

# Botany

## 1. Plant Diversity and Plant Systematics

- 1.1 Introduction, general characteristics, evolution of algae, fungi, bacteria, virus, Lichen bryophytes, pteridophytes, gymnosperms and angiosperms
- 1.2 Nature and concept of taxa: Basic terminologies; Taxonomic characters; Taxonomic hierarchy; Concept and types of species
- 1.3 Taxonomy and nomenclature: Principles and approaches of plant classification; Botanical nomenclature: History, principles and rules
- 1.4 Plant conservation: Convention on Biological Diversity; CITES, IUCN Red List; Ecoregions and global hot spots
- 1.5 Herbarium taxonomy: Surveys and monitoring; Plant collection; Herbarium technique
- 1.6 Plants of Nepal: Botanical exploration in Nepal; Flora of Nepal
- 1.7 Nature and concept of taxa: Basic terminologies; Taxonomic characters; Taxonomic hierarchy; Concept and types of species

## 2. Physiology and Ecology

- 2.1 Water relations of plants: Water availability in soil; water potential; movement of water: diffusion, osmosis; transport of water in plants, transpiration (mechanism and factors affecting transpiration), ascent of sap; water stress: effects and plants' response.
- 2.2 Plant nutrients: Nutrient availability in soil; nutrient absorption by root; macro and micronutrients: roles in plant and symptoms of deficiencies; hydroponics.
- 2.3 Plant development: growth and differentiation; tissue culture and organogenesis; polarity; photomorphogenesis; photoperiodism; seed physiology: seed germination and mobilization of reserved food, seed dormancy, vernalization; senescence.
- 2.4 Plant hormones: concept of hormone; physiological roles of auxins, gibberellins, cytokinins, ethylene, abscissic acid, and brassinosteroids; commercial uses of plant hormones.
- 2.5 Metabolism: Anabolism and catabolism; photosynthesis: radiant energy, ultrastructure of chloroplast, photosynthetic pigments, mechanisms factors affecting photosynthesis; photorespiration; respiration: ultrastructure of mitochondria, anaerobic and aerobic respiration, glycolysis, Krebs' cycle, respiratory chain; chemiosmotic mechanism of ATP synthesis.

- 2.6 Ecology and ecosystem understanding: Branches and scopes of ecology; Biotic and abiotic factors; Biogeochemical cycles Introduction and history of population ecology, community ecology and ecosystem ecology; Structure and function of major ecosystems (forest, grassland and wetland)
- 2.7 Biogeography and ecological zones of Nepal: Biogeography of Nepal; Vegetation types and distribution in Nepal; Nature conservation: Protected areas, Landscape approaches

### **3. Cytogenetics and Embryology**

- 3.1 Cytology: Prokaryotic and eukaryotic cells; Ultrastructure and function of cell organelles; Cell division: cell cycle, karyokinesis (amitosis, mitosis and meiosis) and cytokinesis
- 3.2 Structural organization of genome: Prokaryotic genome; Eukaryotic genome; Physical and chemical nature of chromosomes
- 3.3 Genetics: Structure and functions of nucleic acids (DNA and RNA); DNA replication; gene expression (protein synthesis) and regulation; Gene interactions and co-dominance; Linkage and crossing over; Genetic variation: chromosomal aberrations, polyploidy, and mutation
- 3.4 Mendelian genetics: Mendel's experiments; Mendel's laws of inheritance
- 3.5 Embryology: Structure and development of microsporangium; Microsporogenesis and the male gametophyte; Structure and development of megasporangium, Megasporogenesis and the female gametophyte; Pollination and fertilization; Development and types of endosperm; embryogenesis in typical dicot and monocot plants

### **4. Aromatic and Medicinal Plants:**

- 4.1 General introduction: Aromatic and medicinal plants for poverty alleviation; Value of production; Market structure
- 4.2 Values of medicinal plants: Plants in traditional medicine, Plants in herbal medicine and botanicals, Pharmaceutical medicine, Global use and value of medicinal species
- 4.3 Concerns surrounding medicinal plants: Concerns about loss of biological diversity and the availability of resources, Concerns about declines in local knowledge and cultural survival, Concerns relating to the availability and quality of healthcare services, Concerns relating to the terms of research on medicinal plants
- 4.4 Approaches to medicinal plant conservation: Merits of systems thinking, Approaches to production systems and in situ conservation, Approaches to commercial systems, Approaches to

ex situ conservation, propagation, domestication and the breeding of crop varieties

- 4.5 Conservation and use of MAPs in Nepal: Commercially important MAPs of Nepal, Status of MAPs in Nepal; Distribution and uses, Conservation challenges and threats

## **5. Ethnobotany**

- 5.1 Plant and people: Relationship between plants and people; History of plant-human interaction; Commercialisation and conservation; Sustainable use of plant resources; Ethnobotany in sustainable development
- 5.2 Traditional botanical knowledge: TBN and subsistence; Wild plant resources; Domesticated plants and traditional forestry; Traditional plant use and management; Indigenous perceptions of the natural world
- 5.3 Methods in ethnobotanical study: Use of laboratory techniques to evaluate plant material for potential utilisation
- 5.4 Plants and people of Nepal: Ethnic diversity and plant use in Nepal

## **6. Dendrology**

- 6.1 Introduction of dendrology: History, importance and scope; Trees and forests
- 6.2 Morphological characteristics: Tree stems, twigs, general form of woody trunk; Barks of common trees, color, gums, latex, etc; Leaf characters and types of leaves; Reproductive morphology; Flowers and Seeds; Tree architecture
- 6.3 Anatomy of wood: Anatomy and development of trees; Primary and secondary growth in roots and stems; Formation of wood cambium and its derivatives: peripheral and epical growth components, heart wood initiation
- 6.4 Dendrochronology: Technique and scope, Use in tree-line and tree-ring study, Tree-line study in Nepal Himalaya