GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM
M.Sc. Zoology III Semester (2024-25)

CORE-7: Population Ecology

Learning Outcomes

By the completion of this course, students will:

- Gain knowledge of the basic concepts of population ecology.
- Understand inter-specific relationships.
- Generalize different biogeochemical cycles.

Syllabus

UNIT–I

1.1 Nature and scope of ecology, structure, and function of ecosystems.
1.2 Trophic dynamics of ecosystems – Energy flow; food chain; food web; trophic levels; ecological pyramids.
1.3 Concept of productivity.
1.4 Types of ecosystems – Freshwater, marine, and terrestrial.

UNIT–II

2.1 Population density – Natality and mortality. Forms of population growth – Logistic curve, stochastic and time-log models.
2.2 Population regulation – Effects of increased numbers, harmful effects, beneficial effects, protection, influence on reproduction, division of labor in populations.
2.3 Inter-specific relationships – Positive and negative interactions.
2.4 Eutrophication of lakes, biological indicators, and water quality.

UNIT–III

1.1 Community concept – Community dominance, ecotone, community composition, and stratification.
1.2 Habitat and ecological niche – Ecological equivalents, sympatric and allopatric species.
1.3 Spatial relations of populations – Space requirements, home range, and territory.
1.4 Migration and emigration.

UNIT–IV

1.1 Demography – Life tables, net reproductive rate, longevity, theories of aging, and reproductive strategies.
1.2 Fish population – Population density, population structure, year classes, and estimation of fish population.
1.3 Fish population dynamics – Abundance in population and fishery, population dynamics, and fishery catches.
1.4 Biogeochemical cycles – Nitrogen, carbon dioxide, and phosphorus cycles; global warming, greenhouse effect, and acid rain.

Suggested Reading Material

1. Begon, M., J.L. Harper, and C.R. Townsend. Ecology: Individuals, Populations, and Communities. Blackwell Science, Oxford, UK.
2. Koromondy, E.J. Concepts of Ecology. Prentice Hall, New Delhi.
3. Clarke, G.L. Elements of Ecology. John Wiley & Sons, New York.
4. Odum, E.P. Fundamentals of Ecology. W.B. Saunders, Philadelphia.
5. Krebs, C.J. Ecology. Harper & Row, New York.
6. Jorgensen, S.E. Fundamentals of Ecological Modeling. Elsevier, New York.
7. Chapman, J.L., and Reiss, M.J. Ecology: Principles and Applications. Cambridge University Press.

8. Trivedy, R.K., Goel, and Trisa. Practical Methods in Ecology & Environmental Science.

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

M.Sc. Zoology III Semester (2024-26)

CORE-7: Population Ecology

Practical Syllabus

Population Ecology Lab

1. Enumeration of zooplankton.
2. Enumeration of phytal fauna.
3. Enumeration of rocky shore fauna.
4. Creation of life tables.
5. Calculation of net reproductive rate (Ro), generation time (T), intrinsic growth rate, and optimal age for sexual maturity.
6. Calculation of logistic and exponential growth for a given population.
7. Identification of zooplankton (10 examples).
8. Identification of rocky shore fauna (10 examples).
9. Study of interspecific relationships.

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM
M.Sc. Zoology III Semester (2024-25)
CORE-8: General and Comparative Endocrinology

Learning Outcomes

By the completion of this course, students will:

- Gain knowledge of the basic concepts of the vertebrate endocrine system.
- Understand the structure and function of different endocrine glands.
- Classify various types of endocrine glands.
- Generalize the role of hormones in reproduction**.**

Syllabus

UNIT–I

1.1 Scope and position of endocrinology.
1.2 Concepts of neurohormones and neurotransmitters.
1.3 Discovery of hormones and hormones as messengers.
1.4 Structure, hormones, and functions of pituitary, thyroid, parathyroid, and thymus glands.

UNIT–II

2.1 Structure, hormones, and functions of adrenal, pancreas, pineal, gastrointestinal tract, and gonads.
2.2 General principles of hormone action and hormone receptors.
2.3 Signal transduction mechanisms.
2.4 Hormonal regulation of carbohydrate, nitrogen, and lipid metabolism.

UNIT–III

3.1 Classification of hormones.
3.2 Biosynthesis of steroid hormones.
3.3 Biosynthesis of simple peptide hormones.
3.4 Co-translational and post-translational modifications of hormone structure.

