KUNTHAVAI NAACCHIYAAR GOVERNMENT ARTS COLLEGE FOR WOMEN
An Autonomous College Affiliated to Bharathidasan University
(Re-Accredited by NAAC with 'B' Grade by NAAC)
Thanjavur -613 007, Tamil Nadu, India.

## PG AND RESEARCH DEPARTMENT OF ZOOLOGY

# CBCS & OBE

Scheme of Instruction and Syllabus for

## M.Sc., ZOOLOGY

**(I to IV Semester)**



**(Effective from 2022 - 2023 and onwards)**

**PG AND RESEARCH DEPARTMENT OF ZOOLOGY**

**KUNTHAVAI NAACCHIYAAR GOVERNMENT ARTS COLLEGE FOR WOMEN (AUTONOMOUS)**

**THANJAVUR – 613 007, TAMIL NADU, INDIA**

## I. VISION

- To ingrain the values of life, science and nature in young female students by excellent academic and non-academic avenues ant to transform them into technically adept human resources.

## II. MISSION

- To inculcate the respect and concern for ethical values of life, education and environment.
- To create awareness and responsibility towards the conservation of biodiversity and natural resources.
- To promote comprehensive educational practices that enhances employability and triggers entrepreneurship among young women graduates.
- To promote interdisciplinary and collaborative research at post graduate level.
- To promote responsible women graduates to transform the society through their empowerment.

# III. PROGRAM OUTCOME (PO)

## After completing the M. Sc programme the students will be able to:

**PO1:** Acquire knowledge about the fundamental life concepts, principles and processes involved in the fields of Zoology.

**PO2:** Demonstrate the basic concept of the animal diversity including the knowledge of scientific classification and evolutionary relationship among different group of animals.

**PO3:** Comprehensive knowledge and understanding of major concepts and theoretical principles used in animal studies.

**PO4:** Understand the biological diversity and grade of complexity of various animal forms through their systematic classification and process o f organic evolution.

**PO5:** Understand the importance and role of animals, plants and microbes in the sustainability of the environment and deterioration of the environment due to anthropogenic activities.

**PO6:** Understand and evaluate the concepts and Principles of various branches of Basic and Applied Zoology.

**PO7:** Perform the laboratory procedure as per standard protocols in various branches of Basic and Applied Zoology.

**PO8:** Understand, apply and evaluate the applications of Biological sciences in the field of Biotechnology, Apiculture, Poultry, Fisheries and Vermiculture to provide a job opportunity and to encourage entrepreneurship.

**PO9:** Apply the knowledge gained by Research and skill of problem solving Methodologies in the field of vital statistics.

**PO10:** Understand the ethical values, create Empathy and love towards animals and its contribution in national resources for Nation Building and understanding of Zoology to one's own lif

**K. N. Govt. Arts College (W) Autonomous, Thanjavur - 7.**

**M.Sc. ZOOLOGY Core Course Structure under CBCS**

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

| Semester | Course | Subject Code | Title of the Paper | Inst. Hrs. | Credit | Exam. Hrs. | Marks | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Int. | Ext. | |
| I | CC 1 | 22KP1Z01 | Functional Morphology and Palaeontology of Invertebrates | 6 | 5 | 3 | 25 | 75 | 100 |
| | CC 2 | 22KP1Z02 | Functional Morphology and Palaeontology of Chordates | 6 | 5 | 3 | 25 | 75 | 100 |
| | CC 3 | 22KP1Z03 | Cytology and Genetics | 6 | 5 | 3 | 25 | 75 | 100 |
| | CC 4 (P) | 22KP1Z04P | Practical -I Functional Morphology and Palaeontology of Inveretebrates, Functional Morphology and Palaeontology of Chordates, Cytology and Genetics & Entomology | 6 | 4 | 3 | 40 | 60 | 100 |
| | MBE 1 | 22KP1ZELZ1:1 | Entomology | 6 | 4 | 3 | 25 | 75 | 100 |
| | | 22KP1ZELZ1:2 | Integrated Pest Management | | | | | | |
| | | | | **30** | **23** | | | | **500** |
| II | CC 5 | 22KP2Z05 | Biochemistry and Biophysics | 7 | 6 | 3 | 25 | 75 | 100 |
| | CC 6 | 22KP2Z06 | Animal Physiology | 7 | 5 | 3 | 25 | 75 | 100 |
| | CC 7 | 22KP2Z07 | Microbiology | 6 | 5 | 3 | 25 | 75 | 100 |
| | CC 8 (P) | 22KP2Z08P | Practical - II Biochemistry And Biophysics, Animal Physiology, Microbiology ~~& Apiculture~~ | 6 | 4 | 3 | 40 | 60 | 100 |
| | NME 1 | 22KP2ZEL01 | Apiculture | 4 | 3 | 3 | 25 | 75 | 100 |
| | ECC 1 | 22KP2ECCZ1:1 | Nanotechnology | - | 3 | 3 | - | 100 | 100 |
| | | 22KP2ECCZ1:2 | MOOC (Value Added) | | | | | | |
| | ECC2 | 22KP2ECCZ2 | Add on Course | - | 4 | - | - | - | - |
| | | | | **30** | **23** | | | | **500** |
| III | CC 9 | 22KP3Z09 | Biotechnology and Bioinformatics | 7 | 6 | 3 | 25 | 75 | 100 |
| | CC 10 | 22KP3Z10 | Developmental Biology and Immunology | 7 | 6 | 3 | 25 | 75 | 100 |
| | CC 11 (P) | 22KP3Z11P | Practical - III Biotechnology and Bioinformatics, Developmental Biology and Immunology, Aquaculture ~~& Public health and Hygiene~~ | 6 | 4 | 3 | 40 | 60 | 100 |
| | MBE 2 | 22KP3ZELZ3:1 | Aquaculture | 6 | 4 | 3 | 25 | 75 | 100 |
| | | 22KP3ZELZ3:2 | Fisheries and Management | | | | | | |
| | NME 2 | 22KP3ZEL02 | Public Health and Hygiene | 4 | 3 | 3 | 25 | 75 | 100 |
| | ECC3 | 22KP3ECCZ3:1 | Environmental Toxicology | - | 3 | 3 | - | 100 | 100 |
| | | 22KP3ECCZ3:2 | MOOC (Value Added) | | | | | | |
| | | | | **30** | **23** | | | | **500** |

CONTROLLER OF EXAMINATIONS
01 AUG 2022
K.N. Govt. Arts College for Women (Autonomous), Thanjavur-7

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| IV | CC 12 | 22KP4Z12 | Environmental Management | 6 | 4 | 3 | 25 | 75 | 100 |
| | CC 13 | 22KP4Z13 | Research Methodology and Biostatistics | 6 | 4 | 3 | 25 | 75 | 100 |
| | CC 14 (P) | 22KP4Z14P | Practical - IV Environmental Management, Research Methodology and Biostatistics & Clinical Laboratory Technology | 6 | 4 | 3 | 40 | 60 | 100 |
| | MBE 3 | 22KP4ZELZ3:1 | Clinical Laboratory Technology | 6 | 4 | 3 | 25 | 75 | 100 |
| | | 22KP4ZELZ3:2 | Biosafety and Bioethics | | | | | | |
| | Project Work | 22KP4Z15PW | Project work | 6 | 6 | - | - | 100 | 100 |
| | | | | **30** | **22** | | | | **500** |
| | | | | **120** | **90** | | | | **2000** |

CONTROLLER OF EXAMINATIONS
0 1 AUG 2022
K.N. Govt. Arts College for Women (Autonomous), Thanjavur-7

Head of the Department
Department of Zoology
K.N.Govt.Arts College for Women (Autonomous)
Thanjavur - 613 007.

**Details on the number of courses, Instruction hours and credits**

| Title | No. of Courses | Instruction Hours | Credits |
|---|---|---|---|
| Core Course Theory | 10 | 64 | 50 |
| Core Course Practical | 4 | 24 | 16 |
| Project Work | 1 | 6 | 6 |
| Major Based Elective | 3 | 18 | 12 |
| Non Major Elective | 2 | 8 | 6 |
| SS | 4 | | 26 |
| Total | 20 | 120 | 90 |

**SEMESTER – WISE COURSE STRUCTURE**

| Semester | Course | Total Courses | Ins. Hr/ week | Credit |
|---|---|---|---|---|
| I | CC1,CC2,CC3,CC4 P,MBE 1 | 5 | 30 | 23 |
| II | CC5, CC6,CC7,CC8 P, NME 1 | 5 | 30 | 23 |
| III | CC9,CC10,CC11 P, MBE2, NME2 | 5 | 30 | 22 |
| IV | CC12,CC13,CC14 P, MBE3,CC15 PW | 5 | 30 | 22 |
| | TOTAL | 23 | 120 | 90 |

| SEM I | CC1 | FUNCTIONAL MORPHOLOGY AND PALAENTOLOGY OF INVERTEBRATES | 22KP1Z01 | Inst. Hrs.6 | Credit:5 |
|---|---|---|---|---|---|

***Course objectives**: The main aims of this course to the fundamental aspects of invertebrates, Classification of Invertebrates, to give thorouch understanding in the morphology of invertebrates and to aquire an indepth knowledge on the Palaeontology.*

| CO | STATEMENT |
|---|---|
| 1 | Knowledge of fundamental aspects of different system of invertebrates. |
| 2 | Learn the study of invertebrate classification. |
| 3 | Understand the paleontology, taphonomy, ichnology and Pseudofossils. |
| 4 | Describe the uses of trace fossils and be able indentify a varity of trace fossils. |
| 5 | Gain the knowledge morphological and taxonomic features of major of invertebrate fossils and their study. |

**UNIT I:** Living invertebrate habits and monitoring. Taxonomy: Binomial nomenclature – Rules of nomenclature systematic hierarchy – Outline classification of Animal kingdom upto order, General characteristics of animal phylum.

**UNIT II:** Functional morphology of Locomotion, Nutrition and Respiration in invertebrates – adaptive mechanism of invertebrates.

**UNIT III:** Functional Morphology of Reproduction, Endocrine glands in crustacean and insects

**UNIT IV:** Minor phyla – Structural peculiarities and affinities of Phoronida, Acanthocephala, Nemertinea and Bryozoa.

**UNIT V:** Morphology, ultrstructure and taphonomy of fossils. Introduction of Invertebrate fossils – Trilobites, Ammonoids, Belemnoids, Nautiloids and Echinoderms. Biography concepts and conservation of paleobiology.

**UNIT VI: (Not for semester Examination)-** Mobility of invertebrates, fuctional morphology of Arthropoda and Echinodermata – testing the tidety of the fossils record.

**TEXT BOOKS**


1. Barnes, R.D. (1982), Invertebrate Zoology, IV Ed., Holt Saunders International Edition.
2. Barrington, E.J.W (1979), Invertebrate Structure and Functions, II Ed., ELBS and Nelson.
3. Kotpal, R.L., (1979-1980), A text book of Minor Phyla, Rastogi Publication, Meerut.


**REFERENCE BOOKS**


1. Moore, R.C., Lolicker and Fischer, A.G. (1952). Invertebrate Palaeontology, Mc Graw hill Book Co., Inc., N.Y.
2. Hyman, L.H. (1940, 1951). The Invertebrates, Vol., I to VII., McGraw Hill Book Co., Inc., Vasantika Kashyap (1997). Life of Invertebrates, Vikas Publishing House Pvt.Ltd., New Delhi.


