

Syllabus for M.Sc. Entrance in Botany 2019-20

M.Sc. Botany

Note: The syllabus prescribed for the entrance test has been divided into fifteen units. Each unit carries a weightage of four marks. Paper setters are required to set four multiple choice type questions with only one correct or most appropriate answer separately for each unit, giving uniform representation to the whole syllabus contained therein.

1. Viruses: Discovery, general structure, replication, DNA virus (T-phage); lytic and lysogenic cycle, RNA virus (TMV); Bacteria: General characteristics and cell structure; reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); economic importance; Fungi: General characteristics, classification (Alexopolous, Mims & Blackwell), cell wall composition, nutrition and reproduction; life cycle of *Rhizopus* (Zygomycota), *Venturia* (Ascomycota), *Agaricus* (Basidiomycota). Symbiotic associations: Lichens and Mycorrhiza - general account and significance
2. General characteristics, classification of Algae (Round 1965), criteria for algal classification; range of thallus organization; morphology, reproduction and life cycle of *Nostoc*, *Chlamydomonas*, *Oedogonium*, *Vaucheria*, *Ectocarpus*, *Batrachospermum*; economic importance of algae. Archegoniate – General characteristics, adaptations to land habit. Bryophytes - General characteristics, Proskauer's classification (upto family); morphology, anatomy and reproduction (excluding developmental details) of *Marchantia* and *Funaria*; Evolution of sporophyte; apogamy and apospory; alternation of generation; economic importance of bryophytes.
3. Pteridophytes - General characteristics; classification of Pteridophytes (Sporne 1965); Early land plants (*Rhynia*); morphology, anatomy and reproduction (excluding developmental details) of *Selaginella*, *Equisetum* and *Dryopteris*; heterospory and origin of seed habit; evolution of stellar systems in pteridophytes. Gymnosperms - General characteristics, classification – Christenhusz *et al.* 2011 (upto family); morphology, anatomy and reproduction (excluding developmental details) of *Cycas* and *Pinus*; economic importance of gymnosperms.
4. Introduction to ecology; soil - origin, formation and composition, soil profile; water - states of water in the environment, precipitation types; light and temperature as ecological factors; adaptation of hydrophytes and xerophytes. Plant communities - characteristics; ecotone and edge effect; succession - processes and types. Ecosystem: Structure; energy flow; trophic organization; food chains and food webs; ecological pyramids, primary productivity; biogeochemical cycling of carbon, nitrogen and Phosphorous. Phytogeography - biogeographical zones of India, concept of endemism.
5. Introduction to Plant taxonomy; types of classification - artificial, natural and evolutionary; classification systems - Bentham and Hooker (upto series), Angiosperm Phylogeny Group (APG) (upto order level). Numerical taxonomy - OTUs, character weighing and coding, cluster analysis; phenograms and cladograms (definitions and differences). Role of herbarium and botanical garden, important herbaria and botanical gardens of the world and India; Flora, identification Keys: single-access and multi-access; taxonomic evidences from cytology, phytochemistry and molecular data; taxonomic hierarchy – ranks, categories and taxonomic groups; Botanical nomenclature - principles of ICN; binominal system of nomenclature, typification, author citation, valid publication, principle of priority
6. Meristematic and permanent tissues: Simple and Complex tissue (Types and Functions); Organization of root and shoot apical meristem- Histogen theory; Tunica and corpus theory. Plant organs: Structure of a typical dicot and monocot root, stem and leaf. Secondary growth : Cambium- types, structure and function ; Secondary growth in typical dicot root

