | ext Book(s) | |
| 1 | Anna A. Sher and Richard B. Primack 2019. An Introduction to Conservation | n Biology , |
| | Oxford University press. | |
| 2 | Anon. 2004. Indian Wildlife Protection Act 1972. Natraj Publishers, Dehra D | un. 104p. |
| 3 | Gopal, R. 1992. Fundamentals of Wildlife Management. Justice Home. Allah | abad. 668p. |
| 4 | Navjot S. Sodhi and Paul R. Ehrlich 2010. Conservation Biology for All. Ox | ford University |
| | press. | |
| 5 | Wilson, E. O., and D. Perlman. 2000. Conserving earth's biodiversity. Island | Press, |
| | Washington, D.C. | |
| Ref | ference Books | |
| 1 | Meffe, G. K. and C. R. Carroll 1994. Principles of Conservation Biology, Sir | nauer Associates, |
| | USA | |
| 2 | Michael, P. 1984. Ecological Methods for Field and Laboratory Investigations | s. Tata Mc Graw |
| | Hill Publishing Company Limited, New Delhi. 404 p. | |
| 3 | Peter H. Raven, Navjot S. Sodhi, Luke Gibson, 2013. Conservation Biology: Tropics, Willey Online library. | Voices from the |
| 4 | Odum, E.P. 1996. Fundamentals of Ecology. Natraj Publishers, Dehra Dun 57 | 74p. 19. |
| | Primack, R. B. 2006. Essentials of Conservation Biology, Sinauer Associates, | , USA. |
| 5 | Soule, M. E. 1986. Conservation Biology: The Science of Scarcity and Divers | sity, Sinauer |
| | Associates Inc., USA. | |
| Re | lated Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] | |
| 1 | https://nptel.ac.in/courses/102/104/102104068/ | |
| 2 | https://swayam.gov.in/nd1_noc20_bt39/preview | |
| 4 | https://swayam.gov.in/nd1_noc20_bt38/preview | |
| | https://www.coursera.org | |
| Coi | urse Teacher: Dr. C. GUNASEKARAN | |

| Mappii | Mapping with Programme Outcomes | | | | | | | | | | | | |
|--------|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|--|--|--|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | | | |
| CO1 | S | M | L | S | M | L | S | S | S | S | | | |
| CO2 | M | L | S | M | S | S | S | M | S | M | | | |
| CO3 | S | M | S | M | S | M | M | M | S | S | | | |

| Core Practical-III | 25ZOO-33P | ANIMAL PHYLOGENY & EVOLUTION, | Credits | 4/ Week |
|--------------------|-----------|-------------------------------|---------|---------|
| | | ENVIRONMENTALBIOLOGY & | | |
| | | TOXICOLOGY, BIOPHYSICS & | | |
| | | BIOCHEMISTRY, AND | | |
| | | CONSERVATION BIOLOGY | | |
| | AN | NIMAL PHYLOGENY | 18 hour | S |

Study on the significance of Invertebrate and Vertebrate fossils

- 1. Coelenterate Coral (Carboniferous)
- 2. Arthropoda Trilobite (Silurian)
- 3. Mollusca Lamellibranch (Recent)
- 4. Mollusca Gastropod (Tertiary)
- 5. Mollusca Ammonite (Jurassic)
- 6. Echinodermata Crinoid (Carboniferous)
- 7. Echinodermata Echinoid (Jurassic)
- 8. Vertebrata Shark's tooth (Miocene)

EVOLUTION 18 hours

- 1. Evolutionary significance of following animals
 - a. Inheritance of acquired characters Proteus
 - b. Industrial melanism Peppered moth
 - c. Connecting link (living fossil) Peripatus, Limulus and Archaeopteryx
 - d. Arboreal adaptation Chamaeleon
 - e. Mimicry Krait, Stick insect and Leaf insect
- 2. Study of evolution through the following
 - a. Homologous organs
 - b. Analogous organs
- 3. Study on adaptation of following animals
 - a. Sandy shore fauna
 - b. Muddy shore fauna
 - c. Rocky shore fauna

ENVIRONMENTAL BIOLOGY

18 hours

- 1. Collection, segregation and identification of Plankton.
- 2. Study on primary productivity (Dark and Light bottle method)
- 3. Estimation of pH, Dissolved oxygen, Carbon di-oxide, Salinity and Carbonates and Bicarbonates in water samples.
- 4. Preparation of vermi-compost using earthworm.
- 5. Animal Association Parasitism, Mutualism and Commensalisms.

TOXICOLOGY

18 hours

- 1. Estimations of TDS, TSS, BOD and COD in industrial effluents.
- 2. Acute toxicity test of a given toxicant through LC₅₀ determination.
- 3. Acute toxicity test of a given toxicant through LD₅₀ determination
- 4. Assay of acetyl cholinesterase activity in the brain tissues of a fish species exposed to a toxicant.
- 5. Test for food adulterates coloring substances in red chili and turmeric powder

BIOPHYSICS

18 hours

- 1. Surface tension of liquid (by the method of drops)
- 2. Comparison of viscosities of the liquids: flow method.
- 3. Principles of dialysis, pacemaker, artificial heart valves and radiation therapy.
- 4. Principles of the laws of Thermodynamics.

BIOCHEMISTRY

18 hours

- 1. Estimation of total carbohydrate.
- 2. Estimation of total protein
- 3. Estimation of free amino acid
- 4. Estimation of total lipid.

CONSERVATION BIOLOGY

- 36 hours
- 1. Collection and preservations of fauna (each student should submit at least 3 fauna sps.).
- 2. Sampling Techniques (Transect and quadrate method).
- 3. Identification and use of keys reference specimen.
- 4. Wildlife photography and documentation.
- 5. Remote sensing GIS and their modules for conservation.
- 6. IUCN Red List Exercise, VORTEX and SIS.
- 7. Diversity indices Shannon wiener index, Simpson's index, Species richness and evenness.

| Conte | mporary Issu | es: Expert lectures, Seminars, Webinars | 2 hours |
|-------|------------------------|---|-----------------|
| | | Total practical hours | 146 hours |
| Text | t Book(s) | | |
| 1 | | Practical Zoology by Sinha, J., Chatterjeee A.K., Chattopadhyay en Publishers. | P. 2011. |
| 2 | Publishing | ntal biology and ecology laboratory manual by Lynn. (2003). Ke | |
| 3 | DNA Seque | encing: From Experimental Methods to Bioinformatics, Luke A | lphey, 2018 |
| 4 | Biostatistics | s by P. Ramakrishnan, 2017 | |
| Refe | erence Books | | |
| 1 | A Manual o | f Practical Zoology: Invertebrates by Verma P.S 2010. S Char | nd publication. |
| 2 | A Manual o | f Practical Zoology by Verma P.S. 2000. S Chand publication. | |
| 3 | Clinical Em | bryology: A Practical Guide by 1. Zsolt Peter Nagy, Alex | C. Varghese, |
| | Ashok Agar | wal. 2013. Springer-Verlag New York Inc | |
| 4 | Modern Exp | perimental Zoology by Preeti Guptha and Mridula Chaturvedi. 2 | 2000 |
| 5 | Toxicology Publishing. | Laboratory Lab Manual by . Oberdorster Eva. 2009. | Kendall Hunt |
| 6 | Introduction | to Bioinformatics by Smith | |
| 7 | Biostatistics | s by P.N. Arora, 2021 | |
| Cours | se Teachers: I | Dr. P. SARAVANA BHAVAN; Dr. V. RAMASUBRAMANIAN; | |
| |] | Dr. C. GUNASEKARAN; Dr. N. ARUL; Dr. T. MURALISANKA | AR |