**CO-PO Mapping with programme outcomes: FUNCTIONAL MORPHOLOGY AND PALAENTOLOGY OF INVERTEBRATES Code: 22KP1Z01**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | | | 1 | | 1 | | 1 | 1 |
| CO2 | 2 | | 1 | 1 | | 1 | | | | 1 |
| CO3 | | | | 1 | 1 | | | | | |
| CO4 | 1 | 1 | | | | | 2 | 1 | | 2 |
| CO5 | 1 | | | | | 1 | | | 1 | |

| SEM I | CC2 | FUNCTIONAL MORPHOLOGY AND PALAENTOLOGY OF CHORDATES | 22KP1Z02 | Inst.Hr: 6 | Credit: 5 |
|---|---|---|---|---|---|

***Course Objectives:*** *Functional morphology is the analysis of the mechanical and evolutionary relationship of anatomical form to organizational behaviour and dynamics. As such the area is of great interest to paleontology, holding out the hope that a sufficiently rigorous analysis of a fossil taxon's form might enable us to infer its behaviour in detail.*

| CO | STATEMENT |
|---|---|
| 1 | Understand comparative account of the different vertebrate systems and the pattern of vertebrate evolution, organizations and functions of various systems |
| 2 | Learn the comparative account of integument, skeletal components, their function and modification in diffrent vertebrates |
| 3 | Understand the evolution of heart, modification in aortic arches, structure of respiratory organs used in aquatic, terrestrial and aerial vertebrates; and digestive system and it anatomical specializations with respect to different diets and feeding habits. |
| 4 | Learn the evolution of brain, sense organs and excretory organs to a complex, highly evolved form in mammals |
| 5 | Learn to analyse and critically evaluate the structure and functions of vertebrate system, which helps them to discern the developmental, functional and evolutionary history of vertebrate species |

**UNIT I:** Chordate Phylogeny: Introduction to Prochordates - Origin of Chordates – Structural peculiarities of Cyclostomata – Evolutionary position of Ostracoderms.

**UNIT II:** Evolutionary significance of Fishes, Amphibians and Reptiles, Crossoptergians, Labrynthodont and Dinoaurs - Adaptive radiation of Reptiles

**UNIT III:** Fossil history of Birds - Birds as glorified reptiles - Adaptive radiation in Birds.

**UNIT IV:** Origin of Mammals - Structural peculiarities of prototheria, Metatheria and Eutheria - Adaptive radiation of Mammals

**UNIT V:** Comparative study and Functional Morphology of Exoskeleton and respiratory system and Arterial system.

**UNIT VI: (Not for semester Examination)-** Comparative study and Functional Morphology of Urinogenital system.

**TEXT BOOKS**

1. Ayyer E.K and T.N. Ananthakrishnan(1995). A Mannual of Zoology. Vol.2 (Parts I&II) Viswanathan Pvt. Ltd.,
2. Jordon E.L and P.S. Verma (2000). Chordate Zoology 12th edn. S. Chand & co.,
3. Arumugam, (2008). Chordate Zoology , Vol.2, SARAS Publications.

**REFERENCE BOOKS**

1. Waterman, A.J. (1971). Chordate Structure and Function, The Macmillan Company.
2. Colbert, H.Edwin (1989). Evolution of the Vertebrates, II Ed., Wiley Eastern Limited, New Delhi.
3. Harrcy Pough, John B. Heisher, William N. McFarland (1990). Vertebrate Life. Macmillan

**CO PO Mapping with programme outcomes: FUNCTIONAL MORPHOLOGY AND PALAEONTOLOGY OF CHORDATES Code: 22KP1Z02**

| **CO/PO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 2 | 3 | 2 | 1 | 2 | 3 | | 3 |
| CO2 | 2 | | 1 | 1 | 2 | 1 | 2 | 2 | 2 | |
| CO3 | 2 | 1 | 1 | 1 | | | 1 | 1 | | 2 |
| CO4 | 1 | | 1 | 2 | | 2 | 2 | 2 | | 1 |
| CO5 | 3 | 1 | 3 | | 1 | 2 | | 1 | 1 | 3 |

| SEM I | CC3 | CYTOLOGY AND GENETICS | Code:22KP1Z03 | Ins.Hrs.6 | Credit:5 |
|---|---|---|---|---|---|

***Course Objectives:*** *This course provides a detailed insight into cellular components and their structure, composition and functions. Course also gives structural knowledge on genetic material and their structure, concept behind genetic disorder and gene mutations.*

| CO | STATEMENT |
|---|---|
| 1 | Make the students understand various cellular components, structure and their functions. |
| 2 | To impart knowledge on structure and functions of lysosomes, mitochondria, nucleus and chromosomes. |
| 3 | Understand the fundamental knowledge on gene and genetic materials. |
| 4 | Learn the concept about gene mutation and genetic disorders. |
| 5 | Gain the knowledge on population Genetics and gene equilibrium. |

**UNIT I:** Cellular components and their structure, composition and functions. Membrane models - fluid mosaic model and modification, functions, permeability, active and passive transport mechanisms. Cytoplasmic matrix. Endoplasmic Reticulum- Ultra structure, types and functions, Golgi complex - Ultra structure, transporting, modifying, and packaging proteins and lipids, Ribosomes: Ultra structure, types and functions.

**UNIT II:** Lysosomes – Ultra structure, Functions and intracellular digestion, Polymorphism in Lysosomes. Mitochondria: Organization and function, mitochondrial enzymes, Oxidative phosphorylation, ATP production - chemiosmotic hypothesis and biogenesis. Nucleus: Ultra structure, Interphase nucleus, nucleoplasm, nucleolus. Chromosomes: Ultra structure, organization, types and functions. Giant chromosomes - polytene and Lampbrush chromosomes.

**UNIT III:** Cell cycle - phases- concept of gene - cistron, recon, muton. Nucleic acids, DNA, structure and types, RNA structure and types - DNA Replication - semiconservative, types and mechanisms, DNA as the genetic material, Regulation of gene action - *lac* operon.

**UNIT IV:** Chromosomal aberrations: Gene mutation - pointmutation, tautomerization. Inherited genetic disorders in man - single gene disorder - twins and types. Transposons and Retraposon.

**UNIT V:** Genes in population, Principles of population Genetics, Pedigree charting.
Hardy-Weinberg law. Gene frequencies and changes. Gene pool, genetic drift, shift - genetic equilibrium, factors influencing equilibrium- Eugenics and Euthenics and Euphenics.

**UNIT VI: (Not for semester Examination)-** Chromosomal organization: Nucleosome model, transcription and translation in prokaryotes, steps of transcription in prokaryotes – post transcriptional regulation – Factors influencing genetic diversity. Application of genetic principles to plant and animal breeding.

**TEXT BOOKS**

1. Verma, P.S. and V.K. Agarwal, (2006). Cytology, Chand & Company Ltd., New Delhi, India,
2. Powar, C.B. and Daginwala, (1998). Cell Biology, Himalaya Publishing Co, New Delhi.
3. De Robertis, E. D. P. and De Robertis, L. M. F. (1987). Cell and Molecular Biology, 8th Edition. Lea and Febiger, International Edition.

**REFERENCE BOOKS**

1. Winchester, A.M. (1996) Genetics: A survey of the principles of heredity. Oxford & India Book house, New Delhi.
2. Buns, G.W. (1980). Science of Genetics: An introduction to heredity, Macmillan, New York.

**CO PO Mapping with programme outcomes: CYTOLOGY AND GENETICS**
**Code: 22KP1Z03**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 1 | | 2 | 1 | 1 | | 1 | 1 |
| CO2 | | | | 1 | 1 | 1 | 2 | | | |
| CO3 | 1 | 1 | 1 | 1 | | | 1 | | | |
| CO4 | 1 | | 1 | 2 | | | 2 | | | 1 |
| CO5 | 1 | 1 | | | 1 | 2 | | 1 | 1 | |

| | | | | | |
|---|---|---|---|---|---|
| **SEM I** | **CC 4** | **PRACTICAL I- FUNCTIONAL MORPHOLOGY AND PALAEONTOLOGY OF INVERETEBRATES, FUNCTIONAL MORPHOLOGY AND PALAEONTOLOGY OF CHORDATES, CYTOLOGY AND GENETICS & ENTOMOLOGY** | **22KP1Z04P** | **Inst.Hrs. 6** | **Credit- 4** |

***Course Objectives:*** *The course will include hands on activities Observation of fossil specimen, calibration of cells, giant chromosomes, culturing of Drosophila and collection of insects.*

| CO | STATEMENT |
|---|---|
| 1 | Acquire the knowledge of fossils. |
| 2 | Understand the cell measurements. |
| 3 | Understand the culture methods of Drosophila. |
| 4 | Acquire the knowledge of gene frequency. |
| 5 | Understand the diversity of insects. |

**INVERTEBRATES AND CHORDATES**

1.Fossils- Trilobites, Ammonoids, Nautiloids, Acanthodian, Labyrinthodont, Ichthyosaur, Stegosaurus, Archaeopteryx.
2.Minor phyla – *Cerebratulus, Acanthocephalus, Bugula, Phoronis*

**CYTOLOGY**

1.Micrometry – calibration and measurement of cells.
2.Camera Lucida.
3.Preparation of Human buccal smear
4.Preparation Human blood smear
5.Chironomous larva – Giant chromosomes.

**GENETICS**

1. Drosophila – Culture and life cycle
2. Drosophila - Identification of sexes
3. Drosophila - identification of mutants.
4. Calculation of gene frequency for multiple alleles
5. Human pedigree analysis
6. Human karyotype - normal
7. Human karyotype - chromosomal abnormalities.

**ENTOMOLOGY**

**1.** Identification of Insects
2. Mouthparts- Honey bee/ Mosquito/ Butterfly
3. Insect pest of rice
4. Insect pest of sugarcane
5. Identification of mosquitoes-Culex, Aedes and Anopheles
6. Insect box preparation – (Order Lepidoptera and Coleoptera)
7. Spotters – Silk, Honey and Lac

**CO PO Mapping with programme outcomes: PRACTICAL I- FUNCTIONAL MORPHOLOGY AND PALAEONTOLOGY OF INVERETEBRATES, FUNCTIONAL MORPHOLOGY AND PALAEONTOLOGY OF CHORDATES, CYTOLOGY AND GENETICS & ENTOMOLOGY Code : 22KP1Z04P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | 2 | | | 1 | | 1 | | 1 |
| CO2 | | 1 | | 2 | | 1 | | 1 | | |
| CO3 | | | 2 | | 1 | | 2 | | | 1 |
| CO4 | 2 | | | 1 | | | | | 2 | |
| CO5 | | 2 | | | 1 | | | 1 | | 1 |

| SEM I | MBE I | ENTOMOLOGY | Code: 22KP1ZELZ1:1 | Inst. Hrs. 6 | Credit 4 |
|---|---|---|---|---|---|

***Course Objectives:*** *The course deals with useful and harmful insects as applied to mankind. It provides the detailed information on classification, characteristic features, insects on crops, domestic and mankind and control measures.*

| CO | STATEMENT |
|---|---|
| 1 | Acquire knowledge about the concepts of Entomology |
| 2 | Understand the insect morphology. |
| 3 | Identify the various insects. |
| 4 | Differentiate beneficial insects from harmful insects |
| 5 | Compare the economic loss caused by the insects. |

**UNIT I:** History of Entomology in India – Economic importance of insects classification of insects upto order level - Identification insects.

**UNIT II:** General Entomology: Feeding mechanism – Integument – Head and appendages – Thorax and appendages .Nervous system – Endocrine system –pheromones – Reproductive system – development and metamorphosis.

**UNIT III:** Insects of agricultural importance – Insect pest of rice (rice stem borer, green rice leaf hopper) pests of wheat (wheat thrips, cutworms) pests of millets (sorghum, shoot border, stem border) .

