

RTM, NAGPUR UNIVERSITY, NAGPUR.

SEMESTER PATTERN SYLLABUS

FOR B Sc. BOTANY

B.Sc. SEMESTER- I

PAPER-I	Viruses, Prokaryotes & Algae
PAPER-II	Fungi, Lichen, Plant-Pathology & Bryophyta

B.Sc. SEMESTER-II

PAPER-I	Pteridophyta & Gymnosperms
PAPER-II	Palaeobotany & Morphology of Angiosperms

B.Sc. SEMESTER-III

PAPER-I	Angiosperm Taxonomy
PAPER-II	Cell Biology, Plant Breeding & Evolution

B.Sc. SEMESTER-IV

PAPER-I	Angiosperm Anatomy & Embryology
PAPER-II	Genetics & Molecular Biology

B.Sc. SEMESTER-V

PAPER-I	Biochemistry & Plant Physiology-I
PAPER-II	Plant Ecology I

B.Sc. SEMESTER-VI

PAPER-I	Plant Physiology- II & Biotechnology
PAPER-II	Plant Ecology- II, Techniques & Utilization of Plants.

SEMESTER – I

PAPER – I

VIRUSES, PROKARYOTES AND ALGAE

Unit I

Introduction to Botany.

Virus: General characteristics and nature of Viruses,.

Ultra structure of TMV, Structure and Multiplication of T₄ - Bacteriophage. Economic importance.

Mycoplasma : - structure, Properties, Reproduction.

Comparison between Archaeobacteria and Eubacteria.

Unit II

Bacteria:-Cell structure, Flagella. Reproduction: (Binary fission, Conjugation). Economic importance.

Cyanobacteria: -General account, Economic Importance, Ultra cell structure, Reproduction. eg. *Nostoc*.

Unit III

Algae – General characteristics, Classification (Fritsch 1954),

Life history of: - *Oedogonium*, *Chara*.

Unit IV

Algae - **Life history** of *Vaucheria*, *Ectocarpus*, and Economic importance of Algae.

Note:- Developmental stages not expected

List of Practicals :

Study of Bacterial forms from permanent micropreparation

Gram staining of Bacteria, ultrastructure of Bacteriophage from TEM photographs

Study of Cyanobacteria: *Nostoc*.

Study of Algal genera: *Oedogonium*, *Chara*, *Vaucheria*, *Ectocarpus*.

SEMESTER – I

PAPER – II

FUNGI, LICHEN, PLANT PATHOLOGY, BRYOPHYTA

Unit I

Fungi:- General characteristics, Classification(Alexopoulos 1996), Economic importance

Life history of: - *Albugo*, *Mucor*.

Unit II

Fungi- Life history of :- *Puccinia*, *Cercospora*

Lichens :- Types, Reproduction and Economic importance

Unit III

Plant pathology:- Host, pathogen, symptoms, Causes and Control of following diseases:-Leaf curl of Papaya, Citrus canker and Red rot of Sugarcane

Bryophyta:-Classification (Proskauer 1957), General characters (Hepaticopsida, Anthocerotopsida and Bryopsida), Economic importance, and alteration of generation

Unit IV

Life history of:- *Riccia*, *Anthoceros*, *Funaria*

Note: developmental stages not expected

List of Practicals :

Study of Fungal genera:- *Albugo*, *Mucor*, *Puccinia*, *Cercospora*

Study of Lichen: - Thallus structure, Types

Plant pathology: – Leaf curl of Papaya, Red rot of Sugarcane, Citrus canker

Study of Bryophytes :- *Riccia*, *Anthoceros*, *Funaria*

Botanical Excursions (One short/Long excursion is compulsory).

