SYLLABUS

FACULTY OF SCIENCE

M.Sc. BOTANY
(Semester Program)

M.Sc. (PREVIOUS) EXAMINATION, 2024-25
M.Sc. (FINAL) EXAMINATION, 2025-26

POST GRADUATE STUDIES IN BOTANY
(Semester Program) 2024-2026

POST- GRADUTE COURSE: A DESCRIPTION

The academic program at M.Sc. level is through a semester examination scheme. The course work includes lectures, seminars and laboratory works. It shall be compulsory for all students to attend at least one long distance excursion for field study and for collection of plant materials for class work in addition to 3 to 4 local excursions.
The full course is of FOUR SEMESTERS spread for TWO YEARS duration. A semester-wise list of courses to be offered is given below:

SEMESTER I
Bot 101. Phycology and Microbiology
Bot 102. Diversity of Bryophytes and Pteridophytes
Bot 103. Plant Ecology, Phytogeography and Environmental Monitoring
Bot 104. Biochemistry and Plant Metabolism
Practicals. Ist Practical: Bot 101 & Bot 104. IInd Practical: Bot 102 & Bot 103

SEMESTER II
Bot 201. Mycology and Plant Pathology
Bot 202. Gymnosperms and Palaeobotany
Bot 203. Plant Resource Utilization Ethnobotany
Bot 204. Plant Physiology
Practicals. Ist Practical: Bot 201 & Bot 204. IInd Practical: Bot 202 & Bot 203

SEMESTER III
Bot 301. Angiosperms: Taxonomy and Diversity of Seed Plants
Bot 302. Genetics, Plant Breeding and Biometry
Practicals. Bot 301 & Bot 302

ELECTIVE PAPERS: ANY TWO PAPERS FROM THE SAME GROUP
Bot 303A. Advanced Plant Pathology - I
Bot 304A. Advanced Plant Pathology – II
Bot 303B. Advanced Plant Ecology - I
Bot 304B. Advanced Plant Ecology – II
Bot 303C. Advanced Plant Physiology- I
Bot 304C. Advanced Plant Physiology - II
Bot 303D. Advanced Plant Biotechnology- I
Bot 304D. Advanced Plant Biotechnology- II
Practicals. Bot 303 & Bot 304

SEMESTER IV

Bot 401. Plant Development and Reproduction Biology
Bot 402. Molecular Biology and Biotechnology
Practicals. Bot 401 & Bot 402

ELECTIVE PAPERS: ANY TWO PAPERS FROM THE SAME GROUP

Bot 403A. Advanced Plant Pathology - I
Bot 404A. Advanced Plant Pathology – II
Bot 403B. Advanced Plant Ecology - I
Bot 404B. Advanced Plant Ecology – II
Bot 403C. Advanced Plant Physiology- I
Bot 404C. Advanced Plant Physiology - II
Bot 403D. Advanced Plant Biotechnology- I
Bot 404D. Advanced Plant Biotechnology- II
Practicals. Bot 403 & Bot 404

M. Sc. Previous: 2024-25

(First Two Semesters: I & II)

Total Marks of M. Sc. Previous (Two Semesters) = 1200 (800 Theory + 400 Practicals)
Four papers of three hours duration in each Semester.
Total Marks of each Semester in M. Sc. Previous = 600 (400 Theory+200 Practicals)
Four theory papers of three hours duration:
Maximum Marks of each paper = 100 (20 Internal assessments & 80 Written exam.)
Minimum Passing Marks of each Paper = 25 (05 Internal assessments & 20 Written exam.)
Total Passing Marks of all four papers = for promotion 25% marks is needed in a paper with aggregate 36% in all papers.
Max. Marks of Practical = 200 of each Semester
Semester I: I Practical includes Paper-Bot 101 and Bot 104 of Maximum 100 marks (20 internal assessments & 80 practical exam.).
II Practical includes Paper- Bot 102 and Bot 103 of Maximum 100 marks (20 internal assessments & 80 practical exam.).
Minimum Passing Marks = 36 (08 Internal assessments & 28 Written exam.).
Semester II: I Practical include Paper-Bot 201 and Bot 204 of Max. 100 mark (20 internal assessments & 80 practical exam.).
II Practical includes Paper- Bot 202 and Bot 203 of Maximum 100 marks (20 internal assessments & 80 practical exam.).
Minimum Passing Marks= 36 (08 Internal assessments & 28 Written exam.)
Duration of each practical = 4 hours

PATTERN OF THEORY PAPER

Each paper is divided into 3 Sections

Section A: - Consists of 10 compulsory Questions of 2 (two) marks each. Word limits: Max 50 words.

Instruction for Examiner- Maximum 2 from each unit (10X2=20)

Section B :- Consists of 5 Questions of 6 (six) marks each with internal choice. Students are required to attempt all five questions. Word limits: Max 200 words.

Instruction for Examiner - Maximum 2 from each unit (5X6=30)

Section C: - Consists of 5 Essay type Questions of 10 (ten) marks each. Students are required to attempt any 3 questions from out of five. Word limits: Max 500 words.

Instruction for Examiner - Maximum one from each unit (3X10=30)

TEACHING AND EXAMINATION SCHEME

Per Semester

Course	Periods/Week	Examination hours	IA	WE	Total
Theory Papers					
Course I	4	3	20	80	100
Course II	4	3	20	80	100
Course III	4	3	20	80	100
Course IV	4	3	20	80	100
Practical Courses					
Board I	6 per paper	4	20	80	100
Board II	6 per paper	4	20	80	100

(IA= Internal Assessments; WE= Written Exam)

SEMESTER - I

PAPER- Bot 101: PHYCOLOGY AND MICROBIOLOGY

3 Hrs 100 Marks

UNIT I

Phycology: Algae in diversified habitats (terrestrial, fresh water, marine); Range of thallus organization, cell structure, reproduction, sexuality in Algae. Criteria for classification of Algae: pigments, reserve food & flagella. Major classifications up to orders.

UNIT II

Salient features of Protochlorophyta, Chlorophyta, Charophyta, Xanthophyta, Phaeophyta, Rhodophyta and Cyanophyta with reference to following genera:—

Cyanophyta: *Anabaena, Rivularia*

Chlorophyta: *Nitella, Bulbochaete, Closterium, Acetabularia*.

Xanthophyta: *Botrydium.*

Phaeophyta: *Sargassum.*

Rhodophyta: *Ceramium.*

UNIT- III

General characteristics of Euglenophyta, Dinophyta, Bacillariophyta, Chrysophyta and Cryptophyta. Cyanobacteria: Salient features and biological importance.

Nitrogen fixation in Algae, algal biofertilizers & algal blooms. Economic importance of algae with special reference to food, feed and major uses in industry.

UNIT - IV

Microbiology: Archaebacteria and Eubacteria: General account, ultra structure, nutrition, reproduction, biology and economic importance.

General account of immunology, types of immunity, allergy and its types, properties of antigens and antibodies, serology, brief account of biofilms & biosensors.

UNIT - V

Viruses: Characteristics and ultra structure of virions, chemical nature, replication, transmission and economic importance. **Phytoplasma**: general characteristics and role in causing plant diseases. Viroids and Prions.

Reference Books:

1. An introduction to Algae – Morris, Cambridge Univ. Press, U.K.
2. Introductory Phycology – H.D. Kumar, Affiliated East West Press Ltd., New Delhi.
3. Phycotalk Vol. I and II - H. D. Kumar Rastogi Publ., Meerut.
4. Recent Advances in Phycology - H.D. Kumar Rastogi Publ., Meerut.
5. Aquatic Biology in India - Kachroo P. Bishan S. MahendraPal Singh, Dehradoon
6. The structure and reproduction in the Algae –Vol. I & II, F.E. Fritsch, Cambridge, Uni. Press.
7. Cryptogamic Botany –Vol. I , G.M. Smith,Tata Mac Graw Hill Publication ,New Delhi.
8. Advances in Phycology— edited by B.N. Verma, APC PublicationIndia.
9. Phaeophyceae in India –J.N. Mishra, ICAR Publication ,New Delhi.
10. Sea weeds and their uses –V.J.Chapman
11. Microbiology and Pathology – S.S. Purohit, Agro Bot. Jodhpur.
12. Microbiology – Palezar, Chand and King, McGraw Hills, London.

