

BOTANY B.Sc. SYLLABUS

FIRST SEMESTER

PAPER-I: Diversity of microbes and non vascular plants, Introduction to Microbiology, Viruss, BacteriaCyanobacteria and Algae.	60hrs
1. Aim and scope of Microbiology : A general account of microbes from soil, air and water.	4 hrs
2. Viruses: History, classification and discovery . Characterstics features of viruses. structure of bacteriophage and TMV. Disease caused by TMV, YBMV (Yellow Bean Mosaic Virus) and PLCV (Papaya Leaf Curl Virus), A brief account of Viroids.	7 hrs
3. Mycoplasma : A general account ‘ Sandal Spike Disease’.	2 hrs
4. Bacteria : Occurance of Bacteria in air, water and soil. Contribution of Leeuwenhok and Louis Pasture. Chemistry of Gram +ve Bacteria and Gram –ve Bacteria. Cell walls. A brief account of plasmids. Reproduction in Bacteria. Importance of Bacteria in Agriculture, Medicine and Industary.	8 hrs
5. Cyanobacteria: A general account of occurance. Thallus and ultrastructure of Cyanobacterial cell, photosynthesis and reproduction. Economic importance as bio fertilizer and as food (Single Cell Protein – SCP) Type study of Scytonema, Oscillatoria and Gloeotrichia.	9 hrs
6. Algae (Phycology) : A general account of habitat, thallus structure, pigments, plastids (including pyrenoids), reproduction, life cycle pattern and classification (based on Fritsch). Study of strucyure, reproduction and lifecycles of Volvox. Study of strucyure, reproduction and lifecycles of Oedogonium. Study of strucyure, reproduction and lifecycles of Cosmarium. Study of strucyure, reproduction and lifecycles of Chara. Study of strucyure, reproduction and lifecycles of Vaucheria. Study of strucyure, reproduction and lifecycles of Diatoms (Pinnularia). Study of strucyure, reproduction and lifecycles of Sargassum. Study of strucyure, reproduction and lifecycles of Polysiphonia. Economic importance of Algae, Algal blooms (Diatomaceous earth , Agar – Agar)	30 hrs

REFERENCES:

1. Hans G. (1993) General Microbiology Volume – I Cambridge University, Press Cambridge.
2. F. Whitcomb and J.G Turil (1978) The Mycoplasmas – III Plant and insect Mycoplasmas.

3. C.L. Mandar (1978) Introduction to plant Viruses.
4. Mathews (1981) Plant Viruses.
5. K.M. Smith (1977) Plant Viruses.
6. V. Singh, Pandey and Jain, A textbook of Botany (Algae, Fungi, Virus, Microbiology, Plant pathology, Bryophytes, Pteridophytes and Gymnosperms) Rastogi Publications, Shivaji Road, Meerut.
7. P.D. Sharma, Microbiology and Plant Pathology . Rastogi publications, Shivaji Road, Meerut.
8. B.R Vashista, Sinha, Botany for Degree Students, S. Chand and Company Ltd, Ramnagar, New Delhi.
9. B.P. Pandey, College Botany Vol - I. Chand and Company Ltd, Ram Nagar, New Delhi.
10. L.V. Venkataraman – Algal Biotechnology.

PRACTICALS:

1. Mounting Technique: Mounting of Algae in Glycerine.
2. Gram Staining of Bacteria
3. Study of Cyanobacteria – Myrocysts, Oscillatoria, Scytonema, Gloeotrichia.
4. Morphology, Structure and Reproductive parts of Algae (based on theory syllabus).
5. Study of Viral diseases of plants using local available specimens – Mosaic of Bhendi, Cucurbits, Leaf curl of Papaya, YBMV (affected Bean leaf).
6. Study of plant diseases caused by Bacteria: (Locally available specimens) Citrus canker, Black arm of Cotton.
7. Bacteria – (Types). Coccus, Bacillus, Vibrio, Type (Parmanent slids)

Note: Every student has to submit any five plant disease specimens / Algal specimens.

SCHEME OF EXAMINATION I SEM:

IQ. A. Staining of Bacteria	08 marks
IIQ. B. Cynobacteria / Cynophyceae C. Algae	08 marks
IIIQ. D. Plant viral diseases E. Plant bacterial diseases	06 marks
IVQ. F. Bacteria - type G. Bacteria - disease H. Algae I. Algae	08 marks
VQ. J. Mounting of algae	05 marks
Certified Journal	03 marks
Submission	02 marks
Total -----	40 marks
Internal assessment -----	10 marks

SCHEME OF EVALUATION I SEM:

IQ. Preparation	04 marks	} 08 marks
Procedure	02 marks	
Identification with reasons	02 marks	
IIQ. Staining and mounting	02 marks	} 04 marks
Sketch and label	01 mark	
Identification with reasons	01 mark	
IIIQ. Identification	01 mark	} 03 marks
Labelled diagrams with reasons	02 marks	
IVQ. Identification	01 marks	} 02 marks
Critical points	01 marks	
VQ. Mounting	03 marks	} 05 marks
Labelled diagrams with reasons	02 marks	
Certified Journal	03 marks	
Submission	02 marks	
Total -----	40 marks	
Internal assessment -----	10 marks	

MODEL QUESTION PAPER FOR I SEMESTER PRACTICAL EXAMINATION:

TIME -- 3 hrs

MAX MARKS -- 40

Q1. Stain and mount the given materials 'A' , write procedure and identify with reasons. 8 marks
(leave the preparation for evaluation)

Q2.Prepare the temporary stained slide 'B' & 'C', sketch, label and identify with reasons. 8 marks
(leave the preparation for evaluation)

Q3. Identify the specimen 'D' and 'E' draw labeled diagram with reasons. 6 marks

Q4. Identify and write critical notes on 'F', 'G', 'H', and 'I' . 8 marks

Q5. Mounting the micro slide with reasons 'J'. 4 marks

Q6. Certified Journal 3 marks

Q7. Submission (05 specimens- Algae/ disease plants) 2 marks

Total 40 marks

Internal assessment 10 marks

BOTANY B.Sc. SYLLABUS

SECOND SEMESTER

PAPER II: Diversity of Microbes and Non vascular plants – II (Fungi, Lichens and Plant diseases, Mushroom cultivation, Biofertilizers and Bryophytes) 60hrs