**Semester - I Botany Practical examination
Question Paper**

Time: 5 hrs

Marks: 30

- Q. 1)** Gram Stain the given Bacterial strain / Stain the **Cyanobacterial** material [A], & Identify **04**
- Q. 2)** Identify & give characters of the given **Algal** material [B] and make a temporary Mount **04**
- Q. 3)** Identify & give characters of the given **Fungal** material [C] and make a temporary Mount **04**
- Q. 4)** Identify & give characters of the given **Bryophytic** material [D] and make a temporary Mount **04**
- Q. 5) Spotting :** **06**
- | | | |
|--------------------------------|--------------------|-----------|
| E-Virus/Bacteria/Cyanobacteria | F- Algae | G- Fungi |
| H-Bryophyte | I- Plant pathology | J- Lichen |
- Q. 9)** Viva-voce **03**
- Q. 10)** Practical Record & Excursion Report **05**

SEMESTER – II
PAPER – I
(PTERIDOPHYTA & GYMNOSPERMS)

Unit I

Pteridophyta :- Classification system (Smith 1952), General characters (Psilopsida, Lycopsidea, Sphenopsida and Pteropsida), Economic importance, alternation of generation

Life history of:- *Rhynia, Selaginella*

Unit II

Life history of:- *Equisetum*,

Apogamy, Apospory, Stellar system in pteridophytes, Concept of heterospory and seed habit.

UNIT III

Gymnosperms:- Classification (Stewart 1982), General characters, Economic importance, alternation of generation.

Life cycle of the following:- *Cycas*.

UNIT IV

Life cycle of the:- *Pinus*.

Cycadeoidea (morphology, anatomy of Stem and flower)

NOTE: Developmental stages not expected.

List of Practicals

Study of Pteridophytes : *Rhynia, Selaginella, Equisetum*.

Study of Gymnosperm: *Cycas, Pinus, Cycadeoidea*.

SEMESTER – II

PAPER – II

PALAEOBOTANY & MORPHOLOGY OF ANGIOSPERMS

Unit I

Palaeobotany: Geological time scale

Fossilization: Replacement theory, Infiltration theory

Types of fossils: Impression, Compression, Petrification

Fossil plants: Gymnosperms: *Glossopteris* (Leaf, Scutum),

Unit II-

Root Morphology - Tap root & adventitious roots, Modifications for storage, Respiration & reproduction.

Stem Morphology:- shape, surface, texture, nature, Branching (Monopodial, Sympodial), modifications (Runner, Rhizome, Tuber, Bulb, cladode).

Leaf Morphology:--Typical Leaf, Types (Simple, Compound), Phyllotaxy, Venation, and modifications of leaf (Tendrils, Phyllode)

Unit III-

Inflorescence: Simple (Racemose and Cymose type).

Flower: Details of typical flower, Epigyny, Perigyny & Hypogyny, Androphore, Gynophore & Gynandrophore.

Calyx & Corolla: - Cohesion, Forms of corolla and aestivation.

Unit IV

Flower: Androecium: - Parts, Cohesion & Adhesion, Fixation, dehiscence. **Gynoecium:** - Parts, Cohesion, Adhesion, Placentation.

Fruit: Classification of fruits, simple and aggregate fruits, Composite fruit.

List of Practicals

- i. **Fossils** : Types, *Glossopteris*, *Cycadeoidea*
- ii. Study of **Root**: Types, Modifications.
- iii. Study of **Stem**: shape, surface, texture, nature Branching, Modifications (Ex. *Hibiscus*, *Ocimum*, any grass).
- iv. Study of **Leaf**: Stipules, base, kind, shape, surface, margin, Apex, texture, Phyllotaxy, Venation & Modifications.
- v. **Inflorescence**: Types.
- vi. **Flower**: Parts, Thalamus, Calyx, Corolla, Androecium, Gynoecium.
- vii. **Fruits**: Types.

Botanical Excursion: (Two short or one long out of the state is compulsory).

Semester II practical examination

Question Paper

Time : 5 hrs

Marks : 30

- Q. 1)** Identify & give characters of the given **Pteridophytic** material **[A]** and make temporary Mount. **04**
- Q. 2)** Identify & give characters of the given **Gymnospermic** **[B]** material and make temporary mount **04**
- Q. 3)** Describe the given **leaf** material **[C]** **04**
- Q.4)** Describe (Calyx, Corolla, Androecium & Gynoecium) of given **Flower [D]**. **04**
- Q. 5) Spotting :** **06**
- E. Pteridophyte F. Fossil
G. Gymnosperm H. Vegetative morphology
I. Inflorescence/flower K. Fruit.
- Q. 9)** Viva-voce **03**
- Q. 10)** Practical Record & Excursion Report **05**

SEMESTER – III
PAPER – I
ANGIOSPERM TAXONOMY

Unit I

Origin of Angiosperms (Benettitalean theory). Phylogeny of Angiosperm: Homology, monophyly, polyphyly, Clads.

