

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

Course: MS.BOT.3.01 BIOSTATISTICS, BIOINFORMATICS & NANOTECHNOLOGY

LEARNING OBJECTIVES:

On completion of the course, the student shall be able to-

- Understand the basic concepts of statistics and apply them.
- Use open source computer programs like PSPP for statistical analysis of sampled data.
- Use the internet to conduct Bioinformatic Database searches.
- Develop the skills necessary for writing scientific works.

Unit I: Biostatistics: Chi square test, Hypothesis testing: Type I and type II errors, Null hypothesis, P-values- one v/s two tail P values, z-test, Test of significance, Introduction to ANOVA, One-way and two way ANOVA. Regression.

Unit II: Bioinformatics: Organization of biological data; Querying in databases; Gene finding, motif finding and multiple sequence alignment; Protein sequence analysis (theory and algorithms); Exploration of databases, retrieval of desired data.

Unit III: Nanotechnology: Introduction, synthesis of nanomaterials- various methods for green synthesis of nanomaterial- Polysaccharide, Tollens, Irradiation, Biological and Polyoxometalates methods. Biosynthesis of nanoparticles using biological agents like bacteria, fungi, actinomycetes, yeast, algae and plants.

Unit IV: Scientific writing: scientific writing- literature survey, journals (national and international covering plant sciences), selecting a topic, hypothesis; Aims and objective/s, introduction, method, results and discussion; Citing of references- analysing journal articles and essays, basic mechanics and major errors, citing and using sources. Executive summaries; formatting documents; revising your paper- typesetting punctuation, summarizing.

Practicals MS.BOT.PR.3.01

- 1) Using the software that provides a basic set of capabilities: frequencies, cross tabs comparison of means (t-tests and one way ANOVA); linear regression, logistic regression and re-ordering data, non-parametric tests, factor analysis, cluster analysis, principal component analysis, chi-square analysis.
- 2) Analyze the data for Hypothesis testing, Normal deviate test, Chi-square test, Correlation and regression, test of significance of means, paired and unpaired t-test, application of analysis of variance (ANOVA)
- 3) Multiple alignments- phylogenetic tree,
- 4) Motif finding.
- 5) Synthesis of nanoparticles and its characterization using UV-visible absorption spectrometry and antimicrobial activity of the fabricated nanoparticles.

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

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.
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Course: MS.BOT.3.02 PLANT PATHOLOGY

LEARNING OBJECTIVES

- The students will be able to-
- Distinguish the various symptoms of plant diseases and understand host pathogen relationship.
- Analyze the preventive and control measures and the defense strategies used by plant host.
- Learn the method of studying plant diseases and recognize the factors responsible for causing the plant diseases.
- Understand the whole process of disease cycle in some economically important plants.

Unit I: Plant pathogens, Symptoms and Classification of plant diseases: Plant pathogens- Host pathogen relationship; Dissemination of pathogens; Epidemiology; Disease forecasting. Classification of plant diseases. Symptoms: Necrotic, Atrophic, Hypertrophic.

Unit II: Host defence mechanism, Prevention and Control of Plant diseases : Defence mechanisms of host; Prevention and control, Prophylaxis, therapy and Immunization.

Unit III: Plant diseases-1 : Methods of studying plant diseases. Post harvest diseases and protection of stored and perishable product. Microbes responsible for spoilage in storage: Diseases of post harvest durables i) Factors affecting spoilage, ii) Management of storage fungi; Diseases of post harvest perishables i) Factors affecting post harvest decays; ii) Management of post harvest decays of perishables.

Unit IV: Plant diseases-2 : Causal organism, symptoms, overview of life-cycle and control measures for following diseases: Fungal diseases- wart disease of potato, white rust of crucifers, red rot of sugarcane, downy mildew of pea / grape, tikka disease of ground nut, powdery mildew of cereals / grasses, looser smut of wheat, brown spot of rice. Bacterial diseases- citrus canker, bacterial brown rot of potato. Viral diseases- tobacco mosaic, leaf curl of potato. Diseases caused by nematodes- root knot disease of potato / sugarcane.

Practicals MS.BOT.PR.3.02

- 1) Study the symptoms and causal organism of the plant diseases mentioned in theory (at least three from group 1 and one each from the rest)
- 2) To identify the various symptoms of plant diseases.
- 3) Field trip to any Agricultural Institute / University.

CIA- open book test / assignment / presentation / field report / test/ MCQ.

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Course: MS.BOT.3.03 HORTICULTURE

LEARNING OBJECTIVES

The students will be able to understand-

- The classification systems and know the role of essential environmental factors.
- To recognize and employ the techniques of plant propagation methods.
- To identify the cultivation methods for various plant groups and understanding the required necessary conditions.
- To know and use the principles of landscape designing.

Unit I: Operational Classification systems and Essential Environmental factors:

Classification based on seasonal growth cycle- annual, biennial, perennial; Kinds of stem; Common stem growth forms- erect, decumbent, creeping, climbing; Classification of ornamental plants- Herbaceous ornamentals, Woody ornamentals. Classification based on adaptation (hardiness). Essential environmental factors- an overview, Abiotic- air, water, temperature, light, soil; Biotic- microorganisms, insects, birds, rodents.

Unit II: Plant propagation: Sexual: seminal- sowing seeds, hybrid seeds; transplanting. Asexual: cutting, budding, grafting, layering, underground plant parts, micropropagation, pre and post planting care.