| Elective (Optiona | e Course - III | 25ZOO-3EA | FISHERIES AND AQUACULTUR | E Credits | 4/ Week | | | | | |
|----------------------|---------------------------------------|----------------------------------|---|---|--|--|--|--|--|--|
| Pre-r | equisite | | Knowledge of fishes, prawns, crabs, holpothurians, chanks, oysters, clams, seaweeds and other aquatic plands, and their nutritional and economic values. | | | | | | | |
| Cour | se Objectives: | | To make the students entrepreneur in aquaculture activities after completion of their course. | | | | | | | |
| Expe | cted Course Ou | itcomes: | On the successful completion of the cour 1. Know the fish culture techniques, disease management and export. K 2. Start up their own' farming as e employment opportunity. K3 & K 3. Set-up a museum for aquatic plan | such as bre 1 & K2 ntrepreneur 4 tts and aqua | eeding, feeding, and can offer atic animals of | | | | | |
| 171 I | D 1/2 | T I., 14 1. T2 | their region and can promote eco to | | | | | | | |
| | | - Understand; K | 3 - Apply; K4 - Analyze; K5 - Evaluate; | | | | | | | |
| Un | | - C A - 1 | BASICS OF AQUACULTURE | | 14 hours | | | | | |
| | - | - | - Indian Fisheries – World Fisheries. En | 1 " | 1 1 | | | | | |
| | ulture. World tra | ide of fish and e | export potential. Different varieties of exc | | - | | | | | |
| Unit:2 | C ', 1 | <u> </u> | AQUA FARM ENGINEERING | | 14 hours | | | | | |
| approa | | e fish culture - | and construction of aqua farms - cul- Integrated fish farming. Accessories of | | • | | | | | |
| Unit:3 | ngitting, 010-111t | | EED FORMULATION | | 14 hours | | | | | |
| | nd fooding habit | | maintenance, live feeds (<i>Artemia</i> , Cope | | | | | | | |
| | ation Technolog ation. | gy, Feed additiv | nulation, Feed preparation, Use of Artifies and feed supplements, Importance of DUCED BREEDING AND FISH GEN | pre and pro | | | | | | |
| | | | cole of Ovaprim, Ovatide in induced by | | | | | | | |
| l | • | | ic approach to modern aquaculture - Indu | _ | _ | | | | | |
| Unit:5 | licsis and andio | 1 | FISH DISEASE MANAGEMENT | | 14 hours | | | | | |
| | reservation of or | | ote sensing in fishery management - Vi | | | | | | | |
| disease sympto | es of fishes – cau oms and control | ises, symptoms – Medicines an | and control. Parasitic and nutritional ded vaccines in aquaculture. | | | | | | | |
| Conten | iiporary issues. | Expert rectures | Total Lecture h | Ollke | 72 hours | | | | | |
| | | | Text Book(s) | ours | 12 HVUI S | | | | | |
| 1 | Introduction to | Fish Riology | and Fisheries, Khanna Surjeet Publication | s 2019 | | | | | | |
| 2 | | | nd N. Shukla, Discovery publishing hous | | 2013 | | | | | |
| 3 | _ | | Fechnology, Agnihotri s. B., Swastik Pub | | | | | | | |
| 4 | | | ture, Mirza Akbar Khan, Random Public | | | | | | | |
| 5 | | | otechnology, Shagufta Aph Publishing C | • | | | | | | |
| 6 | - | | h Publishing Corporation, 2011 | 1 | - | | | | | |
| 7 | - | tiers in Wetland | ds, Fishery & Aquaculture, Devashish Ka | r, Dominan | t Publishers& | | | | | |
| 8 | '- | | ure, Braj Kishore Singh, Swastik Publication | s, 2008 | | | | | | |
| 9 | | | | | | | | | | |
| 10 | | | Factors in Aquaculture, Saxena (Amita) Ed, I | | | | | | | |
| 11 | | | hthyology, Moyle, Pearson, 2003 | | | | | | | |
| | | | Reference Books | | | | | | | |
| 1 | A gua aviltaria - | nd the Environ | | | | | | | | |
| 1 | Aquaculture at | na me environi | nent, Pillay T. V. R., Wiley, 2013 | | | | | | | |

| 2 | Aquaculture Biotechnology, Farah Deeba, Anmol Publications PVT.LTD 2013 |
|--------|---|
| 3 | Fish Nutrition in Aquaculture, Chandrasekhar Y.S., Swastik Publications 2013 |
| 4 | Aquaculture, Lucas John S. Wiley-Blackwell 2012 |
| 5 | Fresh Water Fish Culture and Training, Neha Charan, Random Publications, 2012 |
| 6 | Aquaculture and Fisheries Biotechnology, Dunham Rex A., Cabi Publishing, 2011 |
| 7 | Practical book on Fish Nutrition and Feed Technology, S Athithan, Narendra Publishing House, New Delhi, 2014. |
| 8 | Freshwater Aquaculture, Rajendra Kumar Rath, Scientific Publishers India Ltd, 2011 |
| 9 | General and applied Ichthyology (fish and fisheries), S. K. Gupta, P.C. Gupta, S. Chand & company Ltd, |
| | New Delhi, 2010 |
| | Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] |
| 1 | Aquaculture https://www.openlearning.com/courses/aquaculture-sta2473-/ |
| 2 | Indian Agricultural Development : https://www.classcentral.com/course/swayam-indian- |
| | agricultural-development-14119 |
| 3 | Applied and Economic Zoology: https://swayam.gov.in/nd2_cec20_ge23/preview |
| 4 | Food and Nutrition: https://swayam.gov.in/nd2_cec19_ag02/preview |
| Course | e Teacher: Dr. V. RAMASUBRAMANIAN |

| Mapping | Mapping with Programme Outcomes | | | | | | | | | | | |
|---------|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|--|--|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | | |
| CO1 | M | M | L | M | M | S | S | M | S | S | | |
| CO2 | L | M | L | M | M | S | S | S | S | M | | |
| CO3 | L | M | S | L | S | S | M | M | S | S | | |

| Elective Course - III (Optional) | 25ZOO-3EB | MEDICAL ZOOLOGY | Credits | 4/ Week |
|-------------------------------------|---------------------|--|--|-----------------------------------|
| Pre-requisite | 1 | Basic understanding of animal farming | ng and disea | ses. |
| Course Objectives | s: | Study the importance of animal h To Learn the communicable and diseases in humans | non-commu | |
| Expected Course | | Understand the significance of ir List the awareness of diseases in Create the self-employment opporate oppo | humans. K 2 prtunities to qua-industriservations to | students. K3 es. K4 echniques. K4 |
| | | 3 - Apply; K4 - Analyze; K5 - Evalua | | |
| Unit:1 | VERI | EBRATE VECTORS, AND PREDATORS | 14 f | iours |
| Economic importan | nce of rodents, ba | ts, birds, and snakes | | |
| Unit:2 | COMM | UNICABLE DISEASES | 14 } | nours |
| | | small pox, hepatitis, AIDS, in | | |
| | | piasis, malaria, dengue, chikunguny | • | |
| Unit:3 | | LIVESTOCK AND DISEASES | 14 l | nours |
| | - tetanus, anthrax | sheep, dog and rabbit. Livestock, Ranikhet and avian influenza. Live | | |
| Unit:4 | FOOD SPO | ILAGE | 14 1 | nours |
| | | tors affecting their growth and surviv | | |
| Unit:5 | 7 | ACCINES AND ANTIBODIES | 14 ł | nours |
| | | d vaccines; Messenger RNA (ml | | |
| | | njugate vaccines; toxoid vaccines a | | ector vaccines |
| | | etions of IgM, IgD, IgG, IgA, and IgF s, Seminars, Webinars | | iours |
| Contemporary Issue | cs. Expert rectures | Total Lecture l | | ours nours |
| Text Book(s) | | 1000 20000 1 | 10415 / 2 1 | |
| . , | | extbook of Microbiology Edited by P | aniker C.K | J. 2005 (VII |
| 2 A Textbook of Company Ltd. | f Microbiology b | y Dubey, R.C. and Maheshwari, D.I | K. 2007. S. | Chand and |
| 1 0 | logy-K R Rayindi | anathan. Dominant Publishers 2003 | | |
| | | ogy-K.R.Ravindranathan. Wisdom pro | ess 2013 | |
| Reference Books | | | | |
| 1 Economic Zoo | ology, G.S. Shukl | a, V.B. Upadhyay | | |
| | | culture, 1952- Oxford Ibh | | |
| 3 Problems In P | rawn Culture – Sl | nigeno(Kunihiko) – Amerind -1978 | | |
| | India- Venkatana | | | |
| | | ngh(R.K.P) – Danika Publishing Con | npany 2003 | |
| | | iscovery Publishing House 2003 | | |
| 7 Perspectives I | n Indian Apicultu | re – Mishra(R C)- | | |
| 8 Weir, D. M an | nd J. Stewart. 199 | 7. Immunology, Churchill Livingston | e, London, 1 | pp-362 |
| - I | | System (Third Edition), Garland Scie VAYAM, NPTEL, Websites etc.] | ence, USA, | pp-506 |
| | Economic Zoolog | | | |
| | | am.gov.in/nd2_cec20_ge23/preview | | |

