

SadakathullahAppa College

(Autonomous)

(Reaccredited by NAAC at an 'A' Grade. An ISO 9001:2015 Certified Institution)

Rahmath Nagar, Tirunelveli- 11.

Tamil Nadu.

PG DEPARTMENT OF ZOOLOGY



Draft CBCS SYLLABUS

For

M.Sc. ZOOLOGY

(Applicable for students admitted from June 2021 onwards)

**(Submitted before the Zoology BOS Meeting
held on 16.03.2021)**

M.Sc. Zoology

(Applicable for students admitted in June 2021 and onwards)

TITLE OF THE PAPERS, CREDITS & MARKS

| SEM | Category | Title of the Courses | S. Code | H/W | L | T | P | C | Marks | | |
|-----|----------------------|--|-----------|-----|---|---|---|---|-------|----|-------|
| | | | | | | | | | I | E | T |
| I | DSC-I | Biology of Invertebrates and Chordates | 21PCZO11 | 5 | 3 | 2 | - | 4 | 40 | 60 | 100 |
| | DSC-II | Biochemistry | 21PCZO12 | 5 | 3 | 2 | - | 4 | 40 | 60 | 100 |
| | DSC-III | Cell and Molecular Biology | 21PCZO13 | 5 | 3 | 2 | - | 4 | 40 | 60 | 100 |
| | DSE-I | A) Apiculture | 21PEZO11A | 4 | 3 | 1 | - | 4 | 40 | 60 | 100 |
| | | B) Systematics and Animal Diversity | 21PEZO11B | 4 | 3 | 1 | - | 4 | 40 | 60 | 100 |
| | | C) Endocrinology | 21PEZO11C | 4 | 3 | 1 | - | 4 | 40 | 60 | 100 |
| | P - I | Biology of Invertebrates and Chordates Practicals | 21PCZO1P1 | 4 | 1 | - | 3 | 2 | 40 | 60 | 100/2 |
| | P - II | Biochemistry & Cell and Molecular Biology Practicals | 21PCZO1P2 | 4 | 1 | - | 3 | 2 | 40 | 60 | 100/2 |
| | IDC-I | Ornamental fish culture | 21PIZO11 | 2 | 1 | 1 | - | 2 | 40 | 60 | 100 |
| | Library Hour | | 1 | - | - | - | - | - | - | - | |
| II | Core IV | Developmental Biology | 21PCZO21 | 5 | 3 | 2 | - | 4 | 40 | 60 | 100 |
| | Core V | Genetics and Evolution | 21PCZO22 | 5 | 3 | 2 | - | 4 | 40 | 60 | 100 |
| | Core VI | Animal Biotechnology | 21PCZO23 | 5 | 3 | 2 | - | 4 | 40 | 60 | 100 |
| | DSE-II | A) Vermiculture | 21PEZO21A | 4 | 3 | 1 | - | 4 | 40 | 60 | 100 |
| | | B) Environmental Biology | 21PEZO21B | 4 | 3 | 1 | - | 4 | 40 | 60 | 100 |
| | | C) Nanobiotechnology | 21PEZO21C | 4 | 3 | 1 | - | 4 | 40 | 60 | 100 |
| | P - III | Developmental Biology Practicals | 21PCZO2P1 | 4 | 1 | - | 3 | 2 | 40 | 60 | 100/2 |
| | P - IV | Genetics and Evolution & Animal Biotechnology Practicals | 21PCZO2P2 | 4 | 1 | - | 3 | 2 | 40 | 60 | 100/2 |
| | SEC-I | MOOC/ SWAYAM NPTEL Course | 21PSZO21 | 2 | 1 | 1 | - | 2 | 25 | 75 | 100 |
| | Library Reading Hour | | 1 | - | - | - | - | - | - | - | |
| III | Core VII | Animal Physiology | 21PCZO31 | 5 | 3 | 2 | - | 4 | 40 | 60 | 100 |
| | Core VIII | Biostatistics and Bioinformatics | 21PCZO32 | 5 | 3 | 2 | - | 4 | 40 | 60 | 100 |
| | Core IX | Research Methodology | 21PCZO33 | 5 | 3 | 2 | - | 4 | 40 | 60 | 100 |

| | | | | | | | | | | | |
|----------|-----------------------|--|-----------|--------|---|---|----|----|----|-------|-------|
| | DSE-III | A) Microbiology | 21PEZO31A | 4 | 3 | 1 | - | 4 | 40 | 60 | 100 |
| | | B) Fisheries and aquaculture | 21PEZO31B | 4 | 3 | 1 | - | 4 | 40 | 60 | 100 |
| | | C) Parasitology | 21PEZO31C | 4 | 3 | 1 | - | 4 | 40 | 60 | 100 |
| | P -V | Animal Physiology Practicals | 21PCZO3P1 | 4 | 1 | - | 3 | 2 | 40 | 60 | 100/2 |
| | P -VI | Biostatistics and Bioinformatics & Research Methodology Practicals | 21PCZO3P2 | 4 | 1 | - | 3 | 2 | 40 | 60 | 100/2 |
| | IDC-II | Applied Zoology | 21PIZO31 | 2 | 1 | 1 | - | 2 | 40 | 60 | 100 |
| | | Library Reading Hour | | 1 | - | - | - | - | - | - | - |
| IV | Core X | Immunology | 21PCZO41 | 5 | 3 | 2 | - | 4 | 40 | 60 | 100 |
| | Core XI | Entomology | 21PCZO42 | 5 | 3 | 2 | - | 4 | 40 | 60 | 100 |
| | Project | Project | 21PPZO41 | 8+6* | 2 | - | 6 | 8 | - | - | 200 |
| | DSE-IV | A) Sericulture | 21PEZO41A | 4 | 3 | 1 | - | 4 | 40 | 60 | 100 |
| | | B) Poultry and Dairy Science | 21PEZO41B | 4 | 3 | 1 | - | 4 | 40 | 60 | 100 |
| | | C) Animal Feed Technology | 21PEZO41C | 4 | 3 | 1 | - | 4 | 40 | 60 | 100 |
| | P - VII | Immunology Practicals | 21PCZO4P1 | 4 | 1 | - | 3 | 2 | 40 | 60 | 100/2 |
| P - VIII | Entomology Practicals | 21PCZO4P2 | 4 | 1 | - | 3 | 2 | 40 | 60 | 100/2 | |
| | | | Total | 120+6* | | | 90 | | | 2400 | |

Postgraduate Department of Zoology
 Programme Learning Outcomes (PLO)
 (Aligned with Graduate Attributes)

| | |
|------------|---|
| PLO | Upon completion of M.Sc.Zoology Degree Programme, the graduates will be able to: |
| PLO 1 | Disciplinary Knowledge Acquire in-depth scientific knowledge in the core areas of study. |
| PLO 2 | Creative Thinking and Practical Skills / Problem Solving Skills <ul style="list-style-type: none"> • Enrich skills of observation to draw logical inferences from scientific experiments/ programming and skills of creative thinking to develop novel ideas. • Hone problem solving skills in theoretical, experimental and computational areas and to apply them in real life situations. |
| PLO 3 | Sense of inquiry and Skilled Communicator / Research, Innovation and Entrepreneurship <ul style="list-style-type: none"> • Develop the capability for raising appropriate questions relating to the current/emerging issues encountered in the scientific field and to plan, execute and express the results of experiments / investigations through technical writings as well as through oral presentations. • Design innovations for exploring the unexplored areas in diverse fields to accomplish socially relevant and economically beneficial innovative research projects. • Become a skilled entrepreneur for launching start-up / business ventures to improve the economy of the nation. |
| PLO 4 | Ethical Awareness / Team Work / Environmental Conservation and Sustainability <ul style="list-style-type: none"> • Equip them for conducting work as an individual / as a member, or as a leader in diverse teams upholding values such as honesty and precision, and thus preventing unethical behaviors such as fabrication, falsification, misrepresentation of data, plagiarism etc., to ensure academic integrity. • Realise that environment and humans are dependent on one another and to know about the responsible management of our ecosystem for survival, and for the well-being of the future generation as well. |
| PLO 5 | Digital Literacy/Self-Directed Learning/Usage of ICT/Lifelong Learning <ul style="list-style-type: none"> • Get access to digital resources, to use them judiciously for updation of knowledge and also to engage in remote/independent learning. • Inculcate the habit of learning continuously through the effective adoption of ICT to update knowledge in the emerging areas in Sciences for inventions/discoveries so that the knowledge transferred from laboratory to land would yield fruitful results for the betterment of global society. |

PROGRAMME SPECIFIC OUTCOMES (PSO)

| PSO.NO. | Upon completion of M.Sc. Zoology Degree Programme, the graduates will be able to: | PLOs Matched |
|----------------|---|--------------|
| PSO - 1 | Understand the basic concepts in Invertebrates, Chordates and their morphological features, adaptations and classifications, Cell Biology, Biochemistry, Developmental Biology, Genetics, Evolution, Microbiology, Immunology, Research Methodology, Statistics, Physiology, Bioinformatics, Taxonomy, and Ecology. | 1, 5 |
| PSO – 2 | Acquire the practical skills in the fields of Biotechnology, Entomology, Immunology, Fisheries and Aquaculture and Bioinformatics to solve real-time problems. | 1,2,3 |
| PSO – 3 | Generate innovative ideas for performing experiments and researches in the areas of Biological Sciences, Aquaculture, Apiculture, Vermiculture, Mushroom Culture, Sericulture, Ornamental Fish Culture and Poultry and Dairy Science by developing the required skills for generating a source of income to become entrepreneurs. | 2,3,4 |
| PSO – 4 | Analyze the relationships among plants, animals, microbes and deal with the local, national and global environmental issues on matters of sustainability by realizing the responsibilities, ethical values and concern of an individual and society as a whole. | 1,4 |
| PSO – 5 | Develop experimental procedures, tools and techniques to deliver relevant applications in the fields of Biostatistics, Biotechnology and Bioinformatics through self-directed learning with effective adaptation of ICT. | 1,2,5 |

SEMESTER I

| | |
|---------------------|---|
| Course Title | Biology of Invertebrates and Chordates |
| Total Hours | 90/Semester |
| Hours/Week | 5 |
| Subject Code | 21PCZO11 |
| Course Type | DSC |
| Credits | 4 |
| Marks | 100 |

GENERAL OBJECTIVE:

To comprehend the functional morphology, mode of life including the affinities of invertebrates and chordates.

COURSE OBJECTIVES: The learners will be able to:

| CONo | Course Objectives |
|-------------|---|
| CO-1 | Understand the functional morphology of Protozoa, Porifera, Coelenterata and Ctenophora |
| CO-2 | Illustrate the functional morphology, adaptation of Platyhelminthes, Aschelminthes and Annelida. |
| CO-3 | Explain the special morphological features and physiological functions of Arthropoda, Mollusca and Echinodermata. |
| CO-4 | Classify the origin, evolution and functional morphology of Protochordates, Fish and Amphibia. |
| CO-5 | Compile the origin, evolution and functional morphology of Reptiles and Birds. |

Unit I: Protozoa, Porifera, Coelenterata And Ctenophora

Phylogeny of Invertebrates: **Protozoa**-Respiration – locomotion – nutrition-reproduction, Phylogenetic origin and evolution of **Metazoa**; **Porifera**-Cellular organization-skeleton-reproduction; **Coelenterata and Ctenophora**-Polymorphism-colony formation-Corals- polyp, skeleton, types of corals-General organization and affinities of Ctenophora.

Unit II: Platyhelminthes, Aschelminthes and Annelida

Platyhelminthes and Aschelminthes (*Fasciola hepatica* and *Ascaris lumbricoides*)- Nutrition and reproduction- Morphological and physiological adaptations- Larval stages of Trematodes and Cestodes, **Annelida**- Archiannelida, morphological features, filter feeding- Adaptive radiation in Polychaetes- coelom and metamerism.

Unit III: Arthropoda, Mollusca and Echinodermata

Arthropoda-Larval forms of Crustacea- Parasitism in Crustacea-respiration in Arthropods; **Mollusca**-(*Pila* - respiratory and nervous system)- foot in Mollusca, and torsion and detorsion in Gastropods,

Echinodermata- Phylogeny and evolution – (*Asterias* coelom -nervous system- larval forms)

Unit IV: Protochordates, Fish and Amphibia

General organization and affinities of **Protochordates**- Origin of Chordates and Tetrapods **Fish and Amphibia** - integument in Fish(*Labeo rohita*)and Amphibia(*Rana tigrina*)- digestive system in Fish(*Labeo rohita*) and Amphibia(*Rana tigrina*)-circulation in Fish(*Labeo rohita*) and Amphibia(*Rana tigrina*)- respiratory system in Fish(*Labeo rohita*) and Amphibia(*Rana tigrina*)- urinogenital system in Fish(*Labeo rohita*) and Amphibia(*Rana tigrina*).

Unit V: Reptiles, Birds and Mammals

Origin and evolution of Reptiles- origin of Birds-origin of Mammals, circulation in Reptiles(*Calotes versicolor*), Birds(*Columba livia*) and Mammals(*Oryctolagus cuniculus*)- respiration in Reptiles(*Calotes versicolor*), Birds (*Columba livia*)and Mammals(*Oryctolagus cuniculus*)-urino-genital system in Reptiles(*Calotes versicolor*), Birds(*Columba livia*) and Mammals(*Oryctolagus cuniculus*).

Text books:

1. Kotpal R.L (2019) Modern Text Book of Zoology, Invertebrates (12th Edition). RastogiPublications,Meerut.
2. Kotpal RL (2019) Modern Text Book of Zoology Vertebrates. 12th Edition, Rastogi Publications, Meerut.

Reference Books:

1. Jordan EL and PS Verma (2006) Invertebrate Zoology, S. Chand & Co Ltd, New Delhi.
2. Agarwal VK (2000) Invertebrate Zoology, 1st Edition, S. Chand and Co, Ltd. New Delhi. 2661
3. R.S.K. Barnes, P. Calow, P.J.W. Olive, D.W. Golding & J.J. Spicer (2013). The Invertebrates A Synthesis. 3rd Edition. John Wiles & Sons Inc., Hoboken. New Jersey, New Delhi.
4. Jan A. Dechenik. Biology of Invertebrates 7th Edition. (2015). Published by Mc Graw Hill Education (India) Private Limited.
5. F. Harvey Pough, Christine M. Janis, John B. Heiser (2012), Vertebrate Life (9th Edition) Pearson Publisher
6. EkambaranathaAyyar, M. and Ananthakrishnan, T.N. (2003). A Manual of Zoology, Part-II (Chordata), Viswanathan Printers and Publishers, Chennai
7. Jordan, E.L. and Verma, P.S. (2013). Chordate Zoology. 14th Edition, S. Chand & Company, New Delhi.

Course Outcome

| CONo | Course Outcome | PSO's addressed | Cognitive Level |
|------|---|-----------------|-----------------|
| CO-1 | Identify the Phylogenetic origin and evolution of Protozoa, Porifera, Coelenterata and Ctenophora. | 1 | Understanding |
| CO-2 | Explain the Nutrition and reproduction, Morphological and physiological adaptations of Platyhelminthes and Aschelminthes. | 1,2 | Applying |
| CO-3 | Analyze the Anatomy and Physiology of Arthropoda, Mollusca and Echinodermata | 1,3 | Analyzing |
| CO-4 | Distinguish between the digestive, respiratory and urinogenital systems of Fish and Amphibia. | 1,4 | Evaluating |
| CO-5 | Justify the circulatory, respiratory and reproductive system of Reptiles, Birds and mammals. | 1,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | Hours | Credit | | | | | | |
|--|------------------------------------|--|-------|--------|-------|------------------------------------|-------|-------|-------|-------|
| I | 21PCZO11 | Biology of Invertebrates and Chordates | 75 | 4 | | | | | | |
| Course Outcomes (COS) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| CO-3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ |
| Number of matches (✓) = 34 Relationship = Low/Medium/ High | | | | | | | | | | |

Prepared by

Dr.A.Mohaideen

Name and Signature

Checked by

Head of the Department

SEMESTER-I

| | |
|---------------------|---------------------|
| Course Title | Biochemistry |
| Total Hrs | 75 |
| Hrs / Week | 5 |
| Sub. Code | 21PCZO12 |
| Course Type | Core II |
| Credits | 4 |
| Marks | 100 |

General objective:

To impart knowledge on metabolism of biomolecules and to understand the classification, structure and function of carbohydrate and lipids.

Course objectives: The learners will be able to:

| CO. No | Course Objectives |
|---------------|---|
| CO -1 | Describe the structure of atoms and chemical bonds. |
| CO -2 | Explain the primary role of carbohydrates in the body and their properties and functions. |
| CO -3 | Compare the key differences between Acidosis and alkalosis. |
| CO -4 | Evaluate the structures, functions and properties of proteins. |
| CO -5 | Develop the structure and the key biological functions of lipids. |

UNIT I: Structure of Atom and Bioenergetics

Structure of an atom and molecule - chemical bonds, covalent bonds – characteristic geometries, non-covalent bonds, properties of hydrogen bonds, Vander Waals interaction - pH and acid base balance, Henderson – Hasselbach equation, metabolic acidosis and alkaloids, chemical equilibrium and biological fluids, Bioenergetics and thermodynamics - oxidation and reduction reaction - redox potential.

UNIT II: Carbohydrates

Structure, classification -mono and polysaccharides- properties and functions – Metabolism of carbohydrates – Glycolysis, Citric acid cycle - oxidative phosphorylation - electron transport system - Glycogenesis, Glycogenolysis and Gluconeogenesis. Hexose Mono Phosphate Shunt.

UNIT III: Proteins

Amino acid – Structure, classification, properties - Physical and chemical properties and functions- Metabolism of individual amino acids - phenylalanine tyrosine and tryptophan – Kynurenine and serotonin pathway –transamination and deamination. Metabolism of ribonucleotides -Biosynthesis and degradation of purines and pyrimidines - Protein – Hierarchical structure, properties (folding, modification, degradation), Classification –simple, conjugated and derived proteins and functions.

UNIT IV: Lipids

Lipid - structure, Classification – simple, compound and derived lipids - properties and functions - Biosynthesis of fatty acids and Acylglycerol - phospholipids - metabolism of fatty acids – β oxidations, ketogenesis and Cholesterol.

UNIT V: Enzymes, Vitamins and Hormones

Enzymes – nomenclature, classification and functions, Enzyme kinetics – Michael's Menten equation, Coenzymes – activators and inhibitors, Vitamins – composition, structure and functions - Hormones – classification and functions.

Textbooks

1. Amita Saxena. 2006, Text book of Biochemistry Discovery Publishing House, New Delhi – 110002.
2. U.Satyanarayana, Biochemistry. 2017. Books & Allied (P) LTD-Kolkata. ISBN: 9788131248850

Reference Books

1. A.Shanumugam, 2005. Fundamentals of biochemistry for Medical students. Navabharat Printers and Traders, Madras-86.
2. Stryer, L., W. H., 2005. Biochemistry. Freeman and Company, San Francisco.
3. Lehninger, A. L., 2006. Principles of biochemistry. CBS Publishers and Distributors, New Delhi-32.
4. Kuchel P. W. and G. B. Ralston, 2003. Schaum's outlines of biochemistry (2nd edition). Tata McGraw-Hill Edition.
5. Jeremy M. Berg and John L. Tymoczko, Lubert Stryer 2015, Biochemistry W. H. Freeman, 7th edition.