1. **Recent trends and Criteria used in the classification of Fungi (C.J Alexopoulos)** 6hrs
2. **Structure and reproduction :** 10hrs
Albugo, Aspergillus, Pencillium, Puccinia and Ceercospora.
3. **Lichens :** 5hrs
Structure and reproduction, Economic importance of Lichens.
4. **Plant pathology :** 10hrs
Symptoms, causal organisms and control of the following diseases.
Downy mildew of Bajra
Wilt disease of Pigeon pea
Grain Smut disease of Sorghum
Red rot of Sugarcane
5. **Cultivation methods of Mushroom:** 5hrs
Mushrooms production: spawn and Paddy straw polythene method of cultivation.
6. **Bacterial inoculants:**
Rhizobium and its applications.
Mycorhizal associations in plants and their applications.
7. **Use of trichoderma in disease control** 4hrs
8. **Bryophytes:** 20hrs
General characteristics, classification of Bryophytes.
Structure and reproduction of Marchantia.
Structure and reproduction of Anthoceros.
Structure and reproduction of Funaria.
Economic importance of Bryophytes.
Evolution – Gametophytes and Sporophytes.

REFERENCES :

1. Agrios G.N. Plant pathology, Academic Press 1988. San Deigo, London.
2. Alexopoulos and Mims introductory Mycology, Willey Eastern, New York 1988.
3. Rangaswamy G. 1988m Diseases of crop plants in India. Pentice Hall of Inna.
4. Chopra R.N. 1988,Biology of Bryophytes, Willey Eastern Ltd, New Delhi.

5. Gangulee & Kar 1998 Botany Vol II New Central Book Agency Kolkotta.
6. Pandey SN and Ajanta Chadda Text book of Botany Vol I, Vikram Publication house Pvt Ltd, New Delhi.
7. Mehrotra RS 1976, Pathology, Tata McGraw Hill, New Delhi.
8. Pandey B.P. Text book of Algae, Fungi, R. Nath and com Meerut
9. Vashista B.R. Bryophytes, S. Chand and Co., New Delhi 1988.
10. Watson F.V. "Structure of life of Bryophytes" Huchinson University, New Delhi. 1989.
11. Nita Bhal, "Hand book of mushrooms", Oxford / I.B.H. Publication New Delhi 1988.
12. Chang S.T. and Miles P.G "Edible Mushroom and their cultivation, CRC Press Bocaration, USA.
13. Conway LL Powell and Joseph B. V.A Mycorrhiza, C.R.C press Bocaraton, USA.
14. A Verma and B Hock "Mycorrhizae", Springer / Verlag, Berlin Heidelberg.
15. Premhuri Bryophytes- Morphology growth differentiation, Atmaam and sons, New Delhi.
16. N.S. Subarao, Biofertilizers, ICAR Pusa, New Delhi.
17. P.D. Sharma, The Fungi, Rastogi publications , Meerut.
18. B. R Vasjhista A.K. Sharma, Botany for Degree students, Fungi S. Chand and Co New Delhi.
19. B.P. Pandey "Botany B.Sc I" S. Chand and Co New Delhi.
20. Vasishtha B.R and others, Bryophytes S. Chand and Co New Delhi.
21. S.C Dey "Mushroom Growing" Agro Bios Jodhpur.

PRACTICALS:

- Study of the fungal forms mentioned in the syllabus.
- Study of plant diseases mentioned in the syllabus.
- Study of structure and reproductive parts (External and Internal) of Marchantia, Anthoceros and Funaria.
- Demonstration of cultivation of Mushrooms by Polythene method.
- Study of Rhizobium in the root nodules.
- Staining and demonstration of Vesicular and Arbuscules in Mycorrhizal roots.

SUBMISSION:

(Every student has to submit a minimum of five specimens at a time of practical examination) A Local trip of 03 days to study the live forms as per the syllabus.

SCHEME OF EXAMINATION II SEMESTER:

IQ. A ----- Fungi	12 marks
B ----- Fungi	
C ----- Lichens / Apothecium / Thallus	
D----- Bryophyta	
IIQ. E----- Plant pathology	04 marks
IIIQ. F----- Bryophyta	04 marks
IVQ. G----- Fungi / Lichens	15 marks
H----- Slide - Bryophyta	
I----- Slide / Specimen - Pathology	
J----- Question regarding Biofertilizers	
K----- Stage question regarding Mushroom	
Certified Journal	03 marks
Submission	<u>02 marks</u>
Total -----	40 marks
Internal assessment -----	10 marks

SCHEME OF EVALUATION II SEMESTER:

I.	Identification	01 mark	} 03 marks
	Classification	01 mark	
	Reasons (each)	01 mark	
II.	Identification	02 marks	} 04 marks
	Symptoms	01 mark	
	Name of causal organism	01 mark	
III.	Preparations	01 mark	} 04 marks
	Identification	02 marks	
	Reasons	01 mark	
IV.	Identification	01 mark	} 02 marks
	Reasons (each)	01 mark	
	(Fungi, Bryophytes – Reproductive structure / thallus and Apothecium of Lichens)		

Certified Journal	03 marks
Submission	<u>02 marks</u>
Total -----	40 marks
Internal assessment -----	10 marks

MODEL QUESTION PAPER FOR II SEMESTER PRACTICAL EXAMINATION:

TIME -- 3 hrs

MAX MARKS -- 40

Q1. Identify and classify A,B,C & D with distinguishing reasons of the given specimens.	12 marks
Q2. Identify the disease of the given specimen E, describe the symptoms and control of the causal organism.	4 marks
Q3. Prepare micro- preparation of the given material F, and identify giving reasons. (Show the preparation to the examiner for evaluation)	4 marks
Q4. Identify the slides / Specimen G,H,I,J and K giving reasons.	15 marks
Q6. Certified Journal	3 marks
Q7. Submission	2 marks
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	Total 40 marks
	Internal assessment 10 marks