2 Applied Entomology (SWAYAM) web https://swayam.gov.in/nd2 cec20 bt02/preview

Course Teachers: Dr. P. SARAVANA BHAVAN; Dr. V. RAMASUBRAMANIAN; Dr. C. GUNASEKARAN; Dr. N. ARUL; Dr. T. MURALISANKAR

| Mapping with Programme Outcomes | | | | | | | | | | | |
|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|--|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | |
| CO1 | M | M | M | S | S | M | S | S | S | S | |
| CO2 | L | M | M | M | S | S | S | S | S | S | |
| CO3 | L | L | M | M | L | M | M | L | S | S | |
| CO4 | L | L | M | L | S | S | M | M | S | S | |
| CO5 | L | L | S | L | M | M | M | M | S | S | |

| 25ZOO-333 | HEALTH & WELLNESS | 1 hr./ Week | | |
|---------------------------|---|--------------------|--|--|
| Pre-requisite | Knowledge on basic health and wellness. | | | |
| Course Objectives: | To achieve physical fitness, nutrition and mental health. | | | |
| Expected Course Outcomes: | On the successful completion of the course, student will be 1. Demonstrate proficiency in sports training and physical practices. 2. Improve their mental and emotional well-being, fost positive outlook on health and life. 3. Develop competence and commitment as professionals field of health and wellness. | fitness ering a | | |

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit:1 HOLISTIC WELL-BEING AND WELLNESS WHEEL EXERCISE | 2 hours

Physical, mental, emotional and intellectual well-being.

Provide worksheets on all the four components individually and explain the interconnectedness to give an overall understanding.

Guide students to assess their well-being in various life dimensions through exercises on various aspects of wellbeing, and explain the benefits of applying wellness wheel.

Introduce tools to explore the use of technology to support well-being.

Introduce apps for meditation, sleep tracking, and healthy recipe inspiration.

Unit:2 PHYSICAL WELLBEING 4 hours

Fitness: Different types of fitness activities such as basic exercises, cardiovascular exercises, strength training exercises, flexibility exercises, so on and so forth (Include theoretical explanations and outdoor activity).

Nutrition: Facilitate students to reflect on their eating habits, their body type, and to test their knowledge on nutrition, its sources and the benefits.

Yoga & Meditation: Discuss the benefits of Yoga and Meditation for one's overall health. Demonstrate different yoga postures and their benefits on the body through visuals (pictures or videos).

Brain Health: Discuss the importance of brain health for daily life. Habits that affect brain health (irregular sleep, eating, screen time). Habits that help for healthy brains (reading, proper sleep, exercises). **Healthy Lungs:** Benefits of breathing exercises and meditation for healthy lungs. Discuss the importance of lung health for daily life. Habits that affect lung health (smoking, lack of exercises).

Hygiene and Grooming: Discuss the importance of hygienic habits for good oral, vision, hearing and skin health. Discuss the positive effects of grooming on one's confidence level and professional growth.

Suggested Activities (sample):

Nutrition: Invite a nutritionist to talk among the students on the importance of nutrition to the body or show similar videos shared by experts on social media. Organize a 'Stove less/fireless cooking competition' for students where they are expected to prepare a nutritious dish and explain the nutritive values in parallel.

Unit:3 MENTAL WELLBEING 4 hours

Importance of self-reflection: Steps involved in achieving mental well-being (self-reflection, self-awareness, applying actions, achieving mental well-being). Different ways to achieve mental well-being (finding purpose, coping with stress, moral compass, connecting for a common cause). The role of journaling in mental well-being.

Unit:4 EMOTIONAL WELLBEING 4 hours

Stress Management: Trigger a conversation or provide self-reflective worksheets to identify the stress factors in daily life and their impact on students' performance. Introduce different relaxation techniques like deep breathing, progressive muscle relaxation, or guided imagery.(use audio recordings or visuals to guide them through these techniques). After practicing the techniques, have them reflect on how these methods can help manage stress in daily life.

Importance of saying 'NO': Explain the students that saying 'NO' is important for their Physical and mental well-being, Academic Performance, Growth and Future, Confidence, Self-respect, Strong and

Healthy Relationships, building reputation for self and their family (avoid earning a bad name). Factors that prevent them from saying 'NO'. How to practice saying 'NO".

Body Positivity and self-acceptance: Discuss the following with the students.

- What is body positivity and self-acceptance?
- Why is it important?
- Be kind to yourself.
- Understand that everyone's unique.

Suggested Activities(Sample):

(Importance of saying 'NO')

Provide worksheets to self-reflect on...

- ...how they feel when others say 'no' to them
- ...the situations where they should say 'no'

Challenge students to write a song or rap about the importance of saying no and how to do it effectively. Students can perform their creations for the class.

| checurvery. Students can perform their elections for the class. | | | | | |
|---|------------------------|---------|--|--|--|
| Unit: 5 | INTELLECTUAL WELLBEING | 4 hours | | | |

Being a lifelong Learner: An understanding on the following, The relevance of intellectual well-being in this 21st century to meet. The expectations in personal and professional well-being. The Importance of enhancing problem-solving skills. Cultivating habits to enhance the intellectual well-being (using the library extensively, participating in extra-curricular activities, reading newspaper etc.).

Digital Literacy: Discuss the following, The key aspects of digital literacy and its importance in today's world. It is more than just liking and sharing on social media. The four major components of digital literacy (critical thinking, communication, problem-solving, digital citizenship). Why is digital literacy important? Boosting one's digital skills.

Transfer of Learning: Connections between different subjects - How knowledge gained in one area can be applied to others.

