

SYLLABUS

**BOTANY
(UNDER GRADUATE COURSE)**

B. Sc. PART II

2022-23



**Department of Botany
JAI NARAIN VYAS UNIVERSITY JODHPUR**

**B.Sc. Part – II
BOTANY 2023**

Theory

Course	Nomenclature	Number of Papers	Number of Periods per week	Maximum marks	Minimum marks
Paper I	Taxonomy and Embryology of Angiosperms	1	2	50	54
Paper II	Anatomy of Angiosperms, Economic Botany and Ethnobotany	1	2	50	
Paper III	Cell Biology, Genetics, Plant Breeding and Evolution	1	2	50	
PRACTICAL COURSE			6	75	27

Duration of examination of each theory papers

3 hours

Duration of examination of practicals

5 hours

PAPER I: TAXONOMY AND EMBRYOLOGY OF ANGIOSPERMS

Unit I: Diversity in plant form in annuals, biennials and perennials, Canopy architecture in angiosperms: tree-origin, development, arrangement and diversity in size and shape, Flower-modified shoot, structure and development of flower, Inflorescence-types of Inflorescence.

Unit II: Angiosperms: Origin and evolution. Some examples of primitive angiosperms. Angiosperm taxonomy; (Alpha-taxonomy, Omega-taxonomy, holotaxonomy) Taxonomic literature. Botanical nomenclature; principles and rules; taxonomic ranks, type concept, principle of priority. Classification of angiosperms; salient features of the systems proposed by Bentham and Hooker and Engler and Prantl.

Unit III: Major contributions of cytology and molecular biology, phytochemistry and taxometrics to taxonomy. Diversity of flowering plants as illustrated by members of the families Ranunculaceae, Papaveraceae, Caryophyllaceae, Capparidaceae, Cucurbitaceae, Rutaceae and Apiaceae.

Unit IV: Diversity of flowering plants as illustrated by members of the families Asteraceae, Acanthaceae, Apocynaceae, Asclepiadaceae, Scrophulariaceae, Lamiaceae, Euphorbiaceae, Musaceae and Poaceae.

Unit V: Embryology: Structure of anther and pistil. Development of the male and female gametophytes; pollen-pistil interactions, self-incompatibility; Double fertilization; Development of endosperm and embryo; Brief account of experimental embryology. Basics of gene imprinting.

Suggested Laboratory Exercises

Field study of diversities found in leaf shapes, size, thickness and surface properties.

The following families are for detailed taxonomic studies:

(i)	Ranunculaceae:	<i>Ranunculus, Delphinium</i>
(ii)	Papaveraceae:	<i>Papaver, Argemone</i>
(iii)	Caryophyllaceae:	<i>Dianthus, Saponaria</i>
(iv)	Capparidaceae:	<i>Capparis, Cleome</i>
(v)	Cucurbitaceae:	Any cucurbit
(vi)	Rutaceae:	<i>Citrus</i>
(vii)	Apiaceae:	<i>Coriandrum</i>
(viii)	Asteraceae:	<i>Helianthus, Sonchus</i>
(ix)	Acanthaceae:	<i>Adhathoda, Barleria</i>
(x)	Apocynaceae:	<i>Catharanthus, Thevetia, Nerium</i>
(xi)	Asclepiadaceae:	<i>Calotropis</i>
(xii)	Scrophulariaceae:	<i>Antirrhinum, Linaria</i>
(xiii)	Lamiaceae:	<i>Ocimum, Salvia</i>
(xiv)	Euphorbiaceae:	<i>Euphorbia pulcherrima, Ricinus</i>
(xv)	Musaceae:	<i>Musa</i>
(xvi)	Poaceae:	<i>Triticum</i>

Spots:

- (i) **Leaf:** Simple and compound
- (ii) **Inflorescence:** Cyathium, Verticillaster and Umbel
- (iii) **Fruits:** Pepo, Caryopsis, Cremocarp and Hesperidium
- (iv) **Translator structure:** *Calotropis*
- (v) **Study of placentation:** Axile, Free-central, Parietal, Marginal and Basal [slides as well as T.S. of ovary]
- (vi) **Structure of ovule:** Orthotropus (slide), Anatropus (slide & in *Calotropis*, pea & Dog flower), Campylotropus (slide & in *Capparis*, & *Dianthus*) and Amphitropus (slide & in *Ranunculus* & *Papaver*)
- (vii) **Endosperm & embryo:** Coconut and Ruminant in walnut & Sitafal. Embryo developments (slides only)