UNIT–IV

1.1 Hormonal influence on growth and development in invertebrates.
1.2 Hormones and reproduction.
1.3 Hormones in IVF and pregnancy tests.
1.4 Pheromones – Role in induced breeding of fish.

Suggested Reading Material

1. Turner – Endocrinology.
2. E.J.W. Barrington – General and Comparative Endocrinology, Oxford, Clarendon Press.
3. P.J. Bently – Comparative Vertebrate Endocrinology, Cambridge University Press.
4. R.H. Williams – Textbooks of Endocrinology, W.B. Saunders.
5. C.R. Martin – Endocrine Physiology, Oxford University Press.
6. A. Gorbman et al. – Comparative Endocrinology, John Wiley & Sons.

Practical Syllabus

1. Dissection of endocrine systems in fish.
2. Pituitary gland dissection.
3. Determination of insulin levels in blood samples.
4. Identification of human gonadotropic hormones.
5. Dissection of the prawn nervous system.
6. Study of slides of vertebrate endocrine glands:
   - Pituitary
   - Thyroid
   - Parathyroid
   - Adrenal
   - Pineal
   - Gonads
7. Experiments on hormones responsible for carbohydrate regulation.

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM

M.Sc. ZOOLOGY

III SEMESTER

CORE-9: MOLECULAR BIOLOGY

Learning Outcomes

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

- Acquire knowledge of basic molecular biology concepts.
- Differentiate the structure of DNA and RNA.
- Understand molecular mechanisms of DNA repair systems.
- Generalize the DNA fingerprinting process.

Unit-I

1.1. DNA Structure and Types of Replication
1.2. DNA Replication in Prokaryotes and Eukaryotes
1.3. Mechanics of DNA Replication
1.4. Enzymes and Accessory Proteins involved in DNA Replication

Unit-II

2.1. Prokaryotic Transcription
2.2. Eukaryotic Transcription
2.3. RNA Polymerases and Post-transcriptional Modifications in RNA
2.4. Nuclear Export of mRNA

Unit-III

3.1. Genetic Code
3.2. Prokaryotic and Eukaryotic Translation and Regulation of Translation
3.3. Molecular Mechanisms of Antisense Molecules and Ribozyme Technology
3.4. Inhibition of Splicing, Polyadenylation, and Translation

Unit-IV

1.1. Genetic and Physical Maps
1.2. DNA Repair Mechanisms
1.3. Holiday Junction, Gene Targeting, and FISH
1.4. DNA Fingerprinting and its Applications

Suggested Reading Material

1. Watson J.D. et al. Molecular Biology of Gene. Benjamin/Cummings Pub. Co. Inc., California.
2. Alberts B. et al. Molecular Biology of the Cell. Garland Publishing Inc., New York.
3. Lewin B. Gene IV. Oxford University Press, U.K.
4. Meyers R.A. Molecular Biology and Biotechnology. VCH Publishers Inc., New York.
5. Sambrook J. et al. Molecular Cloning: A Laboratory Manual. Cold Spring Harbor Laboratory Press, New York.
6. Daber P.D. Introduction to Practical Molecular Biology. John Wiley & Sons Ltd., New York.
7. Brown T.A. Molecular Biology LabFax. BIOS Scientific Publishers Ltd., Oxford.

Practical Syllabus

ZOO304 - Molecular Biology Lab

1. Estimation of DNA (Colorimetric Method)
2. Estimation of RNA in Tissue (Colorimetric Method)
3. Feulgen Reaction Method for DNA Localization
4. Localization of RNA by Methyl Green Pyronin-Y

5. Polymerase Chain Reaction (Demonstration)
6. RFLP Analysis (Demonstration)

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM
M.Sc. ZOOLOGY
III SEMESTER
SEC-5: BIODIVERSITY AND ANIMAL CONSERVATION

Learning Outcomes:

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

- Gain knowledge of the basic concepts of biodiversity and animal conservation.
- Analyze species diversity, genetic diversity, and environmental diversity.
- Generalize the concept of biodiversity and conservation.

UNIT–I

1.1 Biodiversity: Definition and significance; biodiversity at global, national, and local levels; magnitude and distribution of biodiversity.
1.2 Patterns of biodiversity: Latitudinal and altitudinal gradients; species-area relationship.
1.3 Biogeographic realms of the world.
1.4 Biogeographic zones of India and faunal diversity; hotspots in the world and in India.