BOTANY B.Sc. SYLLABUS

THIRD SEMESTER

PAPER III: Diversity of vascular plants (Pteridophytes, Gymnosperms and Angiosperm morphology) 60hrs

PTERIDOPHYTES:

1. General account and classification of Pteridophytes. **01hr**
2. Structure and reproduction of the following types: Lycopodium, Selaginella, Equisetum Marsilea and Adiantum (Developmental details not required). **10hrs**
3. Paleobotany, Brief account of the Geological time scale, Types and process of Fossilization. **2hrs**
4. A brief study of fossil plants – Rhynia, Lepidodendron, Calamities and Lepidocorpon (seed fossil). **4hrs**
5. Stellar evolution in Pteridophytes, Heterospority and seed habit. **9hrs**

GYMNOSPERMS:

6. General account and classification of Gymnosperms. **8hrs**
7. Structure and reproduction of – Cycas, Pinus and Gnetum (Developmental stages not required)

ANGIOSPERM MORPHOLOGY:

8. Characteristic functions and types of root system – Modification for storage, support and vital functions- (Respiratory, Photosynthetic, Haustorial and Epiphytic). **5hrs**
9. Stem – Characteristics and functions, Types of underground, Aerial and Sub- Aerial modifications. **5hrs**
Leaf – Structure and functions, types of phyllotaxy, venation, types of leaves **6hrs**
(simple and compound), modifications (stipule and leaf), insectivorous plants
(Drosera, Utricularia and Nepenthes).
10. Inflorescence- Types of inflorescence (Racemose, Cymose and special type – Cyathium, Hypanthodium and Verticillaster.) **4hrs**
11. Flowers – Bract, Calyx (variations), Corolla – (variations and aestivation), **6hrs**
Androecium – (variations), Gynoecium (variations) , Placentation and types of flowers
(Technical terms used to describe a flower).
12. Fruits – Classification and types (simple, aggregate and composite). **4hrs**

REFERENCES:

1. Singh, Panday and Jain, Pteridophyta, Gymnosperm and Paleobotany, Rastogi publication, Meerut.
2. S. Sundarajan, College Botany, Vol II, Himalaya publishing House, New Delhi.
3. AC Datta College Botany (For degree students), Manzar Khan Oxford University, Press Kolkatta.
4. Gangulee Das and Dutta – College Botany Vol- I , New central Book Agency, Kolkatta.
5. Pandey and Ajanta Chaddha A.Text Book of Botany Vol II, Vikas Publication Pvt. Ltd, New Delhi.

PRACTICALS:

- Study of morphological, anatomical and reproductive structures in Lycopodium, Selaginella, Equisetum, Marsilea and Adiantum.
- Study of fossils – Rhynia, Lepidodendron, Calamities and Lepidocarpon (slides or materials).
- Study of morphological, anatomical and reproductive features of Cycas, Pinus and Gnetum.
- Angiosperm morphology specimens of morphological interest based on theory.
- A project report on morphological (Angiosperm or Gymnosperms as herbarium or photographs) peculiarities, like calyx forms, corolla forms, stamens, Cycas male or female cones, leaves and stipule modifications.

SCHEME OF EXAMINATION:

Q1.	A ----- Pteridophyta B ----- Pteridophyta C ----- Gymnosperm	} 9 marks
QII.	D ----- Pteridophyta E ----- Gymnosperm	} 8 marks
QIII.	F ----- Pteridophyta G ----- Gymnosperm H ----- Fossil	} 6 marks
QIV.	I to L ----- Morphology (I ----- Root / Stem J ----- Leaf modifications (Simple / Compound) K ----- Flower / Inflorescence L ----- Fruit)	8 marks
QV.	M ----- Technical terms (Angiosperm twig with flower)	4 marks
	Certified Journal	3 marks
	Project report	2 marks
	Total -----	40 marks
	Internal assessment -----	10 marks

SCHEME OF VALUATION:

QI. Identification	½ marks	}	3X3=9 marks
Classification	½ marks		
Reasons (for each)	2 marks (½ marks each)		
QII. Labelled Sketch	2 marks	}	4X2=8 marks
Description(for each)	2 marks		
QIII. Identification	1 marks	}	2X3=6 marks
Comment (for each)	2 marks		
QIV. Comment (for each)	2 marks		4X2=8 marks
QV. Description (for each)	4 marks		4X1=4 mark
Certified Journal	3 marks		
Project report	2 marks		
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Total -----			40 marks
Internal assessment -----			10 marks

MODEL QUESTION PAPER FOR III SEMESTER PRACTICAL EXAMINATION:**TIME -- 3 hrs****MAX MARKS -- 40**

Q1. Identify and classify the specimen A,B and C giving reasons.	9 marks
Q2. Describe the anatomy of specimen D& E with neat labeled diagram.	8 marks
Q3. Identify and comment on the slides: F, G & H	6 marks
Q4. Identify and describe Morphological peculiarities of the Specimen I, J,K & L	8 marks
Q5. Describe the specimen M (in technical terms)	4 marks
Q6. Certified Journal	3 marks
Project report / Submission (Pteridophyte/ Gymnosperm)	2 marks
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Total	40 marks
Internal assessment	10 marks

BOTANY B.Sc. SYLLABUS

FOURTH SEMESTER

PAPER IV: Taxonomy of Angiosperms, Economic Botany and Plant genetic resource management. 60hrs

TAXONOMY:

1. Characteristic feature of Angiosperms and dominance of Angiosperms on earth. **2hrs**
2. Angiosperm – Origin and evolution – some examples of primitive angiosperms. **4hrs**
3. Botanical nomenclature, ICBN Principles and rules, taxonomic ranks, type concept, principles and rules of priority. **6hrs**
4. A brief history of taxonomy of Angiosperms. Salient features of the systems proposed by Linnaeus, Bentham and Hooker, Engler and Prantl, Artificial natural phylogenetic system of classification, Merits and demerits of above systems. **10hrs**

DIVERSITY OF FLOWERING PLANTS AS ILLUSTRATED BY THE FOLLOWING FAMILIES:

5. Dicotyledons: Brassicaceae, Malvaceae, Rutaceae, Leguminaceae (3 sub families), Myrtaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Apocynaceae, Asclepiadiaceae, Solanaceae, Acanthaceae, Verbinaceae, Lauriaceae, Amaranthaceae and Euphorbiaceae. **18hrs**
6. Monocotyledons: Cannaceae, Liliaceae, Arecaceae and poaceae. **9hrs**

ECONOMIC BOTANY:

10hrs

7. Mention Botanical names, Family, Parts used and uses (cultivation methods need not to be discussed).

Cereals and Millets – Wheat, Rice, Sorghum and Bajra.