Course outcomes

| CO.NO | COURSE OUTCOMES | PSO's addressed | COGNITIVE LEVEL |
|-------|--|-----------------|-----------------|
| CO-1 | Enumerate the bioenergetics thermodynamics law and redox potential. | 1,2,3 | Remembering |
| CO-2 | Differentiate and explain the processes of glycogenesis with the pathway of the citric acid cycle. | 1,2,3 | Understanding |
| CO-3 | Interpret the factors that are to be involved in the control of carbohydrate metabolism of glycogenolysis and gluconeogenesis. | 1,2,3 | Applying |
| CO-4 | Explain the metabolism of individual amino acids, purine metabolism and pyrimidine metabolism. | 1,3,4 | Analyzing |
| CO-5 | Assess the different lipid metabolism of β oxidation, ketogenesis and cholesterol. | 1, 3, 5 | Evaluating |

Relationship Matrix

| Semester | Course Code | Title of the Course | Hours | Credit | | | | | | |
|--|------------------------------------|---------------------|-------|--------|-------|------------------------------------|-------|--------------------------------------|-------|-------|
| I | 21PCZO12 | BIOCHEMISTRY | 75 | 4 | | | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | |
| CO-2 | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | |
| CO-3 | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | |
| CO-4 | ✓ | ✓ | ✓ | | | ✓ | | ✓ | ✓ | |
| CO-5 | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | ✓ |
| Number of matches (✓) = ...31.... Relationship = Low/ Medium /High | | | | | | | | | | |
| Prepared by Dr. J. Shifa Vanmathi Name and Signature | | | | | | | | Checked by Head of the Department | | |

SEMESTER - I

| | |
|---------------------|-----------------------------------|
| Course Title | Cell and Molecular Biology |
| Total Hrs | 75 |
| Hrs / Week | 5 |
| Sub. Code | 21PCZO13 |
| Course Type | DSC |
| Credits | 4 |
| Marks | 100 |

General objective:

To understand the fundamental unit of life with specific insight into the organization of prokaryotes and eukaryotes.

Course objectives: The learners will be able to:

| CO. No | Course Objectives |
|---------------|---|
| CO -1 | Differentiate the division between the prokaryotic and eukaryotic organism. |
| CO -2 | Describe the structure and the functions of mitochondria. |
| CO -3 | Explain the composition and the structure of Deoxyribonucleic acids. |
| CO -4 | Compare the mechanics of transcription, translation and termination of plasmid replication. |
| CO -5 | Justify on the role of apoptosis and its significance. |

UNIT I: Structure and Function of Cell Organelles

Structure and function of Eukaryotes and Prokaryotes –. Structure and function of plasma membrane – models, membrane transport - structure and function of lysosomes, Golgi bodies and mitochondria .

UNIT II: Ribosomes and Protein Synthesis

Ribosome – Types and biogenesis of ribosomes - membrane protein and secretory protein – Protein synthesis –mechanism, protein targeting, domains, Motif and Folds - Endoplasmic reticulum - insertion in to Endoplasmic reticulum membrane. Post transitional modifications of proteins both in the RER and SER - Protein glycosylation in endoplasmic reticulum.

UNIT III: Nucleic Acids

Nucleic acids – DNA – structure and functions – DNA replication – unit of replication, enzymes involved, replication origin and replication fork, plasmid replication (Initiation, translation, elongation and termination). RNA – structure, types, RNA polymerases - RNA predated, editing and transport - Reverse transcription- structure and function of reverse transcriptase - DNA repair mechanism.

UNIT IV: Gene Expression

Structure of chromatin and chromosomes - heterochromatin - euchromatin and transposons - Regulatory mechanism of gene expression in eukaryotes - regulation at transcriptional and translational levels - Control of regulatory mechanism of gene expression in prokaryotic organism - Operon concept, *lac* operon, *ara* operon and *trp* operon.

UNIT V: Cancer and Apoptosis

Characteristics of cancer cells - Oncogenes and antioncogenes - P53 gene, cancer cell cycle, Distinction between cancer cells and normal cells, Molecular designing of cancer treatment - Biology of aging and senescence – Significance of apoptosis – apoptosis in *Coenorhabditis elegans* and mammals.

Textbooks :

1. C.B.Powar, 2017. Cell biology, Himalaya publishing house pvt.ltd, Mumbai.
2. P.S.Verma and Agarwal, 2013, Cell biology, Genetics, Molecular biology, Evolution and Ecology.

Reference Books:

1. Ajay paul, 2007. Text book of Cell and Molecular Biology.
2. Rastogi, S.C. 2006 Cell and Molecular Biology 2nd Edition. New Age International Publishers, New Delhi.
3. Gerald Karp, Janet Iwasa, Wallace Marshall. 2016, Cell and Molecular Biology. Concepts and Experiments, John Wiley and Sons, Inc., New York.
4. Gerald Karp, Janet Iwasa, Wallace Marshall, 2015, Karp's Cell and Molecular Biology, 8th Edition, John Wiley and Sons, Inc., New York
5. Harvey Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell. 2000, Molecular Cell Biology, 4th edition New York: W. H. Freeman; 2000.

Course Outcomes

| CO.No | Course Outcomes | PSO's addressed | Cognitive Level |
|-------|--|-----------------|-----------------|
| CO-1 | Summarize on the structure and functions of cell organelles. | 1,2,3 | Understanding |
| CO-2 | Examine the post transitional modifications and protein glycosylation in cytoskeleton of the cell. | 1,2,3 | Applying |
| CO-3 | Classify the major role played by the replication enzymes and replication fork. | 1,3 | Analyzing |
| CO-4 | Discriminate the types of RNA and their structure. | 1,2,3,4 | Evaluating |
| CO-5 | Develop the factors associated with the detail of cancer cell cycle and treatment for cancer. | 1,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | |
|---|---|----------------------------|-------|-------|-------|------------------------------------|-------|--------|-------|--------------------------------------|
| I | 21PCZO13 | CELL AND MOLECULAR BIOLOGY | | | | | 75 | 4 | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| CO-2 | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | |
| CO-3 | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | |
| CO-4 | ✓ | ✓ | | | | ✓ | ✓ | ✓ | ✓ | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ |
| | Number of matches (✓) = ...33.... Relationship = Low/ Medium /High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33) | | | | | | | | | |
| Prepared by Dr. J. Shifa Vanmathi Name and Signature | | | | | | | | | | Checked by Head of the Department |

SEMESTER -I

| | |
|---------------------|-------------------|
| COURSE TITLE | APICULTURE |
| TOTAL HOURS | 60 |
| HOURS/WEEK | 4 |
| SUBJECT CODE | 21PEZO11A |
| COURSE TYPE | DSE |
| CREDITS | 4 |
| MARKS | 100 |

GENERAL OBJECTIVE:

To inculcate the innovative techniques in rearing of honeybee and to develop entrepreneurial skill among students.

COURSE OBJECTIVES: The learners will be able to:

| CO.NO. | COURSE OBJECTIVES |
|---------------|---|
| CO-1 | Understand the different types of bees and their morphology. |
| CO-2 | Develop the techniques in the process of rearing honey bees. |
| CO-3 | Categorize the various byproducts of honey bees and its uses. |
| CO-4 | Classify the various diseases and enemies in a bee colony. |
| CO-5 | Discuss on the importance of the queen bee in a colony. |

UNIT I: MORPHOLOGY AND ANATOMY OF HONEY BEE

Definition, scope, honey bee- classification of bees- rock bee, Indian bee, little bee and dammer bee – their identification and habits – choice of species in apiculture. Bee colony – distinctive features and identification of queen, drones and workers, functions of the members. - Anatomy and organ system of honey bee. - Development of honey bee – egg, larva and pupa – time taken for the development of queen, drone and worker, life history of *Apis cerana indica*.

UNIT II: TECHNIQUES OF REARING AND BEE KEEPING EQUIPMENT

Apiculture techniques, arranging an apiary position – space, acquiring bees – care of newly captured colonies – handling the bees; bee keeping – primitive methods – modern methods; The bee hive– different kinds of cells – burr comb - different types of hives – artificial hives and their advantages – parts of artificial hive – other appliances used in apiaries.

UNIT III: BY PRODUCTS OF HONEY BEE

Honey bee products - honey – extraction of honey – preservation and storage of honey – properties, chemical composition, nutritive value, medicinal values – honey as daily food; Bee wax – production – method of extraction – characteristics and uses; Bee venom – methods of extraction of venom – composition of venom – curative value.

UNIT IV: FAMILIARIZATION WITH DISEASES AND ENEMIES OF BEES

Enemies of bees – greater wax moth, lesser wax moth, ants, wasps, lice, beetles and birds and their control. Diseases of bees: adult and brood diseases – prevention and control measures.

UNIT V: QUEEN BEE REARING AND MISCELLANEOUS MANAGEMENT

Queen rearing and introduction - Supersedure - foraging - swarming – prevention and control; robbing and fighting – prevention and control; uniting stocks – different methods - inter- relationship of plants and bees.

TEXT BOOKS

1. Gupta, J.K., Belavadi V.V. and Sh. Mohinder Singh. 2016. Apiculture ICAR Book.
2. Belsare D.K., Rakesh Kumar Singh, Shashikala and RavindraAliaiRaviraj, 2019. Text Book of Apiculture, Indian Books and Periodicals ISBN: 9789352991983.

REFERENCE BOOKS

1. Gupta, J.K., Sharma, H K and Thakur, R K.2009. Practical Manual on Beekeeping. Department of Entomology and Apiculture, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan, p 83.
2. Gupta, J K.2010. Spring Management of honey bee colonies. In “OAPI-012 Management of honey bee colonies; Seasonal and specific management (Block 2), Indira Gandhi National open university, School of Agriculture, New Delhi, UNIT-I, pp 5-14, p 105.
3. Gatoria, G.S., Gupta, J. K., Thakur, R.K. and Singh, J.2011. Mass queen bee rearing and multiplication of honey bee colonies. All India Co-ordinated project on honey bees and pollinators, ICAR, HAU, Hisar, p70.
4. Diana, S. 2011. The Bee keepers hand book. Comstock publishing.

Course Outcomes

| CO. NO. | COURSE OUTCOMES | PSO's addressed | COGNITIVE LEVEL |
|---------|--|-----------------|-----------------|
| CO-1 | Understand the morphology and anatomy of honey bees. | 1,2 | Understanding |
| CO-2 | Examine the various bee keeping equipment. | 1,3 | Applying |
| CO-3 | Analyze the various by products of honey bees. | 3,4 | Analyzing |
| CO-4 | Evaluate on the various diseases and enemies of bees. | 3,4 | Evaluating |
| CO-5 | Develop the skill of uniting different stocks and analyse the inter relationship of plants and bees. | 2,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | | | |
|--|------------------------------------|---------------------|-------|-------|-------|------------------------------------|-------|--------|-------|-------|--|--|
| I | 21PEZO11A | APICULTURE | | | | | 60 | 4 | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | | |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | | |
| CO-3 | ✓ | | | | ✓ | | | ✓ | ✓ | | | |
| CO-4 | | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ | | |
| Number of matches (✓) = ...30.... Relationship = Low/ Medium /High | | | | | | | | | | | | |

Prepared by
Dr. M.I. Delighta Mano Joyce
 Name and Signature

Checked by

 Head of the Department

SEMESTER -I

| | |
|---------------------|---|
| COURSE TITLE | SYSTEMATICS AND ANIMAL DIVERSITY |
| TOTAL HOURS | 60 |
| HOURS/WEEK | 4 |
| SUBJECT CODE | 21PEZO11B |
| COURSE TYPE | DSE – 1B |
| CREDITS | 4 |
| MARKS | 100 |

GENERAL OBJECTIVE:

- ❖ To build on the concepts of biodiversity and to enlighten the taxonomic classification of animals.

COURSE OBJECTIVES: The learners will be able to:

| CO.NO. | COURSE OBJECTIVES |
|--------|---|
| CO-1 | Understand the concepts of biosystematics and its importance. |
| CO-2 | Develop the methods of collection and preservation techniques in taxonomy. |
| CO-3 | Analyze the application of the important rules of zoological nomenclature. |
| CO-4 | Compare the various structures and functions of eco systems in India. |
| CO-5 | Create knowledge on the importance of diversity of the marine and mangrove eco systems. |

UNIT I: INTRODUCTION TO SYSTEMATICS

Concept of biosystematics, terms used in systematic biology, importance of taxonomy, stages in taxonomy – morphological, embryological, cytological, biochemical and differential systematics, **tasks of taxonomists.**

UNIT II: TAXONOMIC COLLECTION, PRESERVATION AND IDENTIFICATION

Taxonomic Collection – scope of collection, collection methods, preservation of data, curating, storing and cataloging, methods of identification, description of taxonomic characters, taxonomic keys, taxonomic publication.

UNIT III: CLASSIFICATION AND APPLICATION OF ZOOLOGICAL NOMENCLATURE

Classification –components and types of classification, Linnaean hierarchy, Species concepts, Kinds of species, Origin of code, International rules of nomenclature, ICZN, Zoological records, **digitization of taxonomic data.**

UNIT IV: BIODIVERSITY – TERRESTRIAL AND FRESHWATER ECOSYSTEMS

Concepts on biodiversity, Species and genetic diversity-ecosystem of India–Wetlands, reserve forests, rain forests and desert plains in India and their faunal resources, animals of

lotic and lentic ecosystems, threats to wetlands and conservation, **Biotechnological tools for conservation of biodiversity.**

UNIT V: DIVERSITY OF MARINE AND MANGROVE ECOSYSTEMS

Coastal, coral reef, mangrove, sea grass and seaweed ecosystems and their faunal resources, threats to marine biodiversity, animals of lagoons and estuaries; Pelagic and benthic animals of the sea, marine productivity.

TEXT BOOKS

1. Larry S.Roberts, Cleve land P., Hickman, David J.Eisenhour, Allan L and Susan L. Keen. 2014. Animal Diversity. Dewey Edition. Mc Graw Hill Education.
2. Narendran T.C. 2009. An introduction to taxonomy. AICOPTAX, Zoological Survey of India, Kolkata, India. ISBN: 9788181712189.

REFERENCE BOOKS

1. Agarwal and M.U.Gupta, 2004. Animal Taxonomy, S.Chand, New Delhi. 86pp.
2. John Milton M C, 2008.(Ed) Training Manual on GIS and Marine Biodiversity, 320pp.
3. Kapoor V.C.1998.Theory and practice of animal taxonomy, Oxford and IBH, New Delhi, 247pp;
4. Singh B.K 2004.Biodiversity:Conservation and Management, Mangal Deep Publication, 586pp.

Course Outcomes

| CO. NO. | COURSE OUTCOMES | PSOs Addressed | COGNITIVE LEVEL |
|----------------|---|-----------------------|------------------------|
| CO-1 | Compare the stages in taxonomy and the importance of taxonomy. | 1,4 | Understanding |
| CO-2 | Implement the taxonomic method of identifying an organism to its species level. | 1,4 | Applying |
| CO-3 | Distinguish the various kinds of species. | 2,3 | Analyzing |
| CO-4 | Assess the different types of ecosystems in India. | 3,4 | Evaluating |
| CO-5 | Create the patterns involved in marine productivity. | 4,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | Hours | Credit | | | | | | |
|-----------------------|--|---|-----------|----------|-------|------------------------------------|-------|-------|-------|-------|
| I | 21PEZO11B | SYSTEMATICS AND ANIMAL DIVERSITY | 60 | 4 | | | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | |
| CO-3 | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | |
| CO-5 | | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ |
| | Number of matches (✓) = ...32.... Relationship = Low/ Medium /High | | | | | | | | | |

Prepared by
Dr. M.I. Delighta Mano Joyce
 Name and Signature

Checked by
 Head of the Department

Semester – I

| | |
|---------------------|----------------------|
| COURSE TITLE | ENDOCRINOLOGY |
| TOTAL HOURS | 60 / Semester |
| HOURS/WEEK | 4 |
| SUBJECT CODE | 21PEZO11C |
| COURSE TYPE | DSE – I C |
| CREDITS | 4 |
| MARKS | 100 |

GENERAL OBJECTIVE

To make the students to learn the objectives and scope of comparative endocrinology, anatomy, morphology and histology of endocrine tissues of vertebrates, crustacean and insect endocrine organs and their functions.

COURSE OBJECTIVES: The learner will be able to

| CO.NO. | COURSE OBJECTIVES |
|--------|---|
| CO-1 | Understand the endocrine system and the mechanism of hormone action |
| CO-2 | Explain the structure of Pituitary and Thyroid glands |
| CO-3 | Enumerate the Pancreatic hormones and their functions |
| CO-4 | Explain the Reproductive Endocrinology |
| CO-5 | Illustrate the Neuroendocrineendocrine systems in crustaceans |

UNIT I INTRODUCTION TO ENDOCRINOLOGY

Introduction, objectives and scope of endocrinology - endocrine glands in crustaceans (prawn), insects (silkmoth) and vertebrates (kangaroo) - Mechanism of hormone action- - Cell surface receptors and intracellular signalling - general classes of chemical messengers.

UNIT II INSECTS AND CRUSTACEAN ENDOCRINOLOGY

Neuroendocrine systems in crustaceans – endocrine control of moulting and metamorphosis-Neuroendocrine system in insects-endocrine control of moulting – metamorphosis and reproduction.

UNIT III PITUITARY AND THYROID GLANDS

Adenohypophyseal and Neurohypophyseal hormones in human- Hypothalamic control of hypophyseal hormones- Structure and endocrinology of Pituitary- Phylogeny,

structure and functioning of Thyroid gland-Endocrinology of Parathyroid and Calcium regulation in body.

UNIT IV PANCREAS AND ADRENAL GLANDS

Structure of human pancreas-Pancreatic hormones and their functions- Structural organizations of adrenal gland - Functions of cortical and medullary hormones - Hormones in homeostasis; Disorders of endocrine glands.

UNIT V REPRODUCTIVE ENDOCRINOLOGY

Structure of mammalian testis and ovary - male and female sex accessory organs - hormones of testis and ovary - estrous and menstrual cycle – hormones of pregnancy - parturition - hormonal control of lactation.

REFERENCE BOOKS

1. Goswami, M.P. (2013). Endocrinology and Molecular Cell Biology. Delhi: Gaurav book centre Pvt Ltd. Griffing, G & Padilla, M. (Eds.). (2015).
2. Endocrinology: Specialty Review and Self- Assessment, Stat Pearls Publishing, (3rd ed.). USA: Stat Pearls Publishing LLC. Melmed, S., Polonsky, K., Larsen, R.P., Kronenberg, H. (2015).
3. Williams Textbook of Endocrinology, (13th ed.): Elsevier Nussey, S. & Whitehead, S. (2001).
4. Endocrinology - An Integrated Approach. Oxford: BIOS Scientific Publishers. Victor W. Rodwell., David A. Bender., Kathkeen, M., Kennelly, P., Antony, Weil. (2018). Harper's Illustrated Biochemistry (31th ed.): McGraw Education. Williams, R. H. (2011).
5. Textbook of Endocrinology, (12th ed.): Elsevier. Yadav, P. R. (2009). Textbook of Endocrinology. New Delhi: Sonali Publications, Discovery Publishing House Pvt. Ltd.

Course Outcomes

| CO. NO. | COURSE OUTCOMES | PSO's addressed | COGNITIVE LEVEL |
|---------|--|-----------------|-----------------|
| CO-1 | Understand the endocrine glands in crustaceans, insects and vertebrates | 1 | Understanding |
| CO-2 | Describe the hypothalamic control of hypophyseal hormones | 1,3,4 | Applying |
| CO-3 | Compare the Structural organizations of adrenal gland and pancreatic gland | 1,4,5 | Analyzing |
| CO-4 | Discuss the role of hormones in pregnancy | 1,2,4,5 | Analyzing |
| CO-5 | Assess the Neuroendocrine system in insects | 1,4,5 | Evaluating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | | | |
|--|------------------------------------|---------------------|-------|-------|-------|------------------------------------|-------|--------|-------|-------|--|--|
| I | 21PEZO11C | ENDOCRINOLOGY | | | | | 60 | 4 | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | | |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | |
| CO-3 | ✓ | | | | ✓ | | | | ✓ | ✓ | | |
| CO-4 | | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | |
| Number of matches (✓) = ...32.... Relationship = Low/ Medium /High | | | | | | | | | | | | |

Prepared by
Dr. M.I. Delighta Mano Joyce
 Name and Signature

Checked by
 Head of the Department

SEMESTER – I

| | |
|---------------------|--|
| Course Title | Biology of Invertebrates and Chordates Practicals |
| Total Hours | 60/Semester |
| Hours/Week | 4 |
| Subject Code | 21PCZO1P1 |
| Course Type | Core Practical -I |
| Credits | 2 |
| Marks | 100/2 |

General Objective:

To comprehend the functional morphology of Invertebrates and Chordates.

