CORE COURSE II

PRINCIPLES OF ECOLOGY

THEORY **(Credits 4)**

Unit 1: Introduction to Ecology **06**

Levels of organization, Laws of limiting factors, study of physical factors

Unit 2: Population **24**

Population attributes: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion Exponential and logistic growth, equation and Patterns, r and k strategies

Population regulation - density-dependent and independent factors

Population interactions; Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition

Unit 3: Community **12**

Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological succession with one example; Theories pertaining to climax community

Unit 4: Ecosystem **14**

Types of ecosystems with example of marine ecosystem in detail; Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web; Energy flow through the ecosystem; Ecological pyramids and Ecological efficiencies

Nutrient and biogeochemical cycle with example of Nitrogen cycle

Unit 5: Wildlife & Conservation **04**

Wildlife Conservation (ideas of in-situ and ex-situ conservation) Management strategies for tiger conservation; protection laws for wildlife conservation, Bio-resource assessment and planning

Practical (Credits 2)

1. Preparation of nested quardrat and estimation of effective quardrat size
2. Determination of population density in a natural/ hypothetical community by quadrat method and calculation of Sorenson's Similarity & Shannon-Weiner diversity indices for the same community
3. Study of an aquatic ecosystem: Major Phytoplankton and zooplankton (Up to Genus), temperature, turbidity/ penetration of light; determination of pH, and Dissolved Oxygen content (Winkler's method) and free CO2
4. Estimation of Primary productivity by light & Dark bottle method
5. Report on field observations/ study at National Park/Biodiversity Park/Wild life sanctuary/Sea Shore

PRACTICALS

1. Identification of mammalian fauna, avian fauna, herpeto-fauna
2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses)
3. Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc.
4. Demonstration of different field techniques for fauna (Basic idea for any one group- mammalian/avian/insect/fishes)
5. Demonstration of PCQ, Ten tree method, Circular, Square & rectangular plots, Parker's 2 Step and other methods for ground cover assessment, Tree canopy cover assessment.
6. Trail / transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences)

SUGGESTED READINGS

- Caughley, G., and Sinclair, A.R.E. (1994). *Wildlife Ecology and Management*. Blackwell Science.
- Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). *People and Wildlife, Conflict or Co-existence*? Cambridge University.
- Bookhout, T.A. (1996). *Research and Management Techniques for Wildlife and Habitats*, 5 th edition. The Wildlife Society, Allen Press.
- Sutherland, W.J. (2000). *The Conservation Handbook: Research, Management and Policy*. Blackwell Sciences
- Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). *Problem-Solving in Conservation Biologyand Wildlife Management: Exercises for Class, Field, and Laboratory*. Blackwell Publishing.

SEC-2 SERICULTURE

(CREDITS 2)

Unit 1: Introduction **(3)**

Sericulture: Definition, history and present status; Silk route

Types of silkworms, Distribution and Races
Exotic and indigenous races
Mulberry and non-mulberry Sericulture

Unit 2: Biology of Silkworm **(3)**
Life cycle of *Bombyx mori*
Structure of silk gland and secretion of silk

Unit 3: Rearing of Silkworms **(13)**
Selection of mulberry variety and establishment of mulberry garden
Rearing house and rearing appliances
Disinfectants: Formalin, bleaching powder, RKO
Silkworm rearing technology: Early age and Late age rearing
Types of mountages, Spinning, harvesting and storage of cocoons

Unit 4: Pests and Diseases **(4)**
Pests of silkworm: Uzi fly, dermestid beetles and vertebrates
Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial
Control and prevention of pests and diseases

Unit 5: Entrepreneurship in Sericulture **(2)**
Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.

Unit 6:
Project report on visit to any sericulture farm/ institute or review work on any relevant topic on sericulture.

SUGGESTED READINGS

- Manual on Sericulture; Food and Agriculture Organisation, Rome 1976
- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
- Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Stn. & Pub. Govt. Press, Bangalore
- Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
- Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan1972.
- Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
- Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.