Suggested Activities (sample): Intellectual Well-being. Provide worksheets to students for teaching them how to boost intellectual well-being. Ask the students to identify a long-standing problem in their locality, and come up with a solution and present it in the classroom. Also organize an event like 'Idea Expo' to display the designs, ideas, and suggestions, to motivate the students to improve their intellectual well-being.

| Co | ontemporary Issues: Expert lectures, Seminars, Webinars | 2 hours | | | |
|----|--|---------------|--|--|--|
| | Total Lecture hours | 20 hours | | | |
| Oı | nline Resources | | | | |
| 1 | United Nations Sustainable Development Goals - Goal 3 - Good Health & https://www.un.org/sustainable development/health/ | Well- Being: | | | |
| 2 | Mindfulness and Meditation: Stanford Health Library offers mindfulness and meditation https://healthlibrary.stanford.edu/books-resources/mindfulness-meditation.html | on resources: | | | |
| 3 | Breaking Bad Habits: James Clear provides a guide on how to build good habitsand break bad ones: https://jamesclear.com/habits | | | | |
| 4 | 6 Ways to Keep Your Brain Sharp https://www.lorman.com/blog/post/how-to-keep-your-brain-sharp | | | | |
| 5 | What Is Social Wellbeing? 12+ Activities for Social Wellness https://positivepsychology.com/social-wellbeing/ | | | | |
| 6 | How Does Your Environment Affect Your Mental Health? https://www.verywellmind.com/how-your-environment-affects-your-mental-health-5093687 | | | | |
| 7 | How to say no to others (and why you shouldn't feel guilty) https://www.betterup.com/blog/how-to-say-no | | | | |
| Co | ourse Teacher: From Physical Education Department. | | | | |

Closure:

Each student should submit a Handwritten Summary of their Learning. Action Plan for the future.

Assessments:

- Use Self-reflective worksheets to assess their understanding.
- Submit the worksheets to internal audit/external audit.
- Every student's activities report should be documented and the same have to be assessed by the Physical Director with the mentor.
- The evaluation should be for 100 marks. No examination is required.

Scheme of Evaluation:

A - Report - 40 mark
B - Attendance - 20 mark
C - Activities (observation during practice) - 40 mark
----Total - 100 mark*

100 main

^{*}This should be converted into 25 mark

Fourth Semester

| FIELD TRIP | 25ZOO-46A | Institutional, Research Laboratories, Industrial visits etc. | Credits | 4/ Week |
|---------------------------|-----------|--|---------|---------|
| SKILL DEVELOPMENT & | | Summer school/ Training/ Internship etc. | | |
| HEALTH AND WELLNESS | | Health and Wellness | | |

| PROJECT | 25ZOO-47V | Dissertation under a guide (internal) | Credits | 4/ Week |
|-----------|-----------|---------------------------------------|---------|---------|
| WORK & | | | | |
| VIVA-VOCE | | Viva-voce examination (External) | | |

| Elective Course - IV (Optional) | 25ZOO-4EA | BIOETHICS AND INTELLECTUAL PROPERTY | Credits | 4/ Week | | | |
|---|---|--|--------------|-------------|--|--|--|
| 1 / | | RIGHTS | | | | | |
| Pre-requisite | | Basic knowledge on conducting experimaspects on them. | ents and e | thical | | | |
| Course Objectives: | | To make the students be aware of the intention their holdings. | ellectual tl | hings and | | | |
| Expected Course Out | tcomes: | On the successful completion of the course, student will be able to: | | | | | |
| | | 1. Claim the rights for their properties w | nen some | bodies are | | | |
| | | treat them as their own. K1 & K2 | : | : | | | |
| | | 2. Motivated enough to do intellectual th and discovery. K3 & K4 | ings, new | inventions, | | | |
| | | · · · · · · · · · · · · · · · · · · · | fit in with | ain the | | | |
| | | 3. Evaluate their own work, whether is it fit in within the prescribed criteria of a patent filing agency. K4 , K5 & K6 | | | | | |
| K1 - Remember: K2 - | . Understand: K | 3 - Apply; K4 - Analyze; K5 - Evaluate; F | | | | | |
| Unit:1 | INT | RODUCTION TO BIOETHICS | 14 hour | | | | |
| | | fects – Negative effects - Biotechnology e | | - | | | |
| | | aving the Banana- Toxic Soils-Fast Growin | | | | | |
| | | od safety- Environmental concerns- Econo | | ne monaren | | | |
| Social Concerns. | | od sarety Environmental concerns Leone | inio una | | | | |
| Unit:2 | GL | P AND CPCSEA GUIDELINES | 14 hour | S | | | |
| Bioethics regulation f | on frame work in India. GLP introduction – National Good Laboratory Practice | | | | | | |
| _ | | ines for Laboratory Animal Facility. Huma | • | | | | |
| Unit:3 | INTRODUCTION TO IPRs 14 hours | | | | | | |
| Basic concepts and need for Intellectual Property - Industrial Property, Technological Research, Inventions | | | | | | | |
| | | f IPR - Origin of the Patent Regime - History of | | | | | |
| - Basis of Patentability - Patent Application Procedure in India - Patent Granted Under Convention | | | | | | | |
| | Agreement- Opposition to Grant of Patent-Grant and Sealing-Exclusive Rights - Special Provision for selling or distribution - Suits relating to infringements – Compulsory License. | | | | | | |
| or distribution - Suits re Unit:4 | iating to intringe | | 14 how | •6 | | | |
| UIIII.4 | COPYRIGHTS AND 14 hours | | | | | | |

GEOGRAPHICAL INDICATIONS

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad. International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement.

Unit:5 LAWS AND PROTECTION 14 hours

Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act. Cyber Law and Digital Content Protection. Unfair Competition: Meaning and Relationship between Unfair Competition and IP Laws. Case Studies. Infringement of IPRs, Enforcement Measures, Emerging issues and Case Studies.

| Contemporary Issues: Expert lectures, Seminars, Webinars 2 hours | | | | | | | |
|---|---|--|--|--|--|--|--|
| Total Lecture hours 72 hours | | | | | | | |
| Text Book(s) | | | | | | | |
| 1 Research methodology for biological sciences by Gurumani (N). 2011. MJP Publishers | | | | | | | |
| 2 Textbook of laboratory techniques by Chinmoy Goswami. 2011. Wisdom Press | | | | | | | |
| | Ethics in animal experimentation by Sood (O.P), Rattan (Ashok). 2004. Ranbaxy science | | | | | | |
| foundation. | | | | | | | |
| Reference Books | | | | | | | |
| Methods in biotechnology by Swarna Latha C D, Digumarti Bhaskar. 2007.Discovery Publishing House. | | | | | | | |
| 2 Molecular Biotechnology by Mukesh Pasupuleti. 2006. MJP Publishers | | | | | | | |
| Research techniques in biological sciences by Sandhu (G S). 1991. Anmol Publishing | | | | | | | |
| 4 Biological techniques by Knudsen(Jens. W). Harper and Row Publishers. 1966 | | | | | | | |
| Publishing | Notes on Microscopical Technique for zoologists by Pantin(C.F.A). 1960. Cambridge Publishing | | | | | | |
| 6 Guidebook to Microscopical Methods by Grimstone(A.V.), Skaer(R.J.). 1972.Cambrid Publishing | Guidebook to Microscopical Methods by Grimstone(A.V.), Skaer(R.J.). 1972.Cambridge Publishing | | | | | | |
| 7 Handbook of Laboratory Animals by Abhijit Paintal. 1993. Dominant Publishers | | | | | | | |
| 8 Bioethics by Stanley (Shaleesha A). 2018. Wisdom Publication | | | | | | | |
| 9 Methods in biotechnology by Swarna Latha C D, Digumarti Bhaskar. 2007.DiscoveryPul House. | blishing | | | | | | |
| Handbook of Laboratory Animals by Abhijit Paintal. 1993. Dominant Publishers | | | | | | | |
| Bioethics by Stanley (Shaleesha A). 2018. Wisdom Publication | | | | | | | |
| Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] | | | | | | | |
| 1 Research Methodology: https://swayam.gov.in/nd2_cec20_hs17/preview | | | | | | | |
| 2 Understanding Research Methods: https://www.mooc-list.com/course/understandin research-methods-coursera | ng- | | | | | | |
| 3 Experimental Biotechnology: https://swayam.gov.in/nd1_noc20_bt31/preview | | | | | | | |
| 4 Research Ethics: https://swayam.gov.in/nd2_ugc19_ge04/preview | | | | | | | |
| 5 Patent Law For Engineers https://swayam.gov.in/nd1_noc19_hs65/preview | | | | | | | |
| 6 Ethics in animal experimentation by Sood (O.P), Rattan (Ashok). 2004. Ranbaxy science found | lation | | | | | | |
| 7 Methods in biotechnology by Swarna Latha C D, Digumarti Bhaskar. 2007.Discovery Publishin House | ng | | | | | | |
| 8 Experimental Biotechnology: https://swayam.gov.in/nd1_no | | | | | | | |
| 9 Research Ethics: https://swayam.gov.in/nd2_ugc19_ge04/pr6 | | | | | | | |
| Course Teachers: Dr. T. MURALISANKAR | | | | | | | |