Fossil Angiosperms: Flower (*Sahanianthus*).

Angiosperm Taxonomy: Floras, Herbarium, keys (Indented and Bracketed), Holotype, Lectotype, Neotype.

Botanical Nomenclature: Principles (rank and ending of taxa, principle of priority),

Unit II

Classification of angiosperms: Natural, Artificial, Phylogenetic system of classification.

Systems of classification: Bentham & Hooker and Engler & Prantl (along with merits and demerits),

Modern trends in Taxonomy : Cytotaxonomy (Karyotype), Phytochemistry (Proteins, flavonoids, Betalains) , Taxometrics to taxonomy.

Unit III

Study of Families (Dicot): Malvaceae, Brassicaceae, Fabaceae (Papilionoideae, Caesalpinioideae, Mimosoideae)

Unit IV

Study of Families (Dicot): Asteraceae, Asclepiadaceae, Euphorbiaceae

Study of Families (Monocot): Poaceae

List of Practicals

Study of Families covered in the theory portion.

Study of fossil Angiosperms micropreparation and specimens: *Sahanianthus*, *Enigmocarpon*

Botanical Excursions (Two short or One long out of the state is compulsory).

SEMESTER – III

PAPER – II

CELL BIOLOGY, PLANT BREEDING & GENETICS

Unit I

Structure of typical plant cell, Ultrastructure and functions of: Cell wall, Cell Membrane (Fluid mosaic model), Nucleus, Endoplasmic reticulum (RER and SER)

Unit II

Ultrastructure & Functions of: Golgi Complex, Vacuoles, Ribosomes (70S and 80S), Mitochondria, Chloroplasts,

Unit III

Chromosome organization: Morphology (chromatid, chromomere, centromere, telomere, secondary constriction, satellite, karyotype), Molecular organization (Nucleosome model)

Sex Chromosome : Structure of sex chromosome in plants (XY type in *Melandrium*)

Cell division in plants: Mitosis, Meiosis and their significance.

Unit IV

Plant Breeding- Definition and objective, Pure line selection, Hybridization (emasculation, bagging, crossing, labelling), Clonal selection, Heterosis (Definition and scope)

Biostatistics- Mean, Mode, Median, Standard deviation, Standard error, Student's t- test

Evolution- Origin of life (Millers theory),

List of Practicals

Study of Cell organelles with the help of photographs/ Slides

Study of mitosis in plant material

Study of meiosis in plant material

To calculate Mean, Mode, Median, standard error from the given data (At least 10 problems to be solved)

To calculate the student's t-value from the given data (At least 10 problems to be solved)

Semester III practical examination

Question Paper

Time : 5 hrs

Marks : 30

- Q. 1) Describe in technical language the given Angiospermic material [A]. Classify & Identify the Family giving reasons **06**
- Q. 2) Write floral formula and Draw Floral Diagram of the given flower [B] **03**
- Q. 3) Prepare semi-permanent squash / smear of given material [C] & Identify the stage of cell division **05**
- Q. 4) To solve the given problem of biostatistics **04**
- Q. 5) Spotting : **04**
- | | |
|----------------------|------------------------------|
| D. Fossil angiosperm | H. Cell organell (photocopy) |
| E. Cytology | I. Taxonomy |
- Q. 6) Viva-voce **03**
- Q. 7) Practical Record & Excursion Report **05**

SEMESTER – IV

PAPER – I

ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

Unit I

Basic body plan & Modular type of Growth.

Meristems :Classification of meristems based on origin and position.

Permanent tissue and their functions:Simple tissue (parenchyma, collenchyma, sclerenchyma), Complex tissue(xylem and phloem).

Unit II

Apical meristem of Root and Shoot: Apical cell theory, tunica-carpus theory, Types of root apex according to Newman.