**UNIT IV:** Insects pests of Domestic animals – cattle (horsefly, *Tabarus Striatus*) The cattle fly (Hippoboseca maculate) Fowl (The shaft louse, *Menopon gallinae*; chicken flea, *Echinophaga gallinacean* sheep and Goat (Head maggot oestruanovis; biting louse *Bovicola caprae*)

**UNIT V:** Insect in relation to public health – mosquitoes Housefly, Bedbug. Human body louse, ants, termites and control measures – Insect pest management.

**UNIT VI: (Not for semester Examination)-** Productive insects – Lac, Honey, Silk – Economics of insects – Role of productive insects in Indian economy.

**TEXT BOOKS**


1. B.|Vasantharaj David and Kumaresan 1988 .Elements of Economic Entomology, Popular book depot


**REFERENCE BOOKS**


1. Shukla G.s and Upadhyayv.B 1990 Economic Zoology – Rastogi publications.
2. Awasthi 2009 Introduction to General and applied Entomology Scientific publishers.
3. Chapman 2012 The Insects structure and function Cambridge universitypress.
4. Ayyar TVR 1992 Hand Book of Economic Entomology for south India .Narendra Publishing house New Delhi.

**CO PO Mapping with programme outcomes: ENTOMOLOGY Code: 22KP1ZELZ1:1**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | 2 | | | | 1 | 1 | |
| CO2 | 2 | | 1 | | | 1 | | | | 1 |
| CO3 | | | 2 | | 1 | | 1 | | | 2 |
| CO4 | 2 | | | 1 | | | | | 2 | |
| CO5 | | 1 | | | 2 | 1 | | 1 | | |

| SEM I | MBE I | INTEGRATED PEST MANAGEMENT | Code: 22KP1ZELZ1:2 | Inst. Hrs. 6 | Credit 4 |
|---|---|---|---|---|---|

***Course Objectives:*** *The course implies the pest control, veterinary pest and public health Biological measures and the mechanism of action of pesticides.*

| CO | STATEMENT |
|---|---|
| 1 | Acquire knowledge about the pest |
| 2 | Understand the importance of beneficial insects |
| 3 | List out the Agriculture pest |
| 4 | Tabulate the veterinary pest |
| 5 | Understand the Integrated pest management. |

**UNIT 1:** History and origin - definition and Evolution of various related terminologies.

**UNIT II:** Classification of parasites and host – modes of infection – predators – parasitoids – Beneficial insects.

**UNIT III:** Agriculture pests: Pest of paddy, Sugarcane- disease -damage – Economics.

**UNIT IV:** Pests of cattle, Goat and children and their public health importance.

**UNIT V:** Integrated pest Management – Biological control of insects (*Bacillus thurungiensis*). Plant disease and weed control mode of action of biopesticides.

**UNIT VI: (Not for semester Examination)-** Strategies of integrated pest management in India – programmes of integrated pest management.

**TEXT BOOKS**


1. |Vasantharaj David . B and Kumaresan (1988) .Elements of Economic Entomology, Popular book depot


**REFERENCE BOOKS**


1. Shukla G.s and Upadhyayv.B 1990 Economic Zoology – Rastogi publications.
2. Awasthi 2009 Introduction to General and applied Entomology Scientific publishers.
3. Ayyar TVR 1992 Hand Book of Economic Entomology for south India .Narendra Publishing house New Delhi.


**CO PO Mapping with programme outcomes: INTEGRATED PEST MANAGEMENT Code: 22KP1ZELZ1:2**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | | | | 1 | 1 | | 2 | |
| CO2 | 1 | | | 1 | | 2 | | 1 | | 1 |
| CO3 | 3 | | 2 | | | 1 | | 1 | | |
| CO4 | 2 | 1 | | 1 | 1 | | 4 | | | 1 |
| CO5 | | | 2 | | | 1 | | 1 | 1 | |

| SEM II | CC5 | BIOCHEMISTRY AND BIOPHYSICS | Code:22KP2Z05 | Inst.Hrs.7 | Credit:6 |
|---|---|---|---|---|---|

***Course Objectives:*** *The aim of the course is to familiarize students with basic concept of biomolecule, enzymes and biological oxidation. It also provides information related to energy sources and diverse techniques for spectroscopy.*

| CO | STATEMENT |
|---|---|
| 1 | Understand and discuss ramification of biochemistry and biophysics. |
| 2 | Predict the characteristic of enzymes and its activity. |
| 3 | Know the concept of biological oxidation. |
| 4 | Able to understand the energy sources and natural radiations. |
| 5 | Acquire knowledge about principles of spectroscopy and its uses. |

## A.BIOCHEMISTRY

**UNIT I :** Introduction, Scope and importance of Biochemistry. Structure, Properties, Classification, functions and metabolism of Carbohydrates, proteins and lipids.

**UNIT II:** Enzymes :Classification and Properties ; enzyme Kinetics – Line Weaver-Burk plot, Eadie -Hofslee Plot & Hanes plot Ramachandran Plot. Mechanism and action of enzymes; Active Sites, coenzymes; Activators and inhibitors, Isoenzymes, Alloesteric enzymes, abzymes; regulation of enzymatic activity.

**UNIT III :** Biological Oxidation: Nucleotides, Flavoproteins, Cytochromes – Redox Potential. Energy relations; energy rich compounds and their roles. **B. BIOPHYSICS**

**UNIT IV:** Energy sources; principles and application of thermodynamic laws, electromagnetic spectrum and free energy from electromagnetic waves. Natural radiations; properties of natural light, LASER. Radio activity: disintegration, Measurement of radio activity, Gieger – Muller counter, Isotopes as tracers-Autoradiography.

**UNIT V:** Spectroscopy: principles and applications; NMR and ESR spectroscopy. Atomic absorption and Plasma Emission Spectroscopy. X-ray and X-Ray crystallography.
Centrifugation- Ultra gradient centrifuge- principle and applications.

**UNIT VI: (Not for semester Examination)-** Tumor Diagnostic Techniques and Treatment - Biopsy, CT-MRI, PET.

**TEXT BOOKS**


1. Voet, D and Voet, J. (1995) Biochemistry, John Wileyand sons, New York.
2. Ambika Shanmugam. (2016). Fundamentals of biochemistry, Wolters Kulwer india Pvt Ltd.
3. Veerakumar, L (2006). Bio instrumentation, ,MJP Publishers


**REFERENCE BOOKS**


1 Smith, (1985). Principles of Biochemistry, McGraw Hill (Mammalian Biochemistry)
2 Daniel. M. (1989). Basic Biophysics for Biologists. Agro – Botanical Publishers, Bikaner, India.

3 De Robertis, E.D.P. and De Robertis E.M.F. (1987). Cell and Molecular Biology, VIII Edition, Lea anc Febiger, Philodelphia.

**CO PO Mapping with programme outcomes: BIOCHEMISTRY AND BIOPHYSICS, Code: 22KP2Z05**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | | | 1 |
| CO2 | 1 | | 1 | 1 | 2 | 1 | 2 | | | |
| CO3 | 2 | 1 | 1 | 1 | | | 1 | | | |
| CO4 | 1 | | 1 | 1 | | | 2 | | | 1 |
| CO5 | 1 | 1 | | | 1 | 2 | | 1 | 1 | |

| SEM II | CC6 | ANIMAL PHYSIOLOGY | Code: 22KP2Z06 | Hours: 7 | Credit:5 |
|---|---|---|---|---|---|

***Course Objectives:*** *Animal physiology focuses on fundamental concepts of physiology of digestion, blood vascular system, and fundamental concepts of physiology of respiration, renal physiology and muscles. This also develops basic understanding of endocrine system and its interactions with other systems.*

| CO | STATEMENT |
|---|---|
| 1 | Helps the students to know about the basic histology and physiology of mammals. |
| 2 | Explain and recognize the physiological structure and functions of various organs |
| 3 | Apply anatomical knowledge in predicting the physiological consequences |
| 4 | Describes physiological activity of organ system and endocrine glands |
| 5 | Environment and health Air, Water, Soil pollutions and their effects on health.<br>Students understand what the hormones are and how their concentration changes with puberty or some other conditions like menstruation, pregnancy, stress or happy moments |

**UNIT I:** Nutrition, Vitamins and Digestion - Carbohydrates, Proteins, Lipids and Minerals. Digestive enzymes - Gastrointestinal Hormones.

**UNIT II**: Blood: Blood composition and functions, blood clotting. Heart working mechanim - circulation - oxygen dissociation curve, exchange of gases. Blood pressure and ECG. Excretion: Structure and function of Kidney - Nephron - Mechanism of urine formation - Excretion in relation to different habitats- Ornithine cycle with an emphasis on Ammonia,Urea.

**UNIT III:** Phyiology of respiration - respiratory organs, transport of respiratory gases, respiratory pigments. Muscles mechanism- Types of muscle - muscle contraction, sliding.

**UNIT IV:** Neuromuscular junctions - Receptors - Phono and trango receptors - Peripheral Nervous System, Autonomic Nervous System, Central Nervous System - Synaptic transmission - Myelinated and non-mylenated fibers.

**UNIT V:** Reproductive system - Human male and female reproductive organs, primary and secondary sex characters, sex hormones, puberty and menstruation cycle. Endocrine glands - secretion and function - pituitary, Thyroid, Parathyroid, Adrenal and Islets of Langerhans.

**UNIT VI: (Not for semester Examination)-** Lungs carrying capacity - ECG, EEG, Dialysis, Sphygmomanometer, Spirometer and
ECHO.

**TEXT BOOKS**

1. Nagabhushanam R., M.S. Kodarkar and R.Sarojini (1983). Text book of Human Phyiology. 2nd Edn., Oxford & IBH Publihing Co. New Delhi.
2. Rastogi. S.C (2001). Essentials of Animal Phyiology. 3rd Edn., New Age International (P) Ltd. New Delhi.

3. Verma P.S and Agarwal, V.K (2009), animal Physiology S.chand & Co Ltd.

**REFERENCE BOOKS**

1.Suresh R (2013). Essentials of Human Physiology. Book and Allied (P) Ltd., Kolkatta
2.Hoar, W.S., (1975) General and comparative Physiology, Prentice – Hall of India, Pvt Ltd. New delhi
3.Prosser, CL and Frank A. Brown JR.(1965). Comparative Animal Physiology, Second edn. WB Saunders Co. Philadelphia, Toppa Co Tokyo, Japan.

**CO PO Mapping with programme outcomes: ANIMAL PHYSIOLOGY**
**Code: 22KP2Z06**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | | 1 |
| CO2 | 1 | | 1 | 1 | 2 | 1 | 2 | 3 | | 2 |
| CO3 | 2 | 1 | 2 | 1 | | 2 | 1 | | 1 | |
| CO4 | 2 | | 1 | 1 | 2 | | 2 | | 1 | 1 |
| CO5 | 1 | 1 | 2 | | 1 | 2 | 1 | 1 | 1 | 2 |

| SEM II | CC7 | MICROBIOLOGY | Code:22KP2Z07 | Inst.Hrs.6 | Credit:5 |
|---|---|---|---|---|---|

***Course Objectives:*** *This course provides information regarding the status of microbiology and identifies common infectious agents and the diseases that they cause. It also focuses on the able to recall microbial physiology including metabolism, regulation and replication with a detailed inference on the sterilization techniques, fermentation, fertilizers and microbial diseases.*

| CO | STATEMENT |
|---|---|
| 1 | Understand the status of history, Ultrastructure of microbes. |
| 2 | Describing the culture techniques, nutritional requirements for the growth |
| 3 | Explaining the concepts of fermentors, antibiotics, and food microbiology |
| 4 | Analyzing the role of biofertilizers on nitrogen fixation |
| 5 | Interpret the respiratory, intestinal and urinogenetical diseases treatment and prophylaxis |

**UNIT I: Scope of Microbiology:** History of Microbiology, Wittaker's classification Prokaryotes and Eukaryote, Characteristic and Ultra structure of Bacerium and Virus.