PRACTICALS

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12. Molecular mechanism of hormone actions.

LABORATORY COURSES

CORE (P-101) **Full Marks:25**

Practical: Non-Chordate and Chordate

1. Mounting of: *Paramoecium, Nyctotherus, Amoeba, Opalina*, Soil Nematodes, Gut nematode of fish and toad, *Cyclops*, *Daphnia*.
2. Submit a project report to study the diversity of Protista of pond water collected from different places.
3. Identification of Larva: Ephyra, Nauplius, Zoea, Mysis, Megalopa, Glochidium, Trocophore, Veliger, Bipinnaria. Location and extraction of pituitary gland of carp
4. Find position of accessory air-breathing organs of *Anabas* sp. / *Clarias* sp. / *Heteropneustes* sp.
5. Gallus/Columba: 5th and 7th Cranial nerves
6. *Rattus* sp. / *Mus* sp.: Nerves of the neck region

CORE (P-102) **Full Marks:25**

Practical: Biochemistry& Environmental Physiology

1. Quantitation of DNA by UV-vis spectrophotometer
2. Electrophoretic separation of DNA
3. Protein estimation by Folin Lowry method.
4. Comparison of Total RBC and WBC counts in different groups of vertebrates
5. Estimation of Haemoglobin and Differential count of blood in vertebrates
6. Study of the changes of blood glucose level in a vertebrate species

CORE (P-103) **Full Marks: 25**

Practical: Ecology & Behaviour

1. Water Analysis: Estimation of dissolved oxygen, free carbon dioxide; total alkalinity; total hardness and chloride
2. Soil Analysis- Estimation of percentage of calcium carbonate by rapid titration method. Estimation of organic-carbon by wet oxidation method
3. Estimation of primary productivity of aquatic ecosystems using light and dark bottle method.
4. Field Study for Assessment of density, frequency and abundance of plants/animal in a forest area, hill or sea shore using various techniques i.e. transect, quadrate etc.
5. Study the aggressive behavior of Fish (*Channa* sp. / *Betta* sp.)

Group B **Biostatistics** **Full Marks = 25**

1. Biostatistics/Biometry: Definition and utilization in biological assays.
2. Basic Concepts of:
   a) Terminologies used in biostatistics: Variable, Population, Data, Sample estimate.
   b) Measures of Central Tendency
   c) Measures of Variation
   d) Graphical representation of data.
3. Hypothesis Testing and Student's T-test distribution.
4. Probability Distribution-Concept Probability, Binomial Distribution and Poisson Distribution
5. Simple Linear Regression and Correlation
6. Chi-Square Test.
7. Analysis of Variance.
8. Models: Definition, Classification, Usefulness.

LABORATORY COURSES

CORE (P-109) **Full Marks = 25**

Biodiversity & Wildlife + Aquaculture and Fisheries Resources of India

1. Submit a report on the biodiversity study undertaken in your campus/locality/forest/river bed/sea shore — 15 marks
2. Viva voce — 10 marks

DCE -2P

Molecular Immunobiology and Immunogenetics (DCE2-A)

Practical **Full Marks: ~~25~~ 50**

1. Learning basic cell culture techniques: Maintaining Cell Lines (Primary, secondary) Understanding Cellular morphology through microscopy
2. Mouse handling and studying different routes of drug administration in mouse model (oral, topical, *iv, ip, sc, in situ*)
3. Raising polyclonal antibody in mice against sheep RBC, serum collection and estimating antibody titre in serum
4. Differentiate the primary and secondary antibody response in haemagglutination test by using mercaptoethanol.
5. Separation of human lymphocytes in Hypaque Ficoll gradient

Molecular Cytology and Genetics (DCE2-B)

Practical **Full Marks: ~~25~~ 50**

Core (P-110)

Evolution Biology + Population Genetics **Full Marks = 25**

1. Class to be divided into groups and each group shall be allotted a topic on the basis of which group discussion will be done. Evaluation will be done on the basis of individual performance.