Unit III: Cultivation of plants: ornamental plants, growing vegetables and fruit crops, succulents, floriculture, pest management.

Unit IV: Landscaping: goals of landscaping, categories of landscaping- residential and public, commercial, speciality; Landscape designing- basic principles, basic components; Selecting plants.

Practicals MS.BOT.PR.3.03

- 1) Garden tools and implements- Axe, shovel, knives, pruning shears, saw, secateurs, sieve, lawnmower, sprinkler, watering can, rubber hose, hand fork, labels (visit to a plant nursery).
- 2) Propagation by seed, cutting, layering, budding.
- 3) Biofertilizers- Identification of Nostoc, VAM and Rhizobium.
- 4) Identification of ornamental plants.
- 5) Physical properties of soil.
- 6) Measuring the soil pH and its correction by adding chemicals.
- 7) Formulating potting mix.
- 8) Preparing manure from vegetable wastes / preparing compost.

CIA- assignment / presentation / field report / test / MCQ.

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Course: MS.BOT.3.04 Angiosperms- IV

LEARNING OBJECTIVES

The students will be able to-

- Strengthen the fundamentals learnt in under graduate program and will learn new approaches for application of botanical knowledge in human welfare.
- Apply technological tools in unraveling the mystery of evolution, understand phylogeny, identification and understand diversity, using the knowledge in biodiversity, bioprospecting, green belt planning, and IPR.

Unit I: Evolution : Plesiomorphic and Apomorphic characters, Character weighing, The effects of evolutionary theory on systematic, monographic, and floristic development : Primitive versus advanced, Homology and Analogy, Parallelism and Convergence.

Unit II: Phylogeny, Phylogenetic Techniques : Use of cladistic in classification; Understanding phylogeny, constructing phylogeny, Monophyly, Paraphyly and polyphyly; Patterns of variation and phylogenetic trees; Building Trees- Rooting Technique, Distance methods, Maximum likely hood methods, Bootstrapping using trees. Phyllocode.

Unit III: Nomenclature : International code of Botanical Nomenclature 1830-Paris Code to 2011-Melbourne code; Major adaptations considered in these International Botanical Congress; Important Rules of ICBN, Typification, Type concept and Types of type, Basionym, Homonym, Tautonym, Taxonomic and nomenclature synonyms.

Unit IV: Keys and GB: Types of keys- single access and multi access keys, preparation of keys for Taxon, keys based on exomorphic characters. **Green-belt planning-** Concept and recommendations; Utility of GBP; List of plants, ornamental, Flowering, shady; Importance of Green Belt in the current environmental conditions in India.

Practicals MS.BOT.PR.3.04

- 1) Preparation of Dichotomous Key of Five Families (min 5 genera / species from each family)
- 2) Use of keys for identification of family, genus and species.
- 3) Writing of species description using taxonomic terminology.
- 4) Cluster analysis of any family using Cladistics techniques based on morphological characters. (practical will continue the whole semester)
- 5) Preparation of Herbarium specimens. 10 specimens to be prepared and submitted during practical examination.
- 6) Study of published Floras, Revision and Monograph; identification, listing and analysis of their components.
- 7) Field excursion.

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

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Course: MS.BOT.3.05 PLANT BIOCHEMISTRY- V

LEARNING OBJECTIVES

The students will be able to-

- Perceive the actions and influence of vitamins and coenzymes in plants.
- Comprehend the significance of storage proteins and lectins, their biological role in plant growth and defense and their potential.
- Understand the pathways in carbohydrate metabolism and know the position and functions of various metabolic intermediates.
- Realize the mechanisms and steps involved in the synthesis and degradation of nucleotides.

Unit II: Vitamins and Coenzymes: general characteristics of vitamins; Structure, occurrence, functions and activity of all water soluble and fat soluble vitamins; Structure, classification and actions of various coenzymes.

Unit II: Storage proteins and Lectins: storage proteins and their storage mechanism. Plant lectins.

Unit III: Plant metabolism : carbohydrate metabolism- synthesis of sucrose, trehalose and starch; degradation of sucrose and starch; control of metabolism- The hexose phosphate pool, biosynthetic pathways that consume hexose phosphate, Catabolic pathways that generate hexose phosphates; Triose / pentose phosphate metabolite pool; Interaction between the hexose phosphate and pentose phosphate / triose phosphate pools. Mitochondrial metabolism- control of glycolysis and TCA cycle, cataplerosis and anaplerosis, anaplerotic reactions, reactions of reverse of TCA cycle, non-phosphorylating reactions and their role- cyanide resistant and rotenone sensitive pathways.

Unit IV: Nucleotide Biosynthesis and Degradation: Nucleotide structure, Nitrogenous bases- Pyrimidine bases, purine bases. Purine nucleotides biosynthesis and degradation. Pyrimidine nucleotides biosynthesis and degradation.

Practicals MS.BOT.PR.3.05

- 1) Estimation of ascorbic acid.
- 2) Estimation of vit A.
- 3) Separation of seed proteins by PAGE.
- 4) Estimation of total carbohydrates.
- 5) Determination of ATPase activity in plants.
- 6) Determination of acid phosphatase activity.
- 7) Inhibition of Acid Phosphatase.
- 8) Malate / succinate dehydrogenase activity assay and inhibition.

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

**DEPARTMENT OF BOTANY, ST. XAVIER'S COLLEGE (Autonomous), Mumbai.
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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.