**UNIT II: Sterilization techniques, Culture methods**: culture media - composition - types, culture techniques. Isolation and maintenance of pure culture. Nutrition requirements, bacterial growth curve.

**UNIT III**: **Industrial Microbiology** : Fermentors, structure of fermenor - Fermentation products - Ethanol - Antibiotics (Penicillin). Single cell protein (SCP). Food Microbiology : Food spoilage, poisoning, preservation of Milk and meat products.

**UNIT IV : Biofertilizer**:Composting soil microbes, nitrogen fixation - Nif genes

**UNIT V : Microbial diseases:** Respiratory - Tuberculosis and Whooping cough, Intestinal - Cholera, Amoebic dysentry, Urinogenital diseases - Syphilis, Gonorrhea and HIV - Causative agent, pathogenesis, laboratory diagnose, treatment and prophylaxis.

**UNIT VI** : **(Not for semester Examination)- Archaebacteria:** General characteristics, phylogenetic overview, genera belonging to Nanoarchaeota (*Nanoarchaeum*), Crenarchaeota (*Sulfolobus, thermoproteus*) and *Euryarchaeota methanogens* (*Methanobacterium, Methanocaldococcus*), thermophiles (*Thermococcus, Pyrococcus, Thermoplasma*) and Halophiles (*Halobacterium, Halococcus*) Eubacteria: Morphology, metabolism, ecological significance and economic importance of Alpha, Beta and Gamma proteobacteria.

**TEXT BOOKS**

1. Pelzar M.J Chan, ECS and Krieg, N.R. (1993). Microbiology TATA McGraw Hill Edition.
2. N.Arumugam 2000. Microbiology, Saras Publication, Nagercoil
3. Dubey, R.C and Maheswari, D.K (2000). A text book of Microbiology. S.Chand & Co Ltd., New Delhi.

**REFERENCE BOOKS**

1. Srivastava S and Srivastava PS. (2003). Understanding Bacteria. Kluwer Academic Publishers, Dordrecht.
2. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th edition McMillan.
3. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition Pearson Education.

**CO PO Mapping with programme outcomes: MICROBIOLOGY Code:22KP2Z07**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 1 | 2 | 1 | 2 | 1 | | 2 | | |
| CO2 | 1 | | 1 | | 2 | 1 | | 3 | | |
| CO3 | 2 | 1 | | 1 | | 2 | 1 | | 1 | |
| CO4 | 2 | | | 1 | 2 | | 2 | | 1 | 1 |
| CO5 | 1 | 1 | 2 | | 1 | 2 | 1 | 1 | 1 | 2 |

| SEM II | CC 8 (P) | PRACTICAL – II BIOCHEMISTRY AND BIOPHYSICS, ANIMAL PHYSIOLOGY AND MICROBIOLOGY&APICULTURE | Code: 22KP2Z08 P | Inst. Hrs. 6 | Credit:4 |
|---|---|---|---|---|---|

***Course Objectives:*** *The course will include hands on activities on preparation of solutions, measurement of optical density, observation of haemin crystals, staining of Bacteria.*

| CO | STATEMENT |
|---|---|
| 1 | Acquire the Knowledge of preparation of solutions |
| 2 | Understand the concepts of biophysics. |
| 3 | Understand the staining procedures. |
| 4 | Acquire the knowledge motility of bacteria. |
| 5 | Understand the mouthparts of honey bee. |

**BIOCHEMISTRY**

1. Preparation of solutions: Molarity, normality and percentage.
2. Calculation of moles, millimoles, micromoles and nano moles.
3. Buffer preparation
4. Quantitative estimation of proteins
5. Quantitative estimation of carbohydrates
6. Quantitative estimation of lipids

**BIOPHYSICS**

1. Determination of Surface tension of liquids by drop weight method
2. Colorimeter: determination of optical density of samples using standards.
3. Centrifuge: Usage of low and high speed centrifuge.

**ANIMAL PHYSIOLOGY**

1. Estimation of Salivary amylase activity in relation to temperature.
2. Salivary amylase activity in relation to pH
3. Preparation of Haemin crystals
4. Oxygen consumption of fish
5. Rate of salt loss and salt gain in fish using different experimental media

**MICROBIOLOGY**

1. Do’s and don’ts in microbiology
2. Simple staining in bacteria
3. Gram staining in bacteria
4. Observation of live bacteria -hanging drop method
5. Determination of yeast growth curve.

**CO PO Mapping with programme outcomes: PRACTICAL –II BIOCHEMISTRY AND BIOPHYSICS, ANIMAL PHYSIOLOGY & MICROBIOLOGY**
**Code: 22KP2Z08P**

| **C** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 1 | 2 | 1 | 2 | 1 | | 2 | | |
| CO2 | 1 | | 1 | | | | | | | |
| CO3 | 2 | 1 | | | | 2 | 1 | | 1 | |
| CO4 | | | | 1 | 2 | | 2 | | | 1 |
| CO5 | 1 | 1 | 2 | | 1 | 2 | 1 | 1 | 1 | 2 |

| SEM II | NME 1 | APICULTURE | Code: 22KP2ZEL01 | Inst.Hrs.4 | Credit:3 |
|---|---|---|---|---|---|

***Course Objectives:*** *The course is focused on theoretical and applied knowledge on Apiculture, Describe the principles of beekeeping and equipments required for honey extraction. Provide the knowledge on importance of medicinal values and funding agencies for self employment.*

| CO | STATEMENT |
|---|---|
| 1 | Understand the history of Apiculture and their importance |
| 2 | Acquire knowledge about bee colonies and their yield |
| 3 | Get idea about different types of hives |
| 4 | Discuss the commercial importance and medicinal value of Honey |
| 5 | Know about the financial assistance and funding agencies for self employment |

**UNIT I:**History and Scope of Apiculture , Honey bee – Systematic position ,Types of Species, identification and Life history of Honey bee.

**UNIT II:** Bee colony : Methods of Bee Keeping, Traditional Beekeeping, Modern Beekeeping. Queen, drone and Workers Castes – natural colonies and their yield, foraging of Bees.

**UNIT III:** Apiary : Primitive hives and modern Hives, Artificial bee hives- Newton's bee hive; care and management. Pollen and nectar yielding plants. Natural Enemies of honey bee.

**UNIT IV:** Honey : Equipments used for Extraction chemical composition. Nutritive and medicinal values.

**UNIT V:** Prospects of Apiculture :Apiculture development in India, Source of financial assistance and funding agencies for self - employment. Economics of Beekeeping.

**UNIT VI: (Not for semester Examination)-** Diseases and Pest of Honey bees (American Foulbrood, Septicemia, Chalk brood and wax moths) and their management, Byproducts and their uses.

**TEXT BOOKS**


1. Sharma, P. and Singh L. (1987) – Hand book of bee keeping, controller Printing and Stationery, Chandigarh.
2. Cherian, R. & K.R. Ramanathan, (1992) – Bee keeping in India


**REFERENCE BOOKS**


1. Mishra, R.C. 1985 – Honey bees and their management in India. ICAR.
2. Singh, S. 1982 – Bee Keeping – ICAR.
3. Rare, S. 1998 – Introduction to bee keeping, Vikas Publishing house.

**CO PO Mapping with programme outcomes: APICULTURE Code: 22KP2ZEL01**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | 1 | | 3 | 2 | | | |
| CO2 | 1 | | | | | | 1 | 1 | | |
| CO3 | | 1 | | | | | 1 | 1 | 1 | |
| CO4 | | | 1 | | 1 | | 1 | | | 1 |
| CO5 | | | | 1 | | | | | | |

| SEM II | ECC1 | NANOTECHNOLOGY | Code: 22KP2ECCZ1:1 | Inst. Hrs. | Credit:3 |
|---|---|---|---|---|---|

***Course Objectives**: The course provides the basic knowledge of Nanobiotechnology and enhances the synthesis and application of nano-materials in medicine and agriculture. Gives the application knowledge of nano-technology on the DNA, Proteins, Nucleic acids, drug delivery and biomedicine.*

| CO | STATEMENT |
|---|---|
| 1 | Aware the fundamentals of nanomaterials, synthesis. |
| 2 | Get knowledge of synthesis of noano particles |
| 3 | Understand the types and characterization of synthesized nanomaterilas. |
| 4 | Analyze the applications of bionano materials in different field like medicine and Environment. |
| 5 | Apply nano-technological knowledge on health issues |

**UNIT I:** Nanomaterials: Introduction-Definition-Preparation of nanomaterials- Top down approach- Bottom up approach, Gas phase evaporation-sol gel processing, Reverse micellar techniques and biosynthesis of nanoparticles.

**UNIT II:** Properties of nanomaterials: Physico chemical properties, optical properties electrical and electronic properties, mechanical, magnetic properties, catalytic activities.

**UNIT III:** Types of nanoparticles: Silver, Gold, $Tio_2$, $Ceo_2$, $Cuo_2$, $Zno_2$, DNA, RNA and Lipids (Biological systems). Functional properties of nanoparticles.

**UNIT IV:** Characterization of nanoparticles: UV- visible spectroscopy, XRD, FTIR, SEM and TEM.

**UNIT V:** Application of Nanometrials: Magnetic nanoparticls devices for diagnosis. Protocols for nano drug Administration. Biosensor or biolabeling. Membrane based water purification. Biosynthesized nanoparticles on insect and pest control.

**UNIT VI: (Not for semester Examination)-** Applications of nanoparticles on medicine, industry, environment, agriculture and vectors.

**Text books:**

1. Amit Chakaravarthy., Nanotechnology- An Introduction, Rajat Publications.

**Reference books:**

1. G.B. Sergeev.,Nanochemistry Elsevier India Pvt. New Delhi.
2. Y.S.Raghavan,Nanostructures and Nanomaterials. Arised Publishers, New Delhi
3. B.Viswanathan, Nanomaterials.Narosha Publishing Home, New Delhi.
4. Michael Wilson and Kamali Kaannagara, Nanotechnology.

**CO PO Mapping with programme outcomes: NANOTECHNOLOGY Code: 22KP2ECCZ1:1**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | 1 | | | | | 1 | 1 |
| CO2 | | 1 | | | | 1 | | 1 | | |
| CO3 | 1 | | | | 1 | | 1 | | | 1 |
| CO4 | 2 | | | 2 | | | | | 1 | |
| CO5 | | 2 | | | | 2 | | 1 | | 1 |

| SEM III | CC 9 | BIOTECHNOLOGY AND BIOINFORMATICS | Code: 22KP3Z09 | Inst. Hrs:7 | Credit:6 |
|---|---|---|---|---|---|

***COURSE OBJECTIVE:*** *The students know about the Animal Biotechnology, Industrial and Enzyme. Learn knowledge on Agricultural, Environmental and Medical Biotechnology and this course makes the students know about the application of bioinformatics tools on research.*

| CO | STATEMENT |
|---|---|
| 1 | Knowledge about the construction of r-DNA invitro, cloning tools and vectors, construction of genomic and cDNA libraries. |
| 2 | Understand the concept of molecular techniques, gene amplification and sequencing methods. |
| 3 | Understanding of Animal tissue culture techniques and Stem cell culture. |
| 4 | Gain skills in application of biotechnology on human clone production, waste water treatment environmental monitoring and bioremediation. |
| 5 | Application of Bioinformatics on biomolecules in research. |

**UNIT I:** Recombinant DNA Technology – Invitro contruction of rDNA. Tools for cutting and joining DNAs- Restriction endnucleases and Ligase. Cloning vectors, plasmids (pBR 322), phages, cosmids (PLFR5) and shuttle vector (PEB10). Cloning strategies -construction of genomic and cDNA libraries.