Suggested Readings

- Bhandari, M.M. Flora of Indian Desert.
- Bhojwani, S.S. and Bhatnagar, S.P. The Embryology of Angiosperms, 4th Revised and enlarged edition, Vikas Publ., New Delhi, 2002.
- Davis, P.H. and Heywood, V.H. Principles of Angiosperm Taxonomy, Oliver and Boyd, London, 1963.
- Fegerig K. and Vender Pifi The Principles of Pollination Ecology, Pergamon Press, 1979.
- Gifford, E.M. and Foster, A.S. Morphology and Evolution of Vascular Plants, W.H. Freeman and Company, New York, 1979.
- Heywood, V.H. and Moore, D.M. (eds.) Morphology and Evolution of Vascular Plants, W.H. Freeman and Company, New York, 1984.
- Jeffrey, C. An Introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London, 1982.
- Jones, S.D. Jr. and Suhsinger, A.E. Plant Systematic (2nd ed.) McGraw-Hill Book Co., New York, 1986.
- Maheshwari, J.K. Flora of Delhi, CSIR, New Delhi, 1963.
- Redford, A.E.: Fundamentals of Plant Systematics, Harper and Row, New York, 1986.
- Sharma, O.P. Taxonomy: Tata McGraw Hill Pub. Company Ltd., New Delhi 2000.
- Singh, G. Plant Systematics – Theory and Practices, Oxford and IBH Pvt. Ltd., New Delhi, 1999.
- Singh, V., Pandey, P.C. and Jain, D.K. Angiosperms, 2005, Rastogi Pub., Meerut.

PAPER II: ANATOMY OF ANGIOSPERMS, ECONOMIC BOTANY AND ETHNOBOTANY

Unit I: Anatomy of Angiosperms: Concept of stem cell in plants. Root system; Root apical meristem; differentiation of primary and secondary tissues and their roles; structural modification for storage, respiration, reproduction and for interaction with microbes.

Unit II: Shoot system: The shoot apical meristem and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; cambium and its functions; formation of secondary xylem, a general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings, sapwood and heart wood; secondary phloem-structure, function relationship; Periderm.

Unit III: Abnormal secondary growth and Leaf: Abnormal secondary growth in stems due to abnormal origin and activity of cambium. Leaf: Internal structure in relation to photosynthesis and water loss; adaptations to water stress; senescence and abscission.

Unit IV: Economic Botany, Food plants: Rice, wheat, maize, potato, sugarcane. Fibers: Cotton and Jute. Vegetable oils: Groundnut, mustard and coconut, General account of sources of firewood, timber and bamboos. Beverages: Tea and coffee; Rubber.

Unit V: Spices and Condiments: General account. Medicinal plants with special reference to Rajasthan: *Aloe*, *Asparagus*, *Commiphora*, *Boswellia*, *Pedaliump*, *Zyziphus*, *Haloxylon*, *Tribulus*, *Vitex*, and *Withania*. Ethnobotany: Introduction, Methods of Ethnobotanical studies, knowledge of aboriginals in Rajasthan.

Suggested Laboratory Exercises

Anatomy:

- (i) Types of simple and complex tissues: (Sunflower/ Sonchus, Cucurbit stem)
- (ii) **Dicot stem:** *Sunflower*, *Cucurbit*, *Nyctanthes*, *Bignonia*, *Leptadenia*, *Salvadora*, *Boerhavia* and *Achyranthes*, *Capparis*.
- (iii) **Monocot stem:** Maize/ *Triticum* and *Dracaena*
- (iv) **Dicot root:** *Tinospora*
- (v) **Monocot root:** Maize
- (vi) **Dicot leaf:** *Nerium* and *Ficus*
- (vii) **Monocot leaf:** Maize / any other grass

Spots:

- (i) Slide of above any plant material for anatomical study
- (ii) Different types of stomata and thickening in xylem vessels (slides/photographs)
- (iii) Medicinal plants/Ethnobotany specimens:
Medicinal plants: *Aloe*, *Asparagus*, *Commiphora*, *Tribulus* and *Withania*
Ethnobotany: *Abrus*, *Leptadenia*, *Calotropis* and *Crotalaria*

Suggested Readings

Cutter, E.G. Plant Anatomy: Experiment and Interpretation, Part II. Organs, Edward Arnold, London, 1971.