PAPER- Bot 102: DIVERSITY OF BRYOPHYTES AND PTERIDOPHYTES

3 Hrs 100 Marks

UNIT- I

Bryophytes: Origin of Bryophytes (including fossil record), primitive versus advanced features, evolutionary lines, classification. Study of gametophytes and sporophytes of liverworts: *Takakia*, *Calobryum*, *Sphaerocarpus*, *Porella* and *Marchantia*.

UNIT II

Study of gametophytes and sporophytes of Anthocerotales, Sphagnales, Andreales and Bryales with reference to following genera: *Anthoceros*, *Notothylas*, *Sphagnum*, *Andreaea* and *Busxbaumia*.

UNIT- III

Economic importance of Bryophytes with special reference to ecology, pollution indicators and monitoring, geobotanical prospects.

Pteridophytes: General features, alternation of generation, Apomicitic life cycle: Apogamy, apospory & vegetative apomixis. Evolution of stele, Heterospory and seed habit.

UNIT- IV

Systematics, Reproduction and Phylogeny of the following:

Rhyniopsida: *Rhynia, Horneophyton*

Psilopsida: *Tmesipteris, Psilotum*

Lycopsida *lsoetes, Lepidodendron,*

Sphenopsida: *Sphenophyllum, Equisetum*

UNIT- V

Brief account and life cycle of the following:

Pteropsida: *Ophioglossum*

Osmundales: *Osmunda*

Gleicheniales: *Gleichenia*

Salviniales: *Salvinia.*

Soral evolution, Telome concept.

Reference Books:

1. Economic importance of G ymnosperms & Bryophyta – N.S.Parihar, Central Book Depot, Allahabad.
2. Bryophyta – N.S. Parihar, Central Book Depot, Allahabad.
3. Biology and Morphology of Pteridophytes, N.S. Parihar, Central Book Depot, Allahabad.
4. Bryophytes – P. Puri , Atma Ram & Sons, Delhi.
5. The Morphology of Pteridophytes – Sporne, B.I. Publishing Pvt.Ltd. Bombay.
6. The interrelationships of the Bryophyta-Frank Cavers,Folk stone, Kent England.
7. Cryptogamic Botany Vo. I and II - Smith McGraw Hill BookComp., New York.
8. An introduction to Pteridophyta -A. Rashid, Vikas Publ. House,New Delhi.

PAPER-Bot 103: PLANT ECOLOGY, PHYTOGEOGRAPHY AND ENVIRONMENTAL MONITORING

3Hrs 100 Marks

UNIT- I

Introduction of ecology, ecosystem (composition, structure), habitat and ecological niches.

Functions of Ecosystem: Trophic structure, food chain, food web, energy flow, ecological pyramids. Ecosystem productivity and its measurement, Biogeochemical cycles.

UNIT- II

Plant succession: Causes, process, types.

Community structure, development and characters (analytical and synthetic).

Ecological adaptations: Morphological, anatomical and physiological adaptations in hydrophytes, xerophytes and halophytes.

UNIT- III

Pollution: Sources, causes and control of air, water, soil & noise pollution. Effect of environmental pollution on plants, animals and human beings. Environmental impact assessment (EIA).

UNIT- IV

Phytogeography: Plant dispersal and migration. Continuous and discontinuous distribution of plants and geographical barriers. Types and areas of natural distribution, factors affecting distribution. Plant indicators.

Phytogeography of India and Rajasthan: Major habitats, vegetation types.

Major type of biomes and their characteristics.

UNIT- V

Brief account of the following: Afforestation and people's involvement, Social Forestry, Agro forestry, Silvipastures and Wind Breaks. Natural Resources and wildlife resources and their management. Endangered plants and their conservation: National Parks, Wild Life Sanctuaries, Biosphere Reserves and Green Belt. Wild LifePreservation Act (1972) and Indian Forest Conservation Act. (1980). InternationalBiological Programme (IBP), Man and Biosphere (MAB), InternationalUnion for Conservation of Nature and Natural Resources (IUCN) and UnitedNations Environmental

Programme (UNEP).

Reference Books:

1. *Concepts in Indian Ecology* - David N. Sen, Vishal Publishing Co., Jalandhar.
2. Ecology and Field Biology - R.L. Smith, Harper Collins, New York
3. Fundamentals of Ecology - Odum, Saunders, Philadelphia
4. Basic Ecology— Odum, Saunders, Philadelphia.
5. Ecology, Principles and Applications. Chapman and Reiss, Cambridge Univ. Press, Cambridge, U.K.
6. Concepts of Ecology - Kermondy, Prentice Hall of India Pvt. Ltd., New Delhi.
7. Modern Concepts of Ecology - H.D. Kumar,Vikas Publishing House.
8. Aims and Methods of Vegetation Ecology-Muller Dombois and Ellenberg.
9. Ecology- Ambushta,CBS Publication.
10. Global Environmental agreements- Asha Joshi,Gunilla Reisch Pub.
11. Forest Ecology in India- Neena Ambre, Foundation Books.

PAPER- Bot 104: BIOCHEMISTRY AND PLANT METABOLISM

3 Hrs 100 Marks

UNIT-I

Carbohydrates: Occurrence, classification, structure and functions of monosaccharides, oligosaccharides, polysaccharides (starch, cellulose, pectin and chitin).

Lipids: Structure, biosynthesis, α and β oxidations. Glyoxylate cycle.

UNIT-II

Amino acids: Structure, classification and properties.

Proteins: Occurrence, properties, structure (primary, secondary, tertiary and quaternary) and functions. Chemical bonds involved in protein structure.

Enzymes: Structure, properties, enzyme kinetics, nomenclature and classification, mode of action, factors affecting enzyme activity; Coenzymes, allosteric enzymes, isozymes.

UNIT-III

Photosynthesis: Composition and characterization of photo systems I and II; electron flow through cyclic and non-cyclic photophosphorylation.

Carbon reaction of photosynthesis: C_3, C_4 and CAM pathway.

Photorespiration: Mechanism and significance.

UNIT–IV

Bioenergetics: Laws of thermodynamics, concept of free energy, entropy and enthalpy, Energy Coupled Reactions, Structure of ATP and other high energy molecules.

Respiration: Types of respiratory substrates and their utilization in respiration. Glycolysis, TCA cycle and oxidative photophosphorylation, Chemiosmotic regeneration of ATP.

UNIT-V

Tools and techniques: Principle and applications of spectrophotometry and chromatography (adsorption, partition, ion exchange, gel filtration, paper, column, gas liquid and HPLC).

Reference Books:

1. Plant metabolism Dennis, Turpin, Lefebure and Layzell, LongmanEssex, England.
2. Biochemistry and Physiology of Plant Hormones Moore, Springer Verlag, New York, U.S.A.
3. Biochemistry. Lubert Stryer, W.H. Freeman and Comp., New York.
4. A Text book of Plant Physiology and Biochemistry, S.K. Verma, S. Chand & Comp., New Delhi.
5. Plant Biochemistry - Bonner and Varner, Academic Press, New York.
6. Biochemistry –Lehringer, Freman & Co. Ltd.
7. Biochemistry –A.K.Bery, Plant Biochemistry –edited P.M. Dey J.B.Harborne, AcademicPress, New York.

PRACTICAL MARKING SCHEME: SEMESTER I

I Practical (Paper- Bot 101 and Bot 104)

Time 4 hours Max. Marks 100

(20 internal assessments & 80 practical exams.)

Minimum Passing Marks=36 (08 Internal assessment & 28 Written exam.)

1. Phycology	10
2. Microbiology	10
3. Plant Biochemistry	
(a) Major	14
(b) Minor	6
4. Spot (6): Three-Paper-Bot 101 Three-Paper-Bot 104	24

5. *Viva-voce*	8
6. Records	8
7. Internal assessments (Excursion Report/ Seminar/ Regularity/Discipline/Term Test)	20
Total	**100**

(Practical exercises will be based on theory papers)

II Practical (Paper- Bot 102 and Bot 103)

Time 4 hours Max. Marks 100

(20 internal assessments & 80 practical exams.)