**UNIT II:** Blotting techniques – Southern, Northern and Western blotting .Colony hybridization- Polymerase Chain Reaction (PCR), gene amplification, DNA sequencing methods - Sangers. DNA finger printing techniques.

**UNIT III:**Animal Tissue culture: requirements for animal tissue culture lab - Types of culture media- natural and complex and chemically defined media. Isolation of explants. Disaggregation of tissues –mechanical and enzymatic methods. Culture methods - primary culture, sub culture, cell lines and maintenance of cell and tissue culture. Stem cells-Isolation and culture of embryonic stem cells and preservation method.

**UNIT IV:** Animal Biotechnology: Construction of human clone. Environmental Biotechnology: Pollution control- Biological waste treatment (Sewage treatment - primary, secondary, anaerobic digestion, tertiary, reuse of sewage). Biosensors –types and applications. Bioremediation - Construction of superbug and its application. IPR (Copy right, Trade mark, patent).

**UNIT V :** Importance of Bioinformatics, Pairwise sequence Alignment- Dotmatrix method, Local vs Global alignment, Multiple sequence alignment. Biological databases- Nucleotide sequence databases, Protein sequence database, Molecular structure databases. Classification of bioinformatics Tools and phylogenetic analysis. Application of bioinformatics.

**UNIT VI: (Not for semester Examination)-** Applications of r-DNA technology, uses of molecular techniques, applications of biotechnology on mankind and gene banking.

## TEXT BOOKS


1. Kumaresan,N(2015). Biotechnology,Saras Publications,Nagercoil.
2. R.Dubey (2005),Text book of Biotechnology. S.Chand and company Ltd. New Delhi.
3. Ramawat ,K.G, and Shaily Goyal (2009).Comprehensive Biotechnology.S.Chand and company Ltd. New Delhi.


## REFERENCE BOOKS


1. Jocelyn,E.Krebs,Elliott S.Goldstein and Stephen T.Kilpatrick(2014).Lewin's Genes XI, Jones and Bartlett India pvt.Ltd,New Delhi.
2. Yadav,P.R. and Rajiv Tyagi (2006).Biotechnology of Animal culture, Discovery publishing house,New Delhi.
3. C.Subramanian(2009-10) Genomic Bioinformatics, Dominant publishers and distributors.New Delhi.


**CO PO Mapping with programme outcomes: BIOTECHNOLOGY AND BIOINFORMATICS**
**Code: 22KP3Z09**

| **CO/PO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 1 | | 2 | 1 | 1 | - | 1 | - |
| CO2 | 1 | - | 2 | 1 | - | 1 | - | - | - | 1 |
| CO3 | 1 | - | 1 | - | - | 2 | 1 | - | 1 | 1 |
| CO4 | 1 | 1 | - | 1 | - | 1 | 1 | - | 2 | 1 |
| CO5 | 1 | - | 1 | 2 | - | - | 1 | 1 | - | - |

| SEM III | CC10 | DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY | Code:22KP3Z10 | Inst.Hrs. 7 | Credit: 6 |
|---|---|---|---|---|---|

***Course Objectives:*** *On completion of this M.Sc course students could develop the knowledge on Basic concepts of development. To compare the importance of Developmental patterns. To understand the micro technique process intellectually. Gain the application knowledge about Antigen – antibody reaction, Immunotechniques and Immunoelectophoresis.*

| CO | STATEMENT |
|---|---|
| 1 | Acquire knowledge and understanding about the Basic concepts of development. |
| 2 | Familiarize the Developmental Patterns and Morphogenetic movements |
| 3 | Learn the basic techniques on Microtomy, biological Stains and Fixatives |
| 4 | Predict the Influences of hormones on Growth and Metamophosis |
| 5 | Understand about the mechanism of Antigen – antibody reaction |

**UNIT I:** Basic concepts of development: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients cell fate , cell map and cell lineages. Gametogenesis- Spermatogenesis and Oogenesis. Structure of human sperm-fast block ,slow block and Ovum.

**UNIT II:** Fertilization: Types - Mechanism of Fertilization, implantation and Pregnancy .Development-Cleavage, Patterns and Mechanisms-Blastula- Blastulation -Signification Blastopore-Gastrulation-Morphogenetic movements - germ layer-Differentiation-organogenesis and Growth.

**UNIT III:** Metamorphosis- Types - Stages-Influences of hormones on the growth and metamorphosis in Amphibians. Human welfare. Invitro fertilization and embryo transfer in human, Infertility, patient treatment for IVF-Birth Control methods.

**UNIT IV:** Antigen – antibody reaction. Binding sites of Ig – Ab, precipitation, Agglutination, Opsonisation, Cytolysis, flocculation, Complement fixation. Histocompatibility, Hypersensitivity, Allergic reactions. Classification – Type I, Anaphylatic hypersensitivity, Type II – antibody dependent hypersensitivity. Type III, - Immune complex mediated hypersensitivity. Type IV – cell mediated hypersensitivity, V – Stimulated hypersensitivity, Tolerance.

**UNIT V:** Immunotechniques: Brief procedure of ELISA, HLA typing, VDRL test. Immunoelectrophoresis, Radioimmunoassay, Immunoblotting techniques and Immunohistochemistry.

**UNIT VI: (Not for semester Examination)-** Hormonal and Structural changes during different developmental Stages. Recent investigations in Developmental biology. Modern development in immunological field. RT and PCR.

## TEXT BOOKS

1.Arumugam.N. Developmental Biology,Saras Publications,Negargovil.

2.Verma, P.S. and V.K. Agarwal: Chordate Embryology (S. Chand & Co)

3**.** Mary S.Tyler Developmental Biology

## REFERENCE BOOKS

1.Berrill, N.J. And Karp, G. (1976). Developmental Biology, McGraw Hill Inc. New York.
2. Browder, L.N. (1980). Development biology, Saunders College, Philadelphia.
3.Gilbert, S.F. (1995). Developmental Biology, II Edn, Sinamer Associates Inc. Publishers, Sunderland, Massachusetts, USA.

**CO PO Mapping with programme outcomes: DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY Code:22KP3Z10**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | 1 | | 3 | 2 | | | |
| CO2 | 1 | | | | | | 1 | 1 | | |
| CO3 | | 1 | | | | | 1 | 1 | 1 | |
| CO4 | | | 1 | | 1 | | 1 | | | 1 |
| CO5 | | | | 1 | | | | | | |

| SEM III | CC11 (P) | PRACTICAL III BIOTECHNOLOGYAND BIOINFORMATICS, DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY, AQUCULTURE & PUBLIC HEALTH AND HYGIENE | Code: 22KP3Z11P | Inst. Hrs 6 | Credit:4 |
|---|---|---|---|---|---|

***Course Objectives:*** *The course will include hands on activities related to Biotechnology, Developmental stages of animals, culture and husbandary of aquatic animals.*

| CO | STATEMENT |
|---|---|
| **1** | Acquire the skill of PCR technique |
| **2** | Understand the developmental stages of development of animals |
| **3** | Understand the immunological technique |
| **4** | Transfer of the aquaculture techniques to construct the aquafarm |
| **5** | Understand the communicable and contagious diseases and their prevention |

**BIOTECHNOLOGY& BIOINFORMATICS**

1.Isolation of DNA
2.Estimation of DNA
3.PCR Polymerase chain reaction
4.BLAST Basic local alignment search tool
Immobilization technique

**DEVELOPMENTAL BIOLOGY**

1.Observation of spermatozoa and different types of sperm
2.Observation of ovum and different types of eggs
3.Effect of thyroxin on metamorphosis of frog
4.Observation of developmental stages of human (models only)
5..Blastoderm mounting

**IMMUNOLOGY**

1.Determination of Ag-Ab reaction with reference to blood grouping
2.Differential count of leucocytes
3.Immuno diffusion-double immune diffusion

**AQUACULTURE**

1.Collection and identification of planktons from aquarium
2.Morphometry of fishes/prawn/shrimp,calculation of gonad index hepatic index and fecundity index
3.Aqurium maintenance-ornamental fish identification.
4.Identfication of fish diseases Bacterial and fungal diseases wet mount preparation
5.Fish food processing fish pickle and dryfish
6.induced ovulation using hypophysation technique

**CO PO Mapping with programme outcomes: PRACTICAL III BIOTECHNOLOGY& BIOININFORMATICS, DEVELOPMENTAL BIOLOGY& IMMUNOLOGY, AQUCULTURE & PUBLIC HEALTH & HYGIENE Code: 22KP3Z11P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | 2 | | | | 1 | 1 | |
| CO2 | 2 | | 1 | | | 1 | | | | 1 |
| CO3 | | | 2 | | 1 | | 1 | | | 2 |
| CO4 | 2 | | | 1 | | | | | 2 | |
| CO5 | | 1 | | | 2 | 1 | | 1 | | |

| SEM III | MBE 2 | AQUACULTURE | Code:22KP3ZELZ3:1 | Inst.Hrs:6. | Credit:4 |
|---|---|---|---|---|---|

***Course Objectives**: This course will emphasize the students about the principle of Aquaculture production system, water quality, nutrition, spawning, larval culture and culture methodologies with special reference to fish and prawn. The course will include hands on activities related to culture and husbandry of aquatic animals.*

| CO | STATEMENT |
|---|---|
| 1 | Acquire knowledge about fisheries and its types |
| 2 | Understand the factors associated with fish culture. |
| 3 | Compare the biology of Indian Major Carps and Exotic carps. |
| 4 | Illustrate the disease associated with Aquaculture |
| 5 | Design the economics of Aquaculture system |

**UNIT I:** Definition, history, scope and significance of Aquaculture. Different aquaculture systems. General characteristics of fishes and shellfishes ,criteria for selection of species common species for culture. Types of culture systems - Mariculture, Damculture and Riverine culture. Extensive semiintensive and intensive culture and their management practices.

**UNIT II:** Pond construction; Site selection- Layout design- water source -Aeration and aerators. Nutritional requirements of prawn and fishes: feed formulation-supplementary feed and live feed - (*Artemia* and Rotifer).

**UNIT III:** *C*ulture of fish, prawn, lobesters and crab - Nursery, Stocking, Rearing, Culture and Harvest. Rearing species of fish (*Catla, Rohu* and *Mirgal*) - Air breathing fishes.

**UNIT IV:** Disease management: Fish diseases- Bacterial (Dropsy) viral (Viral haemorragic septicemia) fungal (Gill rot). Deficiency diseases.

**UNIT V:** Transport and Marketing- Fish preservation and processing. Funding agencies - Marine Product Export Development Authority (MPEDA), Coastal Aquaculture Authority (CAA), National Fisheries Development Board (NFDB). Economics of Aquaculture.

**UNIT VI: (Not for semester Examination)- S**tandard operating procedure (SOP) for strain development, selection of fishes and prawn-cryopreservation of gametes-Fisheries and pollution.

**TEXT BOOKS**

1. Arumugam,N (2008), Aquaculture, Saras Publications, Nagarcoil
2. Kameleeswar Pandey and Shukla J.P2005Fish and fisheries. Rastogi Publications.
3. GuptaS.K and Gupta P.C(2006) General and Applied Ichthology, S Chand & co publishers.

**REFERENCE BOOKS**

1.Hoar W.S and Randall (1988).Fish Physiology (VolI&II) AcdemicPress Inc.
2.Santhanam, R (1987) Fisheries Science Daya Publishing House
3.Ramasamy P (1992). Diseases of shrimps in Aquculture System. Vanitha Publishing house.

