

Syllabus for Banaras Hindu University M.Sc. Botany Entrance Exam

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Made by : PET BOTANY TEAM

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General: Classification of Plant Kingdom: Two, Three, Four & Five, Six Kingdom Classification & Three domains of Life. Classification specially given for Kingdom 'Plantae' by A. W. Eichler & Oswald Tippo. Characteristic features of each group, their similarity and dissimilarity with other groups.

1. Algae (Phycology):

Pioneer workers in Algae. Classification by Fritsch. General Characters: Cell Wall, Flagella, Reserve Food Material, Pigments, Reproduction in Algae, Alternation of generation. Chlorophyceae (Green algae): General characters, Life Cycle of *Oedogonium*, Life Cycle of *Vaucheria*. Phaeophyceae (Brown algae): General characters, Life Cycle of *Ectocarpus*, Life Cycle of *Sargassum*. Cyanophyceae (Myxophyceae or Blue-Green algae): General characters. Rhodophyceae (Red algae): General characters, Life Cycle of *Batrachospermum*, Life Cycle of *Polysiphonia*. Economic importance of Algae: Useful (Edible algae, Nitrogen fixing algae, Protein rich Algae, Iodine, Carrageenin, Agar-agar) & Harmful (Red rust of tea, Water bloom, Red tides). Evolutionary Significance of *Fritschella* & *Coleochaete*.

Suggested Readings: *A Text Book of Botany by Singh, Pande & Jain Rastogi publication*

Textbook of Algae by O.P. Sharma

2. Fungi (Mycology):

General characters of Fungi. Classification proposed by G.C. Ainsworth. Mastigomycotina: Features of Oomycota, *Synchytrium* (Wart-disease of potato), *Peronospora* (Downy mildew), *Saprolegnia*, *Albugo* (White rust of crucifers), *Pythium* (Damping-off seedling), *Phytophthora* (Late blight of potato). Zygomycotina: *Rhizopus* (Soft rot disease of sweet potato). Ascomycotina: *Erysiphe* (Powdery mildew), *Saccharomyces*, *Aspergillus*, *Neurospora*, *Penicillium*, *Taphrina*, *Claviceps*. Types of fruiting body. Basidiomycotina: General characters, Clamp connection, Dolipore septum. *Agaricus*, *Ustilago* (Smut), *Puccinia* (Rust). Deuteromycotina: *Alternaria* (Potato)

famine of Ireland), *Colletotrichum* (Red rot of sugarcane), *Cercospora* (Tikka disease of groundnut), *Helminthosporium* (Famine of Bengal). Other Common diseases and their causal organism. Hypertrophy & Hyperplasia, Parasitism, Heterothallism, Parasexuality. Economic importance: Edible fungus, Fermentation products of Yeast, Mycotoxins, Aflatoxin, Antibiotic, Source of vitamins, Biopesticide, Commercial production of citric acid, Cyclosporine-A (Cs-A), Fungal symbiosis, Gene-for gene relationship, *Capillitium*, *Pilobolus*, *Phragmidium*.

Suggested Readings: *A Text Book of Botany by Singh, Pande & Jain Rastogi publication*

Botany for degree students – Fungi by B.R. Vashista & A.K. Sinha S. Chand publication

Mycology & Phytopathology by P. D. Sharma Rastogi publication

An Introduction to fungi – H.C. Dube Scientific publication

3. Lichen:

General characters of Lichen. Common names of some Lichens. Nature of association of Phycobiont and Mycobiont in Lichens. Classification based on fungal component; based on thallus structures; based on surface on which they grow. Reproduction and Economic Importance.

Suggested Readings: *A Text Book of Botany by Singh, Pande & Jain Rastogi publication*

4. Bryophytes:

Pioneer workers in Bryophytes. General characters of Bryophytes: Life cycle and alternation of generation, Origin of Bryophytes, Saprophytic bryophytes. General classification of Bryophytes. Hepaticopsida: General characters; *Riccia*, *Marchantia*, *Pellia*; Anthocerotopsida: General characters; *Anthoceros*; Bryopsida: General characters; *Sphagnum*, *Pogonatum*, *Funaria*. Evolution of sporophyte in Bryophytes. Comparative study of all the members. Bryophytes in Geological Time Scale.

Suggested Readings: *A Text Book of Botany by Singh, Pande & Jain Rastogi publication*

A textbook of Botany Archegoniate by Singh, Pandey & Jain Rastogi publication

5. Pteridophytes:

General characters of Pteridophytes: Homospory and Heterospory, Eusporangiate and Leptosporangiate, Microphyllous and Megaphyllous Pteridophytes. General Classification. Important members of Pteridophytes: *Rhynia*, *Equisetum*, *Dryopteris*, *Azolla*, *Selaginella*, *Marsilea*, *Salvinia*. Telome theory. Stellar system. Chromosome in *Ophioglossum*. Common Names of some of important Pteridophytes.