Minimum Passing Marks=36 (08 Internal assessments & 28 Written exam.)

1. Bryophytes	10
2. Pteridophytes	10
3. Ecology(Field study-Quantitative and Analytical characters)	8
4.Ecological Anatomy-Adaptation	6
5. Phytogeography India/World	6
6. Spot (6) Three-Paper-Bot 102 Three-Paper-Bot 103	24
7. *Viva-voce*	8
8. Records	8
9. Internal assessments (Excursion Report/ Seminar/Regularity/ Discipline/Term Test)	20
Total	**100**

(Practical exercises will be based on theory papers)

SEMESTER - II

PAPER- Bot201: MYCOLOGY AND PLANT PATHOLOGY

3 Hrs. 1000 Marks

UNIT- I

Mycology: Introduction, scope and general principles of classification of fungi. Heterothallism, Heterokayrosis and Parasexual cycle.

Role of fungi in industries with reference to production of alcohol, organic acids,

antibiotics, food and fodder. Fungi as biocontrol agents. Mushroom cultivation, Mycorrhiza application in agriculture and plant growth.

UNIT- II

Comparative study of following sub-divisions:

1. Plasmodiogymnomycotina: *Physarum*
2. Haplomastigomycotina: *Synchytrium*
3. Diplomastigomycotina: *Peronospora*
4. Zygomycotina: *Pilobolus*
5. Ascomycotina: *Chaetomium*
6. Basidiomycotina: *Puccinia*
7. Deuteromycotina: *Fusarium*

UNIT- III

Plant Pathology: Symptomatology and identification of diseases with reference to fungal, bacterial and viral infections. Disease control by physical, chemical and biological methods, resistant varieties, IPM (Integrated Pest Management). Crop rotations & plant quarantine.

UNIT- IV

Etiology and control of the following crop diseases:

Late blight of potato, Green ear disease of bajra, Downy mildew of grapes.

Peach leaf curl, Powdery mildew of cucurbits, Ergot of cereals.

Black stem rust of wheat, Rust of linseed, Loose smut of wheat, Smut of bajra.

UNIT- V

Etiology and control of the following crop diseases:

Early blight of potato, Tikka disease of groundnut, Red rot of sugarcane, Wilt of cotton. Citrus canker, Bacterial blight of rice, Tundu disease of wheat, Angular leaf spot of cotton.

Mosaic of tomato and tobacco, Yellow vein mosaic of bhindi, bunchy top of banana.

Reference Books:

1. Introductory Mycology – Alexopolus, John Wiley and Sons Ind.
2. An Introduction to Mycology – Mehrotra and Aneja, New Age Intermediate Press.
3. Introduction to Fungi – Webster, Cambridge Univ. Press.
4. Diseases of India – Rangaswami and Mahadevan, Prentice Hall ofIndia Pvt. Ltd., New Delhi.
5. Plant Diseases - R.S. Singh, Oxford and IBH Publishing.
6. Plant Pathology – Agrios, Academic Press, London.

7. Plant Pathology – Mehrotra, Tata McGraw Hill, New Delhi.
8. Microbiology and Pathology – P.D. Sharma, Rastogi Publication,Meerut.
9. Fundamentals of Plant Pathology – V.N. Pathak Agro Botanica,Jodhpur.
10. A text book of modern Plant Pathology – Bilgrami and Dubey, Vikas Publication, New Delhi.

PAPER- Bot 202: GYMNOPERMS AND PALAEOBOTANY

3 Hrs. 100 Marks

UNIT- I

Gymnosperms: General account, classification of gymnosperms.

Morphology, anatomy, reproduction and interrelationship of:

Pteriodospermales: *Glossopteris*, Bennettitales: *Cycadioidea, Williamsonia.*

Pentoxylales: General account.

UNIT- II

General account, morphology, anatomy, reproduction and phylogenetic position of:

Cycadales: *Cycas*, Ginkgoales: *Ginkgo*, Coniferales: *Pinus* and Taxales: *Taxus*.

UNIT- III

General account, morphology, anatomy, reproduction and phylogenetic position of:

Ephedrales: *Ephedra*, Welwitschiales: *Welwitschia*, Gnetales: *Gnetum*.

UNIT- IV

Palaeobotany: Types of fossils, process of fossilization, techniques to study fossils. Applied aspects of palaeobotany.

UNIT- V

Geological time scale, Distribution of living and fossil Gymnosperms in India. Origin and evolution of Gymnosperms.

Economic importance of Gymnosperms.

Reference Books:

1. Economic importance of G ymnosperms & Bryophyta – N.S. Parihar, Central Book Depot, Allahabad.
2. Paleobotany and the evolution of Plants – Stewart and RothWell, Cambridge Univ. Press.
3. Gymnosperms –Bhatnagar and Moitra, New Age

International Pvt. Ltd., New Delhi.
4. Gymnosperms – O.P. Sharma, Pragati Prakshan, Meerut.
5. Morphology of Gymnosperms – Coulter and Chamberlain,Central Book Depot., Allahabad.
6. Gymnosperms: Structure and Evolution - C.J. ChamberlainDover Pub., New York.
7. Paleobotany and Plant evolution- Iqbal Hussain ABD Publ., Jaipur.

PAPER- Bot 203: PLANT RESOURCE UTILIZATION AND ETHNOBOTANY

3Hrs. 100 Marks

UNIT- I

Origin, history and cultivation of:

Cereals: Wheat, Maize, Rice, Barley, Bajra.

Legumes: Gram, Pea, Pigeon pea, Lentil, Moong bean.

Nuts: Cashew nut, Almond, Walnut.

UNIT- II

Origin, history and cultivation of:

Vegetables: Carrot, Radish, Potato, Onion, Cauliflower, Cucumbers, Tomato.

Fruits: Apple, Grapes, Mango, Banana, Guava, Papaya, Pineapple.

Beverages: Coffee, Tea, Cocoa.

UNIT- III

A general account of following:

Spices and Condiments: Ginger, Turmeric, Cinnamon, Clove, Saffron, Capsicum, Pepper, Fennel, Cumin, Coriander, Cardamom.
Fats and Oils: Mustard, Sesame, Groundnut, Coconut, Soybean, Sunflower.
Fibres: Jute, Cotton, Flex, Hemp.
Timber plants: Teak, Sal, Shisham, Deodar, Pine.

UNIT- IV

A general account of following:

Medicinal Plants: Rauwolfia, Quinine, Opium, Ephedrine, Belladona, Ocimum, Convolvulus, Adhatoda, Aloe, Azadirachta, Balanites.

Industrial Plants: Tannins and dyes, Rubber and other latex products, Gums and resins, Sugar and starch.

Wood Conversion products: Paper, Rayon, Plastic, Cork.

UNIT- V

Ethnobotany: Introduction, history, aims, objectives and scope.

Methods of study of ethnobotany. Ethnobotany of Rajasthan and India.

Ethnic groups of Rajasthan, major tribes and their life styles. Sacred groves and plants used in rituals. Shifting cultivation and consequential damage to forest ecosystem.

Reference Books:

1. Economic Botany- Hill, Mac Graw Hill Book Comp.
2. Economic Botany- Pandey, S. Chand and Com., New Delhi.
3. Sharma, O.P. 1996. Hill's Economic Botany (Late Dr. A.F. Hill, adapted by O.P. Sharma). Tata McGraw Hill Co. Ltd., New Delhi.
4. Kochar, S.L. 1998. Economic Botany of the Tropics, 2nd edition, Macmillan India Ltd., Delhi.
5. Ethnobotany of India, 5-Volume Set, (eds.) T. Pullaiah, K. V. Krishnamurthy & Bir Bahadur. Apple Academic Press.
6. Manual of Ethnobotany, 2nd Revised Edition (2010) by S.K. JAIN (Author). Scientific Publishers.
7. Pimentel, D. and Hall, C.W. (eds) 1989. Food and Natural Resources, Academic Press, London-New York.
8. Wagner, H., Hikino, H. and Famswarth, N. 1989. Economic and Medicinal Plant Research, Vols. 1-3, Academic Press, London.