**CO PO Mapping with programme outcomes: AQUACULTURE**
**Code: 22KP3ZELZ3:1**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 1 | 2 | 1 | - | 1 | - | - | 1 |
| CO2 | 1 | 1 | - | 1 | - | 1 | - | - | 1 | - |
| CO3 | 1 | - | 1 | 1 | - | - | 1 | 1 | - | 1 |
| CO4 | 1 | 2 | 1 | | 1 | 2 | - | - | - | - |
| CO5 | 1 | 1 | 1 | - | 1 | 1 | - | - | 1 | 1 |

| SEM III | MBE2 | FISHERIES AND MANAGEMENT | Code:22KP3ZELZ3:2 | Inst.Hrs:6. | Credit:4 |
|---|---|---|---|---|---|

***Course Objectives**: This course will emphasize the students about the fisheries resources, economic importance, edible products cultured using different culture system, methodologies with special reference to shrimp, fish and lobster. The course will include hands on activities related to culture and husbandry of aquatic animals.*

| CO | STATEMENT |
|---|---|
| 1 | To familiarize the students with the basic concepts and principles of Inland fisheries resources |
| 2 | To study the various cultivable aquaculture species seed production, hatchery skills for finfish and shellfish seed production. |
| 3 | To acquaint the students with the theoretical and practical aspects of the aquatic environment. |
| 4 | To learn the basic concept of freshwater aquaculture for sustainable production |
| 5 | To provide knowledge on National and international aquaculture statistics |

**Unit I:** Fishery resources of India – Present status of the following resources - Elasmobranches, Oil sardines, Indian mackerel, Bombay duck, Tunas, Seer fishes, Pomfrets, Carangids, Silver bellies, Flat fishes, Ribbonfishes, Perch, Sciaenids and Polynemids, Eels and Catfishes. Marine ornamental fishes.

**Unit II:** Present status of the following resources - Shrimps, Lobsters, Crabs, Pearl oysters and Edible Oyster, Mussels, Clams, Gastropods, Squids, Cuttlefish and Octopus. Export of marine products. Impacts of climate change on fisheries.

**Unit III:** Brackish water farming practices of India – Prawn filtration system and Bhasabada fisheries. Culture of milk fish, mullets, pearl spot, Asian sea bass, shrimps, crabs, lobsters. Brackish water molluscan species for aquaculture-mussels and clams present status and prospects.

**Unit IV:** Induced breeding in finfishes and shellfishes. Hatchery techniques of shrimp seed production. Live feed culture techniques.

**Unit V: (Not for semester Examination)-** Coastal culture. Present status and future prospectus of mariculture in India. Cage culture and Pen culture. Culture of pearl oyster, edible oyster and Seaweed. Legal aspects of coastal aquaculture – CRZ Act and Coastal Aquaculture Authority.

**Unit VI:** Economic - importance of fish, prawn, oyster and crab culture.

**TEXT BOOKS**


1. Bal D.V and Virabhadra Rao,K. 1990, Marine Fisheries of India, Tata McGrawHill, 472 p.
2. Jhingran,V.G. 1991. Fish and Fisheries of India, Hindustan Pub. Corp. (India), ISBN 9788170750178., 727 p.
3. Kurian C.V. and Sebastian, V.O. 1976.Prawn and Prawn Fisheries of India. Hindustan Pub. Corp., Delhi.

**REFERENCE BOOKS**


1. Yadav, B.N. 2006. Fish and Fisheries 4thedn., Daya Publishing House, Delhi. ISBN: 81-7035-171-5
2. Bal, D.V. and Rao, K.V. 1990. Marine Fishes of India. 1st tevisededn. Tata McGraw Hill.
3. Beverton, R.J.H. and S.J. Holt, 1957. On the Dynamics of Exploited Fish Populations. Fish. Invest. Minist. Agric. Fish. Food G.B. (2 Sea Fish.), 19: 533p.


**CO PO Mapping with programme outcomes: FISHERIES MANAGEMENT**

**Code: 22KP3ZELZ3:2**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 1 | 2 | 1 | - | 1 | - | - | 1 |
| CO2 | 1 | 1 | - | 1 | - | 1 | - | - | 1 | - |
| CO3 | 1 | - | 1 | 1 | - | - | 1 | 1 | - | 1 |
| CO4 | 1 | 2 | 1 | | 1 | 2 | - | - | - | - |
| CO5 | 1 | 1 | 1 | - | 1 | 1 | - | - | 1 | 1 |

| SEM III | NME 2 | PUBLIC HEALTH AND HYGIENE | Code: 22KP3ZELZ02 | Inst.Hrs.4 | Credit:3 |
|---|---|---|---|---|---|

***Course Objectives:*** *The course provides an insight into the immense importance of health hygiene, dietary issues, diseases related to malnutrition, communicable and non-communicable diseases.* .

| CO | STATEMENT |
|---|---|
| 1 | Classify current national and global public health problems |
| 2 | Understand the role of food and nutrients in health and disease |
| 3 | Aware about the issues of food safety, water safety, vaccination, exercise, and obesity |
| 4 | Develop awareness about the causative agents and control measures of many commonly occurring diseases. |
| 5 | Undertake awareness programmes for maintenance of hygienic conditions, destruction of breeding spots in the vicinity of houses and cattle shed by public health education campaign. |

**UNIT I:** Introduction to public health and hygiene- Nutrition and health-Malnutrition-Vitamin deficiency diseases. Importance of Balanced diet. Anomalies -Anaemia, Kwashiorkar, Marasmus, Rickets, Goiter.

**UNIT II**: Environment and Health-Pollution and health hazards; water and air borne diseases. Noise pollution- Radiation hazards. Impact of solid waste and sewage on human health.

**UNIT III:** Communicable diseases and preventive measures - Viral diseases - measles, chicken pox, Bacterial diseases- Tuberculosis, Typhoid, Fungal diseases - Candida. Sexually transmitted diseases-AIDS and Syphilis.

**UNIT IV:** Non-communicable diseases and its prevention - Hypertension, Osteoporosis and Diabetes -. Gastrointestinal disorders - acidity and peptic ulcer. Obesity - Cancer and their preventive measures. Alcoholism and drug abuse.

**UNIT V:** Health education- Hygienic measure during menstrual period-Health planning programmes in India, WHO, NGO. Vaccination drive in India

**UNIT VI: (Not for semester Examination)-** Brief introduction, types and morphological peculiarities of vectors such as mosquitoes, flies, fleas, lice, bugs, ticks and mites. Causes of diseases outbreak. Social health problems, alcoholism, narcotics. Food hygiene- Food and water-borne infections. Causes of food spoilage and its prevention.

**TEXT BOOKS**

1. Murgesh. N. (2008). Health Education and Community Pharmacy. Sathya Publishers, Madurai.

2. Paramjit Rana, (2002). Total Health- English Edition, Mumbai

3. Srilakshmi, B. (2011). Human Nutrition Dietetics – New Age International Publishers, 6th edition

**REFERENCE BOOKS**

1. Robert, (2001). Hand book of Pollution, control processes. Noyesjaico publishing house, Mumbai.

2. Harnold Shyrlock and Hubert. O. Swartout, P. (1998). You and your health, Pacafic press publishing association- London.

3. Jill Varnes and Stephen. D.C. (2000). Health. Bud Getchell, Rurtypipin. Health and Company, Massachusetts.

**CO PO Mapping with programme outcomes: PUBLIC HEALTH AND HYGIENE Code: 22KP3ZELZ02**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | - | 1 | - | - | - |
| CO2 | 3 | 1 | - | - | - | 1 | - | - | - | - |
| CO3 | 3 | - | 1 | 1 | - | - | 1 | 1 | - | 1 |
| CO4 | 2 | 2 | 1 | 1 | 1 | 2 | - | - | - | - |
| CO5 | 1 | 1 | 1 | - | 1 | 1 | - | - | 1 | - |

| SEM III | ECC3 | ENVIRONMENTAL TOXICOLOGY | Code: 22KP3ECCZ3:1 | Inst. Hrs. | Credit:3 |
|---|---|---|---|---|---|

***Course Objectives:*** *This course is focused on the theoretical and applied knowldge on the effects of xenobiotics on the human health. The students will also get introduced in to the toxicological analysis and the symptoms of the diseases. The students also study the detoxification mechanism and organs involved for detoxication .*

| CO | STATEMENT |
|---|---|
| 1 | Learn the principle of Toxicology. |
| 2 | Explain the sources and entry routes of toxicants. |
| 3 | Illustrate the environmental diseases. |
| 4 | Compare the hazard and risk. |
| 5 | Formulate the dose-response relationship. |

**UNIT I** : Introduction to Ecotoxicology, Principles of toxicology, Types of toxic substances degradable and nondegradable. Influences ecological factors on the effects of toxicity.

**UNIT II**: Toxicants in the Environment: Toxic substances in the environment, their sources and entry routes, Ecosystem influence the fate and the transport of toxicants .Transport of toxicants by air and water.

**UNIT III:** Environmental Disease Asbastosis, Silicosis, Asthma, Synopsis Epimediological issue:Malaria

**UNIT IV:** Environmental Health Hazard and Risk Assesment Hazard and risk. Biological,chemical,Physical,and psychological health hazard .Health risk assessment and management.

**UNIT V:** Man and Environmental toxins: Routes of toxicants to human body-entry through inhalation, s kin absorption, indigestion and injection; Response to toxin exposures-dose respose ,frequency response and cumulative response ;Lethal and sub lethal doses Dose response relationships between chemical and biological reactions.

**UNIT VI: (Not for semester Examination)-** Toxins and ecosystem: Transport of xenobiotics through foodc hain-Biotransformation and Biomagnification.- LC50 organs of detoxification Detoxification mechanisms.

**TEXT BOOKS**

1. Subramaian, MA (2004).Toxicology-Principles and Methods MJP publishers , Chennai.

**RFERENCE BOOKS**

2. Bhattacharia,S (2011).Environmental toxicology-Books and Allied (P) Ltd Kolkotta.

**CO PO Mapping with programme outcomes: ENVIRONMENTAL TOXICOLOGY**

**Code: 22KP3ECCZ3:1**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | 1 | | 1 | | 1 | | 1 | |
| CO2 | 1 | | | 2 | | | | 2 | | 1 |
| CO3 | | 2 | | | | | | | | |
| CO4 | 2 | | 3 | | | 1 | | | | |
| CO5 | | 1 | | | 2 | | 1 | | 2 | |

| SEM IV | CC12 | ENVIRONMENTAL MANAGEMENT | Code:22KP4Z12 | Inst. Hrs.6 | Credit:4 |
|---|---|---|---|---|---|

**Course Objectives:** *This course provides information regarding the status of environment and the remedial efforts undertaken by various agencies. It also focuses on the diversity of living forms particularly animals with a detailed inference on the loss of species due to various reasons and the need for their conservation.*

| CO | STATEMENT |
|---|---|
| 1 | Understand the status of environmental education and public awareness. |
| 2 | Describing the role of organizations and agencies in Environmental Management. |
| 3 | Explaining the fundamental concepts of environmental management. |
| 4 | Analyzing the steps involved in the Environmental Impact Assessment process. |
| 5 | Interpret the loss of species due to various reasons and the need of their conservation. |

**UNIT I:** Environmental Education**:** Objectives and importance. Environmental education programmes. Environmental education in India – Exploitation of land and water resources due to urbanization, industrialization, and agricultural practices. Environmental Problems - Eutrophication, Deforestation, Ozone depletion, greenhouse effect, climate change, acid rain, fisheries depletion, shrinking of glaciers. Threats to biodiversity- Extinction of species.

**UNIT II:** Environmental organizations and agencies**:** Governmental and Non-governmental Organization and International bodies- MoEFCC, CPCB, NBWL, IUCN, WWF, TERI, UNEP, WHO and FAO. Public awareness, people's participation in resource conservation and environmental protection.

