Shri Agrasen Kanya P.G. College
Varanasi
(An Autonomous College)

Syllabus of the Subject

Botany

As per guidelines of Common Minimum Syllabus prepared by Department of Higher Education, Uttar Pradesh Government according to the National Education Policy- 2020 (NEP-2020).
w.e.f. the Session 2021-2022)

M.Sc Botany : Semester Structure

M.Sc Previous Year

I Semester :PG Sem-I

Paper	Code	Description	Marks	Credits
P-I	B040701T	Diversity of Plant Microbes	25+75	4
P-II	B040702T	Algae and Bryophyta	25+75	4
P-III	B040703T	Pteridaphyta	25+75	4
P-IV	B040704T	Gymmusperm	25+75	4
PRACTICAL	B040705P	BASED ON PAPER I,II,III,IV	25+75	4
PROJECT	B040706P	RESEARCH PROJECT		4

IInd Semester :PG Sem II

Paper	Code	Description	Marks	Credits
P-I	B040801T	Taxonomy of higher Plant & Economic	25+75	4
P-II	B040802T	Cell Biology Of Plants	25+75	4
P-III	B040803T	Genetics	25+75	4
P-IV	B040804T	Structure,Devlop and Repn of Flowery	25+75	4
PRACTICAL	B040805P	BASED ON PAPER I,II,III,IV	25+75	4
PROJECT	B040806P	RESEARCH PROJECT	100	4+ 4

M.Sc Botany : Semester Structure

M.Sc Final Year

IIIrd Semester :PG Sem-III

Paper	Code	Description	Marks	Credits
P-I	B040901T	Microbiology	25+75	4
P-II	B040902T	Plant Physiology	25+75	4
P-III	B040903T	Biochemistry	25+75	4
P-IV	B040904T	plant Ecology	25+75	4
PRACTICAL	B040905P	BASED ON PAPER I,II,III,IV	25+75	4
PROJECT	B040906R	RESEARCH PROJECT		4

IVth Semester :PG Sem-IV

Paper	Code	Description	Marks	Credits
P-I	B040001T	Molecular biotechnology	25+75	4
P-II	B040002T	Environmental Biology	25+75	4
P-III	B040003T	Special Paper I : Plant Pathology	25+75	4
P-IV	B040004T	Special Paper II: Plant Tissue Culture	25+75	4
PRACTICAL	B040005P	BASED ON PAPER I,II,III,IV	25+75	4
PROJECT	B040006R	RESEARCH PROJECT	100	4+ 4

M.Sc. Semester- I

Botany Paper – I

(Diversity of Plant microbes)

UNIT-I

1. **Bacteria-** Archaebacteria and Eubacteria, general account, ultra structure, nutrition and reproduction, biology and economic importance.

UNIT-II

2. **Viruses-** Ultra structure of viral particles, isolation and purification of viruses, chemical nature, replication of TMV and bacteriofhage,symptoms and transmission of viruses, Concept of prions

UNIT-III

3. **Fungi-** Classification (Ainsworth and Beesy) General characters, reproduction and life cycles of fungi with reference to Mastigomycotina (*Synchytrium, Saprolegnia, Pythium)*; Zygomycotina (*Rhizopus, Entomphthora*); Ascomycotina (*Protomyces, Taphrina*); Basidiomycotina (*Uromyces, Melampsora, Ustilago*); Deuteromycotina (*Fusarium, Sclerotium*).

UNIT-IV

4. Heterothallism, Parasexuality, Economic importance of fungi, Role of fungi in agriculture, medicine, Biofertilizers, Mycorrhiza.

- PRACTICAL : BASED ON THEORY PAPER

M.Sc. Semester- I

Botany Paper – II

(Algae and Bryophyta)

Algae:

UNIT-I

1. General character, thallus organization, cell ultra structure, reproduction (Vegetative, Asexual and Sexual).

2. Critaria for classification of algae, Cell wall pigment, reserve food, Flagella.

UNIT-II

3. Classification, Salient features of Protochlorophyta, Chlorophyta, Charophyta, Xanthophyta , Bacillariophyta , Phaeophyta, Rhodophyta, Cyanophyta.