Primary structure of root in dicot (Sunflower) and monocot (Maize)

Primary structure of stem in dicot (Sunflower) and monocot (Maize)

Types of vascular bundles- dicots and monocots

Cambium (structure, types, function)

Unit III

Periderm, growth ring, sap wood, heart wood

Secondary growth (Sunflower stem) and anomalous secondary growth in *Bignonia* and *Dracena* stem.

Anatomy of leaf: Dicot (Nerium), monocot (Maize).

Senescence and abscission of leaves.

Unit IV

Pollination: Types and adaptation, significance

Structure of anther, Microsporogenesis, male gametophyte

Types of ovules, structure of anatropous ovule

Megasporogenesis and female gametophyte (polygonum type)

Double fertilization and triple fusion, endosperms and its types, Structure of dicot (Onagad) and monocot embryo.

List of practicals

Study of simple tissue, complex tissue and secretory tissue from permanent slides

Study of types of vascular bundles

Study of internal structure of dicot and monocot root using hand section and prepare temporary mounts -Sunflower, Maize

Study of internal structure of dicot and monocot stem using hand section and prepare temporary mounts -Sunflower, Maize

Study the growth ring in woods-Teak wood

Study of internal structure of secondary growth and anomalous secondary growth using hand section and prepare permanent micropreparations - *Bignonia* stem and *Dracena* stem.

Study of internal structure of leaves- *Nerium*, Maize

Study of types of ovules, anther structure, pollen grains, adaptations for pollination

To calculate the percent pollen germination in the given specimen

Botanical Excursions (One short tour is compulsory).

SEMESTER- IV

Paper-II

Genetics & Molecular Biology

Unit- I

Mendelism: - Laws of inheritance (Law of segregation and independent assortment)

Interaction of genes: Allelic- Incomplete dominance (1:2:1 ratio in *Mirabilis jalapa*); Non-allelic- Complementary (9:7 ratio) and Dominant epistasis (12:3:1 ratio)

Linkage: Definition, Theory of linkage (Coupling and Repulsion theory), types (complete and incomplete), significance

Unit- II

Crossing over: Definition, theories (Breakage and reunion), significance

Variation in chromosome number: Polyploidy (auto- and allo-), aneuploidy (nullisomics, monosomics, trisomics and tetrasomics), significance

Structural changes in chromosome: deficiency, duplication, significance of inversion and translocation.

Unit- III

Structure of DNA (Watson and Crick model)

Semi conservative method of DNA replication in eukaryotes

Concept of gene; Benzer's concept, cistron, mutons and recones, jumping gene.

Mutation: Spontaneous and induced, physical and chemical mutagens, application of induced mutations in crop improvement

DNA damage and repair: Photoreactivation, excision repair

Unit- IV

Satellite and repetitive DNA

Genetic code: Definition and characteristics

t-RNA (Clover leaf model)

Gene expression in prokaryotes: Transcription and translation

Regulation of gene expression (Lac operon model).

List of practicals

To prove the Mendel's law of segregation with the help of coloured beads.

To prove the Mendel's law of independent assortment with the help of coloured beads.

From the given data workout the type of gene interaction in the given cross (Atleast 10 problems of each type mentioned in theory syllabus).

Semester IV Practical examination

Question Paper

Time : 5 hrs

Marks : 30

- Q. 1) Prepare temporary mount of the given material [A](Root/Leaf)& Identify giving diagnostic character **03**
- Q. 2) Prepare double stained permanent mounts of the given material [Stem] [B] & Identify giving diagnostic character **06**
- Q. 3) Calculate percent germination in the given pollen grains [C] **02**
- Q. 4) To prove Mendel's Law of Inheritance through coloured beads [D] **04**
- Q. 5) To work out the type of gene interaction in the given cross from the given data. **03**
- Q. 6) Spotting: **04**
E- Tissue F- Root anatomy
G-Stem anatomy H-Embryology
- Q. 7) Viva-voce **03**
- Q. 8) Practical record and excursion report **05**

SEMESTER – V

PAPER – I

BIOCHEMISTRY & PLANT PHYSIOLOGY-I

Unit I

Carbohydrates: Definition, properties and role; Classification: Aldoses and ketoses; monosaccharides, disaccharides and polysaccharides; Structure of Glucose and starch

Lipids: Definition, properties and role; fatty acids, oils and waxes, beta oxidation.