DCE 4 P LABORATORY COURSES

Molecular Immunobiology and Immunogenetics (DCE 4 A)

Practical **Full Marks:50**

1. Cancer cell line maintenance *in vitro* and *in vivo*
2. Induction of solid tumors, staining and identification of ascitic tumor cells
3. DNA isolation; Primer designing (*in silico*) and PCR technique
4. Agarose gel electrophoresis and SDS PAGE
5. Estimation of cytokines by ELISA (demonstration)
6. Demonstration of Immuno-blotting/ Immunohistochemistry
7. Brief idea on Cell cycle analysis by flowcytometry and Interpretation of FACS results
8. Institutional visit (Optional)- Marks to be added for CE in case it is carried out.

Molecular Cytology and Genetics (DCE 4 B)

Practical **Full Marks:50**

1. Genomic DNA isolation from blood (human), tissue (mice) and quantitation
2. Isolation of plasmid DNA
3. Restriction digestion of Plasmid/Genomic DNA and electrophoresis. Plasmid mapping
4. PCR amplification of known DNA
5. Demonstration: Southern blotting and hybridization
6. Institutional visit (Optional)- Marks to be added for CE in case it is carried out.

Molecular Cell Biology and Oncology (DCE 4 C)

Practical **Full Marks:50**

1. Cancer cell culture.
2. Viability assay by Trypan blue dye exclusion microscopy.
3. Immunohistochemistry/immunocytochemistry demonstration.
4. Protein isolation, quantification, SDS PAGE and Western blotting
5. Institutional visit (Optional)- Marks to be added for CE in case it is carried out.

Parasitology (DCE 4 D)

Practical **Full Marks:50**

1. Life cycle studies of parasites: Protozoans, Nematodes, Helminths
2. Fluorescence/ Immunofluorescence microscope studies on parasite tissues
3. Cryosectioning / Preservation/mounting of parasite tissues
4. Estimation of RNA in tissue (Colorimetric method)
5. Feulgen reaction method for DNA localization
6. Localization of RNA by methyl green pyronin –'Y'
7. Polymerase chain reaction (Demonstration)
8. RFLP Analysis (Demonstration)
9. Biological Sequence analysis- Analysis of DNA and protein sequence
10. Modeling in Epidemiology and Public Health SIR models
11. AI applications in epidemiology-Any two
12. Institutional visit (Optional)- Marks to be added for CE in case it is carried out.

Ecology and Animal Behaviour (DCE 4 E)

Practical **Full Marks:50**

1. Study of primary productivity of a pond using light and dark bottles
2. Physico-chemical analysis of pond water
3. Succession of bacterial population in milk
4. Population studies of *Tribolium* spp.
5. Study in field/zoo/institute. Marks to be added for CE in case it is carried out.

Entomology (DCE 4 F)

Practical **Full Marks:50**

1. a) Host plant/seed preference study
   b) Quantitative assay of damage of host leaf/seed caused by pest
   c) Estimation of biochemical changes in host plant/seed due to pest injury
2. a) study of insects population density (anyone species)
   b) comparison of variance of populations of a pest species from different location and different time
   c) determination of LD50/ LC50 values of pesticides using a pest species
   d) Studies in species RTU/ family level diversity of insect community from crop/forest/grassland/ soil habitat
3. a) Study of life cycle of pest/vector
   b) Submission of stages of life cycle of insects and mite pests of any crop of North Bengal
4. Visit to institution/ experimental plot/ field for acquiring advanced knowledge in entomology (Optional). Marks to be added for CE in case it is carried out.

Fisheries (Limnology aquaculture and fisheries) (DCE 4 G)

Practical **Full Marks:50**

1. Collection and identification of benthic organisms (fish ponds/streams)
2. Collection of Water and Soil samples from different water bodies forthe following analysis:

a) Physico-chemical parameters of Water and Soil quality