| Mappir | Mapping with Programme Outcomes | | | | | | | | | |
|--------|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | M | M | M | M | M | M | M | M | M | M |
| CO2 | M | M | M | M | M | M | M | M | M | M |
| CO3 | L | L | M | L | M | M | M | M | S | S |
| CO4 | L | L | L | L | L | L | L | L | M | M |
| CO5 | L | L | M | L | L | M | L | L | M | M |

^{*}S, Strong; M, Medium; L, Low

| Elective Course -IV (Optional) | 25ZOO-4EB | GLOBAL WARMING AND CLIMATE CHANGE | Credits | 4/ Week | | | | |
|---|--------------------|---|--|---------------------|--|--|--|--|
| Pre-requisite | | Knowledge on temperature, greenhouse of organisms in ecosystems. | Knowledge on temperature, greenhouse gases and abundance of organisms in ecosystems. | | | | | |
| Course Objectives: | | To teach the impacts of greenhouse gase and habitat loss. | es in globa | al warming | | | | |
| Expected Course Out | comes: | On the successful completion of the cou | rse, stude | ent will be | | | | |
| | | able to: 1. Understand that greenhouse gases are warming. K1 & K2 | • | | | | | |
| | | 2. Understand that climate change would loss. K2 & K3 | i lead to t | ologiversity | | | | |
| | | 3. Know uses of GIS and RS application | in assess | sment of | | | | |
| | | species diversity and taking conservat | tion meas | ures. K4, K5 | | | | |
| 174 D 1 174 |) TT 1 | & K6 | T// C | | | | | |
| | | K3 - Apply; K4 - Analyze; K5 - Evaluate | | | | | | |
| Unit:1 | 1 | HOUSE GASES AND GLOBAL WARMIN nhanced greenhouse gas effect - Global wa | | hours | | | | |
| gases policy issue - | Effects and caus | ses of climatic change and its Significan | ce - Impa | act of global | | | | |
| warming on eco- system - Fossil fuel in Global warming - Acid rain, ozone depletion, forest fire - GIS, RS and their application. | | | | | | | | |
| Unit:2 | | AEROSOLS | | hours | | | | |
| | | rect effects - Production mechanisms of a | | | | | | |
| Trends in aerosols - Radiative forcing and GHGs - Definition, concept and processes – | | | | | | | | |
| Forcing – response r of tropospheric aeros | - · | diative forcing by tropospheric ozone, Rac | liative for | cing | | | | |
| Unit:3 | | INDUSTRY AND GLOBAL WARMIN | IG 14 | hours | | | | |
| Role of Indian indus | try in production | n of CFC products - Role of plants - Inno | vative apr | proaches - | | | | |
| Biological modulation | on – Case studie | es. | · ···································· | | | | | |
| Unit:4 | | BIODIVERSITY AND ANIMAL BEHA | | 14 hours | | | | |
| | | biodiversity – IPPC and migration of sp | | | | | | |
| | | n – Climate change and Human Health Ti lator and parasitoid system – Climate | | | | | | |
| | • | - Carbon sequestration. | z change | and vector | | | | |
| Unit:5 | | S, MEASUREMENT AND MANAGEME | NT 14 | hours | | | | |
| | | es - wild animals and plants. GHG, aer | | | | | | |
| , 0 | | voflurane. Portfolio manager, CRIS, NO. | | toacoustic | | | | |
| | | GAGE, ADS GC-MS, MEDUSA GC-MS | | , 1 | | | | |
| Global conservation organization - Deforestation and Defaunation - integrated | | | | | | | | |
| Contemporary Iss | | ures, Seminars, Webinars | 2 h | ours | | | | |
| Contemporary 155 | ues. Expert feet | Total Lecture hours | | ours | | | | |
| Text Book(s) | | 2000 2000 1000 | | | | | | |
| \(\frac{1}{2}\) | Animal behaviou | ar by Hoshang S. Gunderia and Hare Govind | Singh, 200 | 5, S. Chand& | | | | |
| Co.) 2 Ecology (Individ | uals, population a | and Communities) by Michael Begon, John L | | • | | | | |
| Townsend, 2005, Wiley | | | | | | | | |
| Reference Books | 1 4 4. | 1 W.L. A.D. 1 2010 202 | 11 | | | | | |
| _ | | by Walter A. Rocenbaun, 2010, CQ Press Co | | | | | | |
| | | agement by John H. Balduim, 1985, West view The Law by K. Khitoliyan | w Press | | | | | |
| I 1 Linxunonmontol | mmataatian and t | the Levy by V. V. batelayou | | | | | | |

| Re | Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] | | | | | | |
|----|--|--|--|--|--|--|--|
| 1 | Climate Change: A Guide For Teachers Of All Disciplines: | | | | | | |
| | https://onlinecourses.swayam2.ac.in/arp19_ap55/preview | | | | | | |
| 2 | Ecology and Environment: https://www.classcentral.com/course/swayam-ecology-and- | | | | | | |
| | environment-14021 | | | | | | |
| 3 | 3 Environmental Studies: https://onlinecourses.swayam2.ac.in/cec19_bt03/preview | | | | | | |
| Co | Course Teacher: Dr. C. GUNASEKARAN. | | | | | | |

| Mapping with Programme Outcomes | | | | | | | | | | |
|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | L | M | M | S | S | S | S | S | M | M |
| CO2 | S | M | L | S | M | M | S | S | S | S |
| CO3 | L | M | M | S | S | S | S | S | S | S |

^{*}S, Strong; M, Medium; L, Low

JOB ORIENTED COURSE-II

| 25ZO | O-4JA | LEADERSHIP DEVELOPMENT ON BIODIVERSITY CONSERVATION | | | | |
|---|--|---|--|--|--|--|
| Name of the Departn | nent | Department of Zoology | | | | |
| Name of the Facult With Complete Add and e-mail | * | Dr. C. Gunasekaran Assistant Professor Department of Zoology Bharathiar University, Coimbatore – 641 046 Ph: 0422 2428310 Email: gunasekaran@buc.edu.in | | | | |
| Inter / Intra Depart | tment Course | Inter department course | | | | |
| Duration of the Co | urse | 60 hrs. | | | | |
| Eligibility | | Undergraduate students of Arts, Social and Life Science departments | | | | |
| Number of Candida | ates to be Admitted | 40 | | | | |
| Mode of the Course | | Regular / Online / Both Regular and Online | | | | |
| | the Company Address, son, Phone, e-mail etc.) | Collaboration with: Dr. B.A. Daniel, Scientist Zoo Outreach Organization No. 12 Thiruvannamalai Nagar, Saravanampatti -Kalapatti Road, Saravanampatti, Coimbatore 641 035, Tamil Nadu, India Phone # 91 9385339862 and 9385339863 Email: zooreach@zooreach.org | | | | |
| Registration Procee | lure | Selection procedures involving interested students from different disciplines of Arts, Social and LifeScience departments of Bharathiar University. | | | | |
| | ion managers and plans | botanists, landscape ecologists, marine ners, environmental education specialists and ientists, Research Assistant. | | | | |
| The objectives of the | | | | | | |
| | of this course are to: | | | | | |
| | 5 | | | | | |
| - | 2 Impart skills in Biodiversity conservation and sustainable utilization techniques | | | | | |
| fundraising and | Address methods on project designing, planning, organization skills, execution, reporting, fundraising and evaluation methods in implementation of a project | | | | | |
| globally | Have a hands on experience in Conservation education and dissemination of information | | | | | |
| 5 Sensitize capaci resources. | ty building on Biodiver | rsity and sustainable utilization and natural | | | | |
| Course Content | Lecture / Practical | / Project / Internship | | | | |