UNIT–II

2.1 Hierarchical components of biodiversity: Species diversity, genetic diversity, and ecosystem diversity.
2.2 Biodiversity values: Direct values and indirect values.
2.3 Biodiversity in peril: Causes of biodiversity loss and extinction; anthropogenic impact on biodiversity.
2.4 Biodiversity and biotechnology: Genetically modified organisms and bioremediation.

UNIT–III

Biodiversity Management and Conservation

3.1 Conservation biology: Introduction, threats to biological diversity, habitat degradation, fragmentation, and destruction; extinction, overexploitation, global warming. Protected areas: Parks, nature reserves, wildlife corridors; restoration ecology.
3.2 IUCN classification of wildlife.
3.3 Biodiversity threats; In-situ conservation and ex-situ conservation.

UNIT–IV

1.1 Gene banks; conservation of genetic resources; cryopreservation; biological databases.
1.2 Wildlife protection acts; organizations involved in biodiversity protection.
1.3 Environmental Impact Assessment (EIA).

Suggested Reading Material:

1. Agarwal K.C. 1998. Biodiversity, India.
2. Peggy I. Fieldler and Perer M. Kareiva. 1997. Conservation Biology.
3. Prabodh K. Maiti and Paulami Maiti. 2011. Biodiversity: Perception, Peril, and Preservation.
4. Saharia V.V. 1982. Wildlife in India. Natraco Publishers, Dehradun.
5. Tandon R.K. 1999. Biodiversity, Taxonomy & Ecology. Prithipal Singh Scientific Publishers,

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM
M.Sc. ZOOLOGY
III SEMESTER
SEC-5: BIODIVERSITY AND ANIMAL CONSERVATION

Practical Syllabus: Biodiversity and Animal Conservation

1. List of local fauna (invertebrates and vertebrates) (fishes & amphibians).
2. Faunal diversity of man-made ecosystems.
3. Endangered species of the Indian subcontinent (invertebrates and vertebrates).
4. Conservation methods.
5. Examples of biological databases.
6. Values of biodiversity (fauna & flora).
7. Bioremediation.

GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM
M.Sc. ZOOLOGY IV SEMESTER (2023-24)
SEC-6: AQUACULTURE

Learning Outcomes:
By the completion of this course, students will be able to:

- Gain knowledge of the basic concepts of aquaculture.
- Understand fish seed resources.
- Identify different cultivable fish resources.
- Generalize hatchery management.
- Differentiate between various types of culture practices.

Extracurricular Activity:

- Field visit to a shrimp farm/hatchery.

UNIT–I
1.0 History, general principles, and economics of aquaculture.
2.0 Freshwater Aquaculture:

- 2.1 Construction of fish farms and reclamation of swamps.
- 2.2 Selection of species for culture – biological principles.
- 2.3 Preparation and management of nursery ponds, rearing ponds, and stocking ponds along with control of weeds, pests, and predators.

UNIT–II
3.0 Fish Seed Resources:

- 3.1 Procurement and transportation of seed from natural resources.
- 3.2 Transportation of broodstock and induced breeding.

4.0 Freshwater Fish Culture:

- 4.1 Common carp; Indian major carps; composite fish culture; freshwater prawn culture.
- 4.2 Integrated fish farming – Paddy cum fish culture and fish cum livestock culture.

UNIT–III
Fish Nutrition
5.0 Nutritional requirements, energy metabolism, formulation, and preparation of fish feeds.
6.0 Brackishwater Aquaculture:

- 6.1 Selection of site, principles of pond design; traditional, extensive, modified extensive, semi-intensive, intensive, and super-intensive culture of shrimps, including their management and economics.
- 6.2 Finfish culture – Mullets (Mugil), Milkfish (Chanos), and Seabass (Lates).

UNIT–IV
7.0 Hatchery Management:

- 7.1 Principles of shrimp hatchery establishment: Site selection, water source, water management, maturation section, larval and post-larval sections, feed management.
- 7.2 Water quality management – pH, turbidity, dissolved oxygen, BOD, COD, nitrates, phosphates, ammonia, etc.

8.0 Mariculture:

- 8.1 Lobster culture.
- 8.2 Pearl oyster culture.

Additional Inputs:

1. Edible oyster culture.
2. Seaweed culture.

Suggested Reading Material:

1. Pillay, T.V.R. 1990. Aquaculture – Principles and Practices. Fishing News Books Survey, U.K.
2. Jhingran, V.G. 1993. Fish and Fisheries of India. Hindustan Publishing Corporation (India), New Delhi.
3. Ravishankar Piska, 1999. Fisheries and Aquaculture. Lahari Publications, Hyderabad.