

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.
M. Sc. II Botany Syllabus (2016-2017)**

Course: MS.BOT.4.01 TECHNIQUES AND INSTRUMENTATION

LEARNING OBJECTIVES:

The students will be able to-

- Understand the basic concepts of microscopy, centrifugation, chromatography and tracer techniques.
- Understand the applications of techniques mentioned above in biology

Unit I: Microscopy and Spectroscopy: The fluorescence microscopy- working of microscope and applications. Electron microscopy- construction and working of microscope, specimen preparation, scanning and transmission electron microscopy, application of electron microscopy. UV-visible spectrometer, IR, NMR, atomic absorption.

Unit II: Centrifugation: Principles; Preparative centrifugation- Differential, Rate-zonal, Isopycnic and Equilibrium isodensity centrifugation; Density Gradient Centrifugation- Nature of gradient materials, formation of density gradients, sample application to the gradient, removal of gradients from centrifuge tubes. Preparative centrifuges and their uses- General purpose centrifuges, High speed centrifuges, Preparative ultracentrifuges. Analytical ultracentrifugation- Principles, Construction and Applications.

Unit III: Chromatography: HPLC and GC- Principle, Support, Stationary phase, Detection systems. Ion exchange, Exclusion and Affinity Chromatography- Principle, materials, practical procedure, Applications.

Unit IV: Tracer techniques: Principle and application of tracer techniques in biology. Radioactive isotopes and autoradiography. Geiger Muller counter, Liquid Scintillation Counter.

Practicals MS.BOT.PR.4.01 : No Practical course.

CIA- moodle / project / assignments / presentation / field report / test.

DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.
M. Sc. II Botany Syllabus (2016-2017)

Course: MS.BOT.4.02 ANGIOSPERM-V

LEARNING OBJECTIVES:

The students will be able to-

- Learn the diversity, present status and interrelationships among different families apart from their characteristic features and economic importance.
- Know the importance of different anatomical, embryological and palynological features.
- To understand the use of IPR, patents, copyrights in protecting our traditional knowledge.

Unit I: Families II: Angiosperm Diversity. Study the following families with reference to its systematic position, distribution, salient features, floral formula, floral diagram, morphological peculiarities and enlist economic important plants and their uses. Nymphaeaceae, Onagraceae, Vitaceae, Nyctaginaceae, Balsaminaceae, Boraginaceae, Gentianaceae, Cyperaceae, Lentibulariaceae and Commelinaceae. A detailed study of the present status, affinities, phylogeny and interrelationships of the above families.

Unit II: Taxonomic Evidences in relation to Anatomy: Wood Anatomy, Trichomes, epidermal features & Stomata, Leaf Anatomy, Floral Anatomy.

Unit III: Taxonomic Evidences in relation to Embryology and Palynology: Families with distinct embryological features – Podostemaceae, Cyperaceae and Onagraceae. Specific examples of use of embryology in interpreting taxonomic affinities – *Trapa*, *Paeonia*, *Exocarpos*, Loranthaceae. Palynology – Basic structure of Pollen grains and pollen aperture types – Eurypalynous and Stenopalynous Taxa, Evolution of Pollen aperture types. Pollinia in Orchidaceae and Asclepiadaceae.

Unit IV: Intellectual Property Rights (IPR): IPR, Patent, Copy Right, India's IPR System, Traditional Knowledge and IPR, www.iprindia.com, www.ipindia.nic.in, www.copyright.gov.in.

Practicals MS.BOT.PR.4.02 :

- 1) Study of Angiosperm families mentioned for theory with importance of its members.
- 2) Floral Anatomy – Calyx and Androceium in Lamiaceae, Androceium in leguminosae.
- 3) Study of leaf architecture. Prepare permanent slides of any leaf/ leaflet architecture (submission).
- 4) Study of Pollen apertures done in theory; pollinia of Orchidaceae and Asclepiadaceae.
- 5) Embryo mounting –dicot, monocot and polyembryony.
- 6) Study of trichomes, types of stomata.
- 7) A case Study of patent filling.
- 8) Field excursion.

CIA- multiple choice questions / assignment / presentation / field report / test.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.
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Course: MS.BOT.4.03 ANGIOSPERMS-VI

LEARNING OBJECTIVES:

The students will be able to-

- To understand the importance and application of numerical taxonomy, various taxonomic databases and the usefulness of internet in taxonomic studies.
- To understand the use of libraries, literature, herbarium and botanical gardens for taxonomic studies.

Unit I: Numerical Taxonomy (Phenetics Methods: Taxometrics) : Principles of Numerical Taxonomy, OUT, Taxonomic characters, coding of characters, Measuring resemblance, simple matching Coefficient, Taxonomic Distance, Cluster Analysis,

Unit II: Progressive taxonomy: Progressive taxonomy- Internet, Taxonomic databases (Kew, IPNI, the plantlist, tropicos, efloraindia, etc). Present status and future scope of Taxonomy in India- Vegetation survey, Floristics, Revisionary and monographic studies, Ethnobiological studies, Development and establishment of new herbaria, Role of taxonomists and job opportunities for taxonomists.

