

Paper Title: Systematics III (Angiosperms)			Paper Coordinator: Milind Sardesai	
Module-1	Module-2	Module-3	Module-4	Module-5
Systematics: Definition, scope, principles, aims and objectives of systematics, terminologies used in systematics, components of systematics; present concept of Angiosperms in respect to APG, taxonomy as a synthetic discipline, Phases of Taxonomy. Angiosperms: Definition, its characteristic features and probable causes of their evolutionary success.	Origin of Angiosperms: A general account with reference to time, place and probable ancestors: euanthial theory (Bennettitales, Caytoniales, Cycadales) and pseudanthial theory (Pentoxylales, Glossopteridae).	Phylogeny of Angiosperms: Theories on origin and evolution of angiosperms; monophyletic, paraphyletic and polyphyletic origin of angiosperms, herbaceous origin hypothesis, origin of monocotyledons; molecular evidence to angiosperm origin, cradle of angiosperms.	Fossil angiosperms: Malvaceae: Sahnioocarpon; Myrtaceae: Sahnipushpam; Soneratiaceae: Sahnianthus, Enigmocarpon; Palmae: Palmoxylon.	Trends in evolution of characters in flowering plants in habit and habitat, phyllotaxy, stomatal apparatus, nodal anatomy, xylem, phloem, cambium, vascular cambium, floral parts, fertilization, placentation, fruit, seed and seedling.
Module-6	Module-7	Module-8	Module-9	Module-10
Classification: Criteria used for classification; phases of plant classification and brief history on general account of artificial, natural, and phylogenetic systems of classifications.	Artificial and Natural systems of classification; its merits and demerits (Linnaeus, Bentham and Hooker).	Phylogenetic systems of classification –Pre-molecular; its merits and demerits (Cronquist) and Post-molecular; its merits and demerits (APG).	Taxonomic hierarchy: its major, minor and infraspecific categories and ranks Taxonomic Hierarchy: Concept of Taxa: Infraspecific categories, Concept of species, Concept of genus, Concept of family and categories above family level.	Taxonomic evidences: Characters as the basis of taxonomy from morphology, anatomy, embryology and palynology, cytotaxonomy, molecular systematics
Module-11	Module-12	Module-13	Module-14	Module-15

Subject: Botany

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Pune



Micromorphology: SEM and plant surface structure in plant systematics, methodology Ultra-structural Systematics: TEM and dilated cisterneae of endoplasmic reticulum and sieve element plastids, applications of data in the classification of higher taxa, methodology	Chemotaxonomy: Use of various phytochemical data in systematics with special reference to secondary metabolites and techniques used.	Proteins and taxonomy: Importance of seed proteins in plant taxonomy; techniques used for protein studies, aminoacid sequencing, serotaxonomy, allozyme and isozyme variations.	Molecular taxonomy: Acquirement of molecular data, Polymerase Chain Reaction (PCR), Randomly Amplified Polymorphic DNA (RAPD), Restriction Fragment Length Polymorphisms (RFLP), Amplified Fragment Length Polymorphisms (AFLP), Microsatellite DNA and DNA sequencing; Methods of analysis of Molecular systematics.	Botanical Nomenclature: Concept, history of botanical nomenclature (local and scientific) and its advantages, formation of code.
Module-16	Module-17	Module-18	Module-19	Module-20
Botanical Nomenclature: Principles of Botanical Nomenclature; Terminologies used in nomenclature: Scientific names; legitimate name, illegitimate name, autonym, homonym, synonym, basionym, tautonym, isonym, alternative name, ambiguous name, superfluous name, naked name, conserved name, rejected name, abbreviations used in nomenclature. Names of hybrids and cultivars.	Botanical Nomenclature: Procedure to describe new taxon; Latin diagnosis and description, effective and valid publication. Principle of priority and typification; author(s) citation.	Taxonomic Literature and Documentation: General taxonomic indexes, floras and manuals, monographs and revisions, bibliographies, catalogues, review serials, periodicals, glossaries, dictionaries, manuals on cultivated and economically important plants, maps and cartography, biographical references.	Concept of taxonomic character: character & character state, Correlation of Character, Character variations, analytical and synthetic, qualitative and quantitative, genetically and environmentally controlled, good and bad character, character weighing and coding,, taxonomic coefficient.	Phylogenetic relationship: primitive and advanced characters, monophyletic, holophyletic, paraphyletic and polyphyletic, homology and analogy, parallel and convergent evolution.
Module-21	Module-22	Module-23	Module-24	Module-25