4 .Economic importance of algae as food, feed & uses in industry.
Algal blooms & algal biofertilizers.

Bryophyta:

UNIT-III

1. General characters, origin, evolution, classification, Morphology, structure, reproduction, and life history, distribution of Bryophytes.
2. Classification, general account of Marchantiales, Jungermaniales, Anthocerotales, Sphagnales, Funariales and Polytrichales.

UNIT-IV

3. **Economic and ecological importance of Bryophytes.**

4. Reduction in sporogenous tissue and evolution of sporophyte.

* PRTACTICAL : BASED ON THEORY PAPER

M.Sc. Semester- I

Botany Paper – III

(Pteridophyta)

UNIT-I

1. General characters, classification, evolution of steles, Telome Theory
2. Morphology, anatomy and reproduction, homo and heterospory, origin of seed habit in Pteridophytes.

UNIT-II

3. General account of fossil pteridophyta

UNIT-III

4. Classification, distribution, morphology, life history and phylogeny of the following classes with special reference to following genera

a. Psilopsida- *Psilotum.*

b. Lycopsida- *Lycopodium, Isoetes, Selaginella.*

UNIT-IV

c. Sphenopsida- *Equisetum.*

d. Pteridopsida- *Ophioglossum, Osmunda, Marsilea, Gleichenia,* and *Azoll*

- PRACTICAL ; BASED ON THEORY PAPER

M.Sc. Semester- I

Botany Paper – IV

(Gymnosperm)

UNIT-I

1. General characters and classification of gymnosperms.

2. Distribution and economic importance of gymnosperms with special reference to India.

UNIT-II

3. (a). General account of the structure & reproduction of the following-

1.Pteridospermales- (Lyginopteridaceae, Medullosaceae, Caytoniaceae, Glssopteridaceae).

2. Cycadeoidales

3. Cordaitales.

UNIT-III

(b). General account of the structure & reproduction of the following-

1. Ginkgoales - *Ginkgo*
2. Coniferales -. Pinus, Taxodium, Auracaris, Cephalotaxus.
3. Taxales -. Taxus.

UNIT-IV

4. Gnetales - *Gnetum*, *Ephedra.*

5. Welwitschiales -. *Welwitschia.*

* PRACTICAL: BASED ON THEORY PAPER

M.Sc. Semester- II

Botany Paper – I

(Taxonomy of Higher Plants & Economic Botany)

UNIT-I

1. **Scope of Taxonomic:** Introduction, Principle of Taxonomy, Taxonomic Hierarchy, Botanical Nomenclature & ICN.

2. **Recent Trends:** Chemo taxonomy, Numerical taxonomy, & Molecular taxonomy (ABG system).

UNIT-II

3. **System of classification:** Phenetics versus phylogenetic system; significance, merits & demerits, and brief studies of following system of classification: Bentham & Hooker, Engler & Prantl and Takhtajan.

UNIT-III

4. **Salient features of the following families:** Ranunculaceae, Capparidaceae, Tiliaceae, Fabaceae, Anacardiaceae, Sapindaceae, Asteraceae, Primulaceae, Sapotaceae, Oleaceae, Boraginaceae, Polygonaceae, Amarantaceae, Hydrocharitaceae, Amaryllidaceae, Orchidaceae, Liliaceae, Cyperaceae, Poaceae

UNIT-IV

5. **Economic Botany:** Forage and fodder plants, Medicinal plants, Timber, Gum, Resin, Oil yielding plants.

- **PRACTICAL : BASED ON THEORY PAPERS**

M.Sc. Semester- II

Botany Paper – II

(Cell Biology of Plants)

UNIT-I

1. **Cell wall** - Structure and functions, biogenesis growth.
2. **Plasma-Membrane** - Structure, models & functions, sites for ATPase, Ion carriers channel, pump receptors.
3. **Plasmodesmata** - Structure, role in movement of molecules, comparison with gap junction.

UNIT-II

4. **Chloroplast** - Structure and function, genome organization.
5. **Mitochondria**- Structure, genome-organization, biogenesis.
6. **Plant vacuoles** – Membrane transporters, as storage organells.

