

**Shiksha Mandal's
Bajaj College of Science, Wardha**

**Proposed Syllabus for Four Year Multidisciplinary UG
Program with DSC as Major
(Four Year B.Sc. Honors/Research Program)**

**Program: B.Sc.
(Academic Session 2024-25)
Syllabus**

DISCIPLINE SPECIFIC CORE (DSC)

**Semester III and IV courses
in Botany**

Syllabus under Autonomy

As per National Education Policy (NEP) 2020

PLANT TAXONOMY, CELL BIOLOGY & GENETICS

[Credits 6]

[60L + 60P]

Course Description: To acquaint students about the origin, classification, taxonomic description of Angiosperms, ultrastructure and function of Plant cell and cell organelles, basics of inheritance, and Mendel's Laws of inheritance.

Course Objectives:

1. To study origin of Angiosperms, principles, and rules of nomenclature of plants.
2. To study classification systems of Angiosperms and taxonomic characteristics of Angiosperm families.
3. To study the structural organization and functions of cell organelles, illustrate the assembly of chromosomes, types and significance of cell division.
4. To study Mendel's laws, interaction of genes, mechanism and significance of linkage and crossing over.

Course outcomes:

After completion of the course students will gain the knowledge of -

CO1: Origin of Angiosperms, principles and rules of plant nomenclature.

CO2: Classification systems of Angiosperms, taxonomic characteristics of important families.

CO3: Structural organization and functions of the cell organelles.

CO4: Cell division processes within the cell and their significance and differentiate between mitotic and meiotic divisions.

CO5: Mendel's laws of inheritance and importance, Non-Mendelian interaction of genes, Linkage: types and theories and mechanism of crossing over.

CO6: Extra-nuclear genome, structural and numerical aberrations in chromosomes and concept of gene.

Unit I: Origin and Systematics

[10 Hrs.]

- 1.1 Origin of Angiosperms (Benettitalean theory) and Gnetales theory.
- 1.2 Principles and rules International Code of Nomenclature (ICN)
- 1.3 Valid publication, rejection of names, Principle of priority and its limitations
- 1.4 Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Floras; Keys: Indented and Bracketed.

Unit II: Taxonomic hierarchy, Classification and Study of Families

[10 Hrs.]

- 2.1 Concept of taxa (family, genus, species); Categories and taxonomic hierarchy
- 2.2 Systems of Classification: Bentham & Hooker, Engler & Prantl (with merits and demerits) and Overview of Angiosperm Phylogeny Group (APG)
- 2.3 Systematic studies & economic importance of following Families: Dicotyledons (Polypetalae) - Malvaceae, Fabaceae (Papilionoideae, Caesalpinioideae, Mimosoideae)
- 2.4 Systematic studies & economic importance of following Families: Dicotyledons (Gamopetalae) - Asteraceae, Apocynaceae (Monoclamydeae) Euphorbiaceae; Monocotyledons: Liliaceae, Poaceae.

Unit III: Cell Biology I [10 Hrs.]

- 3.1 Characteristics of Prokaryotic and Eukaryotic Cell; Animal cell v/s Plant cell
- 3.2 Ultrastructure and functions of: Cell wall & Cell Membrane (Fluid mosaic model)
- 3.3 Ultrastructure and functions of: Nucleus & Endoplasmic reticulum (RER and SER)
- 3.4 Ultrastructure and functions of: Golgi complex, Ribosomes, lysosomes, Peroxisomes, Mitochondria and Chloroplasts.

Unit IV: Cell Biology II [10 Hrs.]

- 4.1 Chromosome structure: Morphology (chromatid, chromomere, centromere, telomere, secondary constriction, satellite, karyotype)
- 4.2 Sex Chromosomes in plants: XY type in *Melandrium*
- 4.3 Cell division in plants: Mitosis, Meiosis and its significance.
- 4.4 Specialized chromosome – Lampbrush, Polytene and B-chromosome

Unit V: Genetics [10 Hrs.]

- 5.1 Mendel's Laws of Inheritance: Law of Dominance, Law of Segregation and Law of Independent assortment; Monohybrid cross, Dihybrid cross, Test Cross and Back cross)
- 5.2 Interaction of genes : Incomplete dominance (1:2:1 ratio in *Mirabilis jalapa*); Complementary (9:7 ratio); Supplementary (9:3:4 ratio) and Dominant epistasis (12:3:1 ratio)
- 5.3 Linkage: Definition, Theory of linkage (Coupling and Repulsion theory), types (complete and incomplete), significance
- 5.4 Crossing over: Definition, theories (Breakage and reunion), significance

Unit VI: Genetics [10 Hrs.]

- 6.1 Extra-nuclear Genome- Mitochondrial DNA and Chloroplast DNA
- 6.2 Variation in chromosome number: Polyploidy (auto- and allo), Aneuploidy (Nullisomy, Monosomy, Trisomy and Tetrasomy), Significance.
- 6.3 Structural changes in chromosome: deficiency, duplication, inversion translocation and their significance.
- 6.4 Concept of gene; Structure of eukaryotic gene, overlapping gene

Practicals: [60 Hrs.]

- 1. Study of Families covered in the theory.
- 2. Study of fossil Angiosperms micro-preparation and specimens: *Saharianthus*, *Enigmocarpon*.
- 3. Study of Cell organelles with the help of photographs/ Slides.
- 4. Study of mitosis in plant material (Squash).
- 5. Study of meiosis in plant material (Smear).
- 6. To prove the Mendel's law of Segregation with the help of coloured beads.
- 7. To prove Mendel's law of Independent assortment with the help of coloured beads.
- 8. Problems on Gene interaction (03 problems for each)

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**B.Sc. Semester – III Botany
Practical Examination Question Paper**

Time: 7 hrs.