| Mod | Orientation programme on Biodiversity conservation and sustainable Utilization and The scope and meaning of conservation biology: the ethical and philosophical basis | | 6 hours | | | |
|-----|---|---|---------|--|--|--|
| Mod | Module 2 Addressing the needs of the local people and involving them in | | 6 hours | | | |
| Mod | lule 3 | Species conservation – Livelihood support programs and its impact. Developing skills in project designing and planning in Conservation education | 6 hours | | | |
| | lule 4 | Designing a project: Training in project designing, planning organisation skills, execution, reporting and evaluation methods. | 6 hours | | | |
| | lule 5 | Invited Lecture series on various skills on Leadership | 6 hours | | | |
| | lule 6 | Hands on training in project designing and execution plans | 6 hours | | | |
| Mod | lule 7 | Visit to National parks /Sanctuaries/ Zoos / organisation involving in Biodiversity conservation | 6 hours | | | |
| Mod | lule 8 | Laws involving in Environmental, Biodiversity and Wildlife conservation | 6 hours | | | |
| Mod | lule 9 | Biodiversity related Conventions and Conservation policies in India | 6 hours | | | |
| Mod | lule 10 | Understanding in field project implementation, evaluation method and reporting. | 6 hours | | | |
| Exp | ected outc | | | | | |
| 1. | 11. | atural history skills to identify flora and fauna, and recognize and interpal patterns relevant to animal populations and their habitats. (K1) | ret | | | |
| 2. | | nd apply appropriate field techniques and data collection methods to add s relevant to animal populations and their habitats. (K3) | lress | | | |
| 3. | - | le to apply professional judgment to develop future policies and approa | ches to | | | |
| | address o | conservation issues at a regional, national and international level. (K2) | | | | |
| 4. | by emplo | basic Conservation biology research and to demonstrate professionalism oyers. (K3) | • | | | |
| 5. | measure | rstand the origin and distribution of biodiversity, how biodiversity is de d, and how it varies in space and time and to a variety of laws and regul e how natural resources are used and protected. (K4) | | | | |
| 6. | | are conservation leader in the field of Biodiversity Conservation (K6) | | | | |
| | ok(s) for Study | | | | | |
| 1 | Anna A. | Sher and Richard B. Primack 2019. An Introduction to Conservation | | | | |
| 2 | | Oxford University press. | 10/n | | | |
| 3 | J , 1 | | | | | |
| 4 | Navjot S. Sodhi and Paul R. Ehrlich 2010. Conservation Biology for All. Oxford | | | | | |
| | University press. | | | | | |
| 5 | 1 - | | | | | |
| Boo | Book(s) for reference | | | | | |
| 1 | Primack, R.B Essentials of Conservation Biology. 5th Edition. Macmillan | | | | | |
| 2 | Meffe, | G. K. and C. R. Carroll 1994.Principles of Conservation Biology, Stes, USA | inauer | | | |
| 3 | Michael, | P. 1984. Ecological Methods for Field and Laboratory Investigations. T | ata Mc | | | |
| 4 | GrawHill Publishing Company Limited, New Delhi. 404 p. Peter H. Raven, Navjot S. Sodhi, Luke Gibson, 2013. Conservation Biology: Voices from the Tropics, Willey Online library. | | | | | |

| 5 | Odum, E.P. 1996. Fundamentals of Ecology. Natraj Publishers, Dehra Dun 574p. 19. |
|------|--|
| | Primack, |
| | R. B. 2006. Essentials of Conservation Biology, Sinauer Associates, USA. |
| 6 | Soule, M. E. 1986. Conservation Biology: The Science of Scarcity and Diversity, |
| | SinauerAssociates Inc., USA. |
| Rela | ted Online Contents |
| 1 | UK BAP – www.ukbap.org.uk International Union for the Conservation of Nature – |
| | www.iucn.org |
| 2 | IUCN Redlist for Endangered Species – www.redlist.org |
| 3 | Biodiversity Hotspots – www.biodiversityhotspots.org |
| 4 | https://nptel.ac.in/courses/102/104/102104068/ |
| 5 | https://swayam.gov.in/nd1_noc20_bt39/preview |
| 6 | https://swayam.gov.in/nd1_noc20_bt38/preview |
| 7 | https://www.coursera.org |

VALUE ADDED COURSE-II

| | | 25ZOO-4VA | FISH CULTURE | | |
|--|-------------|---|---|-------------|--|
| Name of the Department | | | ZOOLOGY | | |
| 1 | | | DR. V. RAMASUBRAMANIAN | | |
| Nar | me of the] | Faculty Member i/c | Professor, Department of Zoology, | | |
| Wit | th Comple | ete Address with Phone | BharathiarUniversity, Coimbatore- 6 | 41046. | |
| and | l e-mail | | Phone: 0422 2428494. Email: | | |
| vraman68@rediffmail.com | | | Š | | |
| | | Department Course | Intra Department Course | | |
| | | he Course | 60 hours | | |
| | gibility | | B.Sc., Zoology | | |
| Nur | mber of C | andidates to be Admitted | 40 | | |
| | | | Aqua Nova Hatcheries Pvt. Ltd. | | |
| | | | 431, Singaravelan Street, China | | |
| - | | | Neelangarai, Chennai -600 115. | | |
| Reg | gistration | Procedure | Mr. G. SAMARASAM | | |
| | | | Managing | | |
| | | | DirectorPhone: | | |
| | | | 9840095953 | | |
| Iah | Opportu | nitios: | Email: aquanova@ rediffmail.com | | |
| | | | ties especially in the Fish farms and | | |
| | | | ornamental fish culture and edible fish cult | ure) | |
| | | ector, Fisheries Technician. | ornamental fish culture and earote fish cult | ure) | |
| | | es of the Course are: | | | |
| | | ectives of this course are to: | | | |
| 1 | | | nportance of aquaculture, particularly orna | mantal | |
| 1 | | ole fish cultures | inportance of aquaeunture, particularly offia | incinai | |
| 2 | | | for the construction of fish farm | | |
| 3 | To make | e the students understand the fi | sh nutrition and feed technology. | | |
| Exr | pected Co | urse Outcomes: | <u> </u> | | |
| | | il completion of the course, st | udent will be able to: | | |
| | | 1 , | amental and edible fishes. K1 & K2 | | |
| | | <u> </u> | eur and can offer employment opportunity. | K3 & K4 | |
| ľ | | | ble fishes of their region and can promote | | |
| | K5 & K6 | idovam for ornamental and can | or nones of their region and can promote t | co wansiii. | |
| Cot | urse Conto | ent Lecture | | | |
| Mo | dule 1 | Basics of Fisheries - Scope a | and importance of Fisheries | 6 hours | |
| Mo | dule 2 | Development of fish cultur opportunities. | e. Indian Fisheries – Research andcareer | 6 hours | |
| Mo | dule 3 | | nter and Marine Ornamental Fisheries | 6 hours | |
| Module 4 Ornamental Fish Trade- Disease Management for AquariumFishes. | | | | | |