Aminoacids- Chemistry of amino acids present in proteins (Classification), peptide bond

Basics of Enzymology: Nomenclature, Characteristics and properties of Enzymes, factors affecting enzyme activity, Holoenzyme, Apoenzyme, Co-enzymes & Co-factors, Regulation of Enzyme Activity (Enzyme-Substrate Complex Theory), Mechanism of Action (Lock & Key Model, Induced Fit Model)

Unit II

Plant-water relations: Properties of water, diffusion, diffusion pressure deficit and its significance; Osmosis: Concept, types, osmotic potential and its significance; Imbibition: concept and significance

Water conduction through xylem: Root pressure theory, cohesion-adhesion theory; transpiration; stomatal opening mechanism with reference to K⁺-malate hypothesis

Phloem transport: Munch hypothesis

Unit III

Mineral nutrition: Role and deficiency symptoms of macro- and micro- nutrients (N, P, Fe, Mn, B, Ca); Solute transport: passive (Donnan's equilibrium), active (carrier concept)

Lipid metabolism:

Respiration: Types (aerobic and anaerobic respiration), respiratory substrates and Respiration quotient, glycolysis, Krebs's cycle, oxidative phosphorylation (ETS); fermentation (alcohol and lactic acid), photorespiration. Glyoxylate cycle .

Unit IV

Photosynthesis: concept, definition, significance, photosynthetic pigments and their role, action spectra, Emerson's enhancement effect, red drop mechanism; photolysis of water (Hill's reaction), cyclic and non-cyclic photophosphorylation, Light independent reactions: C₃, C₄ and CAM pathways and their significance; factors affecting photosynthesis

Nitrogen metabolism: Mechanism of biological nitrogen fixation, importance of nitrate reductase

List of practicals

To study the effect of various chemicals on permeability of membranes.

To study the ascent of sap in suitable plant material.

To separate chlorophyll pigment by paper chromatography.

To determine the RQ of given plant material.

To perform microchemical tests for determination of reducing and non-reducing sugars, starch, cellulose, oils and proteins.

To study the effect of light intensity and quality, CO₂ concentration and temperature on rate of photosynthesis by suitable method.

To determine osmotic potential of the cell sap by plasmolytic method.

To study the activity of enzyme amylase, catalase and peroxidase.

Miner Physiology experiments

SEMESTER – V
PAPER – II
PLANT ECOLOGY - I

Unit I

Ecology: definition, branches and significance of ecology

Climatic Factors: Atmospheric (Gaseous composition), Light & Temperature (effect on vegetation).

Edaphic Factor :Pedogenesis, Soil profile, Soil properties (physical and chemical)

Unit II

Physiographic factor- Biotic Factor: Interactions between plants and animals and human, Interaction between plants growing in a community, Interactions between plants and soil microorganisms. Biogeochemical Cycles: Nitrogen, phosphorous

Unit III

Ecosystem: Biotic and Abiotic components, Food chain, Food web, Ecological pyramids

Autecology (definition, importance), ecad, ecotype- characteristics and importance

Synecology (or community ecology)- Study of community: analytical (quantitative- frequency, density, abundance; qualitative- Life forms, Raunkier's Biological spectrum) and synthetic characters (presence, fidelity, dominance)

Unit IV

Principles of Phytogeography, Distribution (wides, endemics, discontinuous species), Theories (Landbridge and continental drift), Climatic regions of India, Phytogeographic regions of India (Chatterjee 1962; Name, distribution area, typical vegetation)

List of practicals:

To determine frequency, density, abundance of the community by quadrat method.

To determine the homogeneity of vegetation by Raunkier's frequency diagram.

To determine the water holding capacity of the given soil samples.

To determine the water rising capacity of the given soil samples.

To determine the soil moisture of the given samples.

Botanical Excursions (One short tour is compulsory).