- Esau, K. Anatomy of Seed Plants, 2nd John Wiley & Sons, New York, 1977.
- Fahn, A. Plant Anatomy. 2nd ed. Pergamon Press, Oxford, 1974.
- Kocchar, S.L. Economic Botany in Tropics. 2nd ed. Mac-millan India Ltd., New Delhi, 1998.
- Mauseth, J.D. Plant Anatomy, The Benjamin/Cummings Publ. Company Inc., Menlo Park, California, USA, 1988.
- Sambamurthy, A.V.S.S. and Subramanyam, N.S. A Text book of Economic Botany, Wiley Eastern Ltd., New York, 1989.
- Sharma, O.P. Hill's Economic Botany (Late Dr. A.F. Hill, Adapted by O.P. Sharma), Tata McGraw Hill Co., Ltd., New Delhi, 1996.
- Simpson, B.B. and Conner-Ororzaly, M. Economic Botany Plants in Our World, McGraw Hill, New York, 1986.

PAPER III: CELL BIOLOGY, GENETICS, PLANT BREEDING AND EVOLUTION

Unit I: History of cell biology: Concept of cell and cell theory. Cell cycle and its regulation. Mitosis and meiosis. Structural and Molecular organization of cell. Structure and function of cell wall; plasmodesmata, plasma membrane; Golgi complex, plastid, mitochondria, endoplasmic reticulum, peroxisomes, vacuoles and nucleus.

Unit II: Chromatin organization: Organization and structure of chromosomes. Concept of nucleosomes, chromatin remodeling. Types of chromosomes and determination of sex in plants. Chromosome alteration: Structural alteration; deletion, duplication, translocation, inversion; Numerical variation: aneuploidy and polyploidy. Molecular basis of mutation: Spontaneous and induced, brief account of DNA damage and repair. Introduction to epigenetics.

Unit III: Nature of inheritance; Laws of Mendelian inheritance and its exceptions. Crossing-over and linkage analysis. DNA the genetic material: Structure and replication, brief account of DNA-protein interaction. Definition of a gene-modern Concept of gene (Promoter, coding sequences, terminator). RNA polymerases and general transcription. Regulation of gene expression in prokaryotes and basics of gene regulation in eukaryotes.

Unit IV: Origin of Agriculture, Centers of origin of crop plants and centers of Diversity. Concepts of Centers and Non-center (Harlan Hypothesis) Principles of plant breeding- Domestication, Introduction, Selection, Clonal propagation, Hybridization, Mutation breeding; Breeding work done on wheat; Green revolution; Assessment and Consequences; Biodiversity and Conservation of germplasm.

Unit V: Theories of Evolution: Catastrophism, The Lamarck's theory, Darwin's theory, Evidences of organic evolution, mechanism of evolution. Origin of basic biomolecules evolution of prokaryotic and eukaryotic cell. and Origin of species. Population genetics: Allele and genotype frequency, Hardy-Weinberg principles.

Suggested Laboratory Exercises

Cytogenetics/Genetics/Plant breeding/ Evolution:

1. Slide preparation of *Allium* root tips (mitosis) / *Allium* flower bud (meiosis)

Spots:

- (i) Slides/Models/Photographs/Drawings: Cell structure and cell organelles: Molecular organization of Plasmodesmata&plasmalemma, Chloroplast, Mitochondria, Nucleus Nuclear pore complex, Peroxisome, Chromosomes (Types and Solenoid Model), DNA- Physical & Chemical properties
- (ii) Chart showing pure line and mass selection
- (iii) With the help of seed samples explain the principles involved in the following ratio: 3:1, 1:2:1, 1:1, 9:3:3:1, 9:7 and 12:3:1
- (iv) Hardy-Weinberg's Principle
- (v) Photographs with names, "Scientific Contribution of Darwin, Lamarck, de-Vries Vavilov, J.R. Harlan
- (vi) Chromosomal Abbreviation (Numerical & Structural)