Course Objectives: The learners will be able to:

| Co.No. | Course Objectives |
|---------------|---|
| CO-1 | Remember the anatomy of Earthworm. |
| CO-2 | Examine the anatomy of the Cockroach. |
| CO-3 | Explain the digestive system of the Pila. |
| CO-4 | Evaluate the Invertebrate and Vertebrate animals. |
| CO-5 | Explain the circulatory system of the frog. |

1. Dissection of Earthworm digestive system.
2. Dissection of Earthworm Reproductive system.
3. Dissection of Cockroach nervous system.
4. Dissection of Cockroach digestive system.
5. Virtual Dissection of Pila digestive system
6. Isolation of body setae of earthworm
7. Isolation of Prawn appendages
8. Isolation of placoid scales of Shark.
9. Virtual Dissection of Frog circulatory system (Venous system of frog).
10. Virtual Dissection of Rat urinogenital system.

Biology of Invertebrates and Chordates- Spotters

- 1) Euplectella, 2) Euspongia, 3) Fungia, 4) *Fasciola hepatica*, 5) Penaeus, 6) Bonellia, 7) Pila, 8) Chameleon, 9) Pigeon, 10) Bat.

Field study: Seashore visit and collection of animals and classify.

Course Outcomes

| CO. No. | Course Outcomes | PSO's addressed | Cognitive Level |
|---------|---|-----------------|-----------------|
| CO-1 | Examine the morphology and anatomy of earthworm. | 1,3 | Understanding |
| CO-2 | Identify the nervous and digestive system of the Cockroach. | 1,2 | Applying |
| CO-3 | Analyze and isolate the placoid scales of the Shark. | 1,2,3,4 | Analyzing |
| CO-4 | Explain the appendages of the Prawn. | 1,4,5 | Evaluating |
| CO-5 | Discuss the circulatory system of the Frog. | 1,2,3,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | |
|---|------------------------------------|---|-------|-------|-------|------------------------------------|-------|--------|-------|-------|
| I | 21PCZO1P1 | Biology of Invertebrates and Chordates Practicals | | | | | 60 | 2 | | |
| Course Outcomes (COS) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | | |
| CO-2 | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | |
| CO-3 | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | |
| CO-4 | ✓ | ✓ | | | | ✓ | | | ✓ | ✓ |
| CO-5 | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Number of matches (✓) = 31 Relationship = Low/ Medium /High | | | | | | | | | | |

Prepared by
Dr. A. Mohaideen
 Name and Signature

Checked by
 Head of the Department

SEMESTER - I

| | |
|---------------------|---|
| Course Title | Biochemistry & Cell and Molecular Biology Practicals |
| Total Hrs | 60 / Semester |
| Hrs / Week | 4 |
| Sub. Code | 21PCZO1P2 |
| Course Type | Core Practical - II |
| Credits | 2 |
| Marks | 100/2 |

General objective:

To impart knowledge on estimation methods and preparation of different types of cells

Course objectives: The learners will be able to:

| CO. No | Course Objectives |
|--------|---|
| CO -1 | Define the effect of Salivary amylase activity on enzyme concentration. |
| CO -2 | Examine the separation of amino acids by paper chromatography method. |
| CO -3 | Construct and observe squamous epithelial cells in human beings. |
| CO -4 | Explain the mitotic cell division in onion root tip. |
| CO -5 | Develop the columnar and ciliated epithelial cells. |

1. Effect of Salivary amylase activity on substrate concentration.
2. Effect of Salivary amylase activity in relation to enzyme concentration.
3. Separation of aminoacids by paper Chromatography method.
4. Quantitative estimation of Carbohydrate in tissue sample.
5. Quantitative estimation of protein in muscle.
6. Mounting and observation of mitotic stages of onion root tip.
7. Study of giant chromosomes in chironomous larva.
8. Preparation of squamous epithelial cells of human buccal cavity.
9. Preparation of blood smear (fish, human)
10. Observation of columnar and ciliated epithelial cells

Biochemistry spotters

- a) Spectrophotometer b) pH meter c) Paper Chromatography d) Centrifuge.

Cell and Molecular Biology spotters

- a) Oncogene b) Apoptosis c) Fine structure of Mitochondria d) Structure of DNA
e) Structure of mRNA, tRNA and rRNA

Course outcomes

| CO.No | Course Outcomes | PSOs Addressed | Cognitive level |
|-------|---|----------------|-----------------|
| CO-1 | Classify the salivary amylase activity in relation to enzyme concentration. | 1,2,3 | Understanding |
| CO-2 | Develop the quantitative estimation of the carbohydrates. | 2,4 | Applying |
| CO-3 | Examine the quantitative estimation of protein in muscles. | 2,3,4 | Analyzing |
| CO-4 | Assess the preparation of blood smear from the human blood. | 1,4 | Evaluating |
| CO-5 | Design the giant chromosome in chironomous larva. | 1,2,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | |
|--|------------------------------------|--|------|------|------|------------------------------------|-------|--------|-------|-------|
| I | 21PCZO1P2 | Biochemistry & Cell and Molecular Biology Practicals | | | | | 4 | 2 | | |
| Course Outcomes (COS) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO3 | PLO4 | PLO5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | | ✓ | | | ✓ | ✓ | ✓ | | |
| CO-2 | ✓ | | ✓ | | | | ✓ | | ✓ | |
| CO-3 | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | |
| CO-4 | ✓ | ✓ | | | | ✓ | | | ✓ | |
| CO-5 | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | |
| Number of matches (✓) = ...25.... Relationship = Low/ Medium /High | | | | | | | | | | |

Prepared by
Dr. J. Shifa Vanmathi
 Name and Signature

Checked by
 Head of the Department

SEMESTER - I

| | |
|---------------------|--------------------------------|
| Course Title | Ornamental Fish Culture |
| Total Hours | 30 |
| Hours/Week | 2 |
| Subject Code | 21PIZO11 |
| Course Type | IDC-I |
| Credits | 2 |
| Marks | 100 |

General Objective:

To understand the various aspects of Ornamental fish culture and to adopt and encourage the students become an entrepreneur.

Course Objectives: The learners will be able to:

| CO.No. | Course Objectives |
|---------------|---------------------------------------|
| CO-1 | Classify the popular ornamental fish. |
| CO-2 | Construct an Aquarium. |
| CO-3 | Categorize the fish feed. |
| CO-4 | Assess the breeding techniques. |
| CO-5 | Examine the various diseases. |

Unit I: Ornamental Fish Culture an Introduction

World trade of ornamental fish and export potential, different varieties of exotic and indigenous fish; Ornamental fisheries: A new dimensions in aquaculture entrepreneurship - popular ornamental fish- egg laying Fish-live bearing Fish.

Unit II: Construction of Aquarium

Design and construction of fish tanks- setting up of fish tanks-accessories for fish tanks – ornamental plants.

Unit III: Food and Feeding

Types of feed -natural feed and artificial feed-culture of live food organism – Infusorians, Zooplankton, Rotifers, Copepods, Cladocerans, Brine shrimp, Blood worm and Tubificid- preparation of artificial feed- feeding- balanced diets for aquarium fish.

Unit IV: Breeding of Aquarium Fish

Breeding of ornamental fish: live bearer species-Guppies, Mollies, Sword tail fish and Platy fish, egg layer species-Siamese fighter, Zebra danio, Gold fish, Koi carp and Neon tetra.

Unit V: Fish diseases and treatment, Transport of Fish

Protozoan diseases - Fungal diseases - Bacterial diseases -Viral diseases; transport of fish, oxygen packing, anaesthetics used in fish transport, methods of sedation.

Textbooks:

1. Jameson J.D. and Santhanam R, (1996) Manual of Ornamental fish and farming technologies, FCRI-Tuticorin.
2. Ahilan, B., Felix, N., Santham, R., (2008) A text book of Aquariculture,Daya Publishing House,India
3. M. S. Reddy. (2004), A Text Book of Aquaculture, Discovery Publishing Pvt.Ltd, New Delhi.

Reference Books:

1. Saxena, A. (2011) Fisheries Economics,Daya Publishing House,New Delhi
2. Zaidi, S.G.S (2002) Ornamental fish culture Manual,CIFE, Mumbai
3. Mahapatra, B.K., Dutta S., Pailan, G.H. (2015) Ornamental Fish Breeding, Culture and Trade Manual Kolkata Centre ICAR-Central Institute of Fisheries Education-Kolkata.
4. Dholakia A.D. (2010) Ornamental Fish culture and Aquarium Management,Daya Publishing House, New Delhi
5. Srivastava, C.B.L (2006) A textbook of fishery science and Indian fisheries,Kitab Mahal, New Delhi.

Course Outcome

| CO.No. | Course Outcome | PSO'S addressed | Cognitive Level |
|--------|--|-----------------|-----------------|
| CO-1 | Compare the different types of ornamental fish. | 1,2,3 | Understanding |
| CO-2 | Apply knowledge in setting up of fish tanks. | 1,2,3,4 | Applying |
| CO-3 | Differentiate the live feed and artificial feed preparation. | 1,2,4 | Analyzing |
| CO-4 | Evaluate the process of breeding ornamental fish. | 1,4 | Evaluating |
| CO-5 | Analyse the methods of sedation and Anaesthetics used in fish transport. | 1,3,4,5 | Analyzing |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | |
|-----------------------|---|--------------------------------|-------|-------|-------|------------------------------------|----------|----------|-------|-------|
| I | 21PIZO11 | ORNAMENTAL FISH CULTURE | | | | | 2 | 2 | | |
| Course Outcomes (COS) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | |
| CO-2 | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| CO-3 | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| | Number of matches (✓) =38 Relationship = Low/Medium/ High | | | | | | | | | |

Prepared by
Dr.A.Mohaideen
 Name and Signature

Checked by
 Head of the Department

SEMESTER II

| | |
|---------------------|------------------------------|
| Course Title | DEVELOPMENTAL BIOLOGY |
| Total Hrs | 75 |
| Hrs / Week | 5 |
| Sub. Code | 21PCZO21 |
| Course Type | CORE IV |
| Credits | 4 |
| Marks | 100 |

General objective:

- ❖ To acquire knowledge on gametogenesis and learn the role of hormones on metamorphological changes of organisms.

Course objectives: The learners will be able to:

| CO. No | Course Objectives |
|---------------|---|
| CO -1 | Explain the structure of sperm and eggs. |
| CO -2 | Construct the cleavage patterns and cleavage rules. |
| CO -3 | Analyze the process of organogenesis. |
| CO -4 | Evaluate the types and physiology of placenta. |
| CO -5 | Construct Induced ovulation in humans. |

UNIT I: GAMETOGENESIS AND FERTILIZATION

Gametogenesis: Spermatogenesis – morphology and types of spermatozoan, process of spermatogenesis; oogenesis: structure of egg and types of eggs and egg membranes; Process of oogenesis- vitellogenesis- organization and polarity of eggs; Fertilization: mechanism of fertilization, significance of fertilization; Parthenogenesis – types and significance of parthenogenesis.

UNIT II: CLEAVAGE AND FATE MAPS

Cleavage: characteristics, plane of cleavage, patterns of yolk on cleavage, laws of cleavage and physiology of cleavage; germ layers: cell lineage study- methods and outcome of cell lineage; Cleavage in Amphioxus, Frog, Chick and Man; Fate maps –construction of fate map, fate maps of Frog, Chick, Ascidian and Man.

UNIT III: GASTRULATION AND ORGANOGENESIS

Gastrulation: morphogenetic movements, gastrulation in Amphioxus, Frog, Chick and Mammal; Organogenesis: Development of brain and heart in Chick, development of brain in Frog; gradient theory, cellular differentiation and nuclear transplantation; Teratogenesis-genetic and environmental teratogenesis.

UNIT IV: PLACENTATION AND METAMORPHOSIS

Development, types and physiology of extra embryonic membrane; Placenta- types, morphological classification and functions of placenta, post embryonic development; Organizer: Concept, inductive tissue interactions – Spemann's classical experiment; Metamorphosis – types of metamorphosis in Amphibians and Insects - hormonal regulation of metamorphosis; Regeneration – patterns and mechanism of regeneration in Planaria and Amphibian- Wolffian regeneration.

UNIT V: ADVANCED MODERN TECHNIQUES

Induced ovulation in humans- multiple ovulation and embryo transfer in cattle- embryo splitting – invitro fertilization – Gamete Intra Fallopian Transfer techniques - cryopreservation of gametes - prenatal diagnosis, human cloning and its ethical implications, embryo transfer - Artificial insemination in human and cattle.

TEXTBOOKS

1. Scott F.Gilbert and Susan R. Singer 2011. Developmental Biology Vol. 1 Inc. Publishers, The University of Michigan.
2. Subramanian, M.A. 2011. Developmental Biology Oscar Publications, India

REFERENCE BOOKS

1. Arora, M.P., 2007. Embryology, Himalaya Publishing House, Ramdrot, Dr.Balerao Mass, Gurgaon - Mumbai.
2. Verma, P.S. and Agarwal, V.K.,2014. Chordate embryology, S Chand and Company Limited, New Delhi.
3. Subramoniam, T., 2013. Molecular Developmental Biology, Narosa Publishing House Private Limited, Chennai.
4. Gilbert, S.F. 2011. Developmental Biology, Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
5. Balinsky, B.I. 2012. Introduction to Embryology, Holt Saunders International, (5th Edn),Philadelphia.
6. Todd Strelman, J. 2013. Advances in Evolutionary Developmental Biology. Wiley Blackwell Publishers

Course outcomes

| CO.NO | COURSE OUTCOMES | PSOs Addressed | COGNITIVE LEVEL |
|-------|---|----------------|-----------------|
| CO-1 | Summarize the spermatogenesis, Oogenesis and fertilization mechanism. | 1,2 | Understanding |
| CO-2 | Construct the cleavage and fate map in frog, chick and man. | 1,2,3 | Applying |
| CO-3 | Compare the different concepts of parthenogenesis and teratogenesis. | 1,4 | Analyzing |
| CO-4 | Explain the different types of metamorphosis. | 1,4 | Evaluating |
| CO-5 | Discuss the various methods for artificial insemination in humans and cattle. | 4,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | |
|--|------------------------------------|-----------------------|-------|-------|-------|------------------------------------|-------|--------|-------|-------|
| I | 21PCZO21 | DEVELOPMENTAL BIOLOGY | | | | | 75 | 4 | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | |
| CO-2 | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | |
| CO-3 | ✓ | ✓ | ✓ | | | ✓ | | | ✓ | |
| CO-4 | ✓ | ✓ | ✓ | | | ✓ | | | ✓ | |
| CO-5 | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ |
| Number of matches (✓) = ...27.... Relationship = Low/Medium/High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33) | | | | | | | | | | |

Prepared by
Dr. J. Shifa Vanmathi
 Name and Signature

Checked by
 Head of the Department

SEMESTER - II

| | |
|---------------------|-------------------------------|
| Course Title | Genetics and Evolution |
| Total Hours | 75 |
| Hours/Week | 5 |
| Subject Code | 21PCZO22 |
| Course Type | Core V |
| Credits | 4 |
| Marks | 100 |

General Objective:

To facilitate the students to understand the genetic basis of inheritance and the basic concepts of evolution

COURSE OBJECTIVES: The learners will be able to:

| CO.NO. | COURSE OBJECTIVES |
|--------|--|
| CO-1 | Understand the Mendelian principle. |
| CO-2 | Develop the inherited genetic disorder and inborn errors. |
| CO-3 | Identify the chromosomal disorders. |
| CO-4 | Evaluate the causes of phylogenetic gradualism and punctuated equilibrium. |
| CO-5 | Originate micro and macro evolution. |

UNIT I: Mendelian Principles

Law of Segregation – Law of independent assortment of genes- multiple alleles and genetics of ABO, Rh blood groups in man-Linkage and crossing over-localization of DNA in chromosome and gene mapping- extra nuclear DNA: DNA in mitochondria and plastid-maternal effects and cytoplasmic inheritance.

UNIT II: Concept of Gene

DNA as the genetic material-regulation of gene expression in prokaryotes and eukaryotes- inherited genetic disorder in man-syndromes- sex linked inheritance, colour blindness, haemophilia -inborn errors of metabolism- sickle cell anaemia, albinism and phenylketonuria.

UNIT III: Genetical Disorders

Mutation: Mutation types and mutagens - genetic disorder – Huntington’s chorea – cystic fibrosis – thalassemia – muscular dystrophy and Tay Sac’s disease –screening for genetic disorders – amniocentesis – chorionic villus sampling – fetoscopy – gene therapy.

UNIT IV: Traditional Evolution

Origin and evolution of prokaryotes and eukaryotes – phylogenetic gradualism and punctuated equilibrium; major trends in the origin of higher categories – micro- and macroevolution.

UNIT V: Molecular Evolution

Construction of phylogenetic trees – quantifying genetics – variability –genetic structure of natural population – phenotypic variation – pattern of genetic variation – Founder’s effect and bottle necks – models explaining changes in genetic structures of population.

Textbooks:

1. Genetics: Analysis of Genes & Genomes: 8th Edition. (2009), Daniel L.Harti.
2. Genetics by Verma and Agarwal

Reference Books:

1. M. W. Strickberger. 2005. Genetics.3rd Edition, Prentice-Hall, India.
2. Benjamin Lewin. 2000. Genes VII. Oxford University Press.
3. Robert J. Brooker,2012. Genetics – Analysis and Principles,4th Edition,(International Edition), NY McGraw Hill, New York..
4. Paul Amos Moody. 2011. Introduction to evolution, Nabu Press, United States.
5. Douglas J. Rutuyma. 2013. Evolution, 3rd edition, Sinauer Associates.inc.

COURSE OUTCOME

| CO.No. | Course Outcome | PSO’S addressed | Cognitive Level |
|--------|--|-----------------|-----------------|
| CO-1 | Explain the Law of Segregation. | 1,2,3 | Understanding |
| CO-2 | Experiment with colour blindness, hemophilia - inborn errors of metabolism- sickle cell anemia, albinism. phenylketonuria. | 1,2,3,4 | Applying |
| CO-3 | Examine the Genetical Disorders. | 1,2,3,5 | Analyzing |
| CO-4 | Justify the Traditional Evolution. | 1,3,4 | Evaluating |
| CO-5 | Develop the Molecular Evolution. | 1,3,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | Hours | Credit | | | | | | |
|--|------------------------------------|-------------------------------|-----------|----------|-------|------------------------------------|-------|-------|-------|-------|
| I | 21PCZO22 | GENETICS AND EVOLUTION | 75 | 4 | | | | | | |
| Course Outcomes (COS) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | |
| CO-2 | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| CO-3 | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ |
| CO-4 | ✓ | | ✓ | | ✓ | ✓ | | ✓ | ✓ | |
| CO-5 | ✓ | | ✓ | | ✓ | ✓ | | ✓ | | ✓ |
| Number of matches (✓) = 37 Relationship = Low/Medium/ High | | | | | | | | | | |

Prepared by
Dr.A.Mohaideen
 Name and Signature

Checked by

 Head of the Department

SEMESTER - II

| | |
|---------------------|-----------------------------|
| Course Title | Animal Biotechnology |
| Total Hours | 75 |
| Hours/Week | 5 |
| Subject Code | 21PCZO23 |
| Course Type | CORE VI |
| Credits | 4 |
| Marks | 100 |

General Objective:

To gain knowledge on recombinant DNA technology, gene transfer and transgenicity and its applications

Course Objectives: The learners will be able to:

| CO.NO. | Course Objectives |
|--------|---|
| CO-1 | Remember the basic principle of animal biotechnology. |
| CO-2 | Explain the recombinant DNA technology. |
| CO-3 | Classify the various type of cloning vectors. |
| CO-4 | Evaluate the organ culture of the animal biotechnology. |
| CO-5 | Develop the process of industrial based biotechnology. |

UNIT I: Basics of Animal Biotechnology

Scope of Animal Biotechnology-Current status and future applications of Animal Biotechnology- scope of animal cell culture- types of cell culture- laboratory facilities for animal cell culture-culture media- cell culture products; stem cells: types of stem cells-stem cell therapy – Somatic cell fusion and hybridoma technology.