Semester V Practical examination

Question Paper

Time : 5 hrs

Marks : 30

- | | |
|---|-----------|
| Q. 1) To perform given Physiology Experiment [A] & report the findings | 06 |
| Q. 2) To perform the given Biochemical Experiment [B] & report the findings | 04 |
| Q. 3) To perform the given Ecological Experiment [C] & report the findings | 05 |
| Q. 4) To perform the given microchemical test [D] & report the findings | 03 |
| Q. 5) Spotting : | 04 |
| E - Plant Physiology | |
| F -Plant Physiology | |
| G - Ecology (Component of aquatic ecosystems) | |
| H - Ecology(Component of terrestrial ecosystems) | |
| Q. 6) Viva Voice | 03 |
| Q. 7) Practical Record & Excursion Report | 05 |

SEMESTER – VI

PAPER – I

PLANT PHYSIOLOGY-II & BIOTECHNOLOGY

Unit I

Growth: Concept, growth curve, phases of growth

Phytochromes: Pr and Pfr forms, their role

Circadian rhythms and biological clock

Plant growth regulators: Role of auxin, cytokinins, gibberilins, ABA and ethylene

Plant movements: Tropic and nastic movements

Unit II

Photoperiodism: physiology of flowering, photoperiodism and vernalization, role of florigen

Senescence and abscission

Seed dormancy: Causes and role, methods to break seed dormancy

Plant defence: Definition: Hypersensitive response and Systemic acquired resistance; Role of secondary metabolites (Terpenes and phenolic compounds)

Unit III

Plant tissue culture: definitions of- totipotency, explant, aseptic culture, in vitro, micropropagation; methods of sterilization (autoclaving, dry heat, chemicals), culture media (MS media) hormone requirement & applications of tissue culture.

Callus and organ culture (shoot tip, anther) and its application, cybrid production and its application.

Unit IV

Genetic engineering: Tools- Enzymes (Restriction enzymes, ligases, DNA polymerases), Plasmid as cloning vectors.

DNA library: cDNA and genomic library.

Agrobacterium tumefaciens mediated gene transfer, structure of Ti -plasmids

Advantages and disadvantages of transgenic plants, example Bt cotton and golden rice.

List of Practicals

To determine seed viability by a convenient method

Principle and working of: oven, autoclave, laminar air flow hood

To study the structure of following vectors on the basis of photographs and diagrams: plasmid vector, Binary vector

To study the effect of various plant growth regulators on the growth and development of plants.

To study steps of genetic engineering from photograph example Bt cotton and golden rice.

SEMESTER – VI

PAPER – II

PLANT ECOLOGY, TECHNIQUES & UTILIZATION OF PLANTS

Unit I

Plant succession: Definition, Causes of succession, Hydrosere, Xerosere

Plant adaptations: Morphological, Anatomical & Physiological responses of Hydrophytes, Xerophytes, Halophytes (with one example)

Unit II

Environmental Pollution: Agricultural, noise and thermal pollution, Control of environmental pollution, Environmental management

Natural resources- types (renewable and non-renewable), factors for depletion; conservation of forest and water resources

Unit III

Principle, types and application of: microscopy (Light, fluorescent, SEM, TEM), centrifugation, electrophoresis (SDS-PAGE and Agarose), spectroscopy (UV-Vis), chromatography (Paper chromatography, Thin layer chromatography)

Unit IV

Utilization of **Plants**: Morphology, Utilization and Important chemical constituents of :-

Food: Wheat; Oil: Ground nut; Fibre: Cotton; Spices: Clove; Beverages: Coffee; Medicinal: Neem; and Rubber.

Ethnobotany: Introduction, definition, branches & importance of ethnobotany

List of Practicals

To study the morphological and anatomical characteristics of any one hydrophyte and xerophyte.

To study the morphological characteristics of cladode, phylloclade, phyllode and pneumatophores.

Principle and working of: spectrophotometer, microscope etc.

To determine the DO of water samples

different sources.

To study the dust holding capacity of leaves.

To estimate transparency, pH and temperature of different water bodies

To estimate salinity (chlorides) of different water samples.

To determine the percent leaf-area injury of different leaf samples collected around polluted sites.