Unit III: Tools in taxonomy: Library – Literature: definition, origin, history and evolution of Literature of Taxonomy in India. Classification of Taxonomic Literature: Checklist, Catalogue, Floras, Monographs, Revisions, Encyclopedias, Indices, Dictionaries. Museum (Herbarium)- Definition, Steps involved in development of a herbarium, Maintenance of Herbarium, General account of Herbaria in India. Role of B.S.I in Herbaria, Private herbaria, Herbarium of KEW, Utility and importance of Herbaria in Taxonomy. **Garden-** Origin, History and Development of gardens in India. Types of Gardens, Kew Gardens. Role of gardens in taxonomic studies. Preservation of germplasm techniques and its importance in taxonomy.

Unit IV: Applied Taxonomy: Remote Sensing- History, Principles and types of Remote sensing; Advantages and limitations of remote sensing; Applications of Remote Sensing in Vegetation Classification and Forest resource Management; Remote sensing of soil and water. **Plant quarantine-** Purpose, Historical account, Plant protection organization, Exclusive quarantine, Regular quarantine, Domestic quarantine, Certification of plant materials.

Practicals MS.BOT.PR.4.03 :

- 1) Study of published floras (International, National, regional and local), revision, monograph and check list.
- 2) Nomenclature Exercises
- 3) Review of Taxonomic databases- theplantlist.org, IPNI< TROPICOS, eFloraindia.
- 4) Interpretation of remote sensing images.
- 5) Review of research paper (from any taxonomy related scientific journal)
- 6) Visit to plant quarantine Lab- report to be entered in journal.

CIA- short answer questions / assignment / presentation / field report / test.

DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.
M. Sc. II Botany Syllabus under Autonomy (2016-2017)

Course: MS.BOT.4.04 ANGIOSPERMS- VII

LEARNING OBJECTIVES:

The students will be able to-

- Learn the application of technological tools used in unravelling the mystery of evolution, phylogeny, identification and diversity, using the knowledge in plant geography and ethnobotany along with Taxonomy of angiosperms.

Unit I: Families III: Approaches to Angiosperm Taxonomy- Study the following families with reference to its systematic position, distribution, salient features, floral formula, floral diagram, morphological peculiarities. Enlist economic important plants and their uses. Oleaceae, Plumbaginaceae, Sapotaceae, Bignoniaceae, Caryophyllaceae, Loranthaceae, Urticaceae, Araceae and Orchidaceae. A detailed study of the present status, affinities, phylogeny and interrelationships of the above families.

Unit II: Taxonomic evidence : Taxonomic Evidences in relation with Cytology; Chromosome morphology, Chromosome behavior, Heterochromatin, Use of Cytological data at Family level, Use of Cytological data at family, genus and species level.

Unit III: Plant Geography : Historical Development, Physical geography of earth, theories of plant distribution, Static and Descriptive; major biomes of the world; minor biomes; Phytogeographical regions of India; Dynamic or interpretive plant geography. Endemism- role of Indian endemic flora in plant based discoveries.

Unit IV : Ethnobotany: Ethnobotany- Introduction; a brief history of ethnobotanical studies in the world and in India; scope of ethnobotany. Subdisciplines of ethnobotany. Interdisciplinary approaches, Knowledge of sociological and anthropological terms. Distribution of tribes in India. Knowledge of tribes of Maharashtra; Ethnobotanical works on these tribes. Methods in ethnobotanical research. Research design and cautions in data collections, Practical and field skills; Prior Informed Consent, PRA techniques, interviews and questionnaire methods, choice of resource persons. Ethnobotanical knowledge and communities: Ethnobotanical classification; Folk Taxonomy of Plants. Bioprospecting and commercial use of traditional knowledge. Medical ethnobotany, ethnopharmacology and the search of plant based drugs. Developing research partnerships: Ethics and research guidelines in ethnobotany, equitable research relationships. Equitable Benefit sharing models of the world.

Practicals MS.BOT.PR.4.04 :

- 1) Study of Angiosperm families mentioned for theory with reference to morphological peculiarities and economic importance of its members.
- 2) Morphological description of the entire plant.
- 3) Preparation of synoptic keys to the families; Preparation of synoptic keys to the genera; Preparation of synoptic keys to the species within a genus.
- 4) Study of Cytological characters of taxonomic value- study of Karyotypes of *Allium cepa* and *Aloe vera*.
- 5) Field excursion.

CIA- multiple choice questions / assignment / presentation / field report / test.

DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.
M. Sc. II Botany Syllabus (2016-2017)

Course: MS.BOT.4.05 PLANT PHYSIOLOGY- V

LEARNING OBJECTIVES

The students will be able to understand-

1. The various aspects of nutrition like heterotrophic and foliar nutrition.
2. Mineral toxicity.
3. Minerals in chemical fertilizers.
4. The role of various abiotic and biotic stresses faced by plants in different ways and the response and mechanisms used by plant to overcome them.