UNIT II: Recombinant DNA Technology

Principles and methods of recombinant DNA technology - types of restriction enzymes - ligase linkers and adaptors - c DNA library - transformation - selection of recombinants-hybridization techniques, DNA sequences -gene probe - DNA finger printing-DNA chip technology-Restriction Fragment length polymorphism(RFLP), Randomly

amplified polymorphic DNA (RAPD) - PCR technique - genomic library; Blotting techniques
- Southern blotting - Northern blotting - Western blotting.

UNIT III: Cloning Vectors and DNA techniques

Plasmids: E. coli, pBR 322, Ti plasmid, bacteriophage, cosmids, phasmids, shuttle vectors, yeast and bacterial chromosome, mammalian cells - **Simian virus 40** - Gene cloning
-Gene transfer technologies- Human genome project – biosensors and their applications.

UNIT IV: Genetic Engineering for human welfare

Organ culture - whole embryo culture - embryo transfer in human; transgenic animal, in vitro fertilization (IVF) technology – Dolly- human gene therapy, monoclonal antibodies production and application, **cryobiology** -Bioethics in animal genetic engineering

UNIT V: Biotechnology and Industry

Fermentation - bioreactor - microbial products - primary and secondary metabolites - enzymes technology -antibiotic synthesis- single cell protein (SCP)- **Biopolymers**, Biopesticides and Biofertilizers.

Textbooks:

1. Dubey R.C. Text book of biotechnology, 2012. S.Chand & company Limited,New Delhi.
2. Das, H.K. 2004. Text Book of Biotechnology. Wiley Dreamtech India Pvt.Ltd.,New Delhi.
3. Prakash S Logar 2005. Biotechnology. MJP Publishers, Chennai.
4. P. Ramadoss 2008. Animal Biotechnology, MJP Publishers Chennai
5. LP Rema 2006. Applied Biotechnology.

Reference Books

1. Gupta .P.K. Biotechnology and Genomics.2013. Rastogi Publications, Meerut.
2. Singh.B.D. Genetic Engineering and Animal Biotechnology, 2005,KalyaniPublishers, Chennai – 17.
3. M. W. Strickberger. 2005. Genetics.3rd Edition, Prentice-Hall, India
4. Bruce Alberts,AlexanderJohnson,JulianLewis,MartinRaff,KeithRoberts,PeterWalter. Molecular Biology of the Cell.5th Edition,2007. Garland Science.

COURSE OUTCOME

| CO.NO. | COURSE OUTCOME | PSO'S addressed | Cognitive Level |
|--------|---|-----------------|-----------------|
| CO-1 | Define the Scope of Animal Biotechnology. | 1,2,4 | Remembering |
| CO-2 | Apply the Knowledge on molecular finger printing (DNA finger printing) - RFLP - the PCR techniques. | 1,2,3,5 | Applying |
| CO-3 | Distinguish the various type of cloning vectors - Bacterial, Viral and yeast. | 1,2,3,4 | Analyzing |
| CO-4 | Summarize the Organ culture. | 1,2,5 | Evaluating |
| CO-5 | Develop single cell protein (SCP)- Biopolymers. | 1,2,3,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | | | |
|-----------------------|--|-----------------------------|-------|-------|-------|------------------------------------|-------|--------|-------|-------|--|--|
| II | 21PCZO23 | ANIMAL BIOTECHNOLOGY | | | | | 75 | 4 | | | | |
| Course Outcomes (COS) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | | |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | | |
| CO-3 | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| CO-4 | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ | | |
| CO-5 | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | | ✓ | | |
| | Number of matches (✓) = 36 Relationship = Low/Medium/ High | | | | | | | | | | | |

Prepared by
Dr.A.Mohaideen
 Name and Signature

Checked by
 Head of the Department

SEMESTER - II

| | |
|---------------------|---------------------|
| COURSE TITLE | VERMICULTURE |
| TOTAL HOURS | 60 |
| HOURS/WEEK | 4 |
| SUBJECT CODE | 21PEZO21A |
| COURSE TYPE | DSE –II A |
| CREDITS | 4 |
| MARKS | 100 |

GENERAL OBJECTIVE:

To acquaint with the techniques of vermiculture and to create knowledge on Self - employment opportunity.

COURSE OBJECTIVES: The learners will be able to:

| CO.NO. | COURSE OBJECTIVES |
|---------------|---|
| CO-1 | Understand vermiculture and different species required for rearing. |
| CO-2 | Identify the various culture methods. |
| CO-3 | Examine the various techniques in vermiculture. |
| CO-4 | Evaluate the skill of marketing. |
| CO-5 | Develop the future scope in the area of vermicompost. |

UNIT I: INTRODUCTION TO VERMICULTURE

Vermiculture – definition, scope and importance, common species for culture, environmental requirements; Earthworms– taxonomic position and diversity, types – morphological and ecological grouping – epigeic species, endogeic species and Anecic, ecological roles and economic importance of earthworms – need for earthworm culture.

UNIT II: CULTURE METHODS

Culture methods – wormery – breeding techniques: indoor and outdoor cultures - monoculture and polyculture – relative merits and demerits; Windows method-process – advantages.

UNIT III: VERMICULTURE TECHNIQUES

Vermiculture techniques, advantages of vermiculture, vermicomposting technology, methods of vermicomposting, large scale manufacture of vermicompost, worm casts, vermicompost, vermiwash, vermiwash production techniques, role of earthworms in soil fertility, use of vermicompost for crop production, use of vermicompost in land improvement and reclamation.

UNIT IV: MARKETING STRATEGIES

Marketing the products of vermiculture, quality control, market research, marketing techniques, creating the demand by awareness and demonstration, advertisements, packaging and transport, direct marketing, financial support by governments and NGOs for vermiculture.

UNIT V: FUTURE PERSPECTIVES font size vary

Effect of vermicompost application on soil and plant growth, vermicompost as an organic manure, a good substitute of fertilizers, influence of pests and microbes on vermiculture, earthworms for management of municipal/selected biomedical solid wastes; as feed/bait for capture/culture fisheries, forest regeneration, potentials and constraints for vermiculture in India.

TEXT BOOK

1. Hand book of Biofertilizers and Vermiculture, 2015, by Eri board.
2. Keshav S. 2014. Text Book of vermicompost: Vermiwash and Biopesticides. Published by Biotech books.

REFERENCE BOOKS

1. Sultan Ahmed Ismail, 2005. The Earthworm Book, Second Revised Edition. Other India Press, Goa, India..
2. Dash, M.C., 2012 Charles Darwin's Plough Tool for vermitechnology, I.K. International Publishing House Private Limited, New Delhi.
3. Lekshmy M.S., Santhi R, 2012 Vermitechnology Sara Publications, New Delhi.
4. National Institute of Industrial Research,2010.The complete Technology book on vermiculture and vermicompost, Published by National Institute of Industrial Research, Delhi.

COURSE OUTCOMES

| CO. NO. | COURSE OUTCOMES | PSO'S addressed | COGNITIVE LEVEL |
|---------|--|-----------------|-----------------|
| CO-1 | Understand the morphological and ecological characters of earthworm. | 1,3 | Understanding |
| CO-2 | Carry out the various breeding techniques in vermiculture. | 1,2,3 | Applying |
| CO-3 | Demonstrate vermiculture biotechnology. | 2,3 | Analyzing |
| CO-4 | Select marketing techniques in vermiculture. | 3,4 | Evaluating |
| CO-5 | Find the potentials and constraints for vermiculture in India. | 3,4,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | Hours | Credit | | | | | | |
|---|------------------------------------|---------------------|-------|--------|-------|------------------------------------|-------|-------|-------|-------|
| II | 21PEZO21A | VERMICULTURE | 60 | 4 | | | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | | |
| CO-2 | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | |
| CO-3 | | ✓ | ✓ | | | | ✓ | ✓ | | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | |
| CO-5 | | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| Number of matches (✓) = ...29.... Relationship = Low/ Medium /High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33) | | | | | | | | | | |

Prepared by
Dr. M.I. Delighta Mano Joyce
 Name and Signature

Checked by
 Head of the Department

SEMESTER - II

| | |
|--------------|-----------------------|
| Course Title | ENVIRONMENTAL BIOLOGY |
| Total Hrs | 60/Semester |
| Hrs / Week | 4 |
| Sub. Code | 21PEZO21B |
| Course Type | DSE -II B |
| Credits | 4 |
| Marks | 100 |

General objective:

- ❖ To acquire knowledge on eco system, Realize the unique features of marine natural resources and the impact of climate change and global warming on living organisms.

Course objectives: The learners will be able to:

| CO. No | Course Objectives |
|--------|---|
| CO -1 | Explain the different types of ecosystem. |
| CO -2 | Develop the concept of community ecology, succession, species interactions and ecosystem. |
| CO -3 | Examine the various natural resources and renewable resources. |
| CO -4 | Choose the Biodiversity Hotspots. |
| CO -5 | Discuss the conservation and management In situ and Ex situ conservation. |

UNIT I: INTRODUCTION AND ECOLOGICAL SUCCESSION **give space**

Ecosystem: Concept – types - stability - food chain and food web – types of ecological pyramids; Aquatic ecosystem: freshwater, lentic and lotic ecosystem, marine ecosystem; Terrestrial ecosystem - biogeography-major terrestrial biomass, island biogeography, biogeographical zones of India; Ecological succession : types and general process of succession – concept of climax.

UNIT II: COMMUNITY AND POPULATION ECOLOGY

Community ecology - nature of communities, community structure and attributes, edges, ecotone and ecological dominance - population ecology – population characteristics and population dynamics; Biogeochemical cycles: Water, gaseous and sedimentation cycles; Productivity: Primary productivity process – productivity of different ecosystems – measurement of primary productivity.

UNIT III: NATURAL RESOURCES AND THEIR CONSERVATION

Classification of natural resources: Renewable energy - solar, wind, tidal energy and Water - availability, consumption and prospects in India; Forest-deforestation, afforestation in India; Non-renewable energy: minerals their distribution and prospects, energy, fossil fuel, nuclear energy; Law and environmental protection: India 's environmental laws and policy; Pollution control boards Central and State Government and NGO, International environmental policy, Earth Summit and World Summit.

UNIT IV: BIODIVERSITY AND THREATS TO BIODIVERSITY

Biodiversity: Types - genetic, species and ecosystem diversity, values and uses of diversity, biodiversity hotspots - Western Ghats and Indo- Burma region; threats to animal diversity in India –Status of species – Rare, endemic, threatened and endangered species, loss of biological diversity – IUCN, red list, Bio geographical classification of India; Measurements - Diversity indices: Shannon-Weiner– Diversity and Shimpson’s diversity index.

UNIT V: CONSERVATION AND MANAGEMENT

In situ and Ex situ conservation- Wildlife sanctuaries – National parks and biosphere reserves in India; Special projects for endangered species: Project tiger – the Gir lion sanctuary – crocodile breeding project; Role of MAB, IUCN, IPR, TRIPS and IKS; remote sensing application– radio telemetry as a wildlife research tool – application – radio transmitters and its application.

TEXT BOOKS

1. Trivedi, P. C., Sharma, K. C., 2003, Biodiversity conservation, Aavishkar Publishers, Jaipur
2. Saxsena, K. K., 2004, Environmental Sciences, University Book Hour (P) Ltd.,

REFERENCE BOOKS

1. Anjaneyala, Y. B., 2004, Introduction to environmental science, S. P. B. S. Publications, Hyderabad.
2. Jeffery clarke, 2005.Ecology: Concepts, Methods and Applications..
3. Martin R. Speight, 2002.Marine Ecology: Concepts and Applications. 1st Edition, Library of Conglass Cataloguing in Publications.
4. Sven Erik Jørgensen, 2007, A New Ecology,1st Edition, Elsevier Science
5. Reiss, M. and J. Chapman. 2000. Cambridge press, United Kingdom.
6. Asthana, D.K and M. Asthana. 2003. Environment: Problems and Solutions, S. Chandand company Ltd, Ram Nagar, New Delhi

Course outcomes

| CO.NO | COURSE OUTCOMES | PSO’S addressed | COGNITIVE LEVEL |
|-------|---|-----------------|-----------------|
| CO-1 | Explain the biogeography, ecosystem diversity and biodiversity hotspots of India. | 1,3 | Understanding |
| CO-2 | Develop on the productivity of differen ecosystems and measurement of primary productivity. | 1,2,4 | Applying |
| CO-3 | Compare the natural Renewable and non-renewable resources. | 1,4 | Analyzing |
| CO-4 | Interpret the Indian environmental laws and policy. | 1,4 | Evaluating |
| CO-5 | Develop on the Status of species – Rare, endemic, threatened and endangered species and loss of biological diversity. | 1,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | |
|---|------------------------------------|--------------------------|-------|-------|-------|------------------------------------|-------|--------|-------|-------|
| II | 21PEZO21B | ENVIRONMENTAL BIOLOGY | | | | | 60 | 4 | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | | |
| CO-2 | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | |
| CO-3 | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ | |
| CO-4 | ✓ | ✓ | ✓ | | ✓ | ✓ | | | ✓ | |
| CO-5 | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | ✓ |
| Number of matches (✓) = ...30.... Relationship = Low/ Medium /High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33) | | | | | | | | | | |

Prepared by
Dr. J. Shifa Vanmathi
 Name and Signature

Checked by

 Head of the Department

SEMESTER – II

| | |
|---------------------|--------------------------|
| COURSE TITLE | NANOBIOTECHNOLOGY |
| TOTAL HOURS | 60 |
| HOURS/WEEK | 4 |
| SUBJECT CODE | 21PEZO21C |
| COURSE TYPE | DSE – II C |
| CREDITS | 4 |
| MARKS | 100 |

GENERAL OBJECTIVES

To understand and apply the comprehensive knowledge on the major aspects of nanobiotechnology in their career development in higher education, research and development.

COURSE OBJECTIVES: The learner will be able to

| CO.NO. | COURSE OBJECTIVES |
|---------------|--|
| CO-1 | Understand the importance of nanotechnology in biomedical applications |
| CO-2 | Explain the basic properties of nanomaterials |
| CO-3 | Compile the techniques of nanoparticles synthesis |
| CO-4 | Describe the Characterization of Nanobiomaterials |
| CO-5 | Illustrate the current status of nanobiotechnology |

UNIT I INTRODUCTION TO NANOTECHNOLOGY`

Introduction - History of nanotechnology, Importance of nanoscience and nanotechnology in biomedical applications. Types of solid and powder crystals - Interaction between biomolecules and nanoparticles - Applications of nanotechnology in biotechnology: killing cancer cells, providing oxygen and artificial mitochondria. Nanobiosensors.

UNIT II NANOMATERIALS FOR BIOLOGY

Nanotechnology and nanoscience in Nature; Molecular based study of condensed matter; low dimensional materials; Properties of nanomaterials: size, surface charge, conductivity, optical properties and biocompatibility. Carbon based nanomaterials - carbon nanotubes for biomedical applications, SWCNT and MWCNT. Magnetic nanoparticles - Quantum dots - Quantum dot biomolecular tags - Antibacterial activity; DNA and Peptide based nanomaterials; Polymer nanostructures.

UNIT –III - SYNTHESIS OF NANOPARTICLES

Top-Down approach, Bottom-Up approach, Nano-Lithography, PVD, CVD, Wet deposition techniques, Micro emulsion method, Sol-gel processing. Biological synthesis of

nanoparticles - Use of bacteria, fungi, Actinomycetes for nanoparticle synthesis, Role of plants in nanoparticle synthesis.

UNIT IV CHARACTERIZATION OF NANOBIMATERIALS

Basic principles, operations and applications of UV-Visible spectroscopy, FT-IR spectroscopy, SEM, TEM, STM, Atomic and Molecular spectroscopy, Photoacoustic spectroscopy, Fluorescence spectroscopy, Fluorescent resonance energy transfer (FRET), computations, AFM of DNA, STM of DNA and Confocal microscopy.

UNIT V ENVIRONMENTAL NANOTECHNOLOGY

Nanotoxicology, Environmental and Health impacts of nanomaterials, Waste remediation, Nanoporous polymers and their application in water purification, Energy conversion. Photo-catalytic fluid purification, Current status of nanobiotechnology, Future perspectives of nanobiology and safety measures of nanomaterials.

REFERENCES:

1. Nanomaterials by A.K. Bandyopadhyay, 2007, New Age International Publishers, New Delhi.
2. Tissue, cell and organ engineering, by Challa Kumar, 2006, Wiley-VCH, Verlag.
3. The Chemistry of Nanoparticles (Synthesis, Properties and Applications) by C.N.R. Rao, A. Muller, A.K. Chutham., 2006, Wiley-VCH, Verlag.
4. Nanomedicine, Vol. IIA: Biocompatibility by Robert A. Freitas, 2003, Landes Bioscience, Georgetown
5. Handbook of Nanostructured Biomaterials and Their Applications in Nanobiotechnology - Hari Singh Nalwa, 2006, American Scientific Publishers.
6. Nanobiotechnology, by C.M.Niemeyer, C.A. Mirkin, 2004, WILEY-VCH Verlag GmbH & Co. KG aA, Weinheim
7. Nanocomposite Science & Technology by Pulickel M. Ajayan, Linda S. Schadler, Paul V. Braun, Wiley.
8. Handbook of Nanotechnology - Bharat Bhusha, 2007, Springer.
9. Introduction to Nanotechnology”, C. P. Poole and F. J. Owens, 2006, Wiley.
10. Nanotechnology: A Gentle Introduction to the Next Big Idea”, M. Ratner and D. Ratner, 2002, Prentice Hall.
11. Nanotechnology – Science, Innovation, and Opportunity”, L. E. Foster, 2006, Pearson Education.
12. Pradeep, T. (2017) The Essentials: Understanding Nanoscience and Nanotechnology: Mc- Graw-Hill Education.
13. Phoenix, D.A. and Ahmad, W (2014) Nanobiotechnology. One Central Press Ltd.

| CO. NO. | COURSE OUTCOMES | PSO's addressed | COGNITIVE LEVEL |
|---------|---|-----------------|-----------------|
| CO-1 | Describe the Interaction between biomolecules and nanoparticles | 1 | Understanding |
| CO-2 | Enumerate the Carbon based nanomaterials | 1,3,4 | Applying |
| CO-3 | Examine the various approaches of nanotechnology | 1,4,5 | Analyzing |
| CO-4 | Discuss operations and applications of spectroscopy | 1,2,4,5 | Analyzing |
| CO-5 | Assess the Environmental and Health impacts of nanomaterials | 1,4,5 | Evaluating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | | | |
|---|------------------------------------|---------------------|-------|-------|-------|------------------------------------|-------|--------|-------|-------|--|--|
| II | 21PEZO21C | NANOBIOTECHNOLOGY | | | | | 60 | 4 | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | | |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | |
| CO-2 | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | |
| CO-3 | ✓ | | | | ✓ | | | | ✓ | ✓ | | |
| CO-4 | | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | |
| Number of matches (✓) = ...31.... Relationship = Low/ Medium /High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33) | | | | | | | | | | | | |

Prepared by

Dr. M.I. Delighta Mano Joyce

Name and Signature

Checked by

Head of the Department

SEMESTER-II

| | |
|--------------|----------------------------------|
| Course Title | DEVELOPMENTAL BIOLOGY PRACTICALS |
| Total Hrs | 60 |
| Hrs / Week | 4 |
| Sub. Code | 21PCZO2P1 |
| Course Type | CORE PRACTICAL - III |
| Credits | 2 |
| Marks | 100/2 |

General objective:

- ❖ Understand the developmental stages, reproductive system and fertilization process of living organisms.

