

## **CODE BOT – BT 802C**

### **Plant Taxonomy, Ecology and Evolution**

#### **Plant Taxonomy:**

Taxonomy/Systematic botany, Identification, Nomenclature, classification, Description. Principal of Taxonomy to specify. History of International Code of Nomenclature (ICN/ICBN), aims and important provisions for names of taxa of different ranks and hybrids, rules for valid and effective publication. Taxonomic hierarchy, numerical taxonomy (brief idea). Systems of classifications of Cronquist, Takhtajan and APG (brief idea) systems. Role of Botanic Gardens and Herbaria in taxonomic studies. Role of cytology, embryology, palynology and phytochemistry in taxonomy. Endangered, rare and threatened plants in India and their conservation. Study of angiosperm groups: Characterization of broad groups Caryophyllales, Asterales, Alismatales and Liliales, Cladistics (brief idea) of angiosperm following Cronquist's classification.

#### **Ecology:**

Ecosystem: Biosphere and ecosphere, abiotic and biotic components, biomass-standing crops. Ecological niche—spatial, trophic and multidimensional niche. Autecology, synecology, ecotone and its types. Homeostasis of ecosystem, indicator plants.

Pollution: Environmental deterioration- water Pollution (fresh water bodies), air Pollution, greenhouse effect, importance of ozone layers and its depletion, acid rain, noise pollution, radiation pollution, pollution of land by solid waste.

Soil and water conservation: Soil erosion, its effect and control, water conservation, marine ecosystem, mangrove ecosystem, problems and managements of ecosystems.

Recent sensing technology-History of remote sensing, principles, types of remote sensing, applications. Geographic information system (GIS), Modern techniques of herbarium preparation.

Biodiversity: Concept of biodiversity, impact of human activities on biodiversity, conservation strategies, IUCN categories of threat.

Phytogeography: Theories of plant distribution (Theory of Continental Drift, Age and Area hypothesis and Theory of Tolerance). Endemism and its types, Major biomes of the world, Vegetational types of India.

#### **Evolution:**

Introduction - Pattern and process components of scientific theories: biological variation and evolutionary change (evidence for evolution). Darwin and Wallace – natural selection, adaptation. Microevolution, macroevolution. Evolutionary history: reading trees, monophyly, Tree of life. Evolutionary trends: maximum parsimony, origin and evolution of traits across life and green plants.

The fossil record. Geological fundamentals. Phylogeny and the fossil record. Evolutionary trends. Rates of evolution. The geography of life. Major patterns of distribution. Historical biogeography, phylogeography.

The Modern Synthesis: Concept of Population Genetics. Forces of evolution: Genetic drift – Sampling error; Mutation. Migration/Gene Flow. Adaptation – Fitness, coefficient of selection. One-locus models, multi-locus models, modes of selection. Non adaptive traits. Molecular evolution. Neutral theory. Testing for selection. Modes of selection.

Inferring phylogenies. Maximum Likelihood estimation of trees. Gene trees, species trees.

Hybrid speciation, hybrid zones. Adaptive Radiation.

**SEMESTER II**  
**Plant Tissue Culture & Developmental Biology**

**CODE BOT –BT- 805 Elective (E)**

Plant Tissue Culture: Basic concept, history, principles and scope; Concept of cellular differentiation, totipotency and pluripotency

Callus & Cell Suspension culture: Callus growth and its characteristics, types, Cell suspension cultures, factors affecting cell suspension culture; Assessment of growth and viability of cultured cell. Synchronisation of cell culture, habituation, Application of callus and cell suspension culture in plant biotechnology.

Biochemical basis of in vitro exudation, problem and control measures

*In vitro* technique of plant regeneration: Organogenesis, factors affecting organogenesis, application.

Micropropagation: Concept, in vitro technique, factors affecting stages of micropropagation, vitrification and its control measures; application of micropropagation in plant improvement.

Somaclonal variation, chromosomal instability, Origin and mechanism of somaclonal variation. Significance of somaclonal variation.

Production of virus free plants, virus indexing methods, concept of cross protection.

Androgenesis: Anther and Pollen culture, merits and demerits, factors affecting androgenesis, methods of diploidization of haploids, utilisation of haploidy in agriculture.