Suggested Readings

- Alberts, B., Bray, D. Lewis, J., Raff, M., Roberts, K. and Watson, I.D. *Molecular Biology of cell*. Garland publishing Co., New York, USA
- Chaudhary, H.K. *Elementary principles of plant Breeding*, Oxford & IBH Publishing New Delhi.
- Gupta, P.K. *A Textbook of cell and Molecular Biology*, Rastogi Publications, Meerut,1999
- Gupta, P.K. *Cytology, Genetics, Evolution and plant Breeding*, Rastogi, Publication, Meerut,2000.
- Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. *Molecular Cell Biology*, W.H. Freeman & Co. New York, USA
- Miglani, G.S. *Advanced Genetics*, Narosa publishing Co., Inc., USA
- Russel, P.J. *Genetics*. The Benjamin/ Cummings Publishing Co., Inc., USA
- Shukla, R.S. and Chandel, P.S. *Cytogenetics, Evolution and Plant Breeding*, S.Chand&Co.Ltd., New Delhi
- Singh B.D. *Textbook of plant Breeding*. Kalyani publishers, Ludhiana,1999
- Sinha, U. and Sinha, S. *Cytogenetics, Plant Breeding and Evolution*, Vikas Publishing House, New Delhi, 1997
- Sunstand, D.P. and Simmons, M.J. *Principles of Genetics*, John Wiley & Sons Inc., USA20

Practical Examination Scheme
B.Sc. Part – II (Botany)

Time: 5 hours

Max. Marks: 75
Min. Pass Marks: 27
Regular **Ex-Student**

Q.1	<p>(a) Describe the given flower in botanical terminology language with floral diagram and floral formula, mentioning special features of identification. Cut a T.S. of anther/ovary/ovule of the same flower and describe the arrangement of anther and ovule from taxonomical point of view. (ए) दिए गए पुष्प को वनस्पति शब्दावली भाषा में पुष्प आरेख और पुष्प सूत्र के साथ वर्णन करें, विशेष विशेषताओं का उल्लेख करते हुए पहचान करें। दिए गए पुष्प के परागकोष/अंडाशय/ बीजांड का एक अनुप्रस्थ काट काटें तथा वर्गिकी की दृष्टि से परागकोश और बीजांड की व्यवस्था का वर्णन कीजिए।</p> <p>(b) Prepare a temporary slide of given material (gynoecium/androecium/embryo). Draw a labeled diagram and comment according to embryological point of view. (बी) दी गई सामग्री (जायांग/ पुंकेसर/भ्रूण) की एक अस्थायी स्लाइड तैयार करें। एक नामांकित चित्र बनाइए और भ्रौणिकी दृष्टिकोण के अनुसार टिप्पणी कीजिए।</p>	08	09										
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Q.2	<p>Cut a T.S./V.S. of given stem/root/leaf and make a double-stained slide of the same. Draw labeled diagrams (outline & cellular) and identify with special features. दिए गए तना/जड़/पत्ती का अनुप्रस्थ/उदग्र काट काटें और उसकी द्वि-अभिरंजीत स्लाइड तैयार करें। नामांकित चित्र (आरेखीय और कोशिकीय) बनाएं और विशेष विशेषताओं के साथ पहचानें।</p>	11	13										
Q.3	<p>Prepare a suitable smear of the given material to observe mitosis/meiosis. Draw labeled diagrams of any two visible stages. Submit the slide for evaluation. समसूत्री विभाजन/अर्धसूत्रीविभाजन के निरीक्षण हेतु दी गई सामग्री का एक उपयुक्त स्मीयर तैयार करें। किन्हीं दो दृश्य अवस्थाओं के नामांकित चित्र बनाइए। मूल्यांकन के लिए स्लाइड जमा करें।</p>	11	13										
Q.4	<p>Spots (Three from each paper) प्रादर्श (प्रत्येक पेपर से तीन)</p> <table style="margin-left: 20px; border: none;"> <tr><td style="padding-right: 20px;">1</td><td>6</td></tr> <tr><td>2</td><td>7</td></tr> <tr><td>3</td><td>8</td></tr> <tr><td>4</td><td>9</td></tr> <tr><td>5</td><td></td></tr> </table>	1	6	2	7	3	8	4	9	5		27	27
1	6												
2	7												
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Q.5	Viva voce / मौखिक परीक्षा	06	09										
Q.6	Practical records / प्रायोगिक अभिलेख	09	00										
Total / कुल		<u>75</u>	<u>75</u>										