UNIT-III

7. **Nucleus** - Structure, nuclear pores, nucleosome organization, DNA structure (A, B & Z form), replication.
8. **Ribosomes** - Structure, function, sites of protein synthesis.

UNIT-IV

9. **Cell Shape & Motality** - The cytoskeleton, organization and role of microtubules & microfilaments, motor movements, implications in flagellar & other movements.
10. **Cell division, cell cycle & apoptosis** - Regulation of cell cycle, mechanism of programmed cell death, Retinoblastoma and E2F protein.
11. **Other Cellular Organelles** - Structure & function of microbodies, golgi-appartus, lysosomes, endoplasmic reticulum.

***PRACTICAL: BASED ON THEORY PAPER**

M.Sc. Semester- II

Botany Paper – III

(Genetics)

UNIT-I

1. **Chromosomes-** Morphology and structure, packaging of DNA, C- value paradox, Cot curve and its significance.
2. **Mutation-** Structural and Numerical Aberrations, Molecular basis of mutations, DNA damage and repair, Evolution of major crop plants, transposable genetic elements.

UNIT-II

3. Neo Mendelism, interaction of gene and quantitative inheritance.
4. Mechanism of Genetic recombination, linkage and crossing over, linkage groups, role of rec A, rec B, C , D enzymes.

UNIT-III

5. **Gene Concept-** Benzer's experiment in gene concept Cistron, Recon, Muton, Split gene and overlapping gene, jumping gene.

UNIT-IV

6. Gene expression (Protein synthesis) and regulation (Prokaryotes and Eukaryotes) Lac operon and Tryp operon.

- PRACTICAL : BASED ON THEORY PAPER

M.Sc. Semester- II

Botany Paper – IV

(Structure, Development and Reproduction of flowering plants)

UNIT-I

1. **Root Development-** Organisation of root apical meristem (RAM) differentiation, Vascular tissue differentiation, lateral roots, root hair
2. **Shoot development-** Organisation of shoot, apical meristem (SAM), Cambium anamoly, xylem and phloem, secretory ducts and laticifers, wood development.
3. **Leaf growth and differentiation-** Phyllotaxy, differentiation of epidermis (with special reference to stomata and trichomes) and mesophylls.

UNIT-II

4. **Male gametophyte-** Structure of anther, Microsporogenesis, role of tapetum, pollen development, pollen germination, pollen tube growth guidance.
5. **Female gametophyte-** Ovule development, Megasporogenesis, organization of embryosac and structure of embryosac.

UNIT-III

6. **Pollination-** Types of pollination, Pollen- Pistil interaction and self incompatibility, floral characteristic of self and cross pollinated plants, pollination mechanism and vectors, Double fertilization, *in - vitro* fertilization

UNIT-IV

7. **Seed development and fruit growth-** Endosperms, embryo and polyembryony.

- **PRACTICAL :** BASED ON THEORY PAPERS

M.Sc. Semester- III

Botany Paper – I

(Microbiology)

UNIT-I

1. History and development of Microbiology, Golden era of microbiology and its scope, Diversity of Microbes in Air, Water and Soil.

UNIT-II

2. Micro- organism in Food processing: Cheese, Butter milk, Bread and Vinegar.

UNIT-III

3. Micro- organism in relation to Biotechnology:

(i) **Vaccine production, Antibiotic production, Enzyme production, Alcohol** production.

(ii) Role of micro-organisms in sewage treatment and Alternative source of energy, Microbiology of Potable water.

UNIT-IV

4. Micro-organism and maintenance of Environment; Bioremediation of heavy metal, Biodegradation of Pesticides, Single Cell Protein, Oriental Fungal Food (Mycoproteins).

M.Sc. Semester- III

Botany Paper – II

(Plant Physiology)

UNIT-I

1. Photochemistry and Photosynthesis- General concept and historical backgrounds, evolution of photosynthetic apparatus, photosynthetic pigments and light harvesting complexes, photooxidation of water, mechanism of electron and proton transport, carbon assimilation, Calvin cycle, photorespiration and its significance, the C_4 cycle, CAM pathway, biosynthesis of starch and sucrose, physiology and Ecological considerations.