| Module 5 | Culture of Edible Fishes – Biology of Carps – Culture of Indian Major Carps | 6 hours | | | |
|---------------------------------|--|-----------|--|--|--|
| Module 6 | Integrated Fish Farming – Fish Culture in Rice Fields– Induced Breeding – Procedure of Induced Breeding Hypo-physation. | 6 hours | | | |
| Module 7 | Aqua Feed Formulation Methods – Nutritional Requirement of Finfish - Types of Fish Feeds – Formulated Feeds – Preparation of Supplementary Feed – | 6 hours | | | |
| Module 8 | Immuno-stimulants-Diet Processing – Management of Feeding – Preparation of Natural Food In Fish Pond | 6 hours | | | |
| Module 9 | Construction of a Fish Farm – Site Selection – Size and Depth of the Ponds – Water Quality (Physical Chemical and Biological Factors) | 6 hours | | | |
| Module 10 | Pond Renovation – Harvesting – Post Harvesting – Fish Preservation – Hatchery seed production- Fish Products And By Products. | 6 hours | | | |
| Book(s) for S | Study | | | | |
| Delhi, | on Fish Nutrition and Feed Technology, S Athithan, Narendra Publishing Ho 2014. quaculture, Rajendra Kumar Rath, Scientific Publishers India Ltd, 2011 | ouse,New | | | |
| General and ap New Delhi, 20 | oplied Ichthyology (fish and fisheries), S. K. Gupta, P.C. Gupta, S. Chand & com | panyLtd, | | | |
| Methods In R 2008 | Reproductive Aquaculture, Elsa Cabrita; Vanesa Robles; Paz Heraez, CRC I | Press, | | | |
| Book(s) for r | reference | | | | |
| Applied Fisherie | es and Aquaculture, Braj Kishore Singh, Swastik Publications, 2008 | | | | |
| Fisheries And | Fisheries And Aquaculture Management, Ghosh Shailendra, Adhyayan Publishers And Distributors, 2009 | | | | |
| Control Of Bio | otic and A biotic Factors in Aquaculture, Saxena (Amita) Ed, Daya Publishing Ho | ouse,2003 | | | |
| Fisheries An I | ntroduction To Ichthyology, Moyle Pearson, 2003 | | | | |
| Related Onli | | | | | |
| | https://www.openlearning.com/courses/aquaculture-sta2473-/ | | | | |
| | ultural Development: https://www.classcentral.com/course/swayam-indian | <u>n-</u> | | | |
| | <u>agricultural-development-14119</u> Applied and Economic Zoology: https://swayam.gov.in/nd2 cec20_ge23/preview | | | | |
| | trition: https://swayam.gov.in/nd2 cec19 ag02/preview | | | | |
| | | | | | |

| PROFESSIONAL | 25ZOO-4NS | SWAYAM - MOOC: Study Webs of | Credits | 2/ Week |
|---------------|-----------|---|---------|---------|
| CERTIFICATION | | Active-Learning for Young Aspiring Minds | | |
| COURSE | | (National Programme on Technology | | |
| COCHSE | | Enhanced Learning) - Massive Open Online | | |
| | | Course: This course should have been for the | | |
| | | duration of at least 4 weeks with at least 2 credits. | | |
| | | The course is mandatory and should have been | | |
| | | completed within third semester, i.e., before the | | |
| | | beginning of the 4 th semester. | | |

Supportive Course

| C 4. T | 4.5 7.0.0.001440 | T ALECTAN E DICE VOEC | - C 19 | ., | / ** 1 |
|-------------------------------------|--|--|------------|---------------------------|-----------------|
| Supportive course - I | 25ZOOGS120 | LIFESTYLE DISEASES | Credi | its 2 | / Week |
| Pre-requisite | | Knowledge on lifestyle changes a | nd junk | food | |
| Course Objective: | | | | | |
| | | artments become aware of reason | s for var | rious dise | ases related to |
| | prevailing in this | | | | |
| | | junk food available in the market. | | | |
| Expected Course Ou | | ourse, student will be able to: | | | |
| | | estyle changes and their diseases. | K1 K2 | & K3 | |
| | _ | from IT sector at an occupational | | | 5 & K6 |
| | | - Apply; K4 - Analyze; K5 - Eva | | | |
| | | N TO LIFESTYLE DISEASES | | 7 hours | |
| Introduction- Classifica | tion of disease - L | ifestyle disease (LD) – Non commun | icable di | sease as I | Lifestyle |
| | | llable and uncontrollable Risk factors | s of LD. | | |
| Unit:2 | | L LIFESTYLE DISEASES | | 7 hours | .1 |
| | | nic respiratory disease, Alcoholis | | | |
| disease: Thumb suckin | | tes, osteoporosis, kidney calculus | s, stroke, | , and Chi | ilanooa |
| | | AL LIFESTYLE DISEASES | 7 ł | iours | |
| | | yndrome, Cervical spondylitis, C | | | drome. |
| Psychological stress, C | besity, Hyperten | sion, Cardiovascular diseases, Ínfo | ertility. | J | , |
| Unit:4 EN | | L LIFESTYLE FACTORS AND | 7 ł | iours | |
| | | IEIR IMPACT | | | |
| | | - Electronic Gadgets and their ill | | | |
| Unit:5 | | adult and children, Digital dement CMENT PRACTICES | | rain oxid iours | ative stress. |
| | | ses- Nutrition and Dieting- Physical | | | henefits |
| | | | | hours | ochemis. |
| Contemporary Issues. | Expert fectures, (| online seminars, webinars Total Lecture hor | | hours | |
| Text Book(s) | | Total Lecture not | urs 33 | nour s | |
| | Mark R Cullen C | Carl Andrew Brodkin.Textbook of Cli | inical Oc | cupationa | l and |
| | | aunders (Second edition);2005 | | сиринопи | i dila |
| 2 Sebastian L. John | ston, Stephen T. H | olgate. Asthma: Critical Debates. Jol | nn Wiley | & Sons. 2 | 2008. |
| Reference Books | | | | | |
| 1 WHO (2017) http://www.who.i | | cable diseases. Fact Sheetsheets/fs355/en/ on: 2/05/2017) | et. (Re | etrieved | from: |
| ` ` / | • | ort on noncommunicable diseases ns/ncd_report_full_en.pdf on 1/05/20 | | (Retrieved | d from |
| | | ncommunicable diseases in the wo anisation/World Economic Forum rep | | | |
| | | Common Diseases; Nutrigenomics, Jublishing Switzerland 2016. | DOI 10.1 | 1007/978- | 3-319- |
| | V. Gupta et al., Lifestyle, Stress, and Disorders. Basic and Applied Aspects of Biotechnology, DOI 10.1007/978-981-10-0875-7 22;SpringerScience+Business Media Singapore 2017. | | | | gy, DOI |
| | | Carl Andrew Brodkin.Textbook of aunders (Second edition);2005 | Clinical (| Occupation | onal and |
| 7 Kent Pinkerton F | Richard Harding, | The Lung, Development, Aging an | nd the E | nvironme | nt, 2nd |
| Edition, 2014. | | | | | |
| | tents [MOOC, S | WAYAM, NPTEL, Websites etc | :.] | | |
| Related Online Cont 1 Diet Managem | ent in Health an | | - | | |