Marks: 35

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| Q.1. Describe in technical language the given Angiospermic material. Classify & Identify the Family giving reasons with floral formula and floral diagram. | 08 |
| Q.2. Prepare semi-permanent squash /smear of given material & Identify the stage of cell division. | 05 |
| Q.3. To prove Mendel's Law of Inheritance through coloured beads | 05 |
| Q.4. To work out the type of gene interaction in the given cross from the given data | 04 |
| Q.5. Spotting | 08 |
| A. Fossil Angiosperm | B. Cytology |
| C. Cell Organelles (Photograph) | D. Taxonomy |
| Q.6. Viva-voce | 05 |

PLANT ANATOMY AND EMBRYOLOGY
[Credits 6]
[60L + 60P]

Course Description: To acquaint students with the structure and function of plant tissues, internal structure of root, stem and leaves of dicotyledons and monocotyledons, and reproduction of Angiosperms.

Course Objectives:

1. To study different types of plant tissues and their functions.
2. To study internal structure of root, stem, and leaves dicotyledon and monocotyledon plants.
3. To study developmental stages of plants.
4. To study types of pollination and adaptations of flowers for pollination.

Course Outcomes:

After completion of the course students will gain the knowledge of -

CO1: Structure and function of various meristems, permanent tissues and vascular bundles.

CO2: Primary structure of root, stem and leaf in dicots and monocots, types of vascular bundles in dicots and monocots, secondary growth, and development of growth rings.

CO3: Structure and function of Vascular cambium, anomalous secondary growth in plants and composition of periderm.

CO4: The process and mechanism of microsporogenesis and megasporogenesis.

CO5: Types and adaptations of pollination, fertilization, structure and types of embryo, endosperm, seed and seed dispersal.

CO6: Pollen-pistil interaction, polyembryony, fruit maturation and parthenocarpy.

Unit I: Anatomy

[10 Hrs.]

- 1.1 Types of tissues: Meristematic – Types of meristems: Apical, Intercalary, Lateral
- 1.2 Meristems: Apical cell, Tunica- Corpus and Newman theory.
- 1.3 Permanent tissues – Simple and complex.
- 1.4 Types of vascular bundles in dicots and monocots

Unit II: Anatomy

[10 Hrs.]

- 2.1 Anatomy of root: Primary structure in dicot and monocot root, normal secondary growth in dicot root.
- 2.2 Anatomy of stem: Primary structure in monocot and dicot stem, normal secondary growth in dicot stem.
- 2.3 Characteristics of growth rings, Sapwood, and heartwood.
- 2.4 Anatomy of leaf: Dicot (*Nerium*), Monocot (*Zea mays*)

Unit III: Anatomy

[10 Hrs.]

- 3.1 Vascular cambium- structure and function, seasonal activity.
- 3.2 Adaptive anomalous Secondary growth in *Bignonia*,
- 3.3 Non-adaptive anomalous secondary growth in *Boerhaavia*, *Dracaena*
- 3.4 Periderm: Phellem, Phellogen and Phelloderm

Unit IV: Embryology

[10 Hrs.]

- 4.1 Introduction and scope of plant embryology,

- 4.2 Applications of embryology in Taxonomy, Plant Tissue Culture and Plant Breeding.
- 4.3 Structure of Anther and Microsporogenesis.
- 4.4 Megasporogenesis: Types of ovules, female gametophyte (*Polygonum* type)

Unit V: Embryology

[10 Hrs.]

- 5.1 Pollination: Types and adaptation, significance
- 5.2 Double fertilization and triple fusion,
- 5.3 Embryo and Endosperm: Structure and Types
- 5.4 Seed structure and dispersal mechanism

Unit VI: Embryology

[10 Hrs.]

- 6.1 Pollen pistil - interaction
- 6.2 Self-incompatibility
- 6.3 Polyembryony and Apomixis
- 6.4 Biology of fruit maturation; Parthenocarpy

Practicals:

[60 Hrs.]

1. Study of simple tissue, complex tissue, and secretory tissue from permanent slides.
2. Study of types of vascular bundles (*Zea mays*, *Helianthus*, *Cucurbita*, *Boerhaavia*, etc.)
3. Study of internal structure of dicot and monocot root using hand section and prepare temporary mounts -Sunflower, Maize.
4. Study of internal structure of dicot and monocot stem using hand section and prepare temporary mounts -Sunflower, Maize.
5. Study the growth ring in woods-Teak wood
6. Study of internal structure of secondary growth and anomalous secondary growth using hand section and prepare permanent micro preparations - *Bignonia* stem, *Boerhaavia* stem and *Dracaena* stem.
7. Study of internal structure of leaves- *Nerium*, Maize
8. To prepare double stained permanent slides.
9. Study of stamens, anther structure, pollen grains.
10. Study of types of ovules.
11. Study of types of endosperms
12. Study of types of embryo.
13. Observation of wide range of flowers available in the locality and methods of their pollination.
14. To calculate the percent pollen germination in the given specimen.

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**B.Sc. Semester – IV Botany
Practical Examination Question Paper**

Time: 7 hrs.

Marks: 35

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| Q.1. Prepare temporary mount of the given material (Root/Leaf) and Identify by giving diagnostic characters. | 05 |
| Q.2. Prepare double stained permanent mounts of the given material (Stem) and Identify giving diagnostic characters. | 08 |
| Q.3. Calculate percent germination in the given pollen grains | 05 |
| Q.4. Comment on the type of Anther/ Ovule/ Endosperm/ Embryo/ Pollination. | 04 |
| Q.5. Spotting | 08 |
| A. Anatomy | B. Anatomy |
| C. Embryology | D. Embryology |
| Q.6. Viva-voce | 05 |