Pulses – Pigeon pea, Bengal Gram, Black Gram and Green Gram.

Fibers – Cotton, Coir, Deccan Hemp and Agave.

Beverages – Coffee and Tea.

Spices – Cardamom, Clove, Cinnamomum, Pepper, Coriander and Mustard.

Sugar and Starch – Sugar cane, Beet root and Potato. Timber – Teak, Rose wood Babul and Acacia Arabica.

Paper and Pulp – Bamboo and Eucalyptus.

Narcotic plants – Cannabis sativa and Papaver somniferum and Opium poppy.

Medicinal Plants – Rauwolfia, Withania, Vinca, Phyllanthus, Ocimum, Mentha, Aloe and Garlic.

8.Conservation of genetic resources of economic plants.

In- Situ, Biosphere reserves, National parks, Wild life sanctuaries.

Ex – Situ Field gene banks, Seed banks, Tissue culture and cryopreservation.

Brief study of national and international organizations concerned with explanation, collection and conservation such as BSI (Botanical Survey of India), NBPGR (National Bureau of Plant Genetic Resources), CGAIR (Consultative Group for Indian Agricultural Research).

REFERENCES:

1. Bendre and Kumar, Economic Botany, Rastogi Publication, Meerut.
2. Singh and Jain, Taxonomy of Angiosperm, Rastogi Publication, Meerut .
3. Saxena and Saxena, Plant Taxonomy, Pragathi Prakashan, Meerut .
4. Plant Taxonomy by O.P. Sharma Tata Mc Graw – Hill, Economic Botany BD Pandey S. Chand & Com Ltd New Delhi.

PRACTICAL:

- Study of plant families based on local flora.
- Economic Botany of the specimens from the families studied related to their families.
- Submission of 10 Herberia local weed plants / 5 Photographs of different flowering plants studied with description.
- Study of economic important products based on theory.
- Visit to near by Forests/ Botanical Gardens, Botanical study tour is of three days is compulsory.

SCHEME OF EXAMINATION:

IQ . A to D - Polypetalae Gamopetale Apetalae and Monocot	20
IIQ. E & F - Each one flower from any one group	06
IIIQ. G to I - Each one product from any one group.	09
IVQ. Certified journal	03
Submission 10 Herberia / 5 photographs	02
Total -----	40
Internal Assessment-----	10

SCHEME OF EVALUATION:

IQ. Identification and classification	02 marks	4X5=20 marks
Important distinguishing character	03 marks	
IIQ. Floral formulae + Diagram	01+02 marks	3X2=6 marks
IIIQ. Botanical name	01 mark	3X3=9 marks
Part of economic importance	01 mark	
Uses	01 mark	
IVQ. Certified journal	03 marks	
Submission	02 marks	
		<hr/> 40 marks
	Internal assessment	10 marks

MODEL QUESTION PAPER FOR IV SEMESTER PRACTICAL EXAMINATION:

TIME -- 3 hrs

MAX MARKS -- 40

Q1. Assign the plants A,B, C, D to their respective families classification with important characters.	20 mrks	giving
Q2. Give the floral formula and Floral diagram of specimen E & F	6 marks	
Q3. Identify and mention the economic importance of specimens G, H & I.	9 marks	
Q4. Certified Journal	3 marks	
Submission 10 Herberia / 5 Photographs	2 marks	
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	Total	40 marks
	Internal assessment	10 marks

BOTANY B.Sc. SYLLABUS

FIFTH SEMESTER

PAPER – V: Internal structure, Development and Reproduction in flowering plants. 53 hrs

PLANT ANATOMY:

1. **Meristems:** General account, Classification of meristems – Origin, function, position and development. 03hrs
2. **Tissues:** General account of different permanent tissues and tissue systems. Epidermal tissue system, Ground tissue system, Vascular tissue system and Secretory tissue system – Structure of Xylem and Phloem and brief account of transfer of cells. 06 hrs
3. Anatomy of Dicot stem, root and leaf (ex: Bengal gram) 03 hrs
4. Anatomy of Monocot stem, root and leaf (ex: Grass) 03 hrs
5. Normal secondary growth in Dicot stem and root. A brief account of cambium (origin, types and function). Origin and development of lateral roots. 04 hrs
6. A brief account of anomalous secondary growth in stem – Study of anomalous secondary growth in Amaranthus, Bougainvillia and Boerhaavia (stem). 04 hrs

PLANT EMBRYOLOGY:

7. **Introduction:** Plant embryology a general account 02hrs
8. **Indian embryologists:** P. Maheshwari, B.G.L. Swamy and B.M.Johri 01 hr
9. **Anther development** – Microsporogenesis, Male gametophyte. Types and role of tapetum, ubisch bodies, pollen kit, concept of male germ unit (MGU) and brief account of Palynology. 04hrs
10. **Ovule development:** Megasporogenesis, Female gametophyte – Structure of mature embryo sac (Polygonum). Endothellum, Epistase, Hypostase. 04hrs
11. **Types of embryo sacs:** Monosporic (Polygonium), Bisporic (Allium) and Tetrasporic (Adaxa) 02hrs
12. **Types of Ovule :** Orthotropous, Anatropous, Hemianatropous, Amphitropous, Camphyotropous and Circinotropous. 02 hrs
13. **Pollination:** Self and cross Pollination, general account and Contrivances for self and cross pollination. 05hrs