PAPER- Bot 204: PLANT PHYSIOLOGY

3 Hrs. 100 Marks

UNIT-I

Plant Water relations: Water potential and its components, Intercellular water transport, bulk movement of water. Soil Plant Atmosphere Continuum (SPAC). Stomatal regulation of transpiration, anti-transpirants, internal water deficit and its physiological implications.

UNIT-II

Uptake of minerals: Active and passive uptake of minerals, Donnan's equilibrium, cytochrome pump mechanism and carrier hypothesis, role of calmodulin. Importance of foliar nutrition and use of chelates. Solute transport.

UNIT-III

Nitrogen Metabolism: Sources of nitrogen to plants. N_2 cycle, biological nitrogen fixation, nitrate reduction, reductive amination and transamination.

UNIT- IV

Growth: Growth kinetics. Plant movements.

Growth Regulators: Auxins, Gibberellins, Cytokinins, Abscisic acid and

ethylene- discovery, chemical nature, biosynthesis, bioassay, physiological effects and mode of action.

UNIT-V

Physiology of Flowering: Photoperiodism and role of phytochrome in flowering, vernalisation.

Seed dormancy and germination, fruit ripening.

Circadian rhythms, physiology of senescence and ageing, programmed cell death.

Reference Books:

1. Introduction to Plant Physiology - Hopkins, John Wiley and Sons, NewYork, USA.
2. Plant Physiology. Salisbury and Ross, Wadsworth Publ. Co.,California, USA.
3. Plant Physiology Taiz and Zeiger, Sinauer Associates, Inc Pub. Massachusetts, USA.
4. Biochemistry and Physiology of Plant Hormones Moore, SpringerVerlag, New York, U.S.A.
5. Plant Physiology, Devlin. Yan Nostrand Reinhold Comp. New York. Affiliated East West Press Pvt. Ltd., New Delhi.
6. Plant Physiology C.P. Malik, Kalyani Publishers, New Delhi.
7. A Text book of Plant Physiology and Biochemistry, S.K. Verma, S.Chand & Comp., New Delhi.
8. Physiology of Plant Growth and Development. Edited M.B. Wilkins McGraw Hill, London.
9. Introduction to Plant Physiology - G.R. Noogle & G.J. Fritz PrenticeHall of India Pvt. Ltd., New Delhi.
10. Introduction to Plant Physiology. Mayer, Anderson, Bohning,Frantianne D.Van Nostrand Camp.

PRACTICAL MARKING SCHEME: SEMESTER II

I Practical (Paper- Bot 201 and Bot 204)

Time 4 hours Max. Marks 100

(20 internal assessments & 80 practical exams.)

Minimum Passing Marks=36 (8 Internal assessments & 28 Written exam.)

1. Mycology	10
2. Plant Pathology	10
3. Plant Physiology	
(a) Major	14
(b) Minor	6
4. Spot (6) Three – Paper Bot 201 Three – Paper Bot 204	24
5. *Viva-voce*	8
6. Records	8
7. Internal assessments (Excursion Report/ Seminar/Regularity/ Discipline/Term Test)	20
Total	**100**

(Practical exercises will be based on theory papers)

II Practical (Paper- Bot 202 and Bot 203)

Time 4 hours Max. Marks 100

(20 internal assessments & 80 practical exams.)

Minimum Passing Marks=36 (08 Internal assessments & 28 Written exam.)

1. Gymnosperms	12
2. Palaeobotany	8
3. Economic Botany	12
4. Ethnobotany	8
5. Spot (6) Three-Paper – Bot 202 Three-Paper – Bot 203	24
6. *Viva-voce*	8
7. Records	8
8. Internal assessments (Excursion Report/ Seminar/Regularity/ Discipline/Term Test)	20
Total	**100**

(Practical exercises will be based on the theory papers)

M. Sc. Final: 2025-26

(Two Semesters: III & IV)

Total Marks of M. Sc. Final = 1200 (800 Theory+400 Practical)
Four papers of three hours duration.
Maximum Marks of each paper = 100 (20 Internal assessments & 80 Written exam.)
Minimum Passing Marks of each Paper = 25 (05 Internal assessments & 20 Written exam.)
Total Passing Marks of all four papers = For promotion 25% marks is needed in a paper with aggregate 36% in all papers.

Max. Marks of Practical =200 of each Semester

Semester III: I Practical include Paper-Bot 301 and Bot 302 of Maximum 100 marks (20 internal assessments & 80 practical exam.).
II Practical includes Paper- Bot 303 and Bot 304 of Maximum 100 marks (20 internal assessments & 80 practical exam.).
Minimum Passing Marks= 36 (08 Internal assessments & 28 Written exam.).
Semester II: I Practical include Paper-Bot 401 and Bot 402 of Maximum 100 mark (20 internal assessments & 80 practical exam.).
II Practical includes Paper- Bot 403 and Bot 404 of Maximum 100 marks (20 internal assessments & 80 practical exam.).
Minimum Passing Marks=36 (08 Internal assessments & 28 Written exam.)
Duration of each practical = 4 hrs.

Pattern of Theory Paper

Each paper is divided into 3 Sections.

Section A: - Consists of 10 compulsory Questions of 2 (two) marks each.
Word limits: Max 50 words.
Instruction for Examiner- Maximum 2 from each unit (10X2=20)

Section B:- Consists of 5 Questions of 6 (six) marks each with internal choice. Students are required to attempt all five questions. Word limits: Max 200 words.
Instruction for Examiner- Maximum 2 from each unit (5X6=30)

Section C: - Consists of 5 Essay type Questions of 10 (ten) marks each.
Students are required to attempt any 3 questions out of five. Word limits: Max 500 words.
Instruction for Examiner- Maximum one from each unit (3X10=30)

SEMESTER- III

PAPER-Bot 301: ANGIOSPERMS: TAXONOMY AND DIVERSITY OF SEED PLANTS

3 h 100 marks

UNIT-I

Taxonomy: Botanical exploration: B.S.I., its organization and role, Plant explorations. Herbarium methodology-collection and preservation of plant specimens, World and Indian herbaria. Plant identification-taxonomic keys.

UNIT-II

Botanical nomenclature: ICBN rules, articles, recommendations and amendments of code. Botanical literature: Monographs, lcones, floras and important periodicals with emphasis on Indian floristic. Effective and valid publications.

UNIT–III

Systems of plants classification: Phenetic versus phylogenetic systems; cladistics in taxonomy. Classification: relative merits and demerits of major systems of classifications-Bentham and Hooker, Engler & Prantle, Cronquist and Takhtajan.

UNIT-IV

Role of following branches of Botany in Taxonomic evidence: Morphology, Anatomy, Palynology, Embryology, Cytology, Photochemistry, Nucleic acid hybridization as a tool in taxonomy. Phylogeny of angiosperm: Origin, evolution and inter-relationships in dicots and monocots.

UNIT-V

Salient features, floral diversity, diversity of families and phylogeny of the following orders: Ranales, Centrospermae, Amentiferae, Tubiflorae and Helobieae. Families of heterotrophic nature (parasitic, saprophytic and insectivorous).

Reference Books:

1 Diversity and Classification of Flowering Plants- Takhtajan, ColumbiaUniv. Press, New York.

2 Taxonomy of Angiosperms - V.N. Nair, TMH Publishing Comp. Ltd.,New Delhi.

3 Taxonomy of Angiosperms - Kshetrapal and Tyagi, RBD Pub., Jaipur.

4 Introduction to Principles of Plant Taxonomy-Sivarajan, Oxford & IBH Publishing Co., New Delhi.

5 Plant Systematic - Gurcharan Singh, Oxford & IBH Publishing Co.New Delhi.

6 An introduction to Taxonomy of Angiosperms - Shukla and Mishra,Vikas Publ. House Pvt. Ltd., New Delhi.

7 Modern Plant Taxonomy- N.S. Subranmanyam, Vikas Publ. HousePvt. Ltd., New Delhi.

PAPER-Bot 302: GENETICS, PLANT BREEDING AND BIOMETRY

3 h 100 Marks

UNIT-I

Mendel's laws of inheritance, Gene interaction, non-mendelian inheritance (polygenic inheritance, cytoplasmic inheritance), Sex determination in plants.