UNIT-II

2. Respiration- Overview of plant respiration, glycolysis and TCA cycle, electron transport and ATP synthesis. Pentose Phosphate Pathway, Glyoxalate cycle, alternate oxidase system.

UNIT-III

3. Membrane transport and translocation of water and solutes, plant water relation- Diffusion, inhibition, osmosis, plasmolysis, DPD, water potential, water transport through xylem, comparison of xylem and phloem transport, phloem loading and unloading, Passive and active solute transport, membrane transport protein, water loss.

4. Flowering process- Photoperiodism and its significance, Endogenous clock and its regulation, Floral induction and development, genetic and molecular analysis, role of vernalisation.

5. Stress Physiology- Plant response to biotic, abiotic stress tolerance HR and SAR, water deficit and drought resistance salinity stress, metal toxicity freezing and heat stress, oxidative stress.

UNIT-IV

6. Sensory Photobiology- History and discovery of Phytochromes and cryptochromes and their photochemical and biochemical properties, Photophysiology of light induced responses, cellular localization, molecular mechanisms of phtotomorphogenetic responses.

7. Plant growth regulatory and Elicitor: Physiological effects and mechanism, Action of auxines, gibberllins, Cytokinins, ethylene, Absicissic acid.

- PRACTICAL : BASED ON THEORY PAPER

M.Sc. Semester- III

Botany Paper – III

(Biochemistry)

UNIT-I

1. **Energy Flow** – Principles of thermodynamics, Free energy and chemical potential, Redox-reaction, structure and function of ATP

2. **Fundamentals of Enzymology-** General aspects allosteric mechanism regulatory and active sites, isozymes, Kinetics of enzymatic catalysis, Mechaelis- Menten equation and its significance.

UNIT-II

3. **Signal transduction-** Overview, receptors and G- proteins, phospholipids signaling, role of cyclic nucleotides. Calcium calmodulin cascade, diversity in protein kinases and phosphatases, specific signaling mechanism, Signal transduction pathway.

UNIT-III

4. **Lipid metabolism-** Structure and function of lipid, fatty acid biosynthesis, synthesis of membrane lipids, structural and storage lipids and their catabolism.

UNIT-IV

5. **Nitrogen fixation, nitrogen and sulpher metabolism-** Biological nitrogen fixation in details, sites of N_2 fixation, nodule formation and nod factors, nif genes, mechanism of N_2 fixation in free living and symbiotic systems, ammonium assimilation, sulphate uptake, transport and assimilation.

*PRACTICAL: BASED ON THEORY PAPER

M.Sc. Semester- III
Botany Paper – IV

(Plant Ecology)

UNIT-I

1.Vegetational Organisation – Concept of community and continuum, Analysis of community (analytic and synthetic character, community coefficient, interspecific association, concept of ecological niche, gene ecology.

UNIT-II

2. Vegetation Development - Temporal changes (cyclic and non-cyclic). Mechanism of ecological succession (Reley and Initial floristic composition, Facilitation, Tolerance and inhibition models), Changes in ecosystem properties during succession.

3. Ecosystem Organisation – Structure and function of ecosystem, primary productivity (method of measurement), Tropic organization, energy flow pathway, ecological efficiencies; Litter fall & decomposition.

UNIT-III

4.Ecosystem stability - Concept (resistance and resilience), ecological perturbations (natural & anthropogenic) and their impact on plants and ecosystem; Ecology of plant invasion, Environmental impact assessment; Ecosystem restoration

UNIT-IV

5. Climate Change – Green house gases (CO_2, N_2O, CFCs: sources trends and role) Ozone layer and ozone hole, consequences of climate change(CO_2fertilization, Global warming, Sea level rise, UV radiation).

***PRACTICAL :** BASED ON THEORY PAPER

M.Sc. Semester- IV

Botany Paper – I

(Molecular Biotechnology)

UNIT-I

1.Recombinant DNA technology – Gene cloning, Restriction enzymes and their mode of action, foreign DNA, vectors, principles & techniques, Construction of genomic and c-DNA libraries, DNA sequencing – Max & Gilbert method, chain termination method, PCR, DNA fingerprinting.