Suggested Readings: A Text Book of Botany by Singh, Pande & Jain Rastogi publication

A textbook of Botany Archegoniate by Singh, Pandey & Jain Rastogi publication

6. Gymnosperms:

Pioneer workers in Gymnosper and their contribution. General Characters. Classification with characters and evolution of each group through Geological Time Scale. Fossil Gymnosperms. Members: *Williamsonia*, *Pentaxylon*, *Cycas*, *Pinus*, *Ginkgo*, *Gnetum*. Economic importance. Affinities of Gymnosperms.

Suggested Readings: A Text Book of Botany by Singh, Pande & Jain Rastogi publication

A textbook of Botany Archegoniate by Singh, Pandey & Jain Rastogi publication

7. Angiosperm:

Outline of Classification Systems for Flowering Plants: Artificial, Natural and Phylogenetic classification systems, Linnaeus, Bentham and Hooker, Hutchinson, Thakhatajan, Engler and Prantl. Binomial Nomenclature. Botanical Gardens, Herbarium, Flora, Dichotomus Key, Typification, Outline of Rules and Principles of International Code of Nomenclature for Algae, Fungi and Plants (ICN, previously called ICBN). Modern Trends in Plant Taxonomy. Plant families: *Dicotyledons*: Ranunculaceae, Nymphaeaceae, Nelumbonaceae, Magnoliaceae, Annonaceae, Papaveraceae, Brassicaceae(Cruciferae), Caryophyllaceae, Dipterocarpaceae, Malvaceae, Rutaceae, Meliaceae, Fabaceae (Leguminosae), Rosaceae, Myrtaceae, Puniaceae, Cucurbitaceae, Cactaceae, Apiaceae (Umbelliferae). Rubiaceae, Asteraceae (Compositae), Apocynaceae, Asclepiadaceae, Convolvulaceae, Solanaceae, Scrophulariaceae, Acanthaceae, Verbenaceae, Lamiaceae (Labiatae). Amaranthaceae, Chenopodiaceae, Polygonaceae, Euphorbiaceae, Moraceae. *Monocots*: Orchidaceae, Liliaceae, Iridaceae, Musaceae, Zingiberaceae, Cyperaceae, Poaceae. External Morphology of Vegetative & Reproductive parts: Modifications of Root, Stem, Buds, Leaves etc. Types and modifications of Inflorescence, Flower, Calyx, Corolla, Stamens, Carpels, Ovary, Fruits, Seed; special emphasis in relation to above plant families. Plants important to Humans: Drug, Fibers, Rubber, Oil yielding plants.

Suggested Readings : Diversity of Angiosperms, Systematics, Development & Reproduction by Singh, Pande & Jain Rastogi publication

Plant Taxonomy by O. P. Sharma

8. Embryology:

Microsporangium, Microsporogenesis & Male Gametophyte. Megasporangium, Megasporeogenesis & Female Gametophyte, Embryo sac development. Pollination, Fertilization, Embryogenesis, Apogamy, Apomixis, Apospory, Parthenogamy, Parthenogenesis & Polyembryony.

Suggested Readings: Anatomy and Embryology of Angiosperms by Singh, Pande & Jain Rastogi publication

The Embryology of Angiosperms by S.S. Bhojwani S.P. Bhatnagar

9. Anatomy:

Meristems, Permanent Tissue. Leaf, Stem and Root Anatomy. Types of vascular Bundles with example. Cambium and secondary growth. Anomalous structures with example.

Suggested Readings : Anatomy and Embryology of Angiosperms by Singh, Pande & Jain Rastogi publication

10. Cytology:

Prokaryotes and Eukaryotes. Structure and Function of: Cell Wall, Cell Membrane, Nucleus, Ribosomes, Lysosome, Endoplasmic Reticulum, Golgi Complex, Peroxisomes, Vacuole, Mitochondria, Chloroplast. Cell Division (Mitosis and Meiosis) and Cancer.

Suggested Readings : Cell Biology, Genetics, Molecular biology, Evolution & Ecology Dr. P.S. Verma & Dr. V.K. Agarwal

11. Biochemistry:

Amino Acids: Structure and Properties, Metabolism, Products Derived From Amino Acids. Proteins structure and function. Enzymes: Structure, Function & Classification, Apoenzyme, Coenzyme, Cofactor, Allozymes, Isozymes, Feedback inhibition. Structure and function of Carbohydrates, Nucleic Acids. Lipids: Structure and Properties, Metabolism, Products Derived From Lipid.