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| 14. Fertilization : Double fertilization and triple fusion, porogamy, chalazogamy and misogamy. Pollen pistil interaction. | 03hrs |
| 15. Endosperm : Formation its development and types, Free nuclear, cellular and Helobial. | 02hrs |
| 16. Structure and development of dicot embryo (Cruciferae) | 02 hrs |
| 17. A brief account of Polyembryony, Apomixis and Parthenocarpy. | 03 hrs |

REFERENCES:

1. M.S. Tayal, plant anatomy, Rastogi publications, Meerut.
2. Singh, Pandey and Jain, A textbook of Botany (Angiosperm anatomy, Economic).
3. B.P. Pandey, Embryology of Angiosperm, Rastogi publication, Meerut.
4. B.P. Panday, Plant anatomy, S. Chand and Co. Ltd, Ram nagar, New Delhi.
5. Embryology of Angiosperm Bhajwani and Bhatnagar, 1998 Vikas publicatiobn, New Delhi.
6. Pandey SN and Ajanta Chaddha Plant anatomy and Embryology, Vikas publicatiobn, New Delhi.
7. P.C. Vasista, Plkant anatomy, S.Chand publishing house, New Delhi.

PRACTICALS:

ANATOMY:

- Study of root apex and shoot apex (Permanent slides only)
- Study of tissues, Parenchyma, Collenchyma, Sclerenchyma, Xylem And Phloem (Permanent slides only)
- Maceration of tissues and the observation of sclereids- types, vessels- thickening (10% Chromic acid, 10% Sulphuric acid).
- Study of Stomata and Epidermal hair of (a) Sunflower / Tridax, (b) Tomato/ Vinca/Solanum, (c) Spinach (d) Tradescantia (e) Cucurbits (f) Beetroot Or Any locally available plant.
- Anatomy of young Dicot Stem (TS) – Tridax/ Bengal gram/ Cucurbits.
- Anatomy of young Dicot root (TS) – Bengal gram
- Anatomy of young Monocot stems (TS) Grass/ Sorghum/ Bamboo.
- Anatomy of young Monocot root (TS) Grass/ Sorghum/ Bamboo.
- Anatomy of young Dicot leaf (TS) Sunflower/ Eucalyptus.
- Anatomy of young Monocot leaf (TS) Grass/ Sorghum/ Bamboo.
- Anatomy of Amaranthus stem (TS) – Sectioning.
- Anatomy of Bougainvillea stem (TS) sectioning.
- Anatomy of Boerhaavia Stem (TS) Sectioning.

EMBRYOLOGY:

- Study of anther – microsporogenesis (Permanent slides of different stages)
- Mounting of pollen grains (available flowers only) Ipomea, Vinca, Malvaceae and Legume.
- Study of Ovule – Megasporogenesis and Female gametophyte (permanent slides of different stages)
- Placentation types (Permanent slides)
- Mounting of endosperm – Cucumis/ Croton/ Radish.
- Mounting of Embryo croton/ Tridax/ Cucumis/ Crotalaria/ Cluster bean/ Chilli.
- Study of embryo development by observing Globular, heart shaped and mature dicot embryo (permanent slides)

PROJECT: Study and collection of different pollen grains/ Stomata/ Trichomes/ Secretory tissues/ nectar glands/tissues with examples (simple and complex)

NOTE: Permanent slides should be shown during regular practical wherever necessary.

MODEL QUESTION PAPER FOR V SEMESTER PRACTICAL EXAMINATION:

TIME -- 3 hrs

MAX MARKS -- 40

Q1. Prepare a temporary double stain T.S of material "A" & classify with reasons
(Leave the observation for observation) 7 marks

Q2. Macerate / mount the specimen "B", identify any two elements with labeled
sketch & give reasons/ type of stomata/ trichomes 6 marks

Q3. Mount the endosperm/ embryo of "C" sketch & label the part,
(Leave the observation for observation). 7 marks

Q4. Mount/take the T.S of the given material "D" pollen grain/polonium/placentation.
Sketch & label the parts (Leave the observation for observation). 5 marks

Q5. Identify & describe the slide "E" & "F" with reasons. 8 marks

Q6. Certified Journal 3 marks

Project Submission 2 marks

Total 40 marks

Internal assessment 10 marks

SCHEME FOR EVALUATION :

1. Preparation	03	}	07
Sketch and label	02		
Identification	01		
Reasons for identification	01		
2. Preparation	02	}	06
Sketch and label	02		
Identification	01		
Reasons for identification	01		
3. Mounting	04	}	07
Sketch and label	02		
Identification	01		
4. Mounting	03	}	05
Sketch and label	01		
Identification	01		
5. Identification	01	}	04 (each)
Description	02		
Sketch and label	01		
6. Record submission	03		
7. Project report	02		

Total	40 marks
Internal assessment	10 marks

BOTANY B.Sc. SYLLABUS

FIFTH SEMESTER

PAPER – VI: Ecology, Environmental Biology, Conservation and management of plant resources.

54 hrs

1. Concepts and components of Ecosystem – Types of Ecosystem, trophic organization, ecological pyramids. 6hrs
2. Energy flow models (food chain and food web). 2hrs
3. Cynecology E- cads and Ecotypes. 2hrs
4. Plant Succession – Xerosere, Hydrosere, Climax concept. 3hrs
5. Ecological adaptations – Hydrophytes, Xerophytes, Halophytes, Epiphytes, Parasitic angiosperms. 5hrs
6. Pollution, Air, water and soil pollution – Its definition, pollutants, effects on Plants and control. Noise pollution – Definition, effect and control. Radio active pollution – Definition, effect and control. 9hrs
7. Ozone depletion, Global warming, Acid rain and Nuclear winter. (Definition, cause and control) 2hrs
8. Activities of NEERI, IUCN, WWF, CPCB, BNHS. 3hrs
9. Remote sensing and its applications. 2hrs
10. Biological diversity – Genetic and species diversity, Endemic species, Endangered species, Hot spots, Natural forests and their importance in biodiversity and Red Data Book. 6hrs
11. Energy resources – Renewable and Non renewable energy. 2hrs
12. Phytogeography Major plant communities. 10hrs
 - A. Aquatic – Fresh water, Marine and Esturian communities.
 - B. Terrestrial – Grassland and Desert
 - C. Forest communities – Tropical rain forest, Tropical deciduous and Coniferous forest, Floristic regions of India, Vegetation of Karnataka.