UNIT-II

Crossing over: Molecular mechanism, chromosomal evidence, genetic factors affecting frequency of crossing over. Genetic control of meiosis.
Linkage and chromosomal mapping.

UNIT-III

Plant breeding: Introduction and objectives. Breeding methods in self-pollinated, cross-pollinated and vegetatively propagated crops. Pedigree analysis.

UNIT-IV

Polyploidy, role of polyploidy in evolution and plant breeding.

Heterosis and inbreeding depression, genetic basis of heterosis. Production of hybrid vigour and its applications in plant breeding.

UNIT-V

Biometry: Mean, mode and median, standard deviation; Co-efficient of variation, skewness and kurtosis. Probability, binominal distribution, positive negative binominal distribution. Chi-square test.

Correlation and regression analysis: concept and uses. Test of Significance.

Reference Books:

1 Gene VII - Lewis, Oxford Univ. Press, New York, USA.
2. Genetics - Russel, The Benjamin Publ. Comp. Ltd., USA.
3. Cell Biology and Genetics K.C. Agarwal, Nidhi Publisher, Bikaner.
4. Plant Cell Biology: Structure and Function – Gunnning and Steer, Jonesand Barlett Publ. Boston, Massachusetts.
5. Genetics- A.M. Winchester, Oxford and IBH Publishing Co. New Delhi.
6. Cell and Molecular Biology- De Robertis (Indian Edition) VergheseComp., Bombay.
7. Plant Breeding -V.L Chopra, Oxford& BH Pub. Co. Pvt. Ltd.
8. Elementary principles of Plant Breeding - H .K. Chaudhary, Oxford &IBH Pub. Co. Pvt. Ltd.

PAPER-Bot 303 A: ADVANCED PLANT PATHOLOGY - I

3 h 100 Marks

UNIT- I

History of plants pathology. The nature, origin and evolution of parasitism. Disease cycle: Perennation, production of primary inoculum, dispersal of plant pathogens. Seed transmission diseases. Soil microorganisms, host pathogenicity and virulence.

UNIT- II

Host pathogen interactions: Invasion and establishment of pathogen in host tissues. Infection and post infection development. Factors affecting infection. Host selective toxins and non-host selective toxins. Phytotoxins and vivotoxins. Role of growth regulators in plant disease development.

UNIT- III

Effect of pathogen on host physiology: Absorption, translocation and transpiration, cell water relations, photosynthesis, respiration, nucleic acid metabolism, protein metabolism, growth regulators.

UNIT- IV

Genetics of plant disease: Pathogenicity and host resistance/susceptibility at gene level. Gene mutations, recombination, heterokaryosis. Genetic resistance: vertical resistance and horizontal resistance. Gene for gene concept.

UNIT- V

Environment and plant disease development: Effect of temperature, moisture, light, soil and nutrition.

Defense mechanism: Structural defense and biochemical defense. Phytoalexins, SAR (Systemic Acquired Resistance), ISR (Induced Systemic Resistance).

PAPER-Bot 304 A: ADVANCED PLANT PATHOLOGY -II

3 h 100 Marks

UNIT- I

Histopathology: Calibration of microscope and spore measurement (sporometry). Use of electron microscope in histopathological investigations.

Non-parasitic diseases: Mineral deficiency, mineral excess, air pollutants, oxygen deficiency and water stress (water deficit and water excess).

UNIT- II

Fungal diseases: Symptomatology and disease identification. Classification of plant pathogenic fungi.

Etiology and control of following diseases:

Wart disease of potato, late blight of potato.

Damping off of seedlings, downy mildew of crucifers and grapes.

Green ear disease of bajra, soft rot of roots.

UNIT- III

Etiology and control of following disease:

Leaf curl of peach, stem gall of coriander.

Powdery mildew of grapevines, Ergot of bajra.

Rots and wilts of vegetable crops.

UNIT- IV

Etiology and control of following diseases:

Black stem rust of wheat, rust of linseed.

Loose smut of wheat, kernel bunt and flag smut of wheat.

Bunt of rice, covered smut of barley.

UNIT- V

Etiology and control of following diseases:
Ascochyta blight of gram, early blight of potato.
Tikka disease of groundnut, red rot of sugarcane.
Brown leaf spot of rice, stripe disease of barley.
Wilt of cotton.

PAPER-Bot 303 B: ADVANCED PLANT ECOLOGY – I

3 h 100 Marks

UNIT-I

Environment: Holistic environment, Climatic, Edaphic, Topographic and Biotic factors and their interactions with plants. Air pressure belts, Ocean and Land-Air currents. Population and community ecology and their characters (analytic and synthetic) Succession in plant communities. Plant interaction with other organisms within community

UNIT-II

Ecosystem: structure, function and types Forest, grassland, desert, fresh water, marine water. wetland, natural, manmade, urban and rural ecosystem. Flow of energy, biogeochemical cycles, evolution of ecosystem, system analysis and its applications. Concept of ecosystem, resistance and resilience, natural and anthropogenic ecological perturbations and their impact on plants and ecosystems.

UNIT-III

Ecosystem restoration. Ecology of plant invasion. Allelopathy. Ecological management: concept of sustainable development including millennium development goals and sustainable development goals. Sustainability indicators.

UNIT-IV

Solid, water and hazardous waste management: collection, transportation, processing and recovery. E-waste. Fly ash. Plastic waste. Ocean waste

UNIT-V

Environment, risk and impact assessment: air quality assessment, vehicular emission norms in India, National river conservation plan, types of water. Environment economics. Carbon sequestration, carbon credit, carbon trade, carbon tax.

PAPER-Bot 304 B: ADVANCED PLANT ECOLOGY – II

3 h 100 Marks

UNIT-I

Hot desert of the world: formation, topography, distribution and characteristics including flora and fauna.

UNIT-II

Cold desert of the world: types (Tundra, Alpine, Taiga, Arctic and Antarctic) formation, topography, distribution and characteristics including flora and fauna.

UNIT-III

Rajasthan; geology (rock sequences), physical division (desert, Arawali and hilly areas, eastern besin, south east Hadoti region) and geographical regions described by various authors specially V.C. Mishra and R. L. Singh.

UNIT-IV

Water resources management in Rajasthan; Drainage system and lakes (dams), underground water (problems and conservation). Natural and forest, minerals. live stock resources and rangeland condition of Rajasthan

UNIT-V

Adaptations of plants and animals matching the desert environment.. Ecology of grazing land and impact of overgrazing. Threatened plants of Rajasthan and their conservation strategies; Biosphere reserve, National park, Conservation reserve, wildlife sanctuary.

PAPER-Bot 303 C: ADVANCED PLANT PHYSIOLOGY – I

3 h 100 Marks

UNIT- I

Carbohydrates: Classification, synthesis of sucrose and starch.

Respiration: Anaerobic respiration and fermentation, aerobic respiration, oxidative pentose phosphate cycle (HMP pathway), Photorespiration.

UNIT- II

Photosynthesis: Photosynthetic pigments (Chlorophylls, carotenoids): structure and synthesis, functions. Light reaction and carbon reactions of photosynthesis (C_3 and C_4 pathways).

UNIT- III

Proteins: Structure, properties, classification and functions.

Enzymes: Nomenclature and classification, structure, properties, mechanism of action, inhibition, promotion, activation. Coenzymes, isozymes.

UNIT- IV

Nitrogen metabolism: Overview, biological nitrogen fixation, nodule formation and nod factors; Mechanism of nitrate uptake and reduction. Ammonium assimilation, amino acid synthesis.

Sulphur metabolism: Sulphate uptake, transport and assimilstion.

Lipid metabolism: Classification, saturated and unsaturated fatty acids, fatty

acid oxidation.

UNIT- V

Tools and techniques: Principal and applications of electrophoresis, ultra-centrifugation, isoelectric focusing, immobilized pH gradient, ELISA and RIA.

PAPER-Bot 304 C: ADVANCED PLANT PHYSIOLOGY – II

3 h 100 Marks

UNIT- I

Auxins: Discovery, structure, biosynthesis, mode of action, physiological functions and bioassay.

UNIT- II

Gibberellins: Discovery, structure, biosynthesis, mode of action, physiological functions and bioassay.