Course objectives: The learners will be able to:

| CO. No | Course Objectives |
|--------|---|
| CO -1 | Illustrate the different stages of frog including eggs and cleavage stages. |
| CO -2 | Identify the different types of placenta. |
| CO -3 | Distinguish the testis and ovary of frog. |
| CO -4 | Evaluate the mounting of male gametes in fish. |
| CO -5 | Construct the IVF techniques in human chart. |

1. Mounting and observation of male or female gamete in fish
2. Temporary mounting and observation of chick embryos.
3. Observations on developmental stages of frog (fertilized eggs, stages of cleavage, blastula, gastrula, tadpoles)
4. Effect of growth hormones on amphibian metamorphosis (mini group projec).delete
5. Induced ovulation in fish (Demonstration only).

SPOTTERS

1. Frog a)T.S. of testis and Ovary, b) Fertilized Egg, c)Yolk Plug Stage, d) Neurula, e)Tadpole.
2. Chick embryo: a) Primitive streak, b)24 hours of chick embryo, c)36 hours of chick embryo d)48 hours of chick embryo, e)72 hours of chick embryo, f)96 hours of chick embryo.
3. Slides on cleavage: (Chick) 2 cell, 4 cell and 8 cell stages, blastula and gastrula.
4. Types of Placenta: a) Discoidal placenta b) Diffuse placenta c) Cotyledonary placenta.
5. IVF Techniques in human-Chart.

Course outcomes

| Co.No | Course Outcomes | PSO'S addressed | Cognitive level |
|-------|--|-----------------|-----------------|
| CO-1 | Explain the female gametes in fish. | 1,2 | Understanding |
| CO-2 | Identify the mounting of chick embryos in 24 hrs, 48 hrs, 72 hrs and 96 hrs. | 1,2 | Applying |
| CO-3 | Differentiate the different stages of frog including blastula and gastrula stages. | 1,2,4 | Analyzing |
| CO-4 | Assess the influence of hormone on amphibian metamorphosis. | 1,2,4 | Evaluating |
| CO-5 | Develop the induced ovulation in fish. | 2,3,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | Hours | Credit | | | | | | |
|-----------------------|---|----------------------------------|-------|--------|-------|------------------------------------|-------|-------|-------|-------|
| II | 21PCZO2P1 | Developmental Biology practicals | 60 | 2 | | | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | |
| CO-2 | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | |
| CO-3 | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | |
| CO-4 | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | |
| CO-5 | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | ✓ |
| | Number of matches (✓) = ...29.... Relationship = Low/ Medium /High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33) | | | | | | | | | |

Prepared by
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 Name and Signature

Checked by
 Head of the Department

SEMESTER – II

| | |
|---------------------|---|
| Course Title | Genetics and Evolution & Animal Biotechnology Practicals |
| Total Hours | 60/Semester |
| Hours/Week | 4 |
| Subject Code | 21PCZO2P2 |
| Course Type | Core Practical-IV |
| Credits | 2 |
| Marks | 100/2 |

General Objective:

Understanding the Mendelian principle and Mendelian traits.

To know about the DNA and RNA isolation technique

Course Objectives: The learners will be able to:

| CO.No. | Course Objectives |
|---------------|--|
| CO-1 | Explain Mendel's Law. |
| CO-2 | Identify the ABO Blood group in human population. |
| CO-3 | Compare gene and genotype frequencies based on the blood groups. |
| CO-4 | Measure the density dependent selection in animal population. |
| CO-5 | Elaborate on the Isolation of DNA and RNA. |

1. Verification of Mendel's law-Monohybrid and Dihybrid crosses using coloured beads.
2. Human Mendelian traits.
3. ABO blood group data, in a large sample of human population or classroom sample.
4. Estimation of gene and genotype frequencies in the light of Hardy –Weinberg law based on ABO blood groups
5. Random genetic drift – using colour beads.
6. Demonstration of density dependent selection in animal population using beads.
7. Isolation of DNA and RNA.
8. Separation of DNA by Agarose gel electrophoresis and PAGE for protein.
9. Visit to biotechnology Laboratory and Research institution. Report preparation.

SPOTTERS

- a) Sex-linked inheritance b) Construction of phylogenetic tree c) Colouration: Chamaeleon, Lycodon d) Mimicry: Phyllium, Stick insect e) pBR322 f) CaMV g) Stem cells h) Dolly i) Animal cloning j) Transgenesis

COURSE OUTCOME

| CO. NO. | COURSE OUTCOME | PSO'S addressed | COGNITIVE LEVEL |
|---------|--|-----------------|-----------------|
| CO-1 | Compare the Monohybrid and Dihybrid crosses. | 1,2,3 | Understanding |
| CO-2 | Identify the ABO Blood group in human population or classroom sample. | 1,2, | Applying |
| CO-3 | Examine the Hardy –Weinberg law based on ABO blood groups. | 1,2,3 | Analyzing |
| CO-4 | Deduct the density dependent selection in animal population using beads. | 1,2,4 | Evaluating |
| CO-5 | Develop on the isolation of DNA and RNA. | 1,3,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | |
|--|------------------------------------|--|-------|-------|-------|------------------------------------|-------|--------|-------|-------|
| II | 21PCZO2P2 | GENETICS AND EVOLUTION & ANIMAL BIOTECHNOLOGY PRACTICALS | | | | | 60 | 2 | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| CO-3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ |
| Number of matches (✓) = 38 Relationship = Low/Medium/ High | | | | | | | | | | |

Prepared by
Dr.A.Mohaideen
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Checked by
 Head of the Department

SEMESTER III

| | |
|---------------------|--------------------------|
| COURSE TITLE | ANIMAL PHYSIOLOGY |
| TOTAL HOURS | 75 |
| HOURS/WEEK | 5 |
| SUBJECT CODE | 21PCZO31 |
| COURSE TYPE | CORE -VII |
| CREDITS | 4 |
| MARKS | 100 |

GENERAL OBJECTIVE:

- ❖ To understand the physiology of animals, working mechanism and functions of various organs and to impart knowledge on the recent techniques in physiology

COURSE OBJECTIVES

The learners will be able to:

| CO.NO. | COURSE OBJECTIVES |
|--------|---|
| CO-1 | Illustrate the various process involved in digestion. |
| CO-2 | Identify the blood components and its functions. |
| CO-3 | Differentiate the physiology and anatomy of kidney and lungs. |
| CO-4 | Explain the mechanism of muscle contraction. |
| CO-5 | Develop on the role of hormones and its functions. |

UNIT I: DIGESTIVE SYSTEM

Digestive tract – structure and functions, secretory functions of the alimentary tract and the glands, role of gastro-intestinal hormones in digestion; digestion and absorption of carbohydrates, proteins and lipids – **diseases associated with digestive system.**

UNIT II: BLOOD AND CIRCULATION

Blood components – functions of blood – factors affecting RBC production. Functional anatomy of heart – cardiac cycle – cardiac output – regulation of cardio vascular function – blood pressure and related diseases (hypertension, hypotension, stroke)– coronary circulation – cerebral circulation – placental – foetal and neonatal circulation.

UNIT III: RESPIRATION AND EXCRETION

Respiration: Physiology and anatomy of the respiratory tract – gas transport between the lungs and tissues – regulation of respiration. Respiratory adjustments in health and diseases. Excretion: Excretory products – organs of excretion in different animals. Kidney – nephron – renal circulation – urine formation – renal disorders – micturition and dialysis.

UNIT IV: NEUROMUSCULAR AND SENSORY PHYSIOLOGY

Nervous system: Neuron – nerve fibres – classification and properties – neurotransmitters – synapse – reflex activity – structure and function – spinal cord and brain – electroencephalogram (EEG). Muscular system: Classification and properties – mechanism of muscular contraction – energetics of muscular contraction – neuromuscular junction.

Sense organs and receptors: Sense organs of vision, hearing and equilibrium, smell and taste, cutaneous, deep and visual sensations.

UNIT V: ENDOCRINOLOGY

Basic mechanism of hormone action- endocrine glands in mammal- Pituitary, thyroid, adrenal and islets of langerhans- hormones and functions – hormonal disorders- role of hormones in reproductive cycles –menstrual and estrous cycle- pregnancy – parturition- lactation-hormones and neoplastic growth.

TEXT BOOK

1. Dr. P.B. Reddy, 2015. Text book of Animal Physiology, Ratna Prasad Multidisciplinary Research & Educational Society (Regd) no. 1-90, Near VTPS Main Gate, Ibrahimpatnam, Krishna District, A.P., India
2. Verma P.S., Tyagi, B.S. and Agarwal V. 2010. Text book for Animal physiology S. Chand Publishing.

REFERENCE BOOKS

1. Rastogi S. 2019, Essentials of Animal physiology, New Age international publishers, 4th Edition.
2. Gordon, A., Wyse, Marget Anderson., 2008. Animal Physiology, 2nd edition, Richard W. Hill.
3. Verma, P.S. Tyagi B.S. and V. Agarwal, 2005. Animal Physiology. S. Chand and Company Ltd, New Delhi.
4. Sembulingam K. and P. Sembulingam, 2012. Essentials of Medical physiology, 6th Edition, Jaypee Brothers Medical Publishers Ltd. New Delhi.
5. Kim E. Barrett and Susan M. Barman. 2015. Ganong's Review of medical physiology. 25th edition. Lange Basic Science.
6. A. C. Guyton and J. E. Hall. 2011. Textbook of medical physiology. 12th edition. Saunders Elsevier, Philadelphia..

| CO. NO. | COURSE OUTCOMES | PSO'S addressed | COGNITIVE LEVEL |
|---------|---|-----------------|-----------------|
| CO-1 | Explain the role of hormones in digestion and absorption. | 1,2 | Understanding |
| CO-2 | Identify the different cycles in the circulatory system | 1,2 | Applying |
| CO-3 | Analyze the mechanism of respiration. | 1,2,3 | Analyzing |
| CO-4 | Explain the neuromuscular mechanism. | 1,4 | Evaluating |
| CO-5 | Elaborate the role of hormones in reproductive cycle. | 1,4,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | | | |
|--|------------------------------------|---------------------|-------|-------|-------|------------------------------------|-------|--------|-------|-------|--|--|
| III | 21PCZO31 | ANIMAL PHYSIOLOGY | | | | | 75 | 4 | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | | |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| CO-3 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | |
| Number of matches (✓) = ...35.... Relationship = Low/Medium/ High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33) | | | | | | | | | | | | |

Prepared by

Dr. M.I. Delighta Mano Joyce

Name and Signature

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Head of the Department

SEMESTER - III

| | |
|---------------------|---|
| COURSE TITLE | BIostatISTICS AND BIOinformatics |
| TOTAL HOURS | 75/Semester |
| HOURS/WEEK | 5 |
| SUBJECT CODE | 21PCZO32 |
| COURSE TYPE | CORE - VIII |
| CREDITS | 4 |
| MARKS | 100 |

GENERAL OBJECTIVE:

- ❖ To acquire knowledge on the mathematical principles governing biological systems and statistical analysis of biological data and to know the various bioinformatics databases governing in day to day life.

COURSE OBJECTIVES: The learners will be able to:

| CO.NO. | COURSE OBJECTIVES |
|---------------|--|
| CO-1 | Understand the measures of central tendency. |
| CO-2 | Develop on the theoretical probability distribution. |
| CO-3 | Examine the different kinds of correlation methods. |
| CO-4 | Compare various databases in bioinformatics. |
| CO-5 | Modify the various bioinformatic tools. |

UNIT I: TYPES OF DATA AND MEASURES OF CENTRAL TENDENCY

Types of biological data – ratio scale, interval scale, ordinal scale, nominal scale – sample and population; methods of sampling: random sampling, non- random sampling - Types of mean- Arithmetic mean, harmonic mean, geometric mean; median, mode– frequency distribution - Measures of dispersion: standard deviation, coefficient of variation, mean deviation, variance.

UNIT II: INFERENCE STATISTICS

Theoretical probability distribution: normal, binomial and Poisson – skewness and kurtosis, standard error – student's 't' distribution - Chi-square analysis – test for goodness of

fit – test for independence – types of errors: α and β ; Analysis of variance – one-way, two-way, 'F' test.

UNIT III: CORRELATION

Correlation: kinds, properties –methods: Karl Pearson's, Rank; Regression analysis: simple, linear and non-linear regression and testing its significance.

UNIT IV: INTRODUCTION TO BIOINFORMATICS

Knowledge of various databases: Basic concepts and scope, Nucleic acid sequence database: Gen bank, EMBL and DDBJ, Protein sequence data base: Swiss Prot, TrEMBL, PIR, PDB, Genome data base:NCBI, EBI, TIGR, SANGER other database of patterns.

UNIT V: BIOINFORMATICS TOOLS

Sequence alignment: Pairwise alignment, local and global sequence alignment, multiple sequence alignment- Sequence analyzing tools: BLAST, FASTA – DNA micro array technique – Hidden Markov model – Homology Modeling.

TEXT BOOKS

1. Sharma, A.K. 2005, Text Book of Biostatistics, Discovery Publishing House.
2. Annadurai P. 2007. A Text Book of Biostatistics, 1st Edition, New Age International Publishers.
3. Neelakanta S 2020, A Text Book of Bioinformatics. ISBN: 978-981 -121-288- 8.

REFERENCE BOOKS

1. Murthy C.S.V. 2003, Bioinformatics, Himalaya Publishing House, Mumbai, Delhi, Bangalore, India.
2. Ronald F., Lee E. and Hernandez M. 2006. Biostatistics 2nd Edition, Academic Press. ISBN: 978-008-044-677-26.
3. Rosner B. 2016.Fundamentals of Biostatistics 8th Edition, Cenveo Publishers services.
4. Zar, J.H. 2003.Biostatistical Analysis, Person Edition Asia, New Delhi.
5. Liebler, D.L. 2002, Introduction to Proteomics: Tools for the new Biology, Humana press.

| CO. NO. | COURSE OUTCOMES | PSO'S addressed | COGNITIVE LEVEL |
|---------|---|-----------------|-----------------|
| CO-1 | Classify the measures of central tendency. | 1,2 | Understanding |
| CO-2 | Apply the theoretical probability distribution. | 1,2 | Applying |
| CO-3 | Differentiate correlation and regression. | 1,2,3 | Analyzing |
| CO-4 | Evaluate the various tools in bioinformatics. | 3,4 | Evaluating |
| CO-5 | Create sequence alignment in bioinformatics. | 4,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | Hours | Credit | | | | | | |
|--|------------------------------------|---|-------|--------|-------|------------------------------------|-------|-------|-------|-------|
| III | 21PCZO32 | BIostatistics and Bioinformatics | 75 | 4 | | | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| CO-3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ |
| <p style="text-align: center;">Number of matches (✓) = ...35.... Relationship = Low/Medium/High</p> <p>Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33)</p> | | | | | | | | | | |

Prepared by
Dr. M.I. Delighta Mano Joyce
 Name and Signature

Checked by

 Head of the Department

SEMESTER - III

| | |
|---------------------|-----------------------------|
| COURSE TITLE | RESEARCH METHODOLOGY |
| TOTAL HOURS | 75 / Semester |
| HOURS/WEEK | 5 |
| SUBJECT CODE | 21PCZO33 |
| COURSE TYPE | CORE - IX |
| CREDITS | 4 |
| MARKS | 100 |

GENERAL OBJECTIVE:

- ❖ Enable them to understand what is research and what is not, to impart the knowledge of various techniques in research methodology and to develop the skill of writing and interpret a research report

COURSE OBJECTIVES

The learners will be able to:

| CO.NO. | COURSE OBJECTIVES |
|--------|--|
| CO-1 | Classify the various research methods. |
| CO-2 | Apply the principles and techniques involved in various instruments. |
| CO-3 | Examine the chromatographic technique in writing a research . |
| CO-4 | Evaluate the steps involved in collection of data in research. |
| CO-5 | Compose the steps in writing a research report. |

UNIT I: INTRODUCTION TO RESEARCH METHODOLOGY

Introduction to research methodology: meaning of research, objectives of research, types of research, research approaches, significance of research, research methods v/s methodology, research and scientific methods, research process, criteria of good research.

UNIT II: PRINCIPLES OF VARIOUS TECHNIQUES

Microscopy: principles–Electron Microscopes and types – atomic force and magnetic force microscopes; Centrifuge: types, principles and applications; pH meter: types –

principles and applications; Colorimeter: principles and applications, Cryopreservation and its applications; Freezing and freeze drying microtomes, cytotechniques.

UNIT III: CHROMATOGRAPHIC TECHNIQUE

Chromatography: paper, thin layer, column, gas liquid chromatography, affinity chromatography; Electrophoresis: paper, cellulose acetate, gel –immune electrophoresis; Blotting techniques: southern – northern – western; Radioactive counters: autoradiography – labeling studies; Spectrophotometer: Spectrofluorometer – ESR –NMR Spectrophotometer – Flame Emission Photometry.

UNIT IV: DATA COLLECTION AND ANALYSIS

Collection of data: methods of data collection, sampling methods, data processing and analysis strategies; tools and data analysis with statically package (Sigma STAT,SPSS for student t-test, ANOVA, etc.), hypothesis testing.

UNIT V: INTERPRETATION AND REPORT WRITING

Meaning of interpretation: techniques of interpretation, precaution in interpretation, significance of report writing, different steps in writing report, layout of the research report, types of reports, oral presentation, mechanics of writing a research report, precautions for writing research reports, conclusions.

TEXT BOOKS

1. Prasad W, 2006. Comprehensive text book of biostatistics and research methodology.
2. Kothari C.R. 2004. Research methodology methods and techniques. Revised 2nd edition. New Age International (P) Limited Publishers. ISBN: 978-8122-424-881.

REFERENCE BOOKS

1. Shanthi B.M. and Shashi A 2017. Hand book of Research methodology. Published by Educreation. ISBN: 978-154-570-340-3.
2. Gurumani, N., 2006. Research Methodology for Biological Sciences, MJR Publishers, Chennai.
3. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
4. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications. 2nd Volume.
5. Vijayalakshmi, G. and Sivapragasam, C., 2008. MJP Publishers, Chennai.

| CO. NO. | COURSE OUTCOMES | PSO'S addressed | COGNITIVE LEVEL |
|----------------|---|------------------------|------------------------|
| CO-1 | Summarize the objectives of the research. | 1,2 | Understanding |
| CO-2 | Apply the research experiments using the principles of various instruments. | 1,2 | Applying |
| CO-3 | Classify the techniques in the research. | 1,2,3 | Analyzing |
| CO-4 | Evaluate the data collection in writing a research. | 3,4 | Evaluating |
| CO-5 | Compose and interpret the data collected. | 2,4,5 | Creating |

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Head of the Department

SEMESTER – III

| | |
|---------------------|---------------------|
| Course Title | MICROBIOLOGY |
| Total Hrs | 60 |
| Hrs / Week | 4 |
| Sub. Code | 21PEZO31A |
| Course Type | DSE-III –A |
| Credits | 4 |
| Marks | 100 |

General objective::

- ❖ To impart knowledge on classification, characteristics and significance of microorganisms and to provide knowledge on development of microbiology and industrial application of microbes.

