SYLLABUS

B.Sc. Part-II (Semester-III and IV) Subject Botany

(Session 2021-22, 2022-23 and 2023-24)

Semester-III

THEORY

	External Marks	**Internal Assessment**
Paper-V: Diversity and Systematics of Gymnosperms	40	15 (Attendance: 3 + Assignment: 6 + House Test 6)
Paper-VI: Diversity and Systematics of Angiosperms	40	15 (Attendance: 3 + Assignment: 6 + House Test 6

PRACTICAL

Pertaining to Theory **Paper-V** Pertaining to Theory **Paper-VI**	40

Theory		80 Marks
Practical		40 Marks
Internal Assessment Pertaining to Theory Paper-V & VI		30 Marks
Total	**:**	**150 Marks**

Semester-IV

THEORY

	External Marks	**Internal Assessment**
Paper-VII: Plant Anatomy	40	15 (Attendance: 3 + Assignment: 6 + House Test 6)
Paper-VIII: Development and Reproduction in Flowering Plants	40	15 (Attendance: 3 + Assignment: 6 + House Test 6

PRACTICAL

Pertaining to Theory **Paper-VII** Pertaining to Theory **Paper -VIII**	40
Total Marks (Semester-IV)	

Theory		80 Marks
Practical		40 Marks
Internal Assessment Pertaining to Theory Paper-**VII** & **VIII**		30 Marks
Total	**:**	**150 Marks**

Note:

1) The number of teaching hours per week will be three for each theory paper and three for each practical in every semester. In all, there will be 12 teaching hours per week covering both theory and practical requirements. (Six teaching hours for theory and Six teaching hours for practical per week)
2) Practical paper in each semester will be of 3 hours. The timing of practical examination will be 9.00 am to 12.00 noon.

Paper-V: DIVERSITY AND SYSTEMATICS OF GYMNOSPERMS

Max. Marks: 55 marks
Pass Marks: 35% in Theory and Practical Separately
Theory Paper: 40 marks
Internal Assessment: 15 marks

Total Teaching hours: 45
Time Allowed: 3 Hours

Objective of the paper is to impart knowledge to students about the general characters, classification, evolution and diversity of representatives of different gymnosperms.

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 6 marks each. Section C will consist of 8 short-answer type questions (8-10 lines) of 2 marks each which will cover the entire syllabus uniformly and will carry 16 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

Section-A

1. General features of gymnosperms and their classification; fossil gymnosperms Pentoxylon, Cordaites, Bennettites, Glossopteris, Lyginopteris, Williamsonia, Distribution, Cytology and Economic Importance of Indian Gymnosperms.
2. General characters of Pro-Gymnosperms, morphological features of *Arachaeopteris* and *Aneurophyton*.

Section-B

3. General characters of Cycadales and Coniferales. Morphology, anatomy, reproduction and life cycle of *Cycas* and *Pinus*.
4. General characters of Ephedrales and Gnetales. Morphology, anatomy, reproduction and life cycle of *Ephedra* and *Gnetum*.

RECOMMENDED READINGS

1. Bhatnagar, A.M. 2004. *Gymnosperms*, New Age International (P) Limited, Publishers, New Delhi.
2. Bhatnagar, S.P. and Moitra, A. 1996. *Gymnosperms*, New Age International Limited, New Delhi.
3. Pant, D.D. 1973. *Cyas & Cyadales*, Central Book Dept Allahabad, UP
4. Sharma, O.P. 2002. *Gymnosperms*, Pragati Prakashan, Merrut.
5. Sporne, K.R. 1965. *The Morphology of Gymnosperms*, Hutchinson & Co. (Publishers) Ltd., London.
6. Stewart, W.M. 1983. *Paleobotany and the Evolution of Plants*, Cambridge University Press, Cambridge.

B.Sc. (Botany) Part-II (SEMESTER-III)

Paper-VI: DIVERSITY AND SYSTEMATICS OF ANGIOSPERMS

Max. Marks: 55 marks
Pass Marks: 35% in Theory and Practical Separately
Theory Paper: 40 marks
Internal Assessment: 15 marks

Total Teaching hours: 45
Time Allowed: 3 Hours

Objective of the paper is to acquaint the students about the origin and evolution of angiosperms, angiosperm taxonomy, diagnostic features and technical description of angiosperm families.

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 6 marks each. Section C will consist of 8 short-answer type questions (8-10 lines) of 2 marks each which will cover the entire syllabus uniformly and will carry 16 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

Section-A

1. Origin and evolution of Angiosperms giving suitable examples. Primitive and advanced characters of Angiosperms.
2. Angiosperm taxonomy; brief history, aims and fundamental components (α-taxonomy, β-taxonomy and Ω-taxonomy); identification keys. International code of Botanical nomenclature: Principles and rules; taxonomic ranks; type concept.