Cytokinins: Discovery, structure, biosynthesis, mode of action, physiological functions and bioassay..

UNIT- III

Synthetic growth retardants: Structure, mode of action and physiological effects.

UNIT- IV

Abscisic acid: Discovery, structure, biosynthesis, mode of action, physiological functions and bioassay.

Ethylene: Discovery, structure, biosynthesis, mode of action, physiological functions and bioassay.

UNIT-V

Role of Growth regulators in modern agriculture and horticulture.

Brief account of brassinosteroids, polyamines, jasmonic acid, salicylic acid and nitric oxide signaling in plant defence. Hormone mutants.

PAPER-Bot 303 D: ADVANCED PLANT BIOTECHNOLOGY – I

3 h 100 Marks

UNIT- I

Concept and scope of plant Biotechnology Plant tissue culture: A historical

perspective.

UNIT- II

The phenomenon of morphogenesis, morphogenetic factors for in vitro regeneration. Organogenesis and somatic embryogenesis.

UNIT- III

Micro propagation technology, meristem culture, haploids, anther- pollenculture and their uses.

UNIT- IV

Management of micro propagated plants in laboratory and net houses. Commercial feasibility and advantages of micro propagation.

UNIT- V

Role of plant biotechnology in crop improvement, horticulture, forestry and conservation of biodiversity.

PAPER-Bot 304 D: ADVANCED PLANT BIOTECHNOLOGY – II

3 h 100 Marks

UNIT- I

Basic concept about recombinant DNA technology. Commonly used gene cloning vectors: plasmid, cosmids and phages.

UNIT- II

A brief account of YAC, BAC, HAC. Restriction endonucleases and other enzymes needed in genetic engineering.

UNIT- III

Gene transfer in plants, agro bacterium mediated gene transfer. Crown gall disease, the tumour inducing principle and Ti plasmid, incorporation of T- DNA into plant cells.

UNIT- IV

Direct gene transfer methods for producing transgenic plants, DNA mediated transformation of protoplasts, electroporation, balistic methods used for gene transfer. Herbicide, insect résistance plants.

UNIT- V

Biotechnology and society, socio-economic aspects. Uses of cloned genes in agriculture, medicine and industry.

PRACTICAL MARKING SCHEME: SEMESTER III

I Practical (Paper- Bot 301 and Bot 302)

Time 4 hours Max. Marks 100

(20 internal assessments & 80 practical exams.)

Minimum Passing Marks=36 (08 Internal assessments & 28 Written exam.)

	Max. Marks 100
1. Taxonomy	20
2. Genetics	10
3. Plant Breeding	4
4. Biometry	6
5. Spot (6) three-Paper-Bot 301 Three-Paper-Bot 302	24
6. *Viva-voce*	8
7. Records	8
8. Internal assessments (Excursion Report/ Herbarium of Local Flora/ Seminar/Regularity/ Discipline/Term Test)	20
Total	**100**

(Practical exercises will be based on the theory papers)

II Practical (Paper- Bot 303 and Bot 304)

Time 4 hours Max. Marks 100

(10 internal assessments & 40 practical exams.)

Minimum Passing Marks=36 (08 Internal assessments & 28 Written exam.)

	Max. Marks 100
1.Plant Community Study	16
2.Soil/Water Analysis(Physical/Chemical Characters)	10
3.Phytogeographycal Regions(World/India/Rajasthan)	4
4.Morphological and Anatomical Adaptation	10
5. Spot (6) three-Paper-Bot 303 Three-Paper-Bot 304	24
6. *Viva-voce*	8
7.Records	8
8. Internal assessments (Excursion Report/ Seminar/Regularity/ Discipline/Term Test)	20
Total	**100**

SEMESTER- IV

PAPER-Bot 401: PLANT DEVELOPMENT AND REPRODUCTION BIOLOGY

3 h **100 marks**

UNIT-I

Floral anatomy: general account. Origin and evolution of flower. Stamen- Origin and evolution from foliar to reduced condition. Carpel evolution: Conduplicate, involute, appendicular and recepticular concepts, specialized carpels, poly and syncarpy, semi-inferior and inferior ovary. Evolution and types of placentation.

UNIT-II

Ultra structure and functions of primary and secondary xylem.Ultra structure and function of phloem. Structural variability in leaves and trichomes. Anatomy of dicotyledonous and monocotyledonous seeds. Unique features of plant development.

UNIT-III

Reproduction: Microsporangium, structure and function of wall layers, ultra functional changes in tapetum and meiocytes, role of callose, role of tapetum in pollen development, development of male gametophyte. Anther culture and haploid plants. Mega sporangium (ovule) – types and evolution, mega sporogenesis, embryo sac types, structure of egg, synergids, and antipodal cells.

UNIT-IV

Pollination: structure and histochemical details of style and stigma. Self and interspecific incompatibility. Barriers to fertilization, methods of overcoming incompatibilities. *In-vitro* pollination and its uses.

UNIT-V

Fertilization: discharge and movement of sperms, syngamy and triple fusion, post fertilization changes in embryo sac. Endosperm: Development types, haustoria, cytology and function of endosperm. Embryo development and embryo culture. Polyembryony: types, natural, induced importance. Apomixes: Type and importance. Parthenocarpy.

ReferenceBooks:

1. An introduction to Embryology of Angiosperm - P. Maheshwari, NewDelhi.
2. Recent Advances in the Embryology of Angiosperms-P. Maheshwari,New Delhi.
3. The E mbryology of Angiosperms - Bhajwani and Bhatnagar, VikasPub. House, New Delhi.
4. Morphology of Vascular Plants - A.J. Eames, Tata McGraw Hill Publ.Co. Ltd., New Delhi.
5. Morphology of Angiosperms -A J Eames, McGraw Hill BookComp. Ltd., New York.
6. The Morphology of Angiosperms - Sporne, K.P. Churamani for B.I. Publications, New Delhi.
7. Morphology of Vascular Plants-D.W. Bierhorst Macmillan Comp.,New York.
8. Morphology of Angiosperms - A.J. Eames, Mc Graw Hill Book Comp.,New York.

PAPER-Bot 402: MOLECULAR BIOLOGY AND BIOTECHNOLOGY

3 h 100 Marks

UNIT-I

Molecular Biology: The discovery of DNA, evidences for DNA as genetic material, types of DNA, closed super coiled DNA, denaturing and renaturing of DNA, DNA hybridization.

DNA Replication: mechanism, enzymes, evidences in support of semi-conservative replication.

UNIT-II

RNA: Structures and types.

Transcription, control at initiation and termination, attenuation, heterogenous RNA: processing, capping and tailing.

Gene structure and function: lac operon, tryptophan operon.

UNIT-III

Genetic engineering: Principles and applications.

Techniques employed in recombinant DNA technology: Isolation and purification of DNA, Electrophoresis, DNA sequencing, Southern and Northern blotting, PCR and its applications.

Basic concepts about C-DNA, gene and genomic library.

UNIT-IV

Gene transfer techniques: Vector mediated gene transfer, plasmids, cosmids, phages, YAC, BAC and HAC. Vectorless direct gene transfer. Cloning strategies.

Gene transfer in plants: Agrobacterium mediated gene transfer. Crown gall disease, the tumour inducing principle and T_i plasmid, incorporation of T- DNA into plant cells.

Transgenic plants: applications and achievements.

UNIT-V

Plant tissue culture: Introduction, history, tools, techniques and applications. Micropropagation, callus culture, cell suspension culture, haploid culture, somatic embryogenesis.

Protoplast culture: Isolation, purification and culture, protoplast fusion, Cybrids, somatic hybrids and somaclonal variations.

Biotransformation; Production of useful compounds through cell-culture, biofermentors.

Reference Books:

1. Molecular Biology of the Cell-Albert, Lewis, Raff, Robert andWatson, Garland Publishing Inc., New York.
2. Molecular Biology of the Gene - J.D. Wastson,
3. Molecular Biology and Biotechnology, Nidhi Publisher, Bikaner
4. Molecular Cell Biology- Lodish, Berk, Zipursky, Matsudaira, Baltimoreand Darnell, Freeman and Co., New York, USA.
5. Methods in Plant Molecular Biology and Biotechnology, CRC Press,Boca Raton, Florida.
6. Plants tissue Culture-Bhojwani and Rajdan. Theory and practice. ElsevierScience Publ., New York, USA.
7. Plant Tissue Culture : Applications and limitations-Elsevier Sci. Publi.,New York, USA.
8. Plant Cell and Tissue Culture-Vasil and Thorpe, Kluwer Academic Publishers, Netherland.
9. Elements of Biotechnology – P.K. Gupta, Rastogi Publication, Meerut.

