

Category II

Botany Courses for Undergraduate Programme of study with Botany as one of the Core Disciplines BSc Life Sciences – Botany Component

DISCIPLINE SPECIFIC CORE COURSE – 4: Ecology and Evolution

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 (if any)
		Lecture	Tutorial	Practical/ Practice		
Ecology and Evolution LS-BOT-DSC-04	4	2	0	2	Class XII pass with Biology/ Biotechnology	Nil

Learning objectives:

- To understand basic ecological concepts, processes, inter-relation between the living world and abiotic environment.
- To make students understand the basic concept of evolution and natural selection.

Learning outcomes:

- After successful completion of the course the student shall have adequate knowledge about the basic principles of ecology and evolution.

Unit 1: Introduction to fundamental concepts in Ecology 02 hours

Inter-relation between the living world and abiotic environment. Fundamental concepts: Abiotic and biotic components; Levels of ecological organization: species, population, community, ecosystems, biomes.

Unit 2: Ecological factors

04 hours

Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types; Light, Temperature (Thermal stratification in water bodies and atmosphere) and Wind; Ecological amplitude; Leibig's law of minimum; Shelford law of tolerance.

Unit 3: Population Ecology

04 hours

Population Characteristics (dispersion, natality, mortality, survivorship curve, age pyramids); growth rates (density-dependent/independent); Interactions: mutualism, symbiosis, commensalism, competition, parasitism, predation, ammensalism, antibiosis.

Unit 4: Plant communities **05 hours**

Characters; Ecotone and edge effect; Succession; Processes and types (autogenic, allogenic, autotrophic, heterotrophic, primary and secondary)

Unit 5: Ecosystem **05 hours**

Structure; niche and habitats; Food chains and food webs, Ecological pyramids production and productivity; energy flow (single channel and Y-shaped); trophic organisation; Biogeochemical cycling; Cycling of nitrogen and Phosphorous

Unit 6: Introduction to Evolution **03 hours**

Origin and history of life; Macro and microevolution; Phylogeny and the tree of life.

Unit 7: Evolution of Species **04 hours**

Lamarckism and Neo-Lamarckism; Darwinism – selection (natural and artificial), Neo-Darwinism; Species concept and modes of speciation.

Unit 8: Phytogeography **03 hours**

Phytogeographical regions of India; Endemism (definition, factors and types).

Practicals **60 hours**

1. Principle and operation of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH and detection of carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from atleast two soil samples by rapid field tests.
3. Study of ecological adaptations of hydrophytes and xerophytes (four each).
4. Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobanche*), Epiphytes (Orchids), Predation (Insectivorous plants).
5. Determination of minimal quadrat size and number for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).
6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law.
7. Study of ecological speciation (allopatric and sympatric) with the help of examples.
8. Study phylogenetic relationships among taxa with the help of exercises.

9. Construct phylogenetic tree using MEGA and interpret evolutionary relationships.

Suggested Readings:

1. Douglas J. Futuyma (1998). *Evolutionary Biology* (3rd Edition), Sinauer Associates.
2. Kormondy, E.J. (1996). *Concepts of Ecology*. Prentice Hall, U.S.A. 4th edition.
3. Mark Ridley (2003) *Evolution* (3rd edition), Blackwell.
4. Odum, E.P. (2005). *Fundamentals of Ecology*. New Delhi, India: Cengage Learning India Pvt. Ltd., 5th edition.
5. Reece, J. B., Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., Jackson, R. B. (2014). *Campbell biology* (Vol. 9). Boston: Pearson.

Additional Resources:

1. Rosenbaum, P.E. (2010). *Volpe's Understanding Evolution*. McGraw-Hill, New York.
2. Schulze, E. D., Beck, E., Müller-Hohenstein, K. (2005). *Plant Ecology*. Springer Science & Business Media.
3. Singh, J.S., Singh, S.P., Gupta, S.R. (2014). *Ecology, Environmental Science and Conservation*. New Delhi, India: S. Chand.
4. Smith, R. L., Smith, T. M., Hickman, G. C., Hickman, S. M. (1998). *Elements of ecology*.

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