COURSE OBJECTIVES

The learners will be able to:

| CO.NO. | COURSE OBJECTIVES |
|---------------|---|
| CO-1 | Explain the history and scope in microbiology. |
| CO-2 | Understand the growth kinetics of microorganisms. |
| CO-3 | Examine the structure and functions of genetic materials. |
| CO-4 | Assess the different types of microbial diseases. |
| CO-5 | Construct the steps involved in preservation techniques. |

UNIT I: CLASSIFICATION OF MICROBES

History and scope of microbiology, classification of bacteria, fungi, protozoa and virus; morphology, fine structure and function of bacteria, Virus and fungi; isolation– pure culture techniques, identification and maintenance of microbes.

UNIT II: MICROBIAL GROWTH

Requirements for growth: physical and culture characteristics, culture media curve, measurement of microbial growth, growth curve and growth kinetics; microbial control:

physical and chemical methods- methods of estimation of microorganisms in soil, water and air – isolation and identification of bacteria – biochemical tests.

UNIT III: MICROBIAL GENETICS

Structure and functions of genetic material – transfer of genetic information – transformation, transfection, conjugation, retro transfer, transduction and genetic recombination, regulation of gene expression in bacteria.

UNIT IV: MICROBIAL DISEASES

Protozoan diseases: Plasmodium, Entamoeba; Fungal diseases: Mycotoxicosis, Aspergillosis and Dermatomycoses; Bacterial diseases: Meningitis, Cholera, Typhoid, Gonorrhoea and Syphilis; Viral diseases – Polio, Hepatitis B, Rabies and AIDS – Mode of transmission, diagnosis and treatment –types of vaccines.

UNIT V: APPLIED MICROBIOLOGY

Fermentation – definition and types; bioconversion, bio remediation – industrial production of Penicillin, ethanol, vinegar, vitamin B12 – Citric acid and glutamic acid production; Food microbiology – food spoilage and food preservation, fermented foods, probiotics and prebiotics.

TEXT BOOKS

1. Ananthanaryanan, T and Paniker, J.C.K. 2000. Text Book of Microbiology Orient Longman Ltd., Madras
2. Dubey, H.C., 2004. A text book of fungi, bacteria and viruses, Vikas Publishing House.

REFERENCE BOOKS

1. R. C. Dubey and D. K. Maheshwari, 2009. A textbook of microbiology, S. Chand & Company, New Delhi.
2. Prescott, Harley and Klein, Microbiology, 2004. 6th Edition, McGraw-Hill Higher Education, New York.
3. R. Y. Stainer, J. L. Ingraham, M. L. Wheelis and P. R. Painter, 2007, General microbiology, Macmillan India Ltd.
4. S.S. Purohit, Microbiology: 2002. Fundamentals and applications, Agro Bios, 6th revised Edition, India.
5. N. Kannan, 2002, Laboratory manual in General Microbiology, Palani Paramount Publications.
6. J. Cappuccino and N. Sherman, 2013, Microbiology: A laboratory manual, Pearson Benjamin Cummings, 10th Edition.

COURSE OUTCOME

| CO.NO. | COURSE OUTCOME | PSO'S addressed | COGNITIVE LEVEL |
|--------|--|-----------------|-----------------|
| CO-1 | Explain the classification of various microorganisms. | 1,2 | Understanding |
| CO-2 | Construct the culture methods involved in microbial growth . | 2,3 | Applying |
| CO-3 | Classify the microbial genetics in bacteria. | 2,3 | Analyzing |
| CO-4 | Evaluate the different microbial diseases. | 2,3,4 | Evaluating |
| CO-5 | Discuss the fermentation process in microorganism. | 1,2,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | Hours | Credit | | | | | | |
|--|------------------------------------|---------------------|-------|--------|-------|------------------------------------|-------|-------|-------|-------|
| III | 21PEZO31A | MICROBIOLOGY | 60 | 4 | | | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | |
| CO-2 | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | |
| CO-3 | | ✓ | ✓ | ✓ | | | ✓ | ✓ | | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | |
| CO-5 | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| <p style="text-align: center;">Number of matches (✓) = ...31....</p> <p style="text-align: center;">Relationship = Low/Medium/High</p> <p>Low (If the No. of matches are less than 25)</p> <p>Medium (If the No. of matches are between 25 and 33)</p> <p>High (If the No. of matches are more than 33)</p> | | | | | | | | | | |

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Dr. J. Shifa Vanmathi
 Name and Signature

Checked by

 Head of the Department

SEMESTER-III

| | |
|---------------------|----------------------------------|
| COURSE TITLE | FISHERIES AND AQUACULTURE |
| TOTAL HOURS | 60 |
| HOURS/WEEK | 4 |
| SUBJECT CODE | 21PEZO31B |
| COURSE TYPE | DSE –III B |
| CREDITS | 4 |
| MARKS | 100 |

GENERAL OBJECTIVE:

- ❖ To understand the significance of aquaculture practice and its management in the present scenario.

COURSE OBJECTIVES

The learners will be able to:

| CO.NO. | COURSE OBJECTIVES |
|---------------|--|
| CO-1 | Classify the major groups of fish. |
| CO-2 | Apply the crafts and gears involved in fishing . |
| CO-3 | Analyse the present global and Indian scenario in aquaculture. |
| CO-4 | Explain the culture system in aquaculture. |
| CO-5 | Elaborate the nutritional requirements of fish. |

UNIT I: INTRODUCTION TO FISHERIES

Major group of fish and their characteristics: morphometric and meristic characters of Elasmobranchs and Teleost fish; growth, reproduction, maturation and spawning in fish— inland, estuarine and marine fisheries: Inland fisheries - riverine fisheries, reservoir fisheries, cold water fishery of lakes, estuarine and marine fisheries.

UNIT II: CRAFTS AND GEARS

Fishing crafts and gears: Fishing crafts - Fishing gears, spear and harpoon, fish traps, nets, types of nets, preservation of nets, fishing by electric current, modernization of fishing methods.

UNIT III: INTRODUCTION TO AQUACULTURE

Aquaculture – definition, objectives, history and scope, importance and need for aquaculture, Indian and global scenario of aquaculture; types of aquaculture, culture systems - pond culture, cage culture, raft culture and pen culture - marine aquaculture, integrated farming

UNIT IV: CULTURE SYSTEM AND CULTIVABLE SPECIES

Criteria for selection of species for aquaculture, important brackish water and marine species for aquaculture in India – design and construction of culture ponds – preparation and management of culture ponds- hatchery and nursery ponds - induced breeding in fin fish (hypophysectomy) and shell fish (eye stalk ablation).

UNIT V: FEED AND NUTRITION

Nutritional requirement of cultivable fish-Live feed culture (Microalgal culture, culture of Artemia, Rotifer and copepods) – significance of live feed culture– bioencapsulation; Artificial feed-types of artificial feed, medicated feed - FCR–Feeding strategies and feed dispersion and management.

TEXT BOOKS

1. Khanna S. S., and Singh H.R. 2014. A text book of Biology and Fisheries. Published by Narendra Publishing House. ISBN: 938- 438-712-9.
2. Ahilan B. 2013. Text book on Fresh water Aquaculture. Daya Publishing House, India.

REFERENCE BOOKS

1. Belsare, D.K. 2019. Text book of Fish, Fisheries and Aquaculture. Kindle edition.
2. Sanjay k Gupta and Pawan Kumar B. 2014. Aquaculture and Fisheries environment. Discovery Publishing House.
3. Selvamani, B.R. and Mahadevan, R. K. 2008. Aquaculture, Trends and Issues. Campus Books International. ICAR. 2006. Hand book of Fisheries and Aquaculture. ICAR.
4. Pillay, T.V.R. and Kutty, M. N. 2005. Aquaculture-Principles and Practices. Blackwell.

| CO. NO. | COURSE OUTCOMES | PSO'S addressed | COGNITIVE LEVEL |
|---------|--|-----------------|-----------------|
| CO-1 | Classify the major groups of fish and their characteristics. | 1,2 | Understanding |
| CO-2 | Distinguish crafts and gears involved in fishing. | 1,2 | Applying |
| CO-3 | Examine the different cultures in aquaculture. | 2,3 | Analyzing |
| CO-4 | Explain the different species for culture. | 3,4 | Evaluating |
| CO-5 | Create the different artificial feed for culture fish. | 3,4,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | | | |
|-----------------------|---|---------------------------|-------|-------|-------|------------------------------------|-------|--------|-------|-------|--|--|
| III | 21PEZO31B | FISHERIES AND AQUACULTURE | | | | | 60 | 4 | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | | |
| CO-1 | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | |
| CO-3 | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | |
| | Number of matches (✓) = ...32.... Relationship = Low/ Medium /High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33) | | | | | | | | | | | |

Prepared by
Dr. M.I. Delighta Mano Joyce
 Name and Signature

Checked by
 Head of the Department

SEMESTER - III

| | |
|---------------------|---------------------|
| Course Title | PARASITOLOGY |
| Total Hrs | 60 |
| Hrs / Week | 4 |
| Sub. Code | 21PEZO31C |
| Course Type | DSE – III C |
| Credits | 4 |
| Marks | 100 |

General Objectives

To know the different kinds of parasites, their harmful effects, mode of infection and preventive measures.

Course objectives: The learners will be able to

| | |
|---------------|---|
| CO - 1 | learn the varied applications of the diagnostic tools in parasite control |
| CO - 2 | Categorizing general principles of parasitology, immunity involved in parasitic infections |
| CO - 3 | Discuss about the mode of infection and treatment of protozoan parasites |
| CO - 4 | Know the pathogenicity and treatment of Helminth parasites |
| CO - 5 | Understand the life history and medical importance of disease transmitting vectors of arthropod parasites |

UNIT I INTRODUCTION

Types of animal association- parasitism and types of parasites, primary and secondary hosts, transmission of parasitic infection. Host- parasitic interactions – parasitic effects benefiting the parasites.

UNIT II PARASITIC ADAPTATIONS

Parasitic mode of life – adaptations- morphological, biochemical and ethological adaptation – immune responses of host and self – defense mechanism – molecular characterization of stage specific antigens – nucleotide probes for diagnosis of protozoan diseases.

UNIT III PROTOZOAN PARASITES

Morphology, Life cycle and Biology, mode of infection and treatment of Mastigophora – *Trypanosoma*, *Leishmania*, *Giardia* and *Trichomonas*; Sarcodina- *Entamoeba*, *Iodamoeba*; *Chilophora*-*Balantidium* ; Sporozoa- *Toxoplasma* and *Plasmodium*.

UNIT IV HELMINTH PARASITES

Life cycle, Biology, morphology, pathogenesis and treatment of Nematoda- *Ancylostoma*, *Ascaris*, *Enterobius*, *Wuchereria*, *Onchocerca*, *Loa*, *Trichuris*; Trematoda- *Polystoma*, *Schistosoma*, *Echinostoma*, *Fasciola*; Cestoda- *Taenia*, *Echinococcus* and *Dipylidium*.

UNIT V ARTHROPOD PARASITES

Morphology, life history and medical importance of disease transmitting vectors- Diptera- Culicoides, *Aedes*, *Culex*, *Anopheles* and House fly; Siphonoptera -*Xenophylla*, *Ctenocephalides*, *Echidnophaga* and *Tunga*; Phthiraptera – *Pediculus* and *Pthirus*; Hemiptera - *Cimex*, *Triatoma* ; Malaria, Chikungunya and Dengue fever.

Text book:

1. Prakash Malhotra 2008. Applied Parasitology – Adhyayan Publishers and Distributors
–
New Delhi.

REFERENCES

1. Berger, S. A., Marr J. (2006) Human Parasitic Diseases Sourcebook, Jones & Bartlett.
2. Despommier, Gwadz, Hotez, Knirsch (2005) Parasitic Diseases 5th edition, Apple Trees Productions, LLC.
3. Margo, W. M. S., Pybus J. and Kocan A. A. (2008). Parasitic Diseases of Wild Mammals, 2nd edition, Iowa State University Press, Ames, Iowa, USA
4. Kochhar S.K. 2004. A Text Book of Parasitology. Dominant Publishers and Distributors – New Delhi.
5. Veer Singh Rathore and Yogesh Singh Sengar 2005. Diagnosis parasitology. Pointer Publishers Jaipur – India.

COURSE OUTCOME:

| CONo | Course outcome | PSO's addressed | Cognitive level |
|--------|---|-----------------|-----------------|
| CO - 1 | Explain life patters, morphological adaptation, pathogenicity and diagnostic techniques, protozoans and helminth parasite | 1,2 | Apply |
| CO - 2 | Understand the different components of immune system and antigenic diversity in parasites and the selection of vaccine targets will be understood | 1,2,4 | Understanding |
| CO - 3 | Understand the Morphology, Life cycle and Biology, mode of infection and treatment of protozoan parasites | 1,2,4 | Understanding |
| CO - 4 | Discuss about the Life cycle , Biology , morphology, pathogenicity and treatment of Nematoda | 1,2,4 | Analyse |
| CO - 5 | Discuss the concerned species, life historic, disease transmission, epidemiology and control of the arthropod vectors | 1,2 | Evaluate |

Cognitive level: R - Remember; U-Understanding; A-Apply; An-Analyse; E – Evaluate; C-Create

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | |
|---|------------------------------------|---------------------|-------|-------|-------|------------------------------------|-------|--------|-------|-------|
| I | 21PEZO41B | PARASITOLOGY | | | | | 60 | 2 | | |
| Course Outcomes (COS) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | |
| CO-3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| Number of matches (✓) = 38 Relationship = Low/ Medium /High | | | | | | | | | | |

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Checked by
 Head of the Department

SEMESTER – III

| | |
|---------------------|-------------------------------------|
| COURSE TITLE | ANIMAL PHYSIOLOGY PRACTICALS |
| TOTAL HOURS | 60/Semester |
| HOURS/WEEK | 4 |
| SUBJECT CODE | 21PCZO3P1 |
| COURSE TYPE | CORE PRACTICAL -V |
| CREDITS | 2 |
| MARKS | 100/2 |

GENERAL OBJECTIVE:

❖ To develop the skills of performing experiments, analyzing the results and discussing the observations in Animal Physiology

COURSE OBJECTIVES

The learners will be able to:

| CO.NO. | COURSE OBJECTIVES |
|---------------|--|
| CO-1 | Interpret the effect of temperature on opercular movement of fish. |
| CO-2 | Identify the total haemoglobin in human blood. |
| CO-3 | Examine the haemin crystals in human blood. |
| CO-4 | Determine the Erythrocyte sedimentation rate. |
| CO-5 | Estimate the Salt loss/salt gain in a fish. |

1. Effect of Temperature on opercular movement of fish.
2. Estimation of Total haemoglobin and blood clotting time.
3. Haemin crystals in human blood.
4. Determination of Erythrocyte sedimentation rate (ESR)

5. Rate of Oxygen consumption in a fish
6. Salt loss/salt gain in a fish
7. Quantitative analysis of Nitrogenous waste products.
8. Estimation of blood chloride
9. Virtual dissection of frog- Blood vascular system or Digestive system.
10. Bomb Calorimeter – Demonstration

Spotters

- 1) Simple muscle twitch 2) Sphygmomanometer
- 3) Haemocytometer 4) Reflex arc model
- 5) ECG model 6) Cardiac cycle
- 7) Dialysis 8) Family planning devices

COURSE OUTCOMES

| CO. NO. | COURSE OUTCOMES | PSO'S addressed | COGNITIVE LEVEL |
|----------------|--|------------------------|------------------------|
| CO-1 | Explain the effect of temperature on opercular movement of fish. | 1,2 | Understanding |
| CO-2 | Develop the haemin crystals in human blood. | 1,2 | Applying |
| CO-3 | Examine the Erythrocyte sedimentation rate (ESR) | 1,2,3 | Analyzing |
| CO-4 | Compare salt gain and salt loss in fish. | 3,4 | Evaluating |
| CO-5 | Discuss the various nitrogenous waste products in animals. | 3,4,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | Hours | Credit | | | | | | |
|--|------------------------------------|------------------------------|-------|--------|-------|------------------------------------|-------|-------|-------|-------|
| III | 21PCZO3P1 | ANIMAL PHYSIOLOGY PRACTICALS | 60 | 2 | | | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| CO-2 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| CO-3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| Number of matches (✓) = 35..... Relationship = Low/Medium/ High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33) | | | | | | | | | | |

Prepared by
Dr. M.I. Delighta Mano Joyce

Name and Signature

Checked by
Head of the Department

SEMESTER - III

| | |
|---------------------|---|
| COURSE TITLE | BIostatISTICS AND BIOinformatics & RESEARCH METHODOLOGY PRACTICALS |
| TOTAL HOURS | 60/Semester |
| HOURS/WEEK | 4 |
| SUBJECT CODE | 21PCZO3P2 |
| COURSE TYPE | CORE PRACTICAL- VI |
| CREDITS | 2 |
| MARKS | 100/2 |

GENERAL OBJECTIVE:

- ❖ To analyze and apply statistical techniques and to develop the computational skill and to impart knowledge on various biological databases

COURSE OBJECTIVES: The learners will be able to:

| CO.NO. | COURSE OBJECTIVES |
|--------|---|
| CO-1 | Illustrate the measures of central tendency. |
| CO-2 | Identify the correlation and regression analysis of students. |
| CO-3 | Discuss the study of probability using coin toss. |
| CO-4 | Explain various databases in bioinformatics. |
| CO-5 | Create the bioinformatic tools. |

1. Statistical analysis of mean, median and mode, variance, SD, SE, coefficient of variation using neem leaves.
2. Calculation of correlation coefficient – length and width of neem leaves add
3. Calculation of correlation coefficient – height and weight of students in the class.
4. Calculation of regression co-efficient using length and width of neem leaves. add
5. Study of probability using coin toss.
6. Test of significance (student's t-test)

7. Processing data with statistical package. (SPSS)- Demonstration.
8. Types of Biological Databases and Using it- Anova, Chi-square delete
9. PubMed, NCBI, EMBL, SWISS-PROT – printout
10. Select a topic and write a model research proposal of your own delete

Biostatistics and Bioinformatics spotters

1. Uniprot
2. Protein Data Bank
3. GenBank
4. Use of BLAST, FASTA (Nucleic Acids and Proteins)
5. Use of EMBOSS
6. Molecular Modelling
7. Homology Modelling – Swiss modeler

Research Methodology spotters

1. pH meter 2. Colorimeter 3. Spectrophotometer 4. Chromatography
5. Electrophoresis

| CO. NO. | COURSE OUTCOMES | PSO'S addressed | COGNITIVE LEVEL |
|----------------|---|------------------------|------------------------|
| CO-1 | Compare mean, median, mode in the statistical analysis. | 1,2 | Understanding |
| CO-2 | Develop the correlation and regression analysis. | 1,2 | Applying |
| CO-3 | Analyze the probability by applying the formulae. | 1,2,4 | Analyzing |
| CO-4 | Compare various databases in statistical analysis. | 3,4 | Evaluating |
| CO-5 | Design processing data using SPSS package. | 4,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | |
|---|------------------------------------|---|-------|-------|-------|------------------------------------|-----------|----------|-------|-------|
| III | 21PCZO3P2 | BIostatistics and Bioinformatics & Research Methodology Practicals | | | | | 60 | 2 | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | |
| CO-3 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | |
| CO-4 | | | ✓ | ✓ | | | | ✓ | ✓ | |
| CO-5 | | | ✓ | ✓ | ✓ | | | | ✓ | ✓ |
| Number of matches (✓) = ...28.... Relationship = Low/ Medium /High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33) | | | | | | | | | | |

Prepared by

Checked by

Dr. M.I. Delighta Mano Joyce

Head of the Department

Name and Signature

SEMESTER - III

| | |
|---------------------|------------------------|
| Course Title | Applied Zoology |
| Total Hours | 30/Semester |
| Hours/Week | 2 |
| Subject Code | 21PIZO31 |
| Course Type | IDC-II |
| Credits | 2 |
| Marks | 100 |

General Objective:

To develop entrepreneur skill in various Zoological field like Vermiculture, Apiculture, Prawn Culture, Sericulture and Poultry Management.