PAPER-Bot 403 A: ADVANCED PLANT PATHOLOGY - I

3 h 100 Marks

UNIT- I

Disease diagnosis: Traditional approach and molecular diagnostics.

Disease assessment: Determination of disease severity and crop yield, critical point model and multiple point model.

Plant disease forecasting methods and devices.

Plant disease epidemics, Computer simulation of epidemics.

UNIT- II

Disease management: Principles, cultural practices and physical methods, chemical treatments, fungicides, biological control. IDM – Integrated Disease Managememt, host resistance and production of disease resistant varieties, biopesticides and nanopesticides, plant quarantine.

UNIT- III

Tissue culture techniques and its applications in plant pathology. Techniques of isolation, purification, culture and inoculation of pathogen. Raising virus free plants in cultures. PCR in plant pathology.

UNIT- IV

Nematology: Classification, identification, morphology and anatomy of plant pathogenic nematodes.

Nematode diseases: Ear cockle of wheat, root knot of vegetables, molya disease of wheat.

UNIT- V

Cecidology: Classification, anatomy, mechanism and physiology of insect galls.

Some insect induced plant galls of Rajasthan: Pongamia leaf gall, cordial leaf gall, Ziziphus stem gall, Prosopis stem gall.

PAPER-Bot 404 A: ADVANCED PLANT PATHOLOGY - II

3 h 100 Marks

UNIT- I

Classification and nomenclature of plant pathogenic bacteria.

Symptomatology, morphology, physiology and pathogenicity of bacteria.

Mechanism of infection and disease development in plants by bacteria.

UNIT- II

Bacterial diseases: crown gall disease of vascular plants, citrus canker.

Angular leaf spot of cotton, red strip of sugarcane.

Bacterial blight of rice, tundu disease of wheat.

Bacterial wilt of solanaceous plants.

UNIT- III

Virology: General characteristics, symptomatology, synthesis and mutation.

Isolation, purification and culture of virus.

Mode of viral infection and transmission of plant viruses.

UNIT- IV

Viral diseases: Mosaic of tomato and tobacco, yellow vein mosaic of bhindi.

Cucumber mosaic disease, viral disease of potato.

Papaya leaf curl disease, bunchy top of banana

UNIT- V

General introduction of mycoplasma, phytoplasma, spiroplasma and fastidious vascular bacteria (RLOs).

Diseases: Little leaf of brinjal, phyllody of sesame.

Sugarcane ratoon stunting, sandal spike.

Citrus stubborn disease.

Reference Books:

1. Diseases of India – Rangaswami and Mahadevan, Prentice Hall of India, Pvt. Ltd., New Delhi.
2. Plant Diseases - R.S. Singh,Oxford and IBH Publishing.
3. Plant Pathology – Mehrotra, Tata McGraw Hill, UK.
4. Microbiology and Pathology – P.D. Sharma, Rastogi Publication, Meerut.
5. Principles of Seed Pathology – V.K. Agarwal and J.B.Sissclair Vol.1& II. CBS Publishers and distributors.
6. Plant Pathology – G. N. Agrios. Academic Press, London and New York.
7. Seed Pathology – P. Neergaarde Vol. 1 & 2. The Macmillan Press Ltd., London.
8. Vistas in Seed Biology –T. Singh and P.C.Trivedi. Vol.1 & 2 Prinwell,Jaipur and Hyderabad.
9. Seed Pathology – D. Suranarayana , Vikas Publishing House Pvt. Ltd.
10. Plant Pathology – Tar, Mac Millan, London.
11. Ad. Trities in Plant Pathology ,Vol. I,II,III –Horsfall and Dimond, Academic Press, London.
12. Plant Diseases –David S. Ingram and Noel Robertson ,Callins.
13. Plant Pathology Concept and Laboratory Exercises –Robert N. Trigiana,CRC Press.
14. Host Pathogen interaction in Plant Diseases –J.E.Vander Plank, AcademicPress, New York.

PAPER-Bot 403 B: ADVANCED PLANT ECOLOGY - I

3 h 100 Marks

UNIT-I

Production ecology; organic production in different types of ecosystem, Process and magnitude of production, primary and secondary productivity and methods of estimates of productivity. Laws of thermodynamics -heat transfer.

UNIT-II

Natural resources; Types, exploitative and conservation of forest, soil, water, air and energy. Introduction to world biome. Biodiversity-ecosystem stability relationship. Biodiversity of India. Hot spots. Threats to biodiversity (endangered flora and fauna), biodiversity indices and gradient. conservation of biodiversity: ex situ and in situ.

UNIT-III

Ramsar sites and conventions. CBD (convention of biological diversity). Wildlife protection act, Forest conservation act, Earth summit and different international and national laws related conservation of biodiversity and their amendaments. Assessment of natural resources; remote sensing and GIS. Factors affecting species diversity, edge effect.

UNIT-IV

Pollution: Air, water, soil, noise and thermal, Global warming and climate change. Effect of green house effect: CO_2, CH_4, N_2O,CFC, Ozone layer and hole. PM (Particulated matter) 2.5 and 10. Toxic chemicals. Risk management. National action plan for climate changes. State action plan for climate changes. Rajasthan state forest policy.

UNIT-V

Role of international organizations (IUCN, UNEP, UNESCO). Red Data Book, Water Prevention and Control of Pollution Act, Environmental Protection Act, 1986,Prevent and Control of Pollution Act, 1981, Environmental Impact Assessment (EIA), Environmental Impact Statement (EIS), Environment management plan (EMP), Environment Education, Awareness and Ethics. Overview of environmental laws of India and their amendment's.

PAPER-Bot 404 B: ADVANCED PLANT ECOLOGY - II

3 h 100 Marks

UNIT-I

Rajasthan: Climate, climatic regions according to Köppen, Thornthwaite, Trewartha. Vegetations types. Power resources.

UNIT-II

Rajasthan: Soil resources, erosion, reclamation. Sand dunes types, stabilization. Land utilization, Cropping pattern and problems. Agroclimatic zones, Various projects related to irrigation.

UNIT-III

Rajasthan: Desert as a ecosystems. Special area developmental programme. Desertification; expansion, hazards and their management. Role of AFRI AND CAZRI and various organization to combat desertification.

UNIT-IV

Rajasthan: Effect of abiotic and biotic factors on desert vegetation and distribution. Productivity, cycles and balances. Saline tracts and halophytes. Effect of Indira Gandhi Canal project to Rajasthan vegetation, irrigation and climate.

UNIT-V

Phenology of the desert plants, root investigation, reproduction capacity, seed output, germination, dormancy and viability. Ethnobotany and tribal communities of Rajasthan.

Reference books –

1. *Environment and Plant Life in Indian desert*, David N Sen, Department of Botany, University of Jodhpur, Jodhpur, India.
2. Terrestrial plant ecology –M.G.Barbour,J.H. Burk and W.D.Pitts, Benjamin/CummingPublication Compony, California.
3. Ecology – M. Begon,J.L.Harper and C.R.Townsend ,Blackwell science, Cambridge.
4. Population, environment and development – R.K. Pachausri and L.F. Qureshy,Tyeri, Newdelhi.
5. Population biology of plants – J.L. Harper,.Academic press, Londonand New York.
6. Introduction to plant ecology – Maurice Ashby, Mac Millan Uni. Of Wisconsin
7. Readings in conservation ecology –G.W. Cox, Applelon Century Crofts , Michigan.
8. Plant ecology– .E. Weaver , Ecological Society of America.
9. Forest ecology of India –G.B.Singh, Rawat Publications.
10. Ecology of natural resources –Francois Ramade,John Wiley & SonsLtd.
11. Plants and environment –Daubenmire,
12. Environmental bioloy–K.C.Agarwal,Agrobotanical Pub..
13. Environmental pollution–Timmy Katyal, Anmol Pub..
14. Environment and pollution—Ambasht , CBS Publications.
15. Environmental pollution and health hazard in India –R. Kumar ,Anish publication home.
16. Indian forest ecology –G.S.Puri, Oxford IBH.

