

## POOL OF DISCIPLINE SPECIFIC ELECTIVES

### DISCIPLINE SPECIFIC ELECTIVE COURSE (DSE -1): Evolutionary Biology of Plants

#### 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		
Evolutionary Biology of Plants DSE-1	4	2	0	2	Class XII pass	Nil

#### Learning Objectives:

- This course builds on the fundamental points introduced in the core course on Plant Diversity and Evolution and presents a synthesis of various theories, concepts, evidence and methods to study evolution.

#### Learning Outcomes:

At the end of this course the students will be able to:

- understand the essential theories in evolution
- differentiate between micro and macroevolution and the forces shaping evolution
- construct phylogenetic trees based on morphological and molecular data
- understand evolution of life.

#### Unit 1: Historical Perspective of Evolutionary Concepts

**4 hours**

Pre-Darwinian ideas, Lamarckism, Darwinism, Post-Darwinian era – Modern synthetic theory, Neo-Darwinism

#### Unit 2: Origin of Life

**3 hours**

Chemogeny – An overview of pre-biotic conditions and events; experimental proofs to abiotic origin of micro- and macro-molecules. Current concept of chemogeny – RNA first hypothesis. Biogeny – Cellular evolution based on proto-cell models (coacervates and proteinoid microspheres). Evolution of eukaryotes from prokaryotes

#### Unit 3: Evidences of Evolution

**4 hours**

Paleobiological– Concept of Stratigraphy and geological timescale; fossil study  
Anatomical & Embryological – Vestigial organs; homologous and analogous organs (concept of parallelism and convergence in evolution)  
Taxonomic – Transitional forms/evolutionary intermediates, living fossils  
Phylogenetic – morphology, protein (Cytochrome C) and gene (Globin gene family) based

#### Unit 4: Microevolution and Macroevolution

**8 hours**

Hardy Weinberg equilibrium; Founder effect, Natural and artificial selection. Levels of selection.

Inferring phylogenies- Gene trees, species trees; Patterns of evolutionary change; Adaptive radiation, Evolution and development (evo-devo); Biodiversity- Estimating changes in biodiversity; Taxonomic diversity through the Phanerozoic era.

#### **Unit 5. Forces of Evolution**

**3 hours**

Mutation, Gene flow, Selection, Genetic Drift, Co-adaptation and co-evolution, Anthropogenic activities, Extinction (in brief)- Periodic and Mass-scale – Causes and events.

#### **Unit 6. Speciation**

**4 hours**

Species concept, Modes of speciation – Allopatric; sympatric; peripatric; Patterns of speciation – Anagenesis and Cladogenesis; Phyletic gradualism and Punctuated equilibrium (Quantum evolution); Basis of speciation – Isolating mechanisms.

#### **Unit 7. Evolution of Land Plants**

**4 hours**

Origin of land plants – Terrestrial algae and Bryophytes; alternation of generations. Early vascular plants – Steady evolution; Sporangium evolution; seed habit and evolution of seed. Angiosperms – Phylogeny of major groups.

#### **Practicals**

**60 hours**

1. Study of different types of fossils, connecting links/transitional forms and Living fossils (Specimens/slides/photographs)
2. Sampling of quantitative characters (continuous and discontinuous) in a population (height, weight, number of nodes etc)
3. Study of adaptive strategies (colouration, co-adaptation and co-evolution); (Specimens/photographs)
4. Calculations of genotypic, phenotypic and allelic frequencies from the data provided
5. Simulation experiments using coloured beads/playing cards to understand the effects of Selection and Genetic drift on gene frequencies
6. To study and interpret Phylogenetic trees (reading and using trees) - minimum of three examples.

#### **Suggested Readings:**

1. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A., Minorsky P.V., Jackson, R.B. (2020). *Biology*. San Francisco, SF: Pearson Benjamin Cummings.
2. Ridley, M. (2004). *Evolution*. III Edn. Blackwell Pub., Oxford.
3. Hall, B. K., Hallgrimson, B. (2008) *Strickberger's Evolution*. IV Edn. Jones and Barlett.
4. Zimmer, C., Emlen, D. J. (2013). *Evolution: Making Sense of Life*. Roberts & Co.
5. Futuyma, D. (1998). *Evolutionary Biology*. III Edn. Sinauer Assoc. Inc.
6. Barton, Briggs, Eisen, Goldstein and Patel. (2007). *Evolution*. Cold Spring Harbor Laboratory Press.
7. Nei, M., Kumar S. (2000). *Molecular Evolution and Phylogenetics*. Oxford University Press, New York.
8. Futuyma, J. D., Kirkpatrick, M. (2017). *Evolution*, 4th Ed. Sinauer, Sunderland, MA: Sinauer Associates.