- and stem (*Helianthus*, Sunflower) ; General account of wood structure (Heart wood and Sap wood); Adaptations: General structure and function of cuticle, epidermis and stomata; General account of adaptations in xerophytes and hydrophytes.
7. Structural organization of flower: Development and structure of anther and pollen; Structure and types of ovules; Types of embryo sacs; Structure of a typical embryo sac. Pollination and fertilization: Types of pollination –Floral modifications favoring self and cross pollination; Double fertilization; Seed dispersal mechanism. Embryo and Endosperm: Endosperm development, structure and functions; Structure and development of dicot and monocot embryo (*Capsella-bursa pectoris*; maize). Apomixis and Embryogeny: Definition, types and practical applications of apomixis and polyembryony.
 8. Plant Water Relations: Water potential and its components; Transpiration and its significance; Factors affecting transpiration; Ascent of Sap, Pressure flow model; Phloem loading and unloading. Mineral nutrition: Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport. Photosynthesis: Photosynthetic Pigments (Chl-a, Chl-b, xanthophylls, carotene); light harvest complexes, Photosystem I and II, Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration.
 9. Respiration: Glycolysis, anaerobic respiration, TCA cycle; Pentose Phosphate Pathway, Electron Transport system and Oxidative phosphorylation. Enzymes: Structure, Classification and properties; Mechanism of enzyme action and enzyme inhibition. Nitrogen metabolism: concept of symbiotic and asymbiotic associations, Biological nitrogen fixation; Nitrate and ammonia assimilation. Plant growth regulators: Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA and ethylene. Plant response to light and temperature: Photoperiodism (SDPs, LDPs, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.
 10. Metabolism and its types, Nomenclature, classification and biological significance of monosaccharides; structure, biologically important properties and significance of amino acids. fatty acids, alcohols, sterols and steroids, nucleosides and nucleotides. Structure, types, properties and biological significance of polysaccharides, carbohydrates, proteins, oils and waxes. Methods of crop improvement for self pollinated, cross pollinated and vegetative propagated plants (introduction, selection, acclimatization and hybridization), polyploidy and distant hybridization- role in crop improvement. Inbreeding depression and heterosis; Concept of point mutations, their role in crop improvement.
 11. Mendelian principles of inheritance; modified Mendelian ratios: 2:1- lethal Genes; 1:2:1- Co-dominance, incomplete dominance; 9:7; 9:4:3; 13:3; 12:3:1 and 15:1. Multiple allelism and pleiotropy.. Linkage: concept; complete & incomplete linkage, Bridges experiment. Crossing over: concept and significance. Numerical and Structural changes in chromosomes. Biotechnological techniques: Gene transfer techniques in plants, transgenic plants with special reference to Bt- Cotton & Golden rice; Blotting techniques (Northern, Southern and Western), DNA finger printing; Molecular DNA Markers (RAPD, RFLP& SNPs). essential features of cloning vectors (Plasmids), its role in gene transfer technology
 12. The cell theory; structure of prokaryotic and eukaryotic cells; structure and function of biomembranes; fluid mosaic concept, Cell wall-structure and functions. Structure and functions of ribosomes, centrioles, basal bodies, endoplasmic reticulum, golgi bodies, lysosomes, peroxisomes and glyoxisomes, mitochondria, chloroplast and nucleus. Euchromatin and heterochromatin; mitosis and meiosis; DNA- structure, types and replication-Watson and Crick's model, Griffith's and Avery's transformation experiments. Types of RNA (mRNA, tRNA, rRNA), Transcription and translation in prokaryotes, genetic code. Gene regulation in Prokaryotes: Lac operon and Tryptophan operon.
 13. Principle and types of microscopy, Principle, working and application of light microscopy:

bright field compound microscope, fluorescence microscope, Scanning and transmission electron microscope. Centrifugation and types of centrifugation: Ultra- centrifugation, Differential and Density Gradient centrifugation. Principle working and applications of Spectrophotometry: Principle and types of chromatography (Paper Chromatography, Thin Layer Chromatography (TLC)), Electrophoresis, Agarose gel electrophoresis (AGE); Polyacrlamide gel Electrophoresis (PAGE); Sodium dodycl sulphate (SDS- PAGE).

14. Concept of centers of origin, crop domestication; importance of germplasm diversity. Origin, morphology and uses of Wheat, Rice and Maize. Brief account and importance of millets and pseudocereals. Introduction and importance of legumes: Gram, Soyabean and Kidney Bean. Introduction, systematic position, morphological features and uses of *Crocus sativus*, *Curcuma domestica* and *Piper nigrum*. Processing and uses of tea. Extraction methods of essential oils; systematic position and uses of *Brassica* and Coconut. Classification of fibres (based on origin). Morphology, extraction & uses of Cotton. Chemical constituents and uses of *Saussurea costus* and *Papaver somniferum*.
15. Methods of propagation of fruit crops:. Propagation of fruit crops- concept of scion and rootstock, Rootstock types- seedling and clonal rootstocks, merits and demerits. Techniques of generating clonal rootstocks, Grafting techniques – scion and bud grafting, merits and demerits. Plant pathogens (Characters): Fungi, bacteria, MLO'S and RLO'S. Major diseases, disease symptoms and management practices in apple, pear and apricot. Symptoms, causal organism, disease cycle and control of plant diseases: Late blight of Potato, Paddy blast, *Alternaria* leaf blight of apple, bacterial blight of rice. Plant disease management: Cultural, biological and IPM; Types of fertilizers and their applications in horticultural crops (bio-fertilizers, organic manures, Vermi-composting and green manuring).