PAPER-Bot 403 C: ADVANCED PLANT PHYSIOLOGY – I

3 h 100 Marks

UNIT- I

Alkaloids: Distribution, classification, structure, biosynthesis and functions of alkaloids (pyridine, piperidine, pyrrolidine, quinoline, isoquinoline, indole and purine group alkaloids).

UNIT- II

Phenolic compounds: Distribution, classification, structure, biosynthesis and functions of phenolic compounds (coumarins, flavonoids, tannins, lignins).

UNIT- III

Terpenoids: Distribution, classification, structure, biosynthesis and functions of terpenoids (isoprenoids) and steroids (brassinosteroids, saponins, saponogenins, sterols, steroidal alkaloids).

UNIT- IV

A general account of distribution, classification, structure, biosynthesis and functions of polyketides and non-ribosomal peptides.

UNIT- V

A general account of distribution, classification, structure, biosynthesis and functions of glycosides.

Vitamins: Structure and functions.

PAPER-Bot 404 C: ADVANCED PLANT PHYSIOLOGY – II

3 h 100 Marks

UNIT- I

Plant Photoreceptors: Discovery, distribution and structure of phytochromes, cryptochromes and phototropins, their photomorphogenetic responses, photochemical and biochemical properties.

UNIT- II

Photophysiology of light induced responses, cellular localization. Brief account of molecular mechanism of action and signaling pathways of photomorphogenetic receptors. Coaction of photoreceptors, responses to UV-radiations.

UNIT- III

Control of flowering: Photoperiodism, vernalization; chemical control of flowering (flowering signal and hormonal regulation).

Circadian rhythms in plants. Seed germination and dormancy. Juvenility and senescence.

UNIT- IV

Plant responses to abiotic stress: water deficiency, salinity, flooding, metal toxicity, freezing, high temperature, high light intensity and oxidative stress.

UNIT- V

Plant defense mechanisms against biotic stress (plant pests, pathogens, nematodes).

Role of plant hormones in plant response to stress (ABA and Polyamines). Photoinhibition and physiological activities affected by stress.

Reference book:

1. Introduction to Plant Physiology –W.G. Hopkins, John Wiley & Sons, Inc. New York USA.
2. Biochemistry and Physiology of Plant Hormones –T.C.Moore, Springerand Verlag, Naw York, USA.
3. Plant Physiology–L.Taiz and E.Zeiger, 2nd edition, Sinauer Associates.In. Publisher, Massachusetts, USA.
4. Plant Physiology–F.B. Salisbury and C.W.Ross, 4th edition, WadsworthPublishing Co. , California.
5. Photoperodism in Plants –B.Thomas and D.Vince pure, 2nd editionAcademic press, Sandiego, USA.
6. Plant Physiology—S. Mukharji and A.K.Gosh
7. Plant Physiology –D.Hess, Springer Berlin.
8. Plant Physiology –F.C.Steward, Academic Press, New York.
9. Introduction to Plant Physiology - Hopkins, John Wiley and Sons, NewYork, USA.
10. Plant Physiology. Salisbury and Ross, Wadsworth Publ. Co., California,USA.
11. Plant metabolism Dennis, Turpin, Lefebure and Layzell, Longman Essex, England.
12. Plant Physiology Taiz and Zeiger, Sinauer Associates, Inc Pub.Massachusetts, USA.

13 Plant Physiology, Devlin. Yan Nostrand Reinhold Comp. New York.Affiliated East West Press Pvt.Ltd., New Delhi.

15. Plant Physiology C.P. Malik, Kalyani Publishers, New Delhi.
16. A Text book of Plant Physiology and Biochemistry S.K. Verma, S.Chand& Comp., New Delhi.
17. Physiology of Plant Growth and Development Edited M.B. WilkinsMcGraw Hill, London.

PAPER-Bot 403 D: ADVANCED PLANT BIOTECHNOLOGY- I

3 h 100 Marks

UNIT- I

Somatic embryogenesis- concepts, prospects and uses. Hybrid embryo rescue technique,

UNIT- II

Production of rare hybrids, *in vitro* pollination. Use of somatic embryogenesis in crop improvement.

UNIT- III

Somatic hybridization and cybridization techniques and uses. Concepts about male sterility and their uses in crop improvement.

UNIT- IV

Selection and characterization of mutant cell lines, auxotrophic mutants. Tissue culture as a source of genetic variability.

UNIT- V

Somaclonal variations, basic concepts and its applications. Protoplast production- concepts and applications.

PAPER-Bot 404 D: ADVANCED PLANT BIOTECHNOLOGY–II

3 h 100 Marks

UNIT- I

Southern, Northern and Western blotting technique. PCR: its principles and uses. Gene concepts and molecular biology of gene.

UNIT- II

Transcription and translation in prokaryotes and eukaryotes. Nitrogen fixing and genes and theirgenetic manipulation.

UNIT- III

Ant sense –RNA, principles and applications. Male sterility: types anduses. Molecular farming.

UNIT- IV

Secondary metabolites and strategies to increase their production in tissueculture.

UNIT-V

Transgenic plants: Production and applications. Plant biotechnology and Intellectual Property rights (IPR).

Reference Books:

1. Introduction to Biotechnology –W.J.Thieman and M. A. Palladino,Publisher Benjain Cummings.
2. Plant Biotechnology –Randheer Singh, ISBN.
3. Plant Biotechnology Methods in tissue culture and gene transfer –R.Keshav Chand & K.V.Peter,ISBN
4. Plant Conservation Biotechnology –Ranjeet Kaur Bhalla, ISBN.
5. Plant Biotechnology and Biodiversity Conservation –U.Kumar & A. K.Kumar, Agrobios Jodhpur.
6. Advances in Applied Biotechnology –P.Parihar & L.Parihar, Agrobios,Jodhpur.
7. Text Book of Biotechnology –Preeti Gupta ,ISBN.
8. Introduction to Plant Biotechnology –H.S.Chawla, Amazon.
9. Recent Advances in Plant Biotechnology –A.Kirakosyan & P.B.Kaufman.
10. Biotechnology fundamentals and applications –S.S.Purohit, AgrobiosJodhpur.
11. Biotechnology –S.R. Barnum, Brooks Cole.
12. Plant Biotechnology-P.K. Gupta, Rastogi Publication Meerut.
13. Laboratory Mannual of Biotechnology –P.K.Gupta, RastogiPublication Meerut.

PRACTICAL MARKING SCHEME: SEMESTER IV

I Practical (Paper- Bot 401 and Bot 402)

Time 4 hours Max. Marks 100

(20 internal assessments & 80 practical exams.)

Minimum Passing Marks=36 (08 Internal assessments & 28 Written exam.)

	Max. Marks 100
1. Anatomy	10
2. Morphology	8
3. Embryology	8
4. Molecular Biology	8
5. Biotechnology	6
6. Spot (6) three-Paper-Bot 401 Three-Paper-Bot 402	24
7. *Viva-voce*	8
8. Records	8
9. Internal assessments (Excursion Report/ Herbarium of Local Flora/ Seminar/Regularity/ Discipline/Term Test)	20
Total	**100**

(Practical exercises will be based on the theory papers)

II Practical (Paper- Bot 403 and Bot 404)

Time 4 hours Max. Marks 100

(20 internal assessments & 80 practical exams.)

Minimum Passing Marks=36 (08 Internal assessments & 28 Written exam.)

	Max. Marks 100
1.Plant Community Study	20
2.Soil/Water Analysis(Physical/Chemical Characters)	10
3. .Morphological and Anatomical Adaptation	10
4. Spot (6) three-Paper-Bot 403 Three-Paper-Bot 404	24
6. *Viva-voce*	8
7.Records	8
8. Internal assessments (Excursion Report/ Seminar/Regularity/ Discipline/Term Test)	20
Total	**100**

(Practical exercises will be based on the theory papers)