Unit I: Plant Mineral nutrition: Chemical fertilizers in crop production, biofortification, foliar nutrition, responses of to mineral toxicity, heterotrophic nutrition in higher plants (insectivorous plants)

Unit II: Stress Physiology – I: Abiotic stresses, Plant responses to- Water deficit, Heat stress, and heat shock-adaptation, Chilling and freezing – adaptation/acclimation, Flooding and oxygen deficit.

Unit III: Stress Physiology – II: Abiotic stress, Oxidative stress, Salinity stress and Oxygen deficiency.

Unit IV: Stress Physiology – III: Biotic stresses, Plant responses to pathogens.

Practicals MS.BOT.PR.4.05 :

- 1) Determination of iron (Fe) in plant digest.
- 2) Ash preparation.
- 3) Determination of phosphorus (P) from ash.
- 4) Estimation of proline in water stressed plants.
- 5) Estimation of proline in salt stressed plants.
- 6) Study of SOD in water stressed plants.
- 7) Study of SOD in salinity stressed plants.

CIA- multiple choice questions / assignment / presentation / field report / test.

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.
M. Sc. II Botany Syllabus (2016-2017)**

Course: MS.BOT.4.06 PLANT PHYSIOLOGY-VI

LEARNING OBJECTIVES

The students will be able to understand-

1. The significance of PGRs in modulating plant genome. Their role and exploitation in fruit ripening and preservation.
2. The functions of phytochromes in photophysiology, ecology and plant responses. The properties of phytochrome and their role in gene expression.
3. The contribution of various substrates, intermediates, factors and conditions in controlling the various catabolic pathways in mitochondrial respiration.
4. The gene regulating mechanisms in the development of various floral organs.
5. The process of senescence and the metabolic changes taking place in plant cell during senescence.

Unit I: Plant Growth Regulators: Modulation of plant genomes by natural and synthetic PGRs; Post Harvest Technology – Fruit ripening and Fruit preservation.

Unit II: Plant responses to light: Photochemical and biochemical properties of phytochrome, phytochrome induced whole plant response, ecological roles of phytochrome, functional domains of phytochromes, cellular and molecular mode of action and factors involved in phytochrome regulated gene expression. Photophysiology of blue light responses, blue light photoreceptors, signal transduction.

Unit III: Control of flowering: Floral organs, genes regulating the floral development –floral organ identity genes - MADS box genes, a model for floral evocation;

Unit IV: Senescence and Programmed Cell Death: Programmed cell death (PCD) an overview; Overview of Senescence- Pigment Metabolism during Protein metabolism, Oxidative metabolism during senescence, Degradation of nucleic acids during senescence, Regulation of metabolic activity during senescence, Endogenous PGRs and senescence.

Practicals MS.BOT.PR.4.06

- 1) Study of photomorphogenetic effect of lights on the development of seedlings i) Length of hypocotyls, Size and fresh weight of cotyledons, Differentiation of stomata in the lower epidermis, ii) Estimation of total chlorophyll, iii) Extraction and estimation of anthocyanin.
- 2) Effect of GA on α -amylase induction in cereal grains.
- 3) Separation of sugars from ripe and unripe fruits by paper chromatography.
- 4) Estimation of organic acids by paper chromatography.
- 5) Estimation of carotenoids in the young, mature and senescent leaves.

CIA- multiple choice questions / assignment / presentation / field report / test.

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Course: MS.BOT.4.07 PLANT BIOCHEMISTRY-VI AND BIOTECHNOLOGY

LEARNING OBJECTIVES

The students will be able to understand-

1. The role of various secondary metabolites in plants, their classification, functions and the pathways involved in their synthesis.
2. The cruciality of secondary messengers in biological processes and the dependence of various metabolic pathways on them.
3. The process of tissue culture and its application.
4. The use of IPR, patents, copyrights in protecting our traditional knowledge.

Unit I: Secondary Metabolites: Cutins, waxes and suberin; Role of secondary metabolites; Classes of secondary metabolites– terpenes, phenolics and alkaloids and other nitrogen containing compounds; Overview of the major pathways of secondary-metabolite biosynthesis and their inter-relationship with primary metabolism; Biosynthesis and role of terpenes, phenolics and alkaloids and other nitrogen containing compounds.

Unit II: Signal transduction in plants : Second messengers- Cyclic-AMP, Cyclic-GMP, Cyclic-ADP-ribose, 1,2 – diacylglycerol, inositol 1,4,5-triphosphate, nitric oxide and Calcium ion and their role, structure of calmodulin MAPK cascade.

Unit III: Plant tissue culture- callus culture, organ culture, advantages, applications.

Unit IV: Intellectual Property Rights (IPR): IPR, Patent, Copy Right, India's IPR System, Traditional Knowledge and IPR.

Practicals MS.BOT.PR.4.07 :

- 1) Study of peroxidase activity.
- 2) Detection of tannins, saponins, alkaloids, flavonoids, steroids and triterpenoids, wax, cutin, etc.
- 3) Estimation of total alkaloids from plant material.
- 4) Estimation of total phenolics in plants.
- 5) Estimation of total flavonoids in plants.
- 6) Callus initiation.
- 7) Multiple shoot formation.

CIA- multiple choice questions / assignment / presentation / test.