Section-B

3. Classification of angiosperms: salient features, comparison, merits and demerits of the classification systems proposed by Bentham and Hooker and Engler and Prantl.
4. Diagnostic features, technical description and taxonomic significance of flowering plants as illustrated by members of families Ranunculaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae, Apiaceae, Cucurbitaceae, Rosaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Asteraceae, Lilliaceae and Poaceae.

RECOMMENDED READINGS

1. Chopra, G.L. 2000. *Angiosperms*. Pardeep Publications, Jalandhar.
2. Pandey, B.P. 2004. *A Text Book of Botany: Angiosperms*. S. Chand and Company Ltd. New Delhi.
3. Pullaiah, T.2007. *Taxonomy of Angiosperms* (2nd ed.), Regency Publications, New Delhi.
4. Sambamurty, V.S.S. 2005. *Taxonomy of Angiosperms*, I.K. International, Pvt. Ltd., New Delhi.
5. Singh, G. 2006. Plant Systematic. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
6. Sharma, O.P. 2004. Plant Taxonomy. Tata McGraw-Hill Publishing Company Ltd., New Delhi.

SUGGESTED LABORATORY EXCERCISES

Gymnosperms:

Cycas

I. Study of microsporophyll, megasporophyll and mature seed.
II. Study through permanent slides – normal root (T.S.) and ovule (L.S.)
III. Study through hand sections– coralloid root (T.S.). rachis (T.S.), leaflet (V.S.), pollen grains (W.M.)

Pinus

I. Long and dwarf shoot, male and female cones, winged seeds.
II. Study through permanent slides – root (T.S.), Male cone (L.S.), female cone (L.S.), ovule (L.S.), embryo (W.M.) showing polycotyledonous condition.
III. Study through hand sections and preparation of permanent studies in young stem (T.S.), old stem (T.S., T.L.S. and R.L.S.), needle (T.S.), pollen grains (W.M.).

Ephedra

I. Structure of male and female cones.
II. Hand sections – Stem (T.S.), maceration to show vessel structure; pollen grains (W.M.)

Angiosperms:

The following genera are recommended for study. This list is only indicative. Teachers may select plants available in their locality.

1. Ranunculaceae: *Ranunculus, Delphinium*.	8. Rosaceae : Rosa
2. Brassicaceae: *Brassica, Iberis*.	9. Apocynaceae : Neerium.
3. Malvaceae: *Hibiscus, Abutilon*.	10. Asclepiadaceae: *Calotropis*.
4. Rutaceae: *Murraya, Citrus*.	11. Solanaceae: *Solanum, Withania*.
5. Fabaceae: *Faboideae: Lathyrus, Trigonella*; Caesalpiniodeae: *Cassia*; Mimosoideae: *Acacia, Albizzia.*	12. Euphorbiaceae: *Euphorbia, Phyllanthus*.
	13. Asteraceae: *Helianthus, Ageratum* and *Sonchus*.
6. Apicaceae: *Coriandrum*.	14. Lamiaceae: *Ocimum, Salvia*.
7. Cucurbitaceae: *Cucurbita*	15. Liliaceae: *Asparagus, Allium*.
	16. Poaceae : Avena, Triticum.

Note for teachers:

The students should be made familiar with the families listed in the syllabus in the practical classes with representative species or any other that may be available locally. The teacher should prevent students from collection of plants from nature and submitting them for the practical examination. Instead, the students should be trained in field botany and asked to prepare field reports for which students should be taken for botanical excursion.

INSTRUCTIONS FOR PAPER SETTER
PRACTICAL PAPER-III (PERTAINING TO THEORY PAPER- Paper-V & VI)

	Practical	Marks
1.	Section cutting and preparation of permanent slide	05
2.	Description of complete flower, along with V.S., floral diagram and referring to the family giving reasons.	06
3.	Description of only two floral whorls of a given flower (to be given by the examiner)	04
4.	Field Report	05
5.	Two Morphological notes (Pertaining to Gymnosperms)	06
6.	Identification of two spots and two slides (with atleast two diagnostic features)	06
7.	Note-book	04
8.	Viva-voce.	04
		40 Marks

Paper-VII: PLANT ANATOMY

Max. Marks: 55 marks
Pass Marks: 35% in Theory and Practical Separately
Theory Paper: 40 marks
Internal Assessment: 15 marks
Total Teaching hours: 45
Time Allowed: 3 Hours

Objective of the paper is to impart knowledge to students about the tissue systems, root shoot and leaf anatomy.