**UNIT III:** Environmental Management System (EMS): ISO-14000; Environmental audit, Environmental clearance for establishing industries, Environmental Impact Assessment (EIA)- Purpose and Benefits, **S**teps involved in EIA process. Environmental tax-Green tax. Role of Intellectual Property Rights (IPRs) on environment.

**UNIT IV:** Ecosystem management**:** Importance and applications- Remote Sensing and Geographic Information System (GIS)- Mining, Urban environment, Coastal and marine environment and Wetland environment.

**UNIT V:** Biodiversity and resource conservation programmes**:** Biodiversity-definition types and importance. Kyoto Protocol- Ramsar Convention. Types of biodiversity. Measures of biodiversity. Hotspots. Biodiversity conservation–In-situ e.g., Sanctuaries, National Parks, Biosphere Reserves, World Heritage Sites; Ex-situ e.g., botanical gardens, gene banks, cryopreservation etc. Wildlife conservation in India-Crocodiles, sea turtle, Project Tiger, Project Elephant and Gir lion project census-pug mark.

**UNIT VI: (Not for semester Examination)-** Biomonitoring**:** Environmental pollution - Air, water, and land. Treatment schemes for sewage from dairy, distillery, tannery, sugar and pharma industries etc. Solid Waste Management. Environmental indicators-Red data and Green data.

**TEXTBOOKS**

1. Sharma P.D. (1994). Environmental Biology, Rastogi Publications.
2. Agarwal, V.K (2009). Animal Behaviour. S.Chand & Company Ltd, New Delhi
3. Arumugam, N and V. Kumaresan (2014): Environmental Science and Engineering, Saras Publication

**REFERENCES**

1. Odum, E.P (1953): Fundamentals of Ecology, W.B.Saunders, Philadelphia.
2. Saharia V.B. (1990): Wildlife in India, Nataraj Publications, Dehradun.
3. Giles (1990): Wildlife Techniques, Oxford Publications.

**CO-PO Mapping with Programme Outcome: ENVIRONMENTAL MANAGEMENT Code: 22KP4Z12**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 2 | 1 | - | 2 | 2 | - | - | 1 |
| CO2 | 2 | - | 2 | - | 1 | - | 2 | - | 1 | 2 |
| CO3 | 1 | 1 | 1 | 1 | 1 | - | 1 | - | - | 1 |
| CO4 | 1 | - | 2 | 1 | 1 | 1 | 1 | - | - | 1 |
| CO5 | 1 | - | 1 | 1 | 1 | 1 | 1 | - | - | 1 |

| SEM IV | CC13 | RESEARCH METHODOLOGY AND BIOSTATISTICS | Code:22KP4Z13 | Inst. Hr:6 | Credit:4 |
|---|---|---|---|---|---|

**Course Objectives**: On completion of this M.Sc course students could develop the knowledge on depth of Research and application of statistics in biological studies. To compare the importance of Research documents and thesis writing. To understand the micro technique process intellectually. Gain the knowledge about Antigen – antibody reaction, Immunotechniques and Immunoelectophoresis.

| CO | STATEMENT |
|---|---|
| 1 | Familiarize about Scientific approach in Research Problems |
| 2 | Gain knowledge about Microtomy, biological Stains and Fixatives |
| 3 | Predict the Influences of hormones on Growth and Metamorphosis |
| 4 | Compare the different Chromatography cal Techniques. |
| 5 | Understand the Types of data-Collection, data-Tabulation and various statistical analysis. |

**UNIT I:** Selection of research problem: Experimental approach and design. Preparation of reference cards – Source of Information: Library, Internet websites, collection of literature. Preparation of research document, abstract, and papers. Thesis writing: Components of thesis,

**UNIT II:** Microtechnique: Methodes, Tissue processing – Fixation, Principles, Types, Fixatives, Histochemistry of Fixatives,staining-Purpose,Methode,Types of Stains. Freezing microtomy (Cryostat). Principles involved in identification of Carbohydrate, protein, lipid and DNA.

**UNIT III:** Principles and applications of Chromatography and electrophoresis –High Performance liquid Chromatography (HPLC), GC MS. Principles and applications of Electrophoresis: – SDS – PAGE, immunoelectophoresis. Colorimetry: Spectrophotometer.

**UNIT IV:** Types of data-Collection of data-Tabulation of data( individual, group-continious, discrete.Diagrammatic and graphical representation of data -Measures of central tendency (Mean, Median Mode) dispersion Range-Standard Deviation and Standard Error. Correlation analysis-Pearson and spermann rank Correlation.

**UNIT V:**Regression Analysis – Simple linear regression-hypothesis testing- test of Significance: Student "t" – test – Chi – square test –One – Way Analysis of variance. Introduction to SPSS .

**UNIT VI: (Not for semester Examination)-** Abstract writing, , Model research papers writing. List of UGC revised Journals-Niscar,advanced data computing Software.scopus web of science.

**TEXT BOOKS**

1 Palanichamy, S. and Monoharan, M., Statistical Methods of Biologics (Palani Paramount Publications).

2 Gurumani.N, (2008). Research Methodology: For Biological Sciences.
3 Gurumani .N (2008). An Introduction to Biostatistics.

**REFERENCE BOOKS**

1. Sokai, R.J. an d Rohif. S.J., Introduction to Biostatistics (W.H. Freeman)
2. Kothari, C.R.Research methodology : Methods and Techniques.ISBN 13.
3. Hzar, J., Biostatistical Analysis (McGraw – Hill).

**CO PO Mapping with programme outcomes: RESEARCH METHODOLOGY AND BIOSTATISTICS 22KP4Z13**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | 1 | | 3 | 2 | | | |
| CO2 | 1 | | | | | | 1 | 1 | | |
| CO3 | | 1 | | | | | 1 | 1 | 1 | |
| CO4 | | | 1 | | 1 | | 1 | | | 1 |
| CO5 | | | | 1 | | | | | | |
| CO1 | 1 | | | | 1 | | 1 | | 1 | |

| SEM IV | CC14 (P) | PRACTICAL IV - ENVIRONMENTAL MANAGEMENT, RESEARCH METHODOLOGY AND BIO STATISTICS & CLINICAL LABORATORY TECHNOLOGY | Code: 22KP4Z14P | Ins.Hrs: 6 | Credit:4 |
|---|---|---|---|---|---|

***Course Objectives**: The course will include hands on activities related to preparation of research articles for journals, data analysis and analysis of clinical specimen.*

| CO | STATEMENT |
|---|---|
| 1 | Acquire the skill of Report writing |
| 2 | Understand the preparation of stains |
| 3 | Understand the data analysis |
| 4 | Acquirethe knowledgeof statistical toolsl |
| 5 | Understand the laboratory diagnostic procedures |

**ENVIRONMENTAL MANAGEMENT**

1.Endangered mammals of India.

2.Biodiversity – hot spots in India.

3.National parks and Sanctuaries in Tamil Nadu.

4.Field visit report.

**RESEARCH METHODOLOGY**

1.Preparation of reference cards, Abstract writing, key words, framing of research article
2.Important biological journal and their web sites-UGC –CARE Journal-Citation index, h index, i10 index.
3.Demonstration of Micro techniques: fixation - staining - mounting .
4.Preparation of fixatives - Bouins , zenkers, cornoys ,
5.Preparation of stain Eosin- haematoxylin, malariy's triple staining
6.Microtome, L – blocks and mountant.
7.Verification of Beer Lamberts Law using uv-vis Spectrophotometer

**BIOSTATISTICS**

1.Mean, Median ,Mode,Standard deviation, standard error, Correlation and regression using biological samples.

2.Student "t" test, Chi – square test and One way ANOVA using biological samples.

**CLINICAL LAB TECHNOLOGY**

**Blood Test**

1.Estimation of ESR.
2.Estimation of Hemoglobin content using Hemoglobinometer.
3.Bleeding time and clotting time.
4.Quantitative analysis of Blood sugar
5.Quantitative analysis of Blood cholesterol.

**URINE TEST**

1.Colour, odour, volume and pH.
2.Qualitative analysis of Albumin,
3.Qualitative analysis of Sugar,
4.Qualitative analysis of Bile salts
5.Qualitative analysis of bile pigments.

**CO PO Mapping with programme outcomes: PRACTICAL IV:ENVIRONMENTAL MANAGEMENT, RESEARCH METHODOLOGY AND BIO- STATISTICS & CLINICAL LAB TECHNOLOGY Code:22KP4Z14 P**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | 1 | | | 1 | | 1 | | 1 |
| CO2 | | 2 | | 2 | | 1 | | 1 | | |
| CO3 | | | 1 | | 2 | | 2 | | | 1 |
| CO4 | 2 | | | | | 1 | | | 2 | |
| CO5 | 1 | | | | 1 | | | 1 | | 1 |

–

| SEM IV | MBE 3 | CLINICAL LABORATORY TECHNOLOGY | Code: 22KP4ZELZ3:1 | Hrs:6 | Credit:4 |
|---|---|---|---|---|---|

***Course Objectives**: The main objectives of this course are to provide the knowledge about the Serological and Urological analysis of the Student. To understand fundamental analytical principle and process used in clinical laboratory techniques.*

| CO | STATEMENT |
|---|---|
| 1 | Gives Knowledge related to the techniques involved in Diagnosis of various disease. |
| 2 | Understanding pathology associated with various disease. |
| 3 | Practical skills of conducting basis clinical lab experiments. |
| 4 | Application of knowledge of clinical science and pathology to Own life. |
| 5 | Understanding the pathology of disease caused by various microbes. |

**UNIT I:**The laboratory : Code of conduct for clinical lab personnel – precautions and safety measures in laboratory personal, accidents and first aid in the Lab. Instruments, microscope (compound), centrifuge, glasswares, serological water bath, incubator and hot air oven.

**UNIT II:**Haematology : Blood collection, Haemoglobin estimation, Sahlis haemoglobinometer, bleeding time, clotting time, PCV, blood cell count, ESR. Blood film examination – fixing and staining. Differential count. Blood sugar, creatine and urea – fragility test of RBC.

**UNIT III:**Clinical diagnosis of bacterial diseases such as Tuberculosis, Typhoid, Cholera. Clinical diagnosis of viral disease such as AIDS, Jaundice, Measles. Examination of stool and sputum. Examination of urine – Sugar, albumin, bile pigments and ketone.

**UNIT IV:** Knowledge and skill in the study of analysis of Semen analysis, motility studies. Pregnancy test – any two immunological methods. Hospital wastes, disposal of hospital wastes and infected material. Parasitic analysis in blood and faeces.

**UNIT V:** Cerebrospinal fluid for clinical investigation, Prenatal diagnosis, Ultra Sound Scan, Amniotic fluid analysis, Karyotyping.

**UNIT VI: (Not for semester Examination)-** Molecular Diagnostic technique – RIA, ELISA, VDRL and DNA finger printing.

**TEXT BOOKS**


1. Ramnick Sood, M.D.Medical Laboratory Technology – Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi.
2. Arumugam N.Microbiology (General and Applied) Saras Publication Nagarkovil.
3. Park and Park Benarsides Bharot J.E – Text Book of Preventive medicine – Napier Town.


**REFERENCE BOOKS**

1. Kannani, I Mukerjee, Medical Laboratory Technology, Vol. II, III Tata Mr Grand Hill, Publishing Co., New Delhi.
2. Samual, K.M.Notes on Clinical Lab Techniques, Published by M.K.Gopalan, Chrompet, Chennai.
3. Baker P.J.Silverton – Int.to Medical Laboratory Technology.
4.