Utilization of **Plants**: Morphology, Utilization and Important chemical constituents of plants mentioned in theory. To study the plants of ethnobotanical importance.

Microchemical Tests: Lipid, Proteins, starch, Lignin, Carbohydrates, Cellulose.

Electrophoretic /chromatographic separation of amino acids carbohydrates

Botanical Excursions (One short tour is compulsory).

Semester VI Practical examination

Question Paper

Time : 5 hrs

Marks : 30

- Q. 1) To determine seed viability [A] & report the findings **05**
- Q. 2) To study the given Ecological material [B] & report the findings. **05**
- Q. 3) Electrophoretic/chromatographic separation of amino acid and carbohydrates [D]. **04**
- Q. 4) Morphology, anatomy and utilization of the given plant material [E]. **04**
- Q. 5) **Spotting:** **04**
- E -Ecology (morphology)
 - F - Biotechnology Instruments
 - G - Utilization of plant
 - H -Utilization of plant
- Q. 7) Viva Voice **03**
- Q. 8) Practical Record & Excursion Report **05**

SEM I & II

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SEM III & IV

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B. Sc. Semester V Suggested Laboratory Exercises

MAJOR PLANT PHYSIOLOGY EXPERIMENTS (ANY NINE):

1. To study the permeability of plasma membrane using different concentrations of organic solvents.
2. To study the effect of temperature on permeability of membranes.
3. To determine the osmotic potential of vacuolar sap by plasmolytic method.
4. To determine the water potential of any tuber.
5. To compare the rate of transpiration from two surfaces of leaf- a) bell jar method b) Cobalt chloride method.
6. To determine the path of water (Ascent of sap).
7. To separate chloroplast pigments a) by solvent method and preparation of their absorption spectra b) paper chromatography.
8. To separate amino acids from plant materials on paper chromatography and their identification by comparison with standards.
9. To measure rate of photosynthesis by Wilmott's bubbler under variable conditions of light, temperature and CO₂.
10. To compare rates of respiration of various plant parts.
11. To demonstrate bioassay of auxin, cytokinin, GA, ABA and ethylene using appropriate plant materials.

MINOR MAJOR PLANT PHYSIOLOGY EXPERIMENTS (ANY SEVEN):

1. To demonstrate the phenomenon of dispersion.
2. To demonstrate the phenomenon of adsorption.
3. To demonstrate the phenomenon of imbibitions.
4. To demonstrate the root pressure.
5. To demonstrate that the amount of water absorbed and the amount of water transpired is approximately equal.
6. To demonstrate that the light is necessary for photosynthesis (Ganong's light screen).
7. To demonstrate that the light, chlorophyll and CO₂ are necessary for photosynthesis (using Moll's half-leaf experiment).
8. To demonstrate fermentation by Kuhne's tube.
9. To demonstrate aerobic respiration.
10. To demonstrate the evolution of CO₂ in respiration.
11. To demonstrate that the part of energy is released in the form of heat during respiration.
12. To demonstrate the measurement of growth of germination pea seeds.
13. To demonstrate the phenomenon of gravitropism (geotropism), phototropism and hydrotropism.
14. To demonstrate seed viability test by T.T.C. (Triphenyl-tetrazolium chloride).

15. To demonstrate the phenomenon of nastic movement in *Mimosa pudica* / *Biophytum sensitivum* plants.

Suggested Laboratory Exercises

ECOLOGY EXPERIMENTS (Any nine):