REFERENCES:

1. Agarwal K.C. Biodiversity, Agro Botanical Publishers.
2. Ambasht R.S. Text Book of Plant Ecology, Students Friends Company, Varanasi.
3. Ashby M. Introduction to Plant Ecology, McMillan Co, Ltd, New York.
4. Barycha F.R., A Text Of Plant Geography, Oxford University Press, India.
5. P.K. Gupta, Methods In Environmental Analysis, Water, Soil and Air, Agro Bios, Jodhpur.
6. S.S. Purohit, Air, Environment and Pollution, Agro Bios, Jodhpur.
7. S.S Purohit and R.R. Rajan, Ecology, Environment and Pollution, Agro Bios, Jodhpur.
8. Grant, Diversity in Plant Speciation, Columbia University Press.
9. Kocher P.L. Plant Ecology, Ratan Prakashan, Mandir, Delhi Gate, Agra.
10. Paul Kollinvaux, Ecology John Willey Sons, New York.
11. Rana B.C. Pollution and Biomonitoring, Tata Mc Graw Hill, New Delhi.
12. Sharma P.A. Elements Of Ecology, Rastogi Publication, Meerut.
13. Adrian and Brison Propagation of Horticultural Plants. TATA Mc Graw Hill, Pub. Co. Ltd, New Delhi.
14. Hartman H.T. D.E. Kaster, Plant Propagation, Principles and Practices, Prentice Hall India Pvt. Ltd.
15. Rana R.S, R.K. Saxena, V. Mittel, Conservation and management of plant genetic resources, NBPGR, PUSA, New Delhi.
16. Rana R.S, Bhag Singh, M.N. Koppal, Mathura Rai, S. Kochar and S.S. Dahoor, Plant genetic resources Exploration, Evaluation, Maintenance NAGPUR, PUSA, New Delhi.
17. Rana R.S. and others, Plant genetic Resources, Ex situ conservation, NBPGR, PUSA, New Delhi.
18. O.P. Sharma (2001) Experiment and Techniques in Microbiology, Ecology and Soil science, Pollution, Bio – Chemistry, Plant Physiology, Pragathi Prakashan, Meerut.
19. S.C. Santra, T.P. Chatterji, A.P. Das, College Botany, Practical Vol. 1, Central Book Agency, Kolkatta.
20. P.D. Sharma, Environmental Biology, Rastogi Publication, Meerut.
21. R.S. Shukla and Chandel, Plant ecology and Soil science, S. Chand and Co., New Delhi.
22. P.D. Sharma, Ecology and Environment, Rastogi Publication, Meerut.
23. V.K. Agarwal and Usha Gupta Ecology (Environmental Biology) 2004, S. Chand and Company, New Delhi.
24. S.S. Purohit, ' A Text of Environmental Science', J.V. Publishing House, 322, Rai Bahdur Road, Jodhpur.
25. R.K. Trivedy and P.K. Goel, ' Chemical and Biological Methods for Water Pollution Studies', Environmental Publ., P.O. Box 60 Karad 415110 (M.S).

PRACTICALS:

1. Study of ecological adaptations – (morphological and anatomical) Hydrophytes, Xerophytes, Halophytes and Epiphytes.
2. Ecological Instruments
 - a) Anemometer
 - b) Rain Guage
 - c) Maximum Minimum Thermometer
 - d) Wet and Dry bulb Thermometer
 - e) Hygrometer
3. Analysis of water samples for pH, Chloride, CO₂, Dissolved Oxygen and total hardness.
4. Every student has to undertake a trip to near by forest at least for 3 days to study the vegetation and submit a report.
5. Visit to a pond / forest to study communities.
 - a) Photography copies

SCHEME OF EXAMINATION (VI PAPER, V SEMESTER):

QI. A – Ecology (Adaptations) Entire plant / twig. (Morphology and Anatomy)	10marks
QII. B – Written Slip for Analysis to each student.	10marks
QIII. C – Ecological Slide D – One plant / Specimen from any ecological group E – Ecological instrument F – Ecological slide	12marks
Q. IV. Project Report	3marks
Q.V. Visit / Tour report Certified Journal	2marks 3marks
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	Total 40 marks
	Internal assessment 10 marks

NOTE:

- For every spotting/ identification 05 min. time should be given.
- Alloted full marks should be given after the submission of Tour/Project/both reports. No marks should be granted for not submitting the reports.
- Weightage should be given for students seminarwhile allouting internal assement marks in theory / practicals.

SCHEME OF EVALUATION (VI PAPER):

Q1. Identification	01mark
Morphological adaptation and sketch	04marks
Anatomical peculiarities and sketch	05marks
Q2. Identification	01mark
Sketch and label	03marks
Reason	04marks
Q3. Identification	01mark
Comments	02marks
Project report	03marks
Certified journal	03marks
Tour report	02marks
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Total	40 marks
Internal assessment	10 marks

BOTANY B.Sc. SYLLABUS

VI SEMESTER

PAPER – VII:

Cytology, Genetics, Biostatics, Plant breeding, Plant propagation and Nursery Management

57 hrs

Cytology:

1. Introduction to cytology. 1hr
2. Study of ultrastructure of plant cell and organelles – cell membrane, endoplasmic reticulum, golgi bodies, mitochondria, chloroplast – structure and function. 5hrs
3. Nucleus – structure and function. 2hrs
4. Chromosomes – types, structure and functions, ultrastructure of chromosomes with special reference to the nucleosome. Giant Chromosomes – salivary gland chromosomes and lamp brush chromosomes. 4hrs
5. Chromosomal aberrations: Deletion, duplication, translocation and inversion. 4hrs
6. Numerical variation - Euploidy and Aneuploidy and its significances. 4hrs

Genetics:

1. Introduction, Mendel and his experiments on Pea. Mendel's laws of inheritance, test cross, back cross (with related problems). 4hrs
2. Modification of Mendelian ratio. 4hrs
 - a) Gene interaction – supplementary, complementary Gene, Epistasis – with suitable plant examples.
 - b) Polygenic inheritance – Ear size in maize.
 - c) Multiple alleles – Skin colour in human beings.
3. Sex determination: 3hrs
 - a) Chromosome theory of sex determination – XX – XY. Drosophilla and Mellandrium.
 - b) Sex linked inheritance – Drosophilla eye colour, hypertrichosis.
4. Linkage and crossing over mechanism in maize.(coupling and repulsion) 3hrs
5. Nucleic acids: 1hr
 - a) Structure, chemical composition and function of DNA and RNA. 3hrs
 - b) DNA replication, semiconservative 1hr
6. Genetic Code – meaning and properties, protein synthesis. 3hrs

Biostatistics (Biometry):

1. Mean, mode and median (meaning and definition) 1hr
2. Measures of variation, standard deviation, standard error and correlation, regression (only meaning and definition). 1hr
3. Chi square analysis. 1hr

Plant Breeding:

1. Introduction, objectives. 2hrs
2. Methods in plant breeding; 1hr
 - a) Mass selection
 - b) Pure line selection
 - c) Clonal selection
3. Hybridization and somatic hybridization . 2hrs
4. Heterosis and its significance. 1hr

Plant Propagation and Nursery Management:

1. Tools and materials used in propagation , importance of green house. 7hrs

2. Plant propagation – different methods of propagation – through seeds, cuttings, roots, corn, bulb, rhizome and leaves. Cuttings, layering, budding, grafting.
3. Nursery – definition, importance of nursery management, site selection, planning, budgeting, layout of nursery, preparation of nursery beds, raising of seedlings, transplanting techniques.

References:

1. Genetics – P. K. Gupta, Rastogi Publications, Meerut.
2. College Botany Vol 04 – S. Sundarajan, Himalaya Publishing House, Mumbai.
3. Cytogenetics – P. K. Gupta, Rastogi Publications, Meerut.
4. Cytology, genetics and evolution – P. K. Gupta, Rastogi Publications, Meerut.
5. Cell Biology – Singh and Tomeir, Rastogi Publications, Meerut.
6. A Text book of Cell and Molecular Biology – P. K. Gupta, Rastogi Publications, Meerut.
7. Elements of Biostatistics – Sadguru Prasad, Rastogi Publications, Meerut.
8. Nursery Management – Kulkarni
9. Indoor Gardening – G. V. Publication House, 322, Raibhadur Bazar, Jodhpur.

Practicals (Paper VII – VI Semester):

I. Cytology:

1. Study of cell division – Mitosis in onion root tips (Squash method).
2. Study of cell division – Meiosis in rheodiscolour or Allium Cepa or any available material/flower buds (Smear method).
3. Cytological technique of making (Mitosis and Meiosis) permanent slides.
4. Observation of polytene and lamp brush chromosomes (Permanent slides).
5. To conduct the micro chemical tests (cellulose, lignin, starch, protein, cutin, cystolith, raphides) procedures.

II. Genetics:

1. Genetics problems based on theory syllabus – monohybrid, dihybrid, test cross and interaction of factors.

III. Plant Reading:

1. Practice of hybridization techniques in a self pollinated and cross pollinated plants (any available plant).
2. A visit to agricultural research centre for observation and record of inter variety, inter specified integration plants.

IV. Plant Propagation:

1. Methods of plant propagation
 - a) Budding
 - b) Grafting
 - c) Gooting
 - d) Layering
 - e) Cutting

Note: Students should visit an nursery to know the techniques and submit report.

SCHEME OF EXAMINATION – PAPER VII 6TH SEMESTER

Q1. A.	Mitosis/Meiosis Root tip/ Flower bud	8
Q2. B.	Material for test	
	i) Identification	1
	ii) Procedure (Test)	4
Q3. C.	Propagation method	3
	Procedure	2
Q4. D.	Genetic Problem	5
Q5. E.	Emasculation	2
	Bagging	2
Q6. F.	Mitosis slide	2
G. & H	Meiosis Slides	4
Q7.	Report on field visit to agricultural research institute	2
	Certified Journal	5
	Total:	40
	Internal Assessment:	10

MODEL BOTANY QUESTION PAPER – VI SEMESTER (PAPER VII)

Time: 3 hour

Max. Marks: 40

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|-----|---|-----------|
| Q1. | Make a squash / smear preparation of specimen "A", identify sketch and label any two stages. (Show the preparation to the examiner) | 8 |
| Q2. | Conduct a micro chemical test of specimen "B" and identify the cell inclusion. | 5 |
| Q3. | Prepare a plant for propagation by grafting / cutting / layering / budding and explain its advantages "C" | 5 |
| Q4. | Solve the genetic problem "D" | 5 |
| Q5. | Demonstrate the techniques of hybridization in specimen "E" | 4 |
| Q6. | Identify the slide or specimen "F", "G" & "H" | 6 |
| Q7. | Report on field visit to agricultural research institute | 2 |
| | Certified Journal | 5 |
| | Total: | 40 |
| | Internal Assessment: | 10 |

BOTANY B.Sc. SYLLABUS

VI SEMESTER

PAPER – VIII:

Plant Physiology and Biotechnology

Plant Physiology	52 hour
1. Introduction to plant physiology	1 hour
2. Water source, types and importance to plant life.	1 hour
3. Physical process of water absorption - Imbibition, diffusion, osmosis, Plasmolysis water potential, D.P.D., osmotic potential, pressure potential, T.P. and W.P.	5 hour
4. Absorption of water – Absorbing regions (region of root) Mechanism of absorption – active absorption (osmotic and non-osmotic) Passive absorption (symplast and apoplast). Factors affecting water absorption	4 hour
5. Ascent of Sap – meaning, mechanism and theories. Vital theory, rythemic theory, pulsatory and root pressure theory. Physical theories – capillary force, imbibitional, atmospheric pressure, transpiration pull and cohesive force theory.	4 hour
6. Transpiration – definition, types, structure of stomatal apparatus. Mechanism of opening and closing of stomata. Theories – Photosynthesis theory, Starch and sugar inter conversion theory, active proton or K^+ , transport concept. Factors affecting the process of transpiration (external and internal) Significance of transpiration. Guttation – definition and structure of Hydathode	6 hour
7. Mineral absorption – passive absorption, ion exchange, Donnan's equilibrium. Active absorption – carrier concept, Landgrath's theory, Protien Leacithin theory.	4 hour
8. Enzymes – Nomenclature, classification and mode of action.	3 hour
9. Photosynthesis – Introduction, significance, structure and function of chloroplast. Quantosomes, Pigment System, Solar spectrum and its importance. Mechanism of photosynthesis – Light reaction, cyclic and non-cyclic photophosphorylation. Dark reaction – C_3 , C_4 cycle. Factors affecting photosynthesis	7 hour
10. Respiration – Introduction, definition, types of respiration (aerobic and anaerobic). Mechanism of glycolysis, Kreb's cycle and terminal oxidation.	7 hour

Anaerobic – Alcoholic and acidic fermentation.

Factors affecting respiration (internal and external). RQ

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|-----|--|--------|
| 11. | Growth hormones – Auxins, Gibberellins, Cytokinins, ABA and Ethylene – their role in growth and applications (experimental study not necessary). | 3 hour |
| 12. | Translocation of organic solutes – Cytoplasmic streaming and Münch's mass flow hypothesis | 2 hour |
| 13. | Photoperiodism and Vernalization – Introduction, types of plants (long day, short day and day neutral).
Importance of photoperiodism, Vernalization (Introduction and mechanism). | 3 hour |
| 14. | Movements – Tropic movements | 2 hour |

Biotechnology

7 hour

1. Introduction and scope
2. Tissue culture – Plant tissue culture (major and minor elements)
Growth regulators and other additives.
Induction and maintenance of callus culture and organogenesis
3. Recombinant DNA technology – Introduction, construction of r-DNA, plasmids with special reference to PBR₃₂₂, agrobacterium mediated gene transformation, transgenic plants (BT cotton and Golden rice).

References:

1. Elements of Biotechnology by P. K. Gupta, Rastogi Publications, Meerut.
2. Fundamentals of Plant Physiology by V. K. Jain, S. Chand & Co. New Delhi.
3. Plant Physiology by P. S. Gill, S. Chand & Co., New Delhi.
4. Plant Physiology by H. Srivatsav, S. Chand & Co., New Delhi.
5. Plant physiology by Pandey S. N. & Ajantha Chandha, Vikas Publications Private Limited, New Delhi
6. Plant Physiology by Verma V. , Emkay Publications, New Delhi.
7. Plant Biotechnology by D. C. Dubey, S. Chand & Co., Ramnagar, New Delhi.

Practicals:

Physiology Experiments:

1. Diffusion – Diffusion of solid into liquid (minor)
2. Osmosis – Physical and physiological – Endosmosis and Exosmosis (minor).
3. Plasmolysis and Deplasmolysis – In cells of Rheo discolour leaf.
4. Imbibition – Imbibition process (minor)
– Imbibition pressure
5. Absorption of water – To show passive absorption by showing relationship between absorption and transpiration.
6. Ascent of Sap:
 - a) To show ascent of Sap by Balsam plant and in a fresh plant twig (minor).
 - b) To show root pressure.
 - c) To show suction due to transpiration.
7. Translocation of solutes:
 - a) Girdle Experiment – Phloem as food translocation tissue.

- b) Girdle Experiment –Xylem as conducting tissue.
8. Transpiration:
- a) Experiment to show transpiration by polythene bag (minor).
 - b) Ganong's and Former's Photometer
 - c) Four leaf and CaCl_2
 - d) Effect of wind velocity on transpiration.
 - e) Guttation to be observed (minor).
9. Photosynthesis:
- a) Evolution of oxygen (minor).
 - b) Effect of quality of light on photosynthesis.
 - c) Effect of CO_2 concentration on photosynthesis.
 - d) Light is essential for photosynthesis (minor).
 - e) CO_2 is essential for photosynthesis.
 - f) Chlorophyll separation by paper chromatography method.
 - g) Chlorophyll is necessary for photosynthesis (minor). (with starch test)
10. Respiration:
- a) Aerobic respiration – Evolution of CO_2
 - b) Anaerobic respiration.
 - c) Alcoholic fermentation – Kunhe's tube (minor)
 - d) Measurement of R.Q. comparison
 - e) Rise of heat during respiration (minor)
11. Growth: Arc Auxonometer
12. Plant growth movements:
- a) Phototropism
 - b) Geotropism
 - c) Hydrotropism
 - d) Thigmotropism (minor)
 - e) Clenostat (minor)

Note: Students should visit nearby tissue culture laboratory.

SCHEME OF EXAMINATION – PAPER VIII 6TH SEMESTER

Q1. A.	Major experiment	9
Q2. B.	Minor experiment	6
Q3. C.	Procedure writing	3
Q4.	(Minor Experiments)	15
	D. Water relation/transpiration	
	E. Ascent of Sap	
	F. Photosynthesis	
	G. Respiration	
	H. Growth	
	(One experiment from each group)	
Q5.	Visit to tissue culture lab report	2
	Certified Journal	5
		Total: 40
		Internal Assessment: 10

MODEL BOTANY QUESTION PAPER – VI SEMESTER (PAPER VIII)

Time: 3 hour

Max. Marks: 40

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|-----|---|----|
| Q1. | Setup physiology experiment "A" the conclusion with diagram and show to the examiner (major) | 10 |
| Q2. | Setup physiology experiment "B". Write the diagram, observation and conclusion.
Show to the examiner (minor) | 7 |
| Q3. | Procedure of the inoculation technique/write MS media preparation procedure | 3 |
| Q4. | Identify and comment on the physiological experiment "D", "E", "F", "G" & "H" | 15 |
| Q5. | Submission of report | 2 |
| | Certified Journal | 3 |

Total: 40

Internal Assessment: 10