Suggested Readings : <https://medicostimes.com/lehninger-principles-of-biochemistry/>

<https://medicostimes.com/satyanarayana-biochemistry-pdf/>

12. Molecular Biology:

Structure of DNA and Chromosome: DNA as genetic material: Hershey and Chase, Griffith and Avery. Watson and Crick, A, B & Z-DNA, Histone & Non-histone, Nucleosome, Compaction factor of DNA, Euchromatin & Heterochromatin, Telomeres, Transposons, NOR, Satellite DNA. Karyogram, Karyotype, Histogram, Ideogram, Idiotypic. Stains and Staining techniques of chromosome. Replication: Meselson and Stahl, DNA and RNA polymerase, DNA topoisomerase, DNA ligase, Okazaki fragment. Transcription: Coding strand, Antisense strand, Polycistronic & Monocistronic gene, DNA methylation, Split genes, Exon and intron. Translation: Ribosome and their components, 16S ribosomal RNA, tRNA, Anticodon, Initiation and Termination of transcription, antibiotics affecting translation, Aptamers, Second genetic code. Regulation: *lac* operon, lytic and lysogeny switch control. Mutation: mutagens, transversion and transversion, complementation test, base analogue, alkylating agent, frame shift mutation, dimerization.

Suggested Readings : *Cell Biology, Genetics, Molecular biology, Evolution & Ecology* Dr. P.S. Verma & Dr. V.K. Agarwal

Fundamentals Of Molecular Biology by Veer Bala Rastogi

13. Genetics & Cytogenetics:

Mendelism: Characters considered by Mendel, Law of segregation & Law of independent assortment, Monohybrid cross, Phenotypic and Genotypic ratio in F₁ and F₂ generations. Test cross and Back cross. Dihybrid cross: Phenotypic and Genotypic ratio in F₁ and F₂ generations. Gamete formation in Trihybrid cross & Tetrahybrid cross. Secret of Mendel's success. Extensions of Mendelism: Incomplete Dominance and Codominance, Cytoplasmic inheritance, Epistasis: Recessive Epistasis (9:3:4), Dominant Epistasis (12:3:1), Duplicate Dominant Epistasis (15:1), Duplicate Recessive Epistasis (9:7). Polygenic Inheritance, Multiple alleles, Quantitative inheritance. The Chromosomal Basis of Mendelism: Sex Determination, XY-sex determining mechanism, XX-XO type of sex determination, Heterosomes, Autosomes, Sex-chromosomes, Epigenetics. Variation in Chromosome Number and Structure: Aneuploidy, Monosomy, Nullisomic, Double monosomic, Trisomy (Primary, Secondary, Tertiary, Quaternary and their meiotic behavior). Polyploidy: Autopolyploid, Allopolyploids, Autoallopolyploid, Segmental allopolyploidy, Mitotic non-disjunction, Meiotic non-disjunction. Effect of colchicine, Deletions and Duplications, Translocations and Inversions. Linkage: 7:1:1:7 phenotypic ratio, Absolute linkage, Crossing Over, and Chromosome Mapping.

Suggested Readings : *Genetics* by Veer Bala Rastogi
Cytogenetics by P.K. Gupta Rastogi publication

14. Biotechnology and Plant Tissue Culture:

Escherichia coli and *Agrobacterium tumefaciens* in Biotechnology. Vectors: Cosmid, Plasmid, Lambda phase, YAC, Ti-plasmid. Restriction endonuclease, *Bacillus thuringiensis*. Hybridoma technology and production of monoclonal antibodies. Polymerase Chain Reaction (PCR): Melting temperature (T_m) of DNA, component of PCR. Explant, Callus, Organogenesis, Coconut milk in the embryo culture, Androgenesis and Gynogenesis, Micropropagation, Cybridization, Sexual incompatibility, Ideal homozygosity, Protoplast fusion.

Suggested Readings : *Plant biotechnology by P. K. Gupta Rastogi publication*

15. Ecology & Environment

Date, Years and Full forms in Ecology. Raunkiaer's life forms, Ecological Succession, Monoclimax theory, polyclimax theory, The facilitation model of succession, population growth curve, Niche. K-populations, specific natality rate, Ecophenes, Ecotype, population dispersion, r and k -selection, Carrying capacity. Soil Types and properties, Clay, Loam, Sandy, Gravel; Holard, Chresard, Echard, Capillary water, Hygroscopic water, Gravitational water. Ecosystem Ecology: Ecological pyramid, productivity, trophic level, 10%energy transfer law, food chain, keystone species, energy flow, food webs, biogeochemical cycle, abiotic and biotic components. Species interaction. BOD & COD. Biodiversity: Vulnerable, Rare, Endangered, Red Data Book', Conventional and Non-conventional source, Man and biosphere program, Endemic plant, Alpha diversity, Beta diversity, Gamma diversity, Mega diverse country, Point richness. **Pollution:** Blue baby' syndrome, Itai Itai disease, photochemical smog, SO₂, pollutants and their effect on plants, Acid rain, secondary pollutant, Greenhouse effect, ozone, PAN, Bhopal gas tragedy, sewage purification, ozone layer, Brown air pollution, warming potential, knock-knee syndrome, Eutrophication, soil pollution, Biomagnification, MIC and Chernobyl, water born diseases, Psychrometer, Ringelmann scale, Phenocopies, Ecotypes, Ecotone, stenoeous, Individualistic approach, Organismic approach, Kemp's constant, LC50, Sustainable development, Gaia hypothesis, Ecological Measuring instruments, Ecotoxicology - definition & discovery, dose response relationship.