1. To determine the minimum number of quadrates required for reliable estimate of biomass in grasslands.
2. To study the frequency of herbaceous species in grassland and to compare the frequency distribution with Raunkiaer's Standard Frequency Diagram.
3. To estimate importance value index for grassland species on the basis of relative frequency relative density and relative biomass in protected and razed grassland.
4. To measure the vegetation cover of grassland through point-frame method.
5. To measure the above-ground plant biomass in a grassland.
6. To determine the Kemp's constant for dicot and monocot leaves and to estimate leaf-area-index of a grassland community.
7. To determine diversity indices (Richness, Simpson, Shannon-Wiener) un grazed and protected grasslands.
8. To estimate bulk density and porosity of grassland and woodland soil.
9. To determine moisture content and water holding capacity of grassland and woodland soil.
10. To study the vegetation structure through profile diagram.
11. To estimate transparency, pH and temperature of different water bodies.
12. To measure dissolved oxygen content in polluted and unpolluted water samples.
13. To estimate salinity of different water samples.
14. To determine the percent leaf-area-injury to different leaf samples collected around polluted sites.
15. To estimate dust-holding capacity of the leaves of different plant species.
16. To study the ecological characters (morphological and anatomical) of the following plants-
 - a. **Hydrophytes:** *Hydrilla*, *Vallisneria*, *Nymphaea*, *Potamogeton*, *Eichhornia* and *Trapa*. (Any Four).
 - b. **Xerophyte:** i. For morphological features: *Acacia auriculiformis*, *Parkinsonia*, *Muehlenbeckia*, *Ruscus*, *Asparagus*, *Kalanchoe*, *Euphorbia nerifolia*, *Opuntia*; ii. For morphological and anatomical features: *Nerium*, *Casuarina*.
 - c. **Halophytes:** for morphological features: *Rizophora*.
 - d. **Epiphytes:** for morphological and anatomical features: Orchid (*Vanda*).
 - e. **Parasite:** For morphological and anatomical features: *Cuscuta*.

Note: - 1. Experiment no. 16 is compulsory, 2. Frequent tours to the different ecological sites to study vegetation are compulsory. 3. One long excursion is

essential, 4. Excursion and study tour reports duly signed by the H.O.D. to be submitted at the time of examination.

Suggested Laboratory Exercises

BIOCHEMISTRY EXPERIMENTS (Any nine):

1. To study the ENZYME activity of **Catalase** and **Peroxidase** in suitable plant material as influenced by pH and temperature.
2. To study the ENZYME activity of **Amylase** from germination Barley/ Wheat grains.
3. Colorimetric/Spectrophotometric estimation of sugar and starchy (Carbohydrates in suitable plant materials).
4. To prepare the standard curve of protein and determine the protein content in plant samples.
5. Estimation of Anthocyanin pigments from different plant material (At least two) and preparation of absorption spectra.

Semester VI Practical

Biotechnology:

1. To get acquainted with the laboratory equipments, apparatus and instruments in biotechnology laboratory.
2. To demonstrate the technique of micropropagation by using different explants e.g. axillary buds and shoot meristem.
3. To demonstrate the technique of anther culture.
4. To demonstrate the root and shoot formation from the apical and basal portion of the stem segments in liquid medium containing different hormones.
5. To isolate protoplast from different tissues using commercially available enzymes.
6. Immobilization of embryos from suitable plant seeds using sodium alginate.

Utilization of plants:

1. **Food plants:** Study of morphology, structure and simple micro-chemical tests of the food storing tissues in rice, wheat, maize, potato and pulses (soybean, pea) and sugarcane.
2. **Fibres:** Study of cotton flower, section of cotton ovules developing seeds to trace the origin and development of cellulosic 'fibers' (seed epidermal hair, microscopic study of cotton and test for cellulose). Section and staining of jute stem to show the location and development of fibres, microscopic structure and test for lingo-cellulose.
3. **Vegetable oils:** Study of hand sections of groundnut, mustard and coconut and staining of oil droplets by Sudan-III and Sudan black.
4. **Field visits:** Study sources of firewood (ten plants), timber-yielding trees (ten plants), and bamboos, preparation of list mentioning special features.

5. **Spices:** samples of black pepper, cloves, cinnamon (had sections and opened fruit of cardamom and describe them briefly) survey of spices found and use locally for practical assignment.
6. **Medicinal plants:** preparation of an illustrated inventory of ten medicinal plants used in indigenous system of medicine and allopathy- write their botanical and vernacular names, part/s used and diseases/disorders for which they are prescribed.
7. **Beverages:** study section of boiled coffee beans and tea leaves to study the characteristic structural features.
8. **Rubber:** Collect illustrative materials of *Hevea Brasiliensis*, study morphology of the plant and tapping practices, history of rubber, list the many uses of rubbers.

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