Somatic Embryogenesis: Methods, factors affecting somatic embryo development. Application of somatic embryogenesis in Plant biotechnology.

Protoplast Culture technique: Isolation, purification and Culture of Protoplast, application.

Green House: Concept of green house, types of green houses based on shape of the structure, utility, nature of covering material, uses and utility.

Concept of cell polarity and tissue patterning in plants.

Plant Developmental Genetics: genetical and molecular basis of shoot apical meristem(SAM) and root apical meristem(RAM) development.

Development of leaf, root hairs and trichomes.

Floral induction and development. ABC model of flower development

Signal transduction in plant growth and development. Role of plant protein kinases in signal transduction.

**SEMESTER II**  
**CODE BOT –BT- 806**  
**MOOC**

## **SEMESTER III**

### **Plant Systematics and Biodiversity**

#### **SPECIAL PAPER CODE BOT –BT 902(E1)**

##### **Unit-I**

Systematics: concept and historical development; Natural systems to cladistics: Natural systems, phyletic systems, phenetics and cladistics. Importance of Floras, Revisionary studies, Monographs and Taxonomic literature. Taxonomic characters and their states; sources of characters, evaluation of characters. Preparation of Taxonomic keys and its importance. Phylogenetics: The nature of phylogeny, importance of homology. Classification of Angiosperms: a brief history and comparative study of different systems of classification, APG IV system of classification. Important orders of Angiosperms (Sensu Cronquist) with reference to their characteristics, interrelationship and evolutionary trends. Phenetic in taxonomy, Cladistics in taxonomy, Taxonomic hierarchy, Species, Genus, Family and other categories, Principles used in assessing relationship, Delimitation of taxa and attribution of rank

The species concept: Taxonomic hierarchy, Principles used in assessing relationship; delimitation of taxa and attribution of rank. Historical development of the international Code of Botanical nomenclature (ICBN); Principles and salient provisions of the code; typification; role of priority; retention; rejection and conservation of epithets (names); name of hybrids. Taxonomic evidences: Use of evidences from Palynology, Embryology, Cytology, Phytochemistry, Ultrastructure in taxonomy. Plant genomes: nuclear, mitochondrial, chloroplast; molecular markers.

##### **Unit II**

Biodiversity: concept and levels; distribution and global patterns, IUCN Redlist categories, Strategies for conservation: *in situ* conservation: Government and community initiatives; Protected areas in India- Sanctuaries, National parks, Biosphere reserves, *Ex situ* conservation: botanical gardens, field gene banks, seed banks, in vitro repositories, cryobanks. International treaties and conventions with special reference to Convention on Biological Diversity (CBD) and Conference of Parties (COPs) under CBD.

Herbaria and data information systems. Herbarium specimens, Herbarium operations, Role of Botanic gardens in conservation of biodiversity, Concept of Virtual herbarium, Circumscription, Specimen Imaging, role of Macbeth Color Checker in Virtual herbaria

Phytogeography: Vegetation of the world, Origin of Angiosperms and primitive angiosperms, Endemism, Plant migration, Island biogeography.

**SEMESTER III**  
**Plant Systematics and Biodiversity**

**SPECIAL PAPER**

**CODE BOT–BT 903C**

**Practical paper**

1. Methods of non-destructive field collection and documentation, Techniques of herbaria preparation
2. Preparation of artificial key (at least five) based on appropriate character combination
3. Morphological characterization of selected families of dicots (10 families) and monocots (5 families) and identification upto families
4. Identification of given plant (at least six) up to species with the help of modern flora keys.
5. Live plants/ Herbarium specimens of the following families will be provided in the class for description and identification (classification based on Cronquist, 1981):
6. Writing exercise
7. Nomenclature exercise
8. Classification exercise
9. Cladogram construction and analysis
10. Techniques in molecular systematics
11. Interspecific variation: Species. Phylogenetic trees, reading and using trees.
12. Intraspecific variation: Phenotypic morphological variation: Intraspecific variation in size and shape of leaves. Statistical analysis (distribution, mean, mode, median, standard deviation).