GENERIC ELECTIVE COURSE -23

Concepts of Evolutionary Ecology

Zoo-GE -23

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course	Department offering the course
		Lectures	Tutorial	Practical/ Practice			
Concepts of Evolutionary Ecology ZOO-GE-23	4	2	0	2	As per the Program Eligibility	Nil	Zoology

Learning Objectives

The learning objectives of this course are to:

- Explore the interface of ecological and evolutionary forces that lead to the diversity of the form.
- Understand the function, and behaviour among animals.
- Impart an understanding of the evolutionary origin and drivers of biological variation and diversity, including the significance of genetic variation, natural selection, and genetic drift.
- Unravel the evolution of animals, sexual selection, evolution of mating systems, animal interactions, reaction norms and plasticity.
- Learn about co-evolution between species and ecology from a phylogenetic perspective and compare evolutionary processes behind reproductive and ecological adaptations.
- Understand how communities and species interact with their environment at large-spatial and temporal scales.

Learning Outcomes

- By studying this course, students will be able to :
- Better understand the diverse relationships that the organisms have in the environment.
- Analyze the patterns of distribution of animals in different regions and ecosystems.
- Gain insight into the major events in history of life

- Know the fundamental concepts of natural selection, speciation, mass extinction and macro-evolution.
- Explain the characteristics, dynamics, and growth of populations.
- Appreciate the characteristics of the community, ecosystem development and climax theories.
- Gain knowledge about the relationship of evolution of various species and the environment they live in.

SYLLABUS

THEORY **30 Hrs**

UNIT 1: Overview of Evolutionary Ecology **5 hrs**

Introduction to the relationship between evolution and ecology, Origin of life: chemogeny and endosymbiotic theory. Natural selection, adaptation and fitness. Ecological adaptations of animals to their environment.

UNIT 2: **Population Ecology and Community Interactions** **13 hrs**

Density, mortality, natality, dispersal and dispersion, life tables, fecundity tables, survivorship curves, age and sex ratios. Population growth- exponential and logistic. Life history traits - r and K selection. Population regulation, positive and negative interactions. Community interactions: Community Characteristics: species richness, dominance, diversity and abundance. Organisation of community– habitat, niche, guilds, and dominant species. Interspecific interactions with examples. Species diversity indices. Categories of ecological succession. Climax community, Concept of keystone, flagship, umbrella species with examples.

UNIT 3: Evolutionary Progressions and Concept of Species **7 hrs**

Natural selection and its types, Genetic drift, Artificial selection. Species concept, Isolating mechanisms, Modes of speciation (Allopatric, Sympatric, Parapatric and Peripatric), Adaptive radiation/macroevolution (Darwin's finches).

UNIT- 4: Concept of Coevolution **5 hrs**

Forms of coevolution (pairwise coevolution, diffuse coevolution, and gene-for-gene coevolution); Co-evolutionary interactions (Coevolution of competitors, Predator-prey coevolution, Host-parasite coevolution, Coevolution of mutualists); Evolutionary equilibria. Co-speciation and diversification.

PRACTICALS **60 hrs**

(Laboratory periods: 15 classes of 4 hours each)

1. Study of an aquatic ecosystem- phytoplankton and zooplankton: Sample collection of specimens from an ecosystem (pond/river/lake/forest/garden) to study its biotic components.
2. Estimation of turbidity/penetration of light, temperature, Dissolved Oxygen content (Winkler's method), determination of pH.
3. Determination of population density in a natural/hypothetical community by quadrate method and calculation of Shannon-Weiner diversity index for the same community.
4. Plotting of different types of survivorship curves from the provided life tables of the hypothetical/real data.
5. Understanding the homology, analogy and homoplasy from suitable specimens.
6. Construction of cladograms based on morphological characters.
7. Study and verification of Hardy-Weinberg Law by Chi-square analysis

PROJECT WORK

Project report based on the visit to the natural history museum/National Park/Biodiversity Park/Wildlife Sanctuary.

Essential/recommended readings

1. Futuyma, Douglas and Mark, Kirkpatrick (2017) 3rd Ed. Evolutionary Biology, Oxford University Press
2. Hall, B.K. and Hallgrimson, B. (2013) Evolution; 5th Edition, Jones and Barlett Publishers.
3. Zimmer C. and Emlen D. J., (2013) 1st Ed. Evolution: Making Sense of Life, Roberts & Co.
4. Chapman, J., and Reiss, M. (2012). Ecology Principles and Applications; Cambridge University Press.
5. Odum, E. P. and Barrette, G. W. (2008) Fundamentals of Ecology; 5th Indian edition; Brooks/Cole
6. Miller, T., and Spoolman, S. (2008) 12th Edition Environmental Science- Problems, Concepts and Solutions; Thomson Brooks/Cole.

Suggested readings

1. Smith T. M. and Smith R. L. (2015). Elements of Ecology. 9th International Edition. Publisher: Benjamin Cummings.
2. Ridley, M. (2004). Evolution. III Edition, Blackwell publishing.
3. Southwood, T. R. E., & Henderson, P. a. (2000). Ecological Methods, 3rd Edition; Blackwell Science Ltd. (Vol. 278, Issue 5705).

NOTE: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.