| Supportive course - II | 25ZOOGS38 | INTRODUCTION TO | Credits | 2/ Week | |
|---|--|---|----------------------|-------------|--|
| Supportive course - II | 25200G556 | CONSERVATION BIOLOGY | Credits | 2/ WCCK | |
| D 1.1 | | • Knowledge on the importance of | of various flo | ra and | |
| Pre-requisite | | fauna available in the surroundi | | | |
| Course Objective: | | | - | | |
| | | artments become knowledgeable in | | | |
| | | nce of their conservation for future | usage and pr | event the | |
| biodiversity loss o | <u> </u> | cies. | | | |
| Expected Course Out | | . 1 . 111 11 . | | | |
| On the successful comp | letion of the co | urse, student will be able to: | | | |
| | | fications, and methods related to fu | ndamental pi | rinciple of | |
| conservation of biol | | | | | |
| | | on of natural resources. K3, K4, K5 | | | |
| K1 - Remember; K2 - U | | - Apply; K4 - Analyze; K5 - Evalu | ate; K6 - Cre | ate | |
| Unit:1 | DIVERS | ITY OF SPECIES | 7 hours | | |
| | | m, Genetic and Species diversity) | | | |
| • • | * | ntory survey methods in Animal of | diversity - B | iodiversity | |
| Hotspots (Western Ghats | | | | | |
| Unit:2 | | VERSITY LOSS | 7 hours | | |
| | | Threats to animal diversity in In | | | |
| | - | Measuring status of species in the | wild - IUCN | Red list | |
| exercise - Status of India | | | | | |
| Unit:3 | | RVATION TOOLS | 7 hours | | |
| | | ian animals (Case studies) - Project | | | |
| | | articipation in conservation - Tools | s in Conserva | ation: GIS, | |
| Remote sensing – PVA - | | | | | |
| | | CIES AND ECONOMICS OF CONSERVATION IN INDIA | 7 hours | | |
| Wildlife (Protection) Ac | t of India (1972 | 2) - Protected Area Network - Zoo | policy - Law | s and their | |
| applications in Zoologic | cal parks, Wild | llife sanctuaries and Biosphere res | serves - Eco | nomics of | |
| biodiversity conservation | | | | | |
| | | EDUCATION AND AWARENES | | | |
| | | - How to write popular and Scie | | | |
| | | source materials – wildlife, nature, | | _ | |
| | | zations in wildlife conservation - W | | entation. | |
| Contemporary Issues: E | expert lectures, of | online seminars - webinars | 2 hours | | |
| | | Total Lecture hou | irs 37 hours | | |
| Text Book(s) | | | | | |
| 1 Anna A. Sher and R Oxford University p | | ack 2019. An Introduction to Conse | ervation Biolo | ogy, | |
| 2 Anon. 2004. Indian | Anon. 2004. Indian Wildlife Protection Act 1972. Natraj Publishers, Dehra Dun. 104p. | | | | |
| 3 Gopal, R. 1992. Fur | damentals of W | vildlife Management. Justice Home. | . Allahabad. (| 668p. | |
| - | | 2010. Conservation Biology for A | | | |
| press. | | . | | • | |
| 5 Wilson, E. O., and I | D. Perlman. 200 | 0. Conserving earth's biodiversity. I | Island Press, | | |
| Washington, D.C. | | - | ŕ | | |
| Reference Books | | | | | |
| | | | | | |

Michael, P. 1984. Ecological Methods for Field and Laboratory Investigations. Tata Mc Graw

Hill Publishing Company Limited, New Delhi. 404 p.

USA

| 3 | Peter H. Raven, Navjot S. Sodhi, Luke Gibson, 2013. Conservation Biology: Voices from the Tropics, Willey Online library. | | | |
|----|---|--|--|--|
| 4 | | | | |
| | Primack, R. B. 2006. Essentials of Conservation Biology, Sinauer Associates, USA. | | | |
| | | | | |
| 5 | Soule, M. E. 1986. Conservation Biology: The Science of Scarcity and Diversity, Sinauer | | | |
| D | Associates Inc., USA. | | | |
| R | elated Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] | | | |
| 1 | https://nptel.ac.in/courses/102/104/102104068/ | | | |
| 2 | https://swayam.gov.in/nd1_noc20_bt39/preview | | | |
| 4 | https://swayam.gov.in/nd1_noc20_bt38/preview | | | |
| | https://www.coursera.org | | | |
| Co | Course Designed By: Dr. C. GUNASEKARAN. | | | |

| Suppor | rtive course - III | 25ZOOGS124 | MARINE BIORESOURCES | Credits | 2/ Week |
|---------------|---|--------------------------|---|-------------------|-----------------|
| Pre-re | equisite | | Knowledge on marine plants, li grasses, and marine animals, li sea-cucumber, starfish etc and values. | ke fishes, | prawns, crabs |
| • T | | | pecome knowledgeable in relation to all and medicinal values, their sustain | | |
| Expec | ted Course Outco | | se, student will be able to: | | |
| 1. Ac | quire basic knowle | dge on economic | e importance of marine organisms. | K1, K2 & | : K3 |
| | | | rsity and conservation of marine or rsity. K3 , K4 , K5 & K6 | ganisms f | or future usage |
| K1 - R | Remember; K2 - U | nderstand; K3 - A | Apply; K4 - Analyze; K5 - Evaluate | e; K6 - Cr | eate |
| Unit:1 | | • | E ENVIRONMENT | | ours |
| econo | mic zone. | | Waves, tides and currents- Nutrie | | |
| Unit:2 | | | NE ORGANISMS | | iours |
| Zoopla | ankton- Economic | importance of m | nd mangroves and their importan arine crustaceans, molluscs and Pis | ces. | |
| Unit:3 | | | CONSERVATION | | iours |
| | | | d ex situ conservation- IUCN and | its impor | tance- Sea |
| Tanchi Unit:4 | ng- Marine protect | | UTICALS FROM THE SEA | 71 | nours |
| | | | tive compounds (Bacteria, microa | | |
| | and invertebrates) | | antifungal, antiviral, anti-inflamma | | |
| Unit:5 | | THREATS | S TO MARINE LIFE | 7 ł | nours |
| | e pollution- Type plastics pollution- | | f pollutions- Eutrophication- Hea | vy metal | pollution- |
| Conto | emporary Issues: | Expert lectures, | online seminars - webinars | | hours |
| | | | Total Lecture | hours 37 | hours |
| Text I | Book(s) | | | | |
| 1 | | | 05. Dominant publishers & distribu | | |
| 2 | House, New Delh | i . | ı India by Pillai, N.G.K. 2011. Nare | | |
| Refer | Marine biology, bence Books | iodiversity and Z | oology by Oakenfold. 2018. Syraw | ood Publi | shing House |
| 1 | | | Briggs (John. C).1974. Hill Press. | | |
| 2 | Ocenography and marine biology (volume 2-7) by Barnes (Harold) ED, 1986. CRC Press. | | | | |
| 3 | | | shall (N.B) ED.1969. Zoological So | | |
| 4 | 1984. CRC Press. | , | es by Steidinger (Karen. A) and Wa | ılker (Lind | la.M) ED. |
| 5 | | | Scheuer. 1981. Academic Press | | |
| 6 | Publications. | | isheries by Khanna and Neerja Ka | - | 9. Surjeet |
| 8 | | | ology by Moyle. 2004. Pearson Pub | | |
| 9 | | | nona.B) ED. 1979. Academic Press | | |
| | | | ts by Zottoli (Robert). 1973. Mosby | | |

| Rela | Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] | | |
|------|---|--|--|
| 1 | Marine biology: https://www.mooc-list.com/course/marine-biology-saylororg | | |
| 2 | Marine and Antarctic Science: https://www.classcentral.com/course/open2study-marine-and-antarctic-science-1641 | | |
| 3 | Oceanography: a key to better understand our world: https://www.mooclist.com/course/oceanography-key-better-understand-our-world-coursera | | |
| 4 | Marine megafauna: An introduction to marine science and conservation: https://www.my-mooc.com/en/mooc/megafauna/ | | |
| Cou | Course Designed By: Dr. T. MURALISANKAR | | |