**CO PO Mapping with programme outcomes: CLINICAL LABORATORY TECHNOLOGY**

**Code: 22KP4ZELZ3:1**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | | | | | 1 | | | 1 |
| CO2 | | | 1 | 1 | | | | | | |
| CO3 | | | | 1 | | 1 | | | | |
| CO4 | 1 | | | | | | 1 | 1 | | |
| CO5 | 1 | | | | | | | | 1 | 1 |

| SEM IV | MBE 3 | BIOSAFETY AND BIOETHICS | Code: 22KP4ZELZ3:2 | Inst. Hrs. 6 | Credit 4 |
|---|---|---|---|---|---|

***Course Objectives:*** *The course is a walk for the Post Graduate students' entrant to know biosafety Concepts, practices and procedures. It highlights make students aware about the ethical issues involving biological material. Te also compares with Understand the Ethics in clinical trials and Good Clinical Practices. Students will gain awareness about Intellectual Property Rights.*

| CO | STATEMENT |
|---|---|
| 1 | Define the general biosafety rules and different biosafety levels. |
| 2 | Summarize ethical aspects related to biological, biomedical, health care and biotechnology research |
| 3 | Point out the Roles of Institutional Biosafety Committee, |
| 4 | Analyze the ethical aspects related to biological, biomedical, health care and biotechnology research. |
| 5 | Hypothesis of Bioethics in biological Lab and animal rights. |

**UNIT I:** Introduction to Biosafety and Bioethics – Definition – Concepts of biosafety, Biosafety practices and procedures. Biosafety levels, branches and principles of bioethics Positive and negative aspects of bioethics.

**UNITI II:** Biosafety guidelines – Purpose and Essential components of the biosafety guidelines, Government of India , Roles of Institutional Biosafety Committee, General good laboratory practices, Importance of good laboratory practices, Bioethics in biological Lab and animal rights.

**UNIT III:** Intellectual Property Rights- introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development , IPR in other countries, Types of IP – Patents, Trademarks, Copyright & Related Rights, Importance of IPR – patentable and non patentable; patenting life, WTO guidelines.

**UNIT IV**: Biosafety Levels of Specific Microorganisms, Recommended Biosafety Levels for Infectious Agents and infected Animals, Environmental security and safety – Precautionary measures – health safety. Cartagena Protocol on Biosafety, Biosafety concerned with radioactivity.

UNIT V: Safety, Responsibilities and Rights: Safety and risk - assessment, risk benefit analysis and reducing risk – Social impacts and socioeconomic aspects of Biological weapon. Ethics and Biosafety consideration in Bioremediation.

**UNIT VI: (Not for semester Examination)-** Analyze ethical aspects related to biological, biomedical, health care and biotechnology research, Evaluate the levels and their impact on Environment, national and international regulations. Implementation of advanced Biosafety and Bioethical Methods in Future.

**TEXT BOOKS**

1. M.K. Sateesh, Bioethics and Biosafety, September 2020.

2. Hardcover, Joshi Rajmohan Biosafety and Bioethics.

3. Na.Vikraman, Best Textbook of Bioethics Biosafety and Ipr.

**REFERENCEBOOKS**


1. Sasson A, Biotechnologies and Development, UNESCO Publications, 1988.
2. Sasson A. Biotechnologies in developing countries present and future, UNESCO publishers, 1993.
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New
4. IPR, Biosafety and Bioethics, Deepa Goel and Parashar,2013..


**CO PO Mapping with programme outcomes: BIOSAFETY AND BIOETHICS**

**Code: 22KP4ZELZ3:2**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | 1 | | | 1 | | 1 | | 1 |
| CO2 | | 2 | | 2 | | 2 | | 2 | | |
| CO3 | | | 1 | | 2 | | 2 | | | 2 |
| CO4 | 1 | | | 2 | | 1 | | | 2 | |
| CO5 | 1 | | 2 | | 1 | | | 1 | | 1 |

## VIII. Continuous Internal Assessment System

| | Maximum | Components | | | Passing Minimum |
|---|---|---|---|---|---|
| | | Attendance | CIA | Seminar / Assignment | |
| Theory | **25** | 05 | 15 | 05 | **12** |
| Practical* | **40** | 05 | 25 | 10 (Record) | **20** |

## IX. Question Pattern

| | Part A | Part B | Part C |
|---|---|---|---|
| Semester Exam: Theory (75) | 20 X 1=20 (Answer All) | 4X 5= 25 (Internal choice) | 3 X10 =30 (Open choice) |
| Semester Exam: Practical (60) | 5X10 = 50* | - | - |
| Semester Exam: SBEC Theory (75) | 5 X 5= 25 (Internal choice) | 5X10=50 (Open choice) | - |
| CIA Exam: Theory (50) | 10 X 1=10 (Answer All) | 3 X 5= 20 (Internal choice) | 2 X10 =20 (Open choice) |
| CIA SBEC Theory (50) | 5x5 = 20 (Internal choice) | 3 X10 =30 (Open choice) | - |
| Model Exam Theory (75) | 20 X 1=20 (Answer All) | 4 X 5= 25 (Internal choice) | 3 X10 =30 (Open choice) |
| Model Exam: Practical (50) * | 5X10 = 50 | - | - |

**X . Question Allocation and Blooms Taxonomy for (Direct) Assessment**

| Unit | Section & Marks | Question Number | Blooms Level | Action Verbs |
|---|---|---|---|---|
| **1** | **A (1 mark)** | **1-4** | I / II | ***Level 1:*** *Choose, Define, Find, How, Label, List, Match, Name, Select, Show, Tell, What, When, Where, Which, Who, Why* ***Level II:*** *Classify, Compare, Contrast, Demonstrate, Explain, Extend, Illustrate, Infer, Interpret, Outline, Relate, Show, Summarize, Translate* ***Level III:*** *Apply, Build, Choose, Construct, Develop, Experiment with, Identify, Interview, Make use of, Model, Organize, Plan, Select, Solve, Utilize* ***Level 1V:*** *Analyze, Assume, Categorize, Discover, Dissect, Distinguish, Divide, Examine, Function, Inference, Inspect, Motive, Relationships, Simplify, Survey, Take part in, Test for, Theme* ***Level V:*** *Agree, Appraise, Assess, Award, Conclude, Criteria, Criticize, Decide, Deduct, Defend, Determine, Disprove, Estimate, Evaluate, Importance, Influence, Interpret, Judge, Justify, Mark, Measure, Opinion, Perceive, Prioritize, Prove, Rate, Recommend, Rule on, Select, Support, Value* ***Level VI:*** *Adapt, Combine, Compile, Compose, Construct, Create, Delete, Design, Develop, Discuss, Elaborate, Estimate, Formulate, Happen, Imagine, Improve, Invent, Make up, Maximize, Minimize, Modify, Original, Originate, Plan, Predict, Propose, Solution, Solve, Suppose, Test, Theory* |
| | **B (5 mark)** | **21 (a) and (b)** | I / II | |
| | **C (10 mark)** | **26** | I / II | |
| **II** | **A (1 mark)** | **5-8** | I / II | |
| | **B (5 mark)** | **22 (a) and (b)** | I / II | |
| | **C (10 mark)** | **27** | I / II | |
| **III** | **A (1 mark)** | **9-12** | I / II | |
| | **B (5 mark)** | **23 (a) and (b)** | III / IV | |
| | **C (10 mark)** | **28** | III / IV | |
| **IV** | **A (1 mark)** | **13-16** | I / II | |
| | **B (5 mark)** | **24 (a) and (b)** | III / IV | |
| | **C (10 mark)** | **29** | V / VI | |
| **V** | **A (1 mark)** | **17-20** | I / II | |
| | **B (5 mark)** | **25 (a) and (b)** | V / VI | |
| | **C (10 mark)** | **30** | V / VI | |

| BL | No. Of Questions (Sections) | | | Total Marks | % of Marks |
|---|---|---|---|---|---|
| | A | B | C | | |
| I. Remembering | 12 | 4 | 2 | 12 | 50 |
| II. Understanding | 08 | | | 48 | |
| III. Applying | - | 4 | 2 | **20** | **33** |
| IV. Analyzing | - | | | **20** | |
| V. Evaluating | - | 2 | 1 | 10 | 17 |
| VI. Creating | - | | | 10 | |
| ***Total Questions*** | **20** | **10** | **5** | **120** | **100** |

**XI. Teaching Methodology Adopted:** (**department specific**) + Department may adopted at least a 20 % of ICT enabled classes out of total hours of each course work and proper documents *(Date, Hour, Course and unit, name of the faculty and sign of the representative student)* to be maintained for the same

**XII. Outline of Learning Outcomes- based Curriculum Frame work (LOCF) (**All the following categories of courses will be given with definition, procedure and system of implementation) 1. **LC:** Language Course (Part I):

2. **ELC:** English Language Course (Part II):
3. **CC** : Core Course :
4**. AC :** Allied Course
5. **EC**: Elective Course :
6. **MBE**: Major Based Elective:
7. **SBEC:** Skill Based Elective Courses:
8. (A) Internship-External
(B) Internship-Internal
(C) Field Work
9. **VA**: Value Added courses:
10. **NME** : Non-Major Elective:
11**. VE:** Value Education
12. **ES:** Environmental Studies
13. **SSD:** Soft Skill Development:
14: Extension and Extra Curricular Activities:
15. **ECC** - Extra Credit Course:
(A) **SS**-Self Study:
(B) **MOOC**:
(C) **Add on Course:**

* add-on Certificate Courses with 10-30 contact hrs conducting by Course Coordinator of the department /College

# List of MOOC Courses will be given by the Course Coordinator

$ **External or Internal Internship:** 2 weeks During Month of March - April Executed by Internship Coordinator through internal guide

**OR**

**Field work:** Can be a field study / industrial visit During Month of March - April Executed by Internship Coordinator through internal guide with submitting a 10 to 15 page report.

**QUESTION BLUE PRINT (75 Marks)**

| ***Q.No*** | ***Unit*** | ***Blooms Level*** |
|---|---|---|
| ***Part A*** | | |
| 1 | 1 | Remembering I / Understanding II |
| 2 | 1 | Remembering I / Understanding II |
| 3 | 1 | Remembering I / Understanding II |
| 4 | 1 | Remembering I / Understanding II |
| 5 | II | Remembering I / Understanding II |
| 6 | II | Remembering I / Understanding II |
| 7 | II | Remembering I / Understanding II |
| 8 | II | Remembering I / Understanding II |
| 9 | III | Remembering I / Understanding II |
| 10 | III | Remembering I / Understanding II |
| 11 | III | Remembering I / Understanding II |
| 12 | III | Remembering I / Understanding II |
| 13 | IV | Remembering I / Understanding II |
| 14 | IV | Remembering I / Understanding II |
| 15 | IV | Remembering I / Understanding II |
| 16 | IV | Remembering I / Understanding II |

| | | |
|---|---|---|
| 17 | V | Remembering I / Understanding II |
| 18 | V | Remembering I / Understanding II |
| 19 | V | Remembering I / Understanding II |
| 20 | V | Remembering I / Understanding II |
| ***Part B*** | | |
| 21 (a) | 1 | Remembering I / Understanding II |
| (b) | 1 | Remembering I / Understanding II |
| 22 (a) | II | Remembering I / Understanding II |
| (b) | II | Remembering I / Understanding II |
| 23 (a) | III | Applying III / Analyzing IV |
| (b) | III | Applying III / Analyzing IV |
| 24 (a) | IV | Applying III / Analyzing IV |
| (b) | IV | Applying III / Analyzing IV |
| 25 (a) | V | Creating V / Evaluating V I |
| (b) | V | Creating V / Evaluating V I |
| ***Part C*** | | |
| 26 | I | Remembering I / Understanding II |
| 27 | II | Remembering I / Understanding II |
| 28 | III | Applying III / Analyzing IV |
| 29 | IV | Applying III / Analyzing IV |
| 30 | V | Creating V / Evaluating V I |