Course Objectives: The learners will be able to:

| CO.No. | Course Objectives |
|--------|--|
| CO-1 | Explain the Earthworm culture technology. |
| CO-2 | Develop knowledge on apiculture, maintaining bee hives and bee products. |
| CO-3 | Classify the process involved in prawn culture. |
| CO-4 | Assess the sericulture techniques and its economy value. |
| CO-5 | Elaborate the process involved in poultry industry. |

UNIT I: Vermiculture

Introduction to Vermiculture - types of earthworm, biology of *Eudriluseuginea*-rearing of earthworms, equipment/devices used in vermiculture- Vermicompost technology – methods and products-Vermiwash collection- composition and use.

UNIT II: Apiculture

Morphology and biology of honey bees – honey bee species – social behavior of honey bees – bee keeping and ancillary industries – Newton's bee hive extraction of honey – medicinal value of honey – bee products – importance of bee colonies in crop pollination.

UNIT III: Prawn Culture

Prawn fishery – types of prawn fishery – culture of fresh water prawn – culture of marine prawn – preparation of farm; preservation and processing of prawn, export of prawn.

UNIT IV: Sericulture

History and present status - sericulture in India - types of silkworms and distribution; silkworm rearing technology: food plant cultivation, seed production, reeling, re-reeling, twisting, doubling and weaving; diseases and pests of silkworm: protozoan, viral, bacterial and fungal diseases; silkworm pests: Indian Uzi fly and Dermestid beetles.

UNIT V: Poultry Management

Breeds of fowl, housing and equipment, deep litter system, laying cages, methods of brooding and rearing, debeaking; management of growers, layers, broilers; feed formulations for chicks, growers and broilers; diseases of fowl; nutritive value of egg and meat; incubation and hatching of eggs.

Textbooks

1. Applied Zoology, Arumugam, N., Murugan, T., Johnson Rajeswar and R. RamPrabhu (2009) Saras Publication, Nagercoil. second change
2. A Hand book on Economic Zoology, Jawaid Ahsan and Subhas Prasad Sinha (2009) S. Chand Publications, New Delhi.

REFERENCE BOOKS

1. Dash, M.C., 2012 Charles Darwin's Plough Tool for vermitechology, I.K. International Publishing House Private Limited, New Delhi.
2. Ganga, G . 2004. Comprehensive Sericulture, Vol. II, Silk worm Rearing and Silk Reeling, India Book House Private Ltd.
3. Scanes, C.G, Brant, G and Ensminger, M.E., 2004. Poultry Science, 4th Ed. Prentice Hall, USA.
4. Gatoria, G.S., Gupta, J. K., Thakur, R.K. and Singh, J.2011. Mass queen bee rearing and multiplication of honey bee colonies. All India Co-ordinated project on honey bees and pollinators, ICAR, HAU, Hisar, p70.

COURSE OUTCOME

| CO.NO. | COURSE OUTCOME | PSO'S addressed | COGNITIVE LEVEL |
|--------|---|-----------------|-----------------|
| CO-1 | Explain the Vermiculture technology | 1,2,3,4 | Understanding |
| CO-2 | Develop the techniques involved in Apiculture. | 1,2,3 | Applying |
| CO-3 | Classify the fresh water prawn and marine prawn. | 1,3 | Analyzing |
| CO-4 | Estimate the Silkworm cocoon and its economy value. | 1,2,3,4 | Evaluating |
| CO-5 | Create the self-employment opportunity in poultry industry. | 1,5 | Creating |

Cognitive Level; R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Relationship Matrix

| Semester | Course Code | Title of the Course | Hours | Credit | | | | | | |
|--|------------------------------------|---------------------|-------|--------|-------|------------------------------------|-------|-------|-------|-------|
| III | 21PIZO31 | APPLIED ZOOLOGY | 30 | 2 | | | | | | |
| Course Outcomes (COS) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| CO-3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ |
| Number of matches (✓) = 40 Relationship = Low/Medium/ High | | | | | | | | | | |

Prepared by
Dr.A.Mohaideen
 Name and Signature

Checked by
 Head of the Department

SEMESTER IV

| | |
|---------------------|--------------------|
| Course Title | Immunology |
| Total Hrs | 75/Semester |
| Hrs / Week | 5 |
| Sub. Code | 21PCZO41 |
| Course Type | Core X |
| Credits | 4 |
| Marks | 100 |

General objective:

- ❖ To understand the fundamental aspects of infective organisms and the potential of the living systems to resist infections

Course objectives: The learners will be able to:

| CO. No | Course Objectives |
|---------------|---|
| CO -1 | Classify the cells of immune system and lymphoid organs. |
| CO -2 | Examine the structure, types and biological properties of immunoglobulins |
| CO -3 | Compare the Classical and alternate pathways of complement system. |
| CO -4 | Asses the immuno response to tumour and immuno diagnosis of tumour. |
| CO -5 | Elaborate on the Transplantation techniques and Treatments. |

UNIT I: History and Types of Immunity

Introduction: History, types of Immunity: Innate Immunity and Acquired immunity – active and passive immunity – adoptive immunity; Cells of immune system: Lymphoid lineage – T cells and its types – B cells and its types – null cells and its types- Myeloid lineage; organs of immune system: primary lymphoid organs: thymus – bone marrow- bursa of Fabricius – Secondary lymphoid organs: lymph node and spleen.

UNIT II: Immune Response

Humoral immune response: Primary and secondary humoral immune response – importance of B cells in humoral immune response – factors influencing antibody formation; Cell mediated immune response: cells involved in the cell mediated immune response – cytokines and their actions – Hypersensitivity reaction: Factors causing hypersensitivity – types of hypersensitivity – type I, II, III, IV and V – hypersensitivity reactions; Complement system: Classical and alternate pathways of complement system – biological functions of complement system.

UNIT III: Antigens and Antibodies

Antigens: types of antigens – chemical nature of antigen – essential factors for antigenicity; Antibodies: Antibodies and immunoglobulins – structure of immunoglobulin – types of immunoglobulin – biological properties of immunoglobulins G, M, A, D, and E – Monoclonal and polyclonal antibodies; Antigens and antibody reactions: salient features and mechanism of immune complex.

UNIT IV: Clinical Immunology

Transplantation immunology: types of transplantation: classification of grafts – mechanism of graft rejection – graft versus host reaction – immuno suppressive therapy during transplantation; Tumour immunology: properties of tumour cells –tumour antigens – immune response to tumour – immune surveillance – immuno diagnosis of tumour – immuno therapy of tumour; tumour vaccines.

UNIT V: Diseases and Vaccines

Auto immune diseases: characteristics– causes and classification of auto immune diseases – treatment of auto immune diseases; Immune response to infectious diseases: protozoan parasite (malaria) – bacterial disease (Tuberculosis) – viral disease (HIV) – ELISA and Western Blot; Immuno therapy: immunization and immunization schedule – vaccines – attenuated vaccine – killed vaccine – recombinant vaccine – vector vaccine and DNA vaccine.

Textbooks:

1. C. V. Rao 2004. An introduction to immunology. Narosa Publishing House.

2. Chakraborty, A.L. 2006. Immunology and Immunotechnology. Oxford University Press, New Delhi.

Reference Books:

1. Klaus D. Elgert, 2009. Immunology: Understanding the Immune System, 2nd Edition, Wiley-Blackwell Publishers Co.
2. Donald M. Weir and John Stewart. 2001. Immunology, 9th edition. ELBS Publication.
3. Aruna Bhatia. 2006. Manual of Practical Immunology..Palani Paramount Publications, Palani
4. Talwar, G. P. 2000. A handbook of Practical Immunology, Vikas Publication House Ltd. New Delhi.
5. Hudson, L. and Hay, F. 2001. Practical Immunology, 3rd edition, Blackwell Scientific Publication.

Course outcomes

| CO.NO | COURSE OUTCOMES | PSO'S addressed | COGNITIVE LEVEL |
|--------------|--|------------------------|------------------------|
| CO-1 | Compare the different types of immunity and humoral , cell mediated immune response. | 1,2 ,4,5 | Understanding |
| CO-2 | Identify the types and chemical nature of antigens. | 2,4,5 | Applying |
| CO-3 | Examine the Factors causing hypersensitivity and types of hypersensitivity. | 1,2,3 | Analysing |
| CO-4 | Recommend the Immunization and immunization schedule – vaccines. | 1,2,4 | Evaluating |
| CO-5 | Develop the tumour immunology and tumour therapy | 2,4,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | |
|-----------------------|--|---------------------|-------|-------|-------|------------------------------------|-------|--------|-------|-------|
| IV | 21PCZO41 | Immunology | | | | | 75 | 4 | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ |
| CO-2 | ✓ | | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ |
| CO-3 | ✓ | | ✓ | ✓ | | ✓ | ✓ | | ✓ | |
| CO-4 | ✓ | | ✓ | ✓ | | ✓ | ✓ | | ✓ | |
| CO-5 | ✓ | | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ |
| | Number of matches (✓) = ...35.... Relationship = Low/Medium/ High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33) | | | | | | | | | |

Prepared by
Dr. J. Shifa Vanmathi

Name and Signature

Checked by

Head of the Department

SEMESTER - IV

| | |
|---------------------|--------------------|
| Course Title | Entomology |
| Total Hours | 75/Semester |
| Hours/Week | 5 |
| Subject Code | 21PCZO42 |
| Course Type | Core XI |
| Credits | 4 |
| Marks | 100 |

General Objective:

To understand the aspects of insect classification and to know the harmful insects and beneficial insects, pest management.

Course Objectives: The learners will be able to:

| CO.No. | Course Objectives |
|---------------|---|
| CO-1 | Classify the insects in biological order. |
| CO-2 | Explain the morphological structure and functions of different organ systems. |
| CO-3 | Classify the fine structure of receptor organs of insects. |
| CO-4 | Compare the harmful and beneficial insects. |
| CO-5 | Modify the various principles and methods of pest control. |

UNIT I: Taxonomy

Insect classification – Principles and classification of insects based on order– key characteristics with Indian examples – Coleopteran, Diptera, Hemiptera, Dermoptera, and Lepidoptera.

UNIT II: Structure and Function I

General structure of head, thorax with their appendages, abdomen - integumentary system: structure and chemistry – structure and physiology of digestive system; respiratory system: aerial and aquatic respiration – respiration in endoparasites; circulatory system: structure of heart, mechanism of haemolymph circulation– diversity of haemocytes and their function; excretory system: Malpighian tubules and their function; reproductive system: post-embryonic development.

UNIT III: Structure and Function II

Fine structure of compound eye, coeloconic, Johnston's organ, chordotonal organs and stridulatory organ – bioluminescence; endocrine control of moulting and metamorphosis, vitellogenesis.

UNIT IV: Harmful and Beneficial Insects

Insect pests of economically important crops: cotton, paddy, sugarcane and vegetables; insects injurious to man: Mosquitos, House Fly and Sand Fly; beneficial insects: biology, culture and economic importance of honey bees and lac insects.

UNIT V: Methods and Principles of Pest Control

Control measures: cultural, mechanical, physical, legal, chemical, biological, genetic chemo sterilant, pheromones, concepts of bio integrated pest control, Biointensive Integrated Pest Management (BIPM).

Textbooks

1. Rajendra Singh, 2007 Elements of Entomology, Rastogi Publications, Meerut
2. Pedigo, L. P., 1996, Entomology and pest management (2nd edition) –Upper Saddle River, N. J. Prentice Hall.

Reference Books

1. Nayar, K. K., David, B. V. and Anantha Krishnan, T. N., 2004, General and applied entomology, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
2. David B. V. Ramamurthy T., 2000, Elements of economic entomology, Popular Book Depot, Chennai.
3. D. P. Ambrose, 2004, The insects: Structure, function and biodiversity, Kalyani Publishers, Ludhiana,
4. D. P. Ambrose, 2017, The insects: beneficial and harmful aspects, Kalyani Publishers, Ludhiana.

COURSE OUTCOME

| CO.No. | Course Outcome | PSO'S addressed | Cognitive Level |
|--------|---|-----------------|-----------------|
| CO-1 | Understand the taxonomy of insects. | 1,2,3 | Understanding |
| CO-2 | Identify the digestive system; respiratory system, circulatory system and excretory systems of insects. | 1,2,3,4 | Applying |
| CO-3 | Examine the fine structure compound eye, coeloconic, Johnston's organ, chordotonal organs and stridulatory organ. | 1,2,3 | Analyzing |
| CO-4 | Explain the culture of the economically important honey bees and lac insects | 1, 3,4 | Evaluating |
| CO-5 | Discuss the Biointensive Integrated Pest Management (BIPM). | 1,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | Hours | Credit | | | | | | |
|--|------------------------------------|---------------------|-------|--------|-------|------------------------------------|-------|-------|-------|-------|
| IV | 21PCZO42 | ENTOMOLOGY | 75 | 4 | | | | | | |
| Course Outcomes (COS) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| CO-3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ |
| Number of matches (✓) = 40 Relationship = Low/Medium/High | | | | | | | | | | |

Prepared by
Dr. J. Shifa Vanmathi
 Name and Signature

Checked by
 Head of the Department

SEMESTER - IV

| | |
|---------------------|---------------------|
| COURSE TITLE | PROJECT |
| TOTAL HOURS | 120/Semester |
| HOURS/WEEK | 8 |
| SUBJECT CODE | 21PPZO41 |
| COURSE TYPE | PROJECT |
| CREDITS | 8 |
| MARKS | 200 |

GENERAL OBJECTIVE:

Every PG student is required to prepare the project subject related – based on the guidelines of his project guide.

The following are the guidelines to be adhered to

- The project should be an individual one
- The language for the project is **English**
- The Minimum number of pages should be **60**
- Project observations, suggestions and conclusion shall form part of the project.
- The Projects will be evaluated both by the Internal as well as External Examiner each for 100 marks. The distribution of mark should be **60 marks for the Project Report and 40 marks for the Viva-voce Examination.** The Division of marks for the Project Report is as mentioned below:

| Particulars | Internal Examiner | External Examiner |
|---|--------------------------|--------------------------|
| Wording of Title | 5 | 5 |
| Objectives/ Formulation including Hypothesis | 5 | 5 |
| Review of Literature | 10 | 10 |
| Relevance of Project to Social Needs | 5 | 5 |
| Methodology/ Technique/ Procedure Adopted | 10 | 10 |
| Result and Discussion | 10 | 10 |
| Summary/ Findings/ Conclusion/Future recommendations. | 5 | 5 |
| Bibliography/ Annexure/ Foot notes | 10 | 10 |
| Total | 60 | 60 |

The average mark of Internal and External Examiner is considered as marks of Dissertation report.

Prepared by
Dr. M.I. Delighta Mano Joyce

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Head of the Department

SEMESTER - IV

| | |
|--------------|--------------|
| Course Title | SERICULTURE |
| Total Hrs | 60 |
| Hrs / Week | 4 |
| Sub. Code | 21PEZO41A |
| Course Type | DSE – IV – A |
| Credits | 4 |
| Marks | 100 |

General objective:

- ❖ To understand the various aspects of sericulture and encourage the students for self employment.

| CO. No | Course Objectives |
|--------|---|
| CO -1 | Explain Sericulture industry in India and Tamilnadu. |
| CO -2 | Construct the Life cycle of silkworm. |
| CO -3 | Distinguish the diseases of mulberry and non-mulberry plants. |
| CO -4 | Compare the diseases of silk worm. |
| CO -5 | Design the reeling operations applied in sericulture. |

UNIT I: HISTORY AND IMPORTANCE OF SERICULTURE

Importance of sericulture - sericulture industry in India and Tamilnadu - sericulture as a cottage industry - role of central silk board, research institutes, national silk seed organization; Moriculture – morphology of Mulberry plant, **Mulberry varieties**, Artificial seed preparation - package of practices for mulberry and **castor plant cultivation**.

UNIT II: LIFE CYCLE OF MULBERRY AND NON- MULBERRY SILKWORM

Classification of mulberry silkworm, life cycle - habit and habitat - voltinism, races – morphology of silkworm - structure of egg, larva, pupa, and adult, sexual dimorphism of larva and pupa, fine structure of silk gland; **non mulberry silk worm – classification- life cycle and morphology of Eri silkworm**.

UNIT III: DISEASES OF MULBERRY AND NON –MULBERRY PLANTS

Diseases of mulberry: Fungal diseases – (Root and Shoot diseases), bacterial diseases (Tukra) - leaf blight disease, rot disease; Viral diseases – Mulberry leaf mosaic disease, dwarf disease; Deficiency diseases: nitrogen, phosphorus, magnesium and calcium deficiency - symptoms and control measures - major pests of mulberry; **non mulberry plant diseases and control measures.**

UNIT IV: SILKWORM DISEASES

Diseases of silk worm: Protozoan – Pebrine, Viral – Flacherie, Gattine, Bacterial – septicemia, sotto, Fungal - Muscardine, Pests –Uzi fly; **diseases of non-mulberry silkworm – Bacterial, fungal, viral diseases and control measures.**

UNIT V: COCOON MARKETING AND REELING OPERATIONS

Rearing of silk worm: selection and construction of rearing house, rearing appliances, rearing operation, maintenance of optimum conditions; Chawki rearing - rearing of late age larva — characteristics of cocoons - defective cocoons; cocoon production, harvesting and marketing; Silk reeling: cocoon stifling - storage of cocoons, cocoon boiling and deflossing; Process of reeling: different methods, reeling techniques- lacing, skinning, twisting and reeling.- **raw silk and marketing.**

TEXT BOOKS

1. Ganga, G. and SulochanaChetty. I , 2014.- An Introduction to Sericulture. Oxford & IBH Publishing Company Private Ltd .New Delhi .
2. Kesary, M . and M .Johnson, 2007. Sericulture , Department of Zoology, N. M. Christian College, Marthandam - 629 165 .

REFERENCE BOOKS

1. Dandin, S. B. , Jayant Jayaswal and K. Giridhas, 2000. Hand Book of Sericulture Technologies, Central Silk Board, Madivala, Bangalore - 68.
2. Ganga, G. 2003,- Comprehensive Sericulture, Vol. I, Morigulture, Science Publishers.U.S..
3. Ganga, G . 2004. Comprehensive Sericulture, Vol. II, Silk worm Rearing and Silk Reeling, India Book House Private Ltd.
4. Ullal, S. and Narasimhana, M.N. 2003. Hand Book of Practical Sericulture- CSB,Bombay.

Course outcomes

| CO.No | Course Outcomes | PSO'S addressed | Cognitive level |
|-------|---|-----------------|-----------------|
| CO-1 | Summarize the importance of moriculture. | 1,2 | Understanding |
| CO-2 | Develop the fine structure of silk gland of silkworm. | 1,2,3 | Applying |
| CO-3 | Differentiate the diseases of mulberry plant. | 2,3,4 | Analyzing |
| CO-4 | Explain the various diseases of silkworm. | 2,3,4 | Evaluating |
| CO-5 | Formulate the various cocoon marketing techniques. | 1,4,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | | | |
|-----------------------|--|---------------------|-------|-------|-------|------------------------------------|-------|--------|-------|-------|--|--|
| IV | 21PEZO41A | SERICULTURE | | | | | 60 | 4 | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | | |
| CO-1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | |
| CO-3 | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | | | |
| CO-4 | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | |
| | Number of matches (✓) = ...36.... Relationship = Low/Medium/ High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33) | | | | | | | | | | | |

Prepared by
Dr. M.I. Delighta Mano Joyce
 Name and Signature

Checked by
 Head of the Department

SEMESTER - IV

| | |
|--------------|----------------------------------|
| Course Title | Poultry and Dairy Science |
| Total Hrs | 60/ Semester |
| Hrs / Week | 4 |
| Sub. Code | 21PEZO41B |
| Course Type | DSE-IVB |
| Credits | 4 |
| Marks | 100 |

General objective:

To acquire more recent knowledge on modern Poultry and Dairy Science technology on self employment opportunity.