UNIT-II

2. Genetic Engineering of Plant – Strategies for development of transgenic plants (with suitable example). *Agrobacterium* – the natural genetic engineers, t-DNA and mechanism of gene transfer, Transposon meditated gene tagging, Intellectual property rights, Ethical concern, Rules of release of G.M. plant in India.

UNIT-III

3. Microbial genetic manipulation – Bacterial transformation, selection of recombinants & transformations, genetic improvement of industrial microbes. Fermentation technology, designing of fermentor, operation of fermentor.

UNIT-IV

4. Genomics & Proteomics – Genetic and physical mapping of genes, molecular marker (RFLP, RAPD, STR, MSDNA) Artificial chromosomes, Rice genome project, Bioinformatics (Tools of Bioinformatics, sequencing, data bases), Golden rice. Genomics (functional, structural, comparative). Microarray, Protein profiling and its significance.

* PRACTICAL : BASED ON THEORY PAPER

M.Sc. Semester- IV

Botany Paper – II

(Environmental Biology)

UNIT-I

1. Environmental pollution: Air, Water, Soil, Noise & Radioactive pollution & their control.

UNIT-II

2. Biodiversity: Definition, magnitude, levels, causes of depletion, categories of depleted Taxa.
3. Sustainable development: concept, scope of sustainable development.

UNIT-III

4. Natural Resources : Types, Uses, & it's conservation.
5. (a) In situ conservation: Principle, protected areas of India, Sanctuaries, National parks, Biosphere reserve, wetland, mangrove & coral reefs for conservation of wild biodiversity.

   (b) Ex Situ conservation : Principle &practices, Botanical gardens, gene bank, seed bank, cryobiology.

UNIT-IV

6. General account of the activities of BSI, NBPGR, ICAR, CSIR, NBA, & DBT for conservation.
7. Environmental episodes: Bhopal tragedy, Chernobyl disaster, Photochemical smog, Threat to Taj Mahal & monuments, Chipko & Apiko movement.
8. Environmental Laws.

* PRACTICAL: BASED ON THEORY PAPER

M.Sc. Semester- IV

Botany Paper – III

Special Paper-I (Plant Pathology)

UNIT-I

1. **Introduction and history of plant pathology**- General account, history of Indian plant pathology, Pathogen, plant disease, endemic and epidemic, sporadic disease.

2. **Symptom of plant disease**- symptoms caused by fungi, bacteria, plant viruses, mycoplasma and nematodes.

UNIT-II

3. **Host pathogen interaction**- Modes of entry of pathogens and infection, roles of hosts, enzymes and toxins in development plant diseases, changes in host.

4. **Plant disease control**- Physical, chemical and biological control, environmental factors, pesticides like fungicides, fumigants and antibiotic, integrated disease management.

UNIT-III

5. **Local important plant fungal diseases**- Late blight of potato, Powdery mildew of pea, Wilt of arahar, Leaf spot of crucifer, Stem gall of coriander,Rust of Linseed.

UNIT-IV

6. Local important bacterial and viral diseases .Citrus canker, Blight of rice, Yellow vein mosaic of bhindi, Bunchy top of banana, Little leaf of brinjal, Grassy shoot of sugarcane, Damping of seedlings, Tungru disease of rice, Scab disease of potato, Ring rot of Potato, Mosaic of Bhindi.

M.Sc. Semester- IV

Botany Paper – IV

Special Paper-II (Plant Tissue Culture)

UNIT-I

1. **Introduction**- History and scope of plant biotechnology.

2. Totipotency and concept of cellular differentiation, Plant cell and tissue culture, embryo culture, embryo rescue.

UNIT-II

3. **Organogenesis and adventives embryogenesis-** Fundamentals aspects of morphogenesis and androgenesis, mechanisms, techniques and utility, mentor technology.

UNIT-III

4. **Somatic hybridization-** Protoplast isolation, Fusion and culture, hybrid selection and regeneration, possibilities, achievements and limitations of protoplast research, cybridization and cybrid production, electroporation, particle bombardment of gun, biolistic missile.

UNIT-IV

5. **Application of plant tissue culture-** Clonal propagation, artificial seed, production of secondary metabolism, natural products, future of plant tissue culture technology in India, cryopreservation and germplasm storage.

- **PRACTICAL** : BASED ON THEORY PAPER