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 6 marks each. Section C will consist of 8 short-answer type questions (8-10 lines) of 2 marks each which will cover the entire syllabus uniformly and will carry 16 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

Section-A

1. Tissue Systems**:** Epidermal: Structure and types of stomata, idioblasts, trichomes, nectaries, hydathodes. Fundamental: parenchyma, collenchyma, and sclerenchyma; Vascular system.
2. The root system: the root apical meristem and its histological organization; anatomical details of Dicot and Monocot roots.

Section-B

3. The shoot system: The shoot apical meristem and its histological organization. Anatomical details of Dicot and Monocot stems. Cambium and its functions. Secondary growth including anomalous secondary growth
4. Leaf: Anatomy in Dicots and Monocots and modification with special reference to their function.

RECOMMENDED READINGS

1. Esau, K. 1977. *Anatomy of Seed Plants 2nd* Edition, John Wiley & Sons., New York.
2. Fahn, A. 1974. *Plant Anatomy 2nd* Edition, Pergamon Press, Oxford.
3. Mauseth, J.D. 2008. *Plant Anatomy*, Blackburn Press, New Jersey, USA.
4. Rudall, P. 2007. *Anatomy of Flowering Plants,- An Introduction to structure and Development*, Cambridge University Press, Cambridge, U.K.

Paper-VIII: DEVELOPMENT AND REPRODUCTION IN FLOWERING PLANTS

Max. Marks: 55 marks
Pass Marks: 35% in Theory and Practical Separately
Theory Paper: 40 marks
Internal Assessment: 15 marks

Total Teaching hours: 45
Time Allowed: 3 Hours

Objective of the paper is acquaint the students about the vegetative and sexual reproduction in angiosperm, structure of male and female gametophytes and post fertilization changes.

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 6 marks each. Section C will consist of 8 short-answer type questions (8-10 lines) of 2 marks each which will cover the entire syllabus uniformly and will carry 16 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

Section-A

1. Vegetative Reproduction: Various methods of vegetative propagation and applications in floriculture and horticulture.
2. Flower: a modified shoot; structure, development of flower; Inflorescence types; structure of anther and pistil.

Section-B

3. Male and female gametophyhtes; types of pollination; pollen-pistil interaction, self incompatibility, double fertilization.
4. Post fertilization changes, endosperm and embryo development; seed development, structure and dispersal; dormancy fruit development and types of fruit.

RECOMMENDED READINGS

1. Bhojwani, S.S. and Bhatnagar, S.P. 2000. *The Embryology of Angiosperms*; 4th revised and enlarged edition, Vikas Publishing House, Delhi.
2. Larsten, N.R. 2008. *Flowering Plant Embryology*, John Wiley & sons, New York, USA.
3. Pullaiah, T. 2001. *Text Book of Embryology of Angiosperms*, Regency Publications, New Delhi.

SUGGESTED LABORATORY EXERCISES

Teachers may select plant/material available in their locality/institution.

1. To study the anatomy of Dicot and Monocot root, stem and leaves from the locally available material.
2. Study of anomalous secondary growth in *Boerhavia, Nyctanthus, Bougainvillea, Mirabilis*.
3. Examination of flowers for their pollination mechanism (*Salvia, Ficus, Calotropis, Triticum*).
4. Structure of anther, microsporogenesis (using slides) and pollen grains and pollinia (using whole mounts).
5. Study of Pollen viability using glycero-acetocarmine.
6. Structure of ovule and embryo sac. (Permanent slides)
7. Nuclear and cellular endosperm. Embryo development in monocots and dicots.(Permanent slides)
8. Simple experiments to show vegetative propagation (leaf cuttings in *Bryophyllum*; stem cuttings in rose, money plant, sugarcane and *Bougainvillea)*.
9. Testing percentage seed viability through tetrazolium chloride and actual seed germination.
10. Study of placentation, fruit types and seed types.

INSTRUCTIONS FOR THE PAPER SETTER

PRACTICAL PAPER-IV (Pertaining to theory paper Paper-VII & VIII)

		Marks
1.	Study of anatomical details of root/stem/leaves in Dicots and Monocots including study of anomalous secondary growth.	07
2.	Maceration/Stomatal Study	05
3.	Study of pollen viability/Seed viability	04
4.	Flower study in relation to pollination/study of Inflorescence and Fruit types	05
5.	Study of polyembryony/ Placentation /Vegetative Propagation	05
6.	Identification of four slides with two diagnostic features each	06
7.	Practical Note-book.	04
8.	Viva-voce	04
		40 Marks