Biosystematics: scope and significance; principles and procedures; relationship between experimental and classical taxonomy; experimental categories.	Phytogeography: Continental Drift, Land Bridges, shifting of poles, theories of differentiation and natural selection, types and areas of natural distribution, centre of origin, theory of tolerance, patterns of geographical distribution, disjunction, vicariance and their relevance to plant taxonomy, Phytogeographic zones in India.	Endemism: Concept of endemism, categories, biodiversity hot-spots in world with special reference to India, Endemism in Indian flora, megacentres of endemism in India; Keystone and flagship species, sacred groves and their importance.	Numerical Taxonomy: Phenetics and Cladistics Cladistics: Operational Taxonomic Units (OTU), Plesiomorphous and apomorphous characters; homologous and analogous characters; homoplasy; monophyly, polyphyly and paraphyly; parsimony and maximum likelihood methods in cladistics; softwares; cladistics and classification.	Speciation: plant speciation: allopatric/ abrupt/ sympatric/ hybrid/ apomictic speciation and isolation mechanism; genus and infraspecific taxa. Types of speciation: quantum, Myrean, catastrophic, local, geographic and phyletic. Causes of variation in population, ecotypes and ecads, evolution and differentiation of species, adaptive radiations.
Module-26	Module-27	Module-28	Module-29	Module-30
Floristics: Need and significance, methodology, analysis and data presentation.	Herbarium: Introduction to Herbarium, History, Objectives and function of a herbarium, Types of herbaria, role of herbarium in Systematics, Floristics, Assessment and documentation of phytodiversity and Public Education. Important herbaria of India and the world.	Herbarium: importance, Herbarium Methodology: Collection, Processing of specimen (Poisoning, Pressing, Drying, Mounting, Stitching) and Maintenance. Virtual herbarium its importance and advantages.	Botanic Gardens: History and role of botanic gardens, special types of botanic gardens: Arboretum, Pineatum, Orchidarium, Bambusetum, Fernary. Important Botanic Gardens in India and World.	Taxonomic Keys: Purpose, types (Single entry (dichotomous vs bracketed) and multiple entry keys); suggestions for construction and use of keys; computerized key construction. Botanical Illustration: Role of Botanical Illustration in plant taxonomy
Module-31	Module-32	Module-33	Module-34	Module-35
Tools used in taxonomy: GIS, GPS, Use of computers and online databases in angiosperms taxonomy.	Botanical explorations and Conservation: Botanical explorations in India. Role of Botanical Survey of India. Biodiversity, its importance, assessment, loss and conservation, ethical principles of conservation biology, IUCN, Red List categories of IUCN, means and ways for conservation.	Barcoding in Plants – a new tool for identifying species.	Families: A general survey of the following Angiosperm families with salient features, inter-relationships, evolutionary trends and economic importance: Amborellales: Amborellaceae Nymphaeales: Nymphaeaceae, Hydatellaceae Austrobaileyales: Illiciaceae Magnolids: Magnoliaceae Monocot: Alismataceae, Liliaceae, Amaryllidaceae, Arcaceae,	Families: A general survey of the following Angiosperm families with salient features, inter-relationships, evolutionary trends and economic importance: Eudicots: Ranunculaceae, Dilleniaceae Rosids: Celastraceae, Euphorbiaceae, Podostemaceae, Rhizophoraceae, Fabaceae, Moraceae, Cucurbitaceae, Myrtaceae,

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			Araceae, Commelinaceae, Zingiberaceae, Orchidaceae and Poaceae Ceratophyllales: Ceratophyllaceae	Meliaceae, Malvaceae Asterids: Loranthaceae, Nyctaginaceae, Apocynaceae, Lamiaceae, Solanaceae, Boraginaceae, Asteraceae and Apiaceae.
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