B.Sc. Part – II
BOTANY 2019

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 taximetrics 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;

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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:

1. Ranunculaceae: *Ranunculus, Delphinium*
2. Papaveraceae: *Papaver, Argemone*
3. Caryophyllaceae: *Dianthus, Gypsophylla, Saponaria*
4. Capparidaceae: *Capparis, Cleome*
5. Rutaceae: *Murraya, Citrus*
6. Apiaceae: *Coriandrum, Foeniculum, Anethum*
7. Cucurbitaceae: *Luffa* or anyCucurbit
8. Asteraceae: *Helianthus, Calandula, Sonchus*
9. Acanthaceae: *Adhatoda, Barleria*
10. Apocynaceae: *Catharanthus, Thevetia, Nerium*
11. Asclepiadaceae: *Calotropis*
12. Scrophulariaceae: *Linaria, Antirrhinum*
13. Euphorbiaceae: *Euphorbia, Phyllanthus*
14. Lamiaceae: *Ocimum, Salvia*
15. Musaceae: *Musa*
16. Poaceae: *Avena, Triticum, Hordeum, Poa, Sorghum*

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. Freemad 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 Suchsinger, 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.

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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, Pedalium, 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, Cucurbit stem)
(ii) **Dicot stem**: *Sunflower, Cucurbit, Capparis, Nyctanthes, Bignonia, Leptadenia, Salvadora, Boerhavia* and *Achyranthes*
(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

ECONOMIC BOTANY: Food plants: Study of morphology and structure. Simple microchemicals tests of the food storing tissues in rice, wheat, maize, potato and sugarcane. Microscopic examination of starch in these plants (except sugarcane)
Fibers: Study of cotton fiber, tests for cellulose. Vegetable oils: study of hand sections of Groundnut, Mustard and Coconut and staining of oils droplets by Sudan III and Sudan Black
Field visits: To study sources of firewood (10 plants), timber-yielding trees (10 trees) and bamboos. A list to be prepared mentioning special features

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Medicinal Plants & Spices: Black pepper, cloves, cardamom describe them in briefly. Study of 10 medicinal plants. Write their botanical and common names, parts used and diseases/disorders for which they are prescribed.
Beverages & Rubber: Cofee, Tea & Rubber
ETHNOBOTANY: Ethobotanically important plants of Rajasthan (*Abrus, Leptidenia*and *Calotropis*)

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., Menloc 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.
Simposon, 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,

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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 Lamark'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

CYTOLOGY

1. Study of cell structure from onion leaf peels
2. Comparative study of cell structure in onion cells and *Hydrilla*
3. Smear preparation of root tips for different stages in *Allium* root tip
4. Cytological examination special types of chromosomes (Slides)
5. Examination of electron micrographs of eukaryotic cells and cell organelles

GENETICS

1. Working out laws of inheritance using seed mixtures
2. Monohybrid, dihybrid and test crosses using seed samples

PLANT BREEDING

1. Demonstration of Emasculation techniques.

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., USA 2000

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Practical Examination Scheme
B.Sc. Botany Part II

Time: 5 hours **Max. Marks 75**
Min. Pass Marks 27

		Regular	Ex-student
Q.1	(a) Describe the given flower in semi-technical language with floral diagram and floral formula, mentioning special feature of identification. Cut a T.S. of anther/ovary/ovule of the same flower and describe from embryological point of view. **Material 'A'**	10	12
	(b) Prepare a temporary Slid of GivenGynoecium / Androecium / Embryo material. Draw a Labeled Diagram and comment on it Embryological point of view.**Material 'B'**	4	4
Q.2	Cut a T.S./V.S. of given stem/root/leaf and make a double stained preparation of the same. Draw a labeled diagram (outline & cellular), identify with special features. **Material 'C'**	14	16
Q.3	Prepare a suitable smear preparation of the given plant material to observe mitosis. Draw a labeled diagram of any two visible stages. Submit the smear for evaluation. **Material 'D'**	14	16
Q.4	Spots (Three from each paper)	27	27
Q.5	Practical records	06	-
	Total	**75**	**75**

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