Suggested Readings: *Ecology & Environment by P.D. Sharma Rastogi publication*

16. Evolution:

Weismann: Germplasm theory, Lamarck, Charles Darwin: Origin of species, Natural Selection, Speciation. Synthetic theory.

Suggested Readings : *Cell Biology, Genetics, Molecular biology, Evolution & Ecology Dr. P.S. Verma & Dr. V.K. Agarwal*

17. Microbiology:

Prokaryotic and Eukaryotic Cell, Endosymbiotic evolution, 16S rRNA sequencing. Bacteria: General characters, Size, Shape, Structure of bacterial cell, Cell wall, Gram staining with procedure, flagella, Plasmid. Nutrition in Bacteria. Growth curve. Reproduction in bacteria: Transformation, Transduction, Conjugation. Economic importance: Germ theory of disease, Citrus canker, Bacterial blight of rice, Processing of sugarcane Tabtoxin Riboflavin, Allelopathy, Vinegar, Antibiotics, Chloramphenicol. Polluted water treatment with the help of microbes. Flax/jute stem 'retting', Citrus acid is production, alcohol production, Bioaugmentation. Archea: Thermoacidophiles, Methanogens and Halophiles. General characters, Differentiate characters from Bacteria and Eukarya. Viroid. Virus: Capsomere, Interferon, largest virus, bacteriophage, Disease is caused by Viruses, Twort-d Herelle phenomenon, DNA and RNA viruses, TMV, HIV, retroviruses, Cyanophages. Lytic and Lysogenic cycle, vaccination. Acquired immunity and Innate immunity. Mycoplasma, PPLO, Little leaf of brinjal. Prions.

Suggested Readings : Microbiology and Plant Pathology by P. D. Sharma Rastogi publication

18. Plant Physiology:

Translocation of water, Casparian strip, translocation of sugars, Transpiration, Guttation, Hydathodes, Root pressure, Autoradiography. Micro and Macronutrients: Roles and deficiency. Plasmolysis, Imbibition, pH, Surface tension, Hydrophilic effect, Types of solution: Hypotonic, Hypertonic, Isotonic. Diffusion, Osmosis, Diffusion pressure deficit, Turgor pressure, Osmotic pressure, Water potential, Pressure potential, Matric potential. Respiration: Anaerobic respiration, Fermentation, Glycolysis, Pyruvate oxidation, Krebs's cycle, Electron Transport Chain, Respiratory quotient, Glycoxylate pathway, Embden-Mayor-Pathway, Oligomycin, Substrate level phosphorylation. Calculation of ATP, NADH₂ and FADH₂ generated. Photosynthesis: Chlorophyll, Adenosine triphosphate (ATP), Quantosomes, visible spectrum, Photosystems, Light harvesting complexes , Light reaction, Oxygen Evolving Complex, Blackman's Law of limiting factor, Dark reaction (Calvin cycle). Ribulose bisphosphate carboxylase- oxygenase, C₃, C₄ plant, Photorespiration, Crassulacean acid metabolism, Dimethyl urea and DCMU inhibitors of electron transport. Plant Hormones: Structure, functions and physiological roles of Auxin, Gibberellin, Cytokinin, Ethylene, Abscisic acid. Bakane disease of rice. Phototropism, Photoperiodism, Long day plant only & Short day plant only, Phytochrome, Vernalization. Plant movement: Thigmonasty or Seismonasty. Nitrogen Metabolism: Free living and symbiotic nitrogen fixation. Enzymes and organisms involved in Biological nitrogen fixation, Ammonification, Denitrification, Nitrification. Secondary metabolites: their roles in plants.

Suggested Readings : Fundamentals of Plant Physiology by V. K. Jain

Plant physiology taiz and zeiger

Useful competitive Botany Books -

- 1. GRB objective botany - KUMAR & Malik***
- 2. Modern BOTANY -- Dr. M.P. Kaushik Prakash publication***
- 3. Krishna Objective Botany - N.P. Saxena - Krishna publication***
- 4. Pathfinder Life Sciences I & II***

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