Course objectives: The learners will be able to:

| CO. No | Course Objectives |
|--------|--|
| CO -1 | Explain the poultry industry in India and 5 years plan for improvement of poultry field. |
| CO -2 | Interpret the Managements of chicks, growers, layers and broilers. |
| CO -3 | Analyse debeaking and forced moulting for poultry birds. |
| CO -4 | Evaluate the protein and amino acid requirements for chicks, growers, layers and broilers. |
| CO -5 | Develop the Dairy breeds of India : Cattle and Buffaloes, Native and Exotic Breeds. |

UNIT I: Deep Litter and Cage System

Poultry in India- a survey- historical review- progress through 5 year plans; types of poultry birds, choosing commercial layers and broilers- poultry housing – construction of poultry sheds - deep litter system – litter management, laying cages, Californian cages; debeaking: methods of debeaking and forced moulting; lighting for chicks, growers, layers and broilers.

UNIT II: Management of Poultry Birds

Managements of chicks- management details and disease control measures – management of growers – feeding and disease control programmes, management of layers – final housing and daily tasks; management of broilers- broiler growing programme and feed management; summer and winter managements - management of cage birds; poultry diseases – bacterial, fungal and viral diseases.

UNIT III: Poultry Nutrition

Poultry nutrition- protein and amino acid requirements – carbohydrates and fats as energy sources – requirements of fat soluble and water soluble vitamins for chicken – essential inorganic minerals for chicks and layers – deficiency symptoms; feed stuffs for poultry –energy sources, vegetable protein sources, animal protein sources, mineral sources and pigmentation sources; non-nutritive feed additives - types.

UNIT IV: Dairy Breeds and Nutrition

Dairy breeds of India: Cattle and Buffaloes, native and exotic breeds - nutritive value of milk and dairy products in India- milk synthesis and secretion, composition of milk; artificial insemination programme in cattle - merits and demerits of inbreeding and outbreeding.

UNIT IV: Farm Management

Housing and equipments of dairy forms- feed, care and management of adult and newborn calves, marketing of dairy products; live stock diseases and management – mastitis, render pest, foot and mouth disease, vaccination programme.

Textbook:

1. Gnaanamani M.R., 2008. Modern aspects of commercial poultry keeping, Giri.
2. Prashad J. 2005. Poultry Production and Management. Kalyani Publishers, New Delhi.

Reference Books:

- 1.G.S. Shukla and V.B. Upadhyay, 2000. Economic Zoology, Rastogi Publications, NewDelhi.
2. Scanes, C.G, Brant, G and Ensminger, M.E., 2004. Poultry Science, 4th Ed. PrenticeHall, USA.
3. Jull, M.A. 2003. Successful Poultry Management.
4. Leeson, S and Summers, J.D. 2005. Commercial Poultry Nutrition, International Pub.House.

Course outcomes

| CO.NO | Course Outcomes | PSO'S addressed | Cognitive Level |
|-------|--|-----------------|-----------------|
| CO-1 | Identify the deep litter system and their importance. | 1,2,3,4 | Understanding |
| CO-2 | Develop the management of cage birds. | 1,2,4 | Applying |
| CO-3 | Classify the different types of Poultry diseases- prevention and control. | 2,3, | Analysing |
| CO-4 | Justify carbohydrates and fats as energy sources – essential fatty acids. | 1,2,3,4 | Evaluating |
| CO-5 | Modify the Non-nutritive feed additives- merits and demerits of additives. | 1,3,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | | | |
|-----------------------|--|---------------------------|-------|-------|-------|------------------------------------|-------|--------|-------|-------|--|--|
| IV | 21PEZO41B | POULTRY AND DAIRY SCIENCE | | | | | 60 | 4 | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | | |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | |
| CO-3 | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | | | | |
| CO-4 | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | | | |
| CO-5 | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | | | |
| | Number of matches (✓) = ...36.... Relationship = Low/Medium/ High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33) | | | | | | | | | | | |

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 Name and Signature

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 Head of the Department

SEMESTER - IV

| | |
|--------------|------------------------|
| Course Title | ANIMAL FEED TECHNOLOGY |
| Total Hrs | 60/semester |
| Hrs / Week | 4 |
| Sub. Code | 21PEZO41C |
| Course Type | DSE – IV C |
| Credits | 4 |
| Marks | 100 |

General objectives

To understand the techniques of processing of feed ingredients, various types of feed and strategies of feed storage additives.

Course objectives: The learner will be able to

| CO. No | Course Objectives |
|--------|---|
| CO -1 | Categorizing the components of foods |
| CO -2 | Explain the digestion and metabolism of nutrients |
| CO -3 | Outline the nutritional characteristics of foods |
| CO -4 | Checking Protein concentrates, Food additives |
| CO -5 | Formulating the feed for animals. |

UNIT I THE COMPONENTS OF FOODS

Animal food- Classification of animal food- Carbohydrates- Monosaccharides, Monosaccharides derivatives, Oligosaccharides, Polysaccharides and Lignin. Lipids- Fat, Glycolipids, Phospholipids, Waxes, Steroids and Terpenes. Protein- Amino acid and Peptides -Vitamins and Minerals.

UNIT II THE DIGESTION AND METABOLISM OF NUTRIENTS

Enzymes – Classification of enzymes, Nature of enzymes, Mechanism of enzyme action. **Digestion**-Digestion of Monogastric Mammals, Microbial digestion in ruminants and other herbivores, alternative sites of microbial digestion nutrient

digestion and the environment **Metabolism** – Energy metabolism, Protein synthesis, fat Synthesis and carbohydrate synthesis.

UNIT III THE NUTRITIONAL CHARACTERISTICS OF FOODS

Grass and forage crops- Grasses, Legumes, Other forages. Silage- Classification of silages, Nutritive value of silages, Whole crop cereal and legume silages. Hay, artificially dried forages, straws and chaff- Roots, tubers and related by-products- Cereal grains and cereal by-products

UNIT IV PROTEIN CONCENTRATES, FOOD ADDITIVES

Protein concentrates - Oilseed cakes and meals, Leguminous seeds, Animal protein concentrates, Single cell protein and synthetic amino acids. **Food additives**– Antibiotics, Probiotics, Oligosaccharides, Enzymes, Organic acids, Spray-dried plasma, Modifiers of rumen fermentation.

UNIT V FEED FORMULATION

Need for feed formulation-square method-Linear programming-feed manufacturing (Basissoffeedmill) - Feedstability-feed storage-feed spoilage (Bacterial and Fungal toxins)-factors affecting feed storage and nutrient loss.

TEXTBOOKS

1. P Mc Donald *et al.*, 2011, Animal nutrition, Seventh Edition, Prentice Hall

REFERENCE BOOKS

1. Pillai, TVR. and M.N. Kutty., 2005. Aquaculture: Principles and Practices, Wiley-Blackwell.
2. Michael, B. New. 1985. Feed and feed technology.
3. CMFRI Bulletin-1: Feed Technology

COURSE OUTCOME

| CO.NO. | COURSE OUTCOME | PSO's addressed | COGNITIVE LEVEL |
|--------|---|-----------------|------------------|
| CO-1 | Classifying Carbohydrates- Lipids- Protein- Vitamins and Minerals | 1,2,3 | U- Understanding |
| CO-2 | Determining the metabolism of Carbohydrates, Lipids and Protein | 2,3,4 | A-Apply |
| CO-3 | Categorizing Grass , forage crops Silage- Hay, straws, chaff-Roots, tubers Cereal grains and cereal by-products | 3,4 | An-Analyse |
| CO-4 | Measuring Antibiotics, Probiotics, Oligosaccharides, Enzymes, Organic acids, Spray-dried plasma | 1,5 | E – Evaluate |
| CO-5 | Making feedmanufacturing | 1,2,5 | C-Create |

Cognitive level: R - Remember; U-Understanding; A-Apply; An-Analyse; E – Evaluate; C-Create

Relationship Matrix

| Semester | Course Code | Title of the Course | | | | | Hours | Credit | | |
|---|------------------------------------|------------------------|-------|-------|-------|------------------------------------|-------|--------|-------|-------|
| IV | 21PEZO41C | ANIMAL FEED TECHNOLOGY | | | | | 60 | 2 | | |
| Course Outcomes (COS) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | |
| CO-3 | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| Number of matches (✓) = 38 Relationship = Low/ Medium /High | | | | | | | | | | |

Prepared by

Dr.A.Mohaideen

Name and Signature

Checked by

Head of the Department

SEMESTER - IV

| | |
|---------------------|------------------------------|
| Course Title | Immunology Practicals |
| Total Hrs | 60/Semester |
| Hrs / Week | 4 |
| Sub. Code | 21PCZO4P1 |
| Course Type | CORE PRACTICAL VII |
| Credits | 2 |
| Marks | 100/2 |

General objective:

- ❖ To understand the different kinds of immunological methods

Course objectives: The learners will be able to:

| CO. No | Course Objectives |
|---------------|--|
| CO -1 | Explain the Antigen antibody interaction in vitro - ABO typing and Rh typing. |
| CO -2 | Examine the typhoid antigens by widal test. |
| CO -3 | Examine the Total Counting of WBC - differential count in a blood sample. |
| CO -4 | Choose the culture media for growth of microorganisms (liquid, semisolid and solid). |
| CO -5 | Test the Differential staining and capsular staining. |

1. Antigen antibody interaction in vitro - ABO typing, Rh typing.
2. Radio immuno assay
3. ELISA (Demonstration).
4. Rocket immuno Electrophoresis
5. Testing for Typhoid Antigens by Widal Test
6. Dissection of lymphoid organs in fish.
7. Total Counting of WBC - differential count in a blood sample.
8. Isolation of Monocytes from Blood
9. Visit to Medical microbiology laboratory and submission of report (compulsory).

SPOTTERS:

1. Primary Lymphoid organs
2. Secondary Lymphoid organs
3. Blood grouping
4. Monoclonal antibodies
5. Flow cytometer
6. Elisa titre plate
7. Vortex Mixer
8. Primary & delete Secondary immunization
9. Agglutination
10. Immunoglobulin types
11. Natural Killer Cell
12. Macrophages.

Course outcomes

| CO.NO | COURSE OUTCOMES | PSO'S addressed | COGNITIVE LEVEL |
|-------|--|-----------------|-----------------|
| CO-1 | Explain the Radio immuno assay method. | 1,2,4,5 | Understanding |
| CO-2 | Identify the lymphoid organs in fish. | 2,4,5 | Applying |
| CO-3 | Analyse the testing for typhoid antigens by Widal Test . | 2,3 | Analysing |
| CO-4 | Evaluate the Elisa titre plate and Vortex Mixer | 2,4,5 | Evaluating |
| CO-5 | Elaborate the mechanism of Agglutination. | 2,4,5 | Creating |

Relationship Matrix

| Semester | Course Code | Title of the Course | Hours | Credit | | | | | | |
|-----------------------|--|-----------------------|-------|--------|-------|------------------------------------|-------|-------|-------|-------|
| IV | 21PCZO4P1 | IMMUNOLOGY PRACTICALS | 60 | 2 | | | | | | |
| Course Outcomes (COs) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ |
| CO-2 | ✓ | ✓ | ✓ | | ✓ | | ✓ | | ✓ | ✓ |
| CO-3 | ✓ | ✓ | ✓ | | ✓ | | ✓ | | ✓ | |
| CO-4 | ✓ | ✓ | ✓ | | ✓ | | ✓ | | ✓ | ✓ |
| CO-5 | ✓ | ✓ | ✓ | | ✓ | | ✓ | | ✓ | ✓ |
| | Number of matches (✓) = ...36.... Relationship = Low/Medium/ High Low (If the No. of matches are less than 25) Medium (If the No. of matches are between 25 and 33) High (If the No. of matches are more than 33) | | | | | | | | | |

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 Name and Signature

Checked by
 Head of the
 Department

SEMESTER - IV

| | |
|---------------------|------------------------------|
| Course Title | Entomology Practicals |
| Total Hours | 60/Semester |
| Hours/Week | 4 |
| Subject Code | 21PCZO4P2 |
| Course Type | Core Practical – VIII |
| Credits | 2 |
| Marks | 100/2 |

General Objective:

- ❖ To understand insect morphology and physiology

Course Objectives: The learners will be able to:

| CO.No. | Course Objectives |
|--------|---|
| CO-1 | Understand the morphology of an insect. |
| CO-2 | Construct the digestive system, nervous system, excretory system and reproductive system of the Grass Hopper and Cockroach. |
| CO-3 | Analyze the mouth parts of Honey bees. |
| CO-4 | Evaluate the mouth parts of the Silk worm larva. |
| CO-5 | Discuss the insect preservation technique. |

1. Study of morphology of an insect (local insects to be used).
2. Dissection of digestive, nervous, excretory, reproductive delete systems of insects of different orders (Grass Hopper or Cockroach).
3. Mounting of different types of mouthparts (Honey bees, Silk worm larva.)
4. Collect insect species and preserve in insect box.

Mount any 5 insects

5. Identification of at least 12 insects belonging to different orders.
 - a) Silverfish b) Dragonfly c) Stick insect d) Leaf insect e) Cricket f) Shield bug g) Water scorpion h) Backswimmer i) Rice weevil j) Rhinoceros beetle. delete
- 6 a. Field study for various methods of pest management.
 - b. Field visit to ware houses and plant protection centres.

Course Outcomes

| CO.No | Course Outcome | PSO'S addressed | Cognitive Level |
|-------|---|-----------------|-----------------|
| CO-1 | Understand the morphology of Cockroach. | 1,2,3 | Understanding |
| CO-2 | Identify the Grass Hopper and Cockroach Organ system. | 1,2 | Applying |
| CO-3 | Dissect the Honey bee mouth. | 1,2,3 | Analyzing |
| CO-4 | Evaluate the insects belonging to different orders. | 1,4 | Evaluating |
| CO-5 | Create the insect box. | 1,2,5 | Creating |

Cognitive Level; R-Remember; U-Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

Relationship Matrix

| Semester | Course Code | Title of the Course | Hours | Credit | | | | | | |
|--|------------------------------------|-----------------------|-------|--------|-------|------------------------------------|--------|-------|-------|-------|
| IV | 21PCZO4P2 | ENTOMOLOGY PRACTICALS | 60 | 2 | | | | | | |
| Course Outcomes (COS) | Programme Learning Outcomes (PLOs) | | | | | Programme Specific Outcomes (PSOs) | | | | |
| | PLO 1 | PL O 2 | PLO 3 | PLO 4 | PLO 5 | PSO 1 | PS O 2 | PSO 3 | PSO 4 | PSO 5 |
| CO-1 | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | |
| CO-2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| CO-3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| CO-4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | |
| CO-5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| Number of matches (✓) = 37 Relationship = Low/Medium/ High | | | | | | | | | | |

Prepared by

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Name and Signature

Checked by

Head of the Department

| SEM | Category | Title of the Courses | S. Code | H/W | L | T | P | C | Marks | |
|-----|----------------------|--|-----------|-----|---|---|---|---|------------------|----------------|
| | | | | | | | | | Corrections Done | No Corrections |
| I | DSC-I | Biology of Invertebrates and Chordates | 21PCZO11 | 5 | 3 | 2 | - | 4 | | |
| | DSC-II | Biochemistry | 21PCZO12 | 5 | 3 | 2 | - | 4 | | |
| | DSC-III | Cell and Molecular Biology | 21PCZO13 | 5 | 3 | 2 | - | 4 | | |
| | DSE-I | A) Apiculture | 21PEZO11A | 4 | 3 | 1 | - | 4 | | |
| | | B) Systematics and Animal Diversity | 21PEZO11B | 4 | 3 | 1 | - | 4 | | |
| | | C) Endocrinology | 21PEZO11C | 4 | 3 | 1 | - | 4 | | |
| | P - I | Biology of Invertebrates and Chordates Practicals | 21PCZO1P1 | 4 | 1 | - | 3 | 2 | | |
| | P - II | Biochemistry & Cell and Molecular Biology Practicals | 21PCZO1P2 | 4 | 1 | - | 3 | 2 | | |
| | IDC-I | Ornamental fish culture | 21PIZO11 | 2 | 1 | 1 | - | 2 | | |
| | Library Hour | | 1 | - | - | - | - | | | |
| II | Core IV | Developmental Biology | 21PCZO21 | 5 | 3 | 2 | - | 4 | | |
| | Core V | Genetics and Evolution | 21PCZO22 | 5 | 3 | 2 | - | 4 | | |
| | Core VI | Animal Biotechnology | 21PCZO23 | 5 | 3 | 2 | - | 4 | | |
| | DSE-II | A) Vermiculture | 21PEZO21A | 4 | 3 | 1 | - | 4 | | |
| | | B) Environmental Biology | 21PEZO21B | 4 | 3 | 1 | - | 4 | | |
| | | C) Nanobiotechnology | 21PEZO21C | 4 | 3 | 1 | - | 4 | | |
| | P - III | Developmental Biology Practicals | 21PCZO2P1 | 4 | 1 | - | 3 | 2 | | |
| | P - IV | Genetics and Evolution & Animal Biotechnology Practicals | 21PCZO2P2 | 4 | 1 | - | 3 | 2 | | |
| | SEC-I | MOOC/ SWAYAM NPTEL Course | 21PSZO21 | 2 | 1 | 1 | - | 2 | | |
| | Library Reading Hour | | 1 | - | - | - | - | | | |

| | | | | | | | | | | |
|----------|-----------------------|--|-----------|------|---|---|---|---|--|--|
| III | Core VII | Animal Physiology | 21PCZO31 | 5 | 3 | 2 | - | 4 | | |
| | Core VIII | Biostatistics and Bioinformatics | 21PCZO32 | 5 | 3 | 2 | - | 4 | | |
| | Core IX | Research Methodology | 21PCZO33 | 5 | 3 | 2 | - | 4 | | |
| | DSE-III | A) Microbiology | 21PEZO31A | 4 | 3 | 1 | - | 4 | | |
| | | B) Fisheries and aquaculture | 21PEZO31B | 4 | 3 | 1 | - | 4 | | |
| | | C) Parasitology | 21PEZO31C | 4 | 3 | 1 | - | 4 | | |
| | P -V | Animal Physiology Practicals | 21PCZO3P1 | 4 | 1 | - | 3 | 2 | | |
| | P -VI | Biostatistics and Bioinformatics & Research Methodology Practicals | 21PCZO3P2 | 4 | 1 | - | 3 | 2 | | |
| | IDC-II | Applied Zoology | 21PIZO31 | 2 | 1 | 1 | - | 2 | | |
| | Library Reading Hour | | 1 | - | - | - | - | | | |
| IV | Core X | Immunology | 21PCZO41 | 5 | 3 | 2 | - | 4 | | |
| | Core XI | Entomology | 21PCZO42 | 5 | 3 | 2 | - | 4 | | |
| | Project | Project | 21PPZO41 | 8+6* | 2 | - | 6 | 8 | | |
| | DSE-IV | A) Sericulture | 21PEZO41A | 4 | 3 | 1 | - | 4 | | |
| | | B) Poultry and Dairy Science | 21PEZO41B | 4 | 3 | 1 | - | 4 | | |
| | | C) Animal Feed Technology | 21PEZO41C | 4 | 3 | 1 | - | 4 | | |
| | P - VII | Immunology Practicals | 21PCZO4P1 | 4 | 1 | - | 3 | 2 | | |
| P - VIII | Entomology Practicals | 21PCZO4P2 | 4 | 1 | - | 3 | 2 | | | |

*** Please, tick (✓) the appropriate remark for each course**