

SYLLABUS

FACULTY OF SCIENCE

M.Sc. BOTANY
(Semester Program)

M.Sc. (PREVIOUS) EXAMINATION, 2023-24
M.Sc. (FINAL) EXAMINATION, 2024-25



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BIKANER

POST GRADUATE STUDIES IN BOTANY

(Semester Program) 2023-2025

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 Mycology

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. Microbiology 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: 2022-23

(First Two Semesters: I & II)

Total Marks of M. Sc. Previous (Two Semester) = 600 (400 Theory+200 Practicals)

Four papers of three hours duration in each Semester.

Total Marks of each Semester in M. Sc. Previous = 300 (200 Theory+100 Practicals)

Four theory papers of three hours duration:

Maximum Marks of each paper = 50 (10 Internal assessments & 40 Written exam.)

Minimum Passing Marks of each Paper = 13 (03 Internal assessments & 10 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 =100 of each Semester

Semester I: I Practical includes Paper-Bot 101 and Bot 104 of Maximum 50 mark (10 internal assessments & 40 practical exam.).

II Practical includes Paper- Bot 102 and Bot 103 of Maximum 50 marks (10 internal assessments & 40 practical exam.).

Minimum Passing Marks=18 (04 Internal assessments & 14 Written exam.).

Semester II: I Practical include Paper-Bot 201 and Bot 204 of Maxi. 50 mark (10 internal assessments & 40 practical exam.).

II Practical includes Paper- Bot 202 and Bot 203 of Maximum 50 marks (10 internal assessments & 40 practical exam.).

Minimum Passing Marks=18 (04 Internal assessments & 14 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 1 (one) mark each.

Word limits: Max 50 words.

Selection of question of Examiner- Maximum 2 from each unit (10X1=10)

Section B :- Consists of 5 Questions of 3 (three) marks each with internal choice. Students are required to attempt all five questions. Word limits:

Max 200 words.

Selection of question of Examiner- Maximum 2 from each unit (5X3=15)

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

Selection of question of Examiner- Maximum one from each unit (3X5=15)

TEACHING AND EXAMINATION SCHEME

Per Semester

Course	Periods/Week	Examination hours	IA	WE	Total
Theory Papers					
Course I	4	3	10	40	50
Course II	4	3	10	40	50
Course III	4	3	10	40	50
Course IV	4	3	10	40	50
Practical Courses					
Board I	6 per paper	4	10	40	50
Board II	6 per paper	4	10	40	50

(IA= Internal Assessments; WE= Written Exam)

SEMESTER - I

PAPER- Bot 101: PHYCOLOGY AND MYCOLOGY

3 Hrs

50 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.

Nitrogen fixation in Algae, algal biofertilizers & algal blooms.

Economic importance of algae with special reference to food, feed and major uses in industry.

Mycology: General characters and broad classification of fungi, Heterothallism, Heterokaryosis and Parasexual cycle.

UNIT - IV

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 - V

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.

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, Dehradun
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. Introductory Mycology – Alexopolus, John Wiley and Sons Ind.
12. An Introduction to Mycology – Mehrotra and Aneja, New Age Intermediate Press.
13. Introduction to Fungi – Webster, Cambridge Univ. Press.

PAPER- Bot 102: DIVERSITY OF BRYOPHYTES AND PTERIDOPHYTES

3 Hrs

50 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, Apomictic 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 *Isoetes*, *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 Gymnosperms & 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, Folkstone, 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

50 Marks

UNIT- I

Ecology: Definition and scope, concept of habitat and ecological niches. Composition and structure of an ecosystem; food chain, food web and trophic levels.

UNIT- II

Functions of Ecosystem: Energy flow, ecological pyramids and recycling of N, P, C and S cycles in nature. Plant succession.

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, main habitat and vegetation types of the world. Major type of biomes and their characteristics. Classification of vegetation of India and Rajasthan.

UNIT- V

Brief account of the following: Afforestation and people's involvement, Social Forestry, Agro forestry, Silvopastures and Wind Breaks. Natural Resources & Wildlife resources. Endangered plants and their conservation: National Parks, Wild Life Sanctuaries, Biosphere Reserves and Green Belt. Wild Life Preservation Act (1972) and Indian Forest Conservation Act. (1980). International Biological Programme (IBP), Man and Biosphere (MAB), International Union for Conservation of Nature and Natural Resources (IUCN) and United Nations 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

50 Marks

UNIT-I

Biochemistry: Carbohydrates: Classification, occurrence, structure and functions of monosaccharides, oligosaccharides, polysaccharides including starch, cellulose, pectin and chitin.

Lipids: Structure, lipid biosynthesis, α and β oxidations.

UNIT-II

Proteins: Occurrence, structure- primary, secondary, tertiary and quaternary, properties and functions.

Enzymes: Allosteric and Branch Point Enzymes: Structure, classification and mode of action

UNIT-III

Photosynthesis: Energy pathway in photosynthesis, chloroplast as an energy transducing organelle, composition and characterization of photo systems I and II, electron flow through cyclic, non-cyclic and pseudo cyclic photophosphorylation, pathway of CO₂ fixation, difference between C₃ and C₄ photosynthesis, different kinds of C₄ pathways, CAM pathway, photorespiration.

UNIT-IV

Respiration: Types of respiratory substrates and their utilization in respiration. Glycolysis and TCA cycle with emphasis on enzyme system, ATP synthesis through oxidative electron-transfer chain (cytochrome system), Chemo-osmotic regeneration of ATP, glyoxalate cycle.

UNIT-V

Metabolism: Concept of free energy and entropy, Energy Coupled Reactions, Structure of ATP, High-Energy Molecules, Reduction-Oxidation Coupled Reactions.

Secondary metabolites: Definition, distribution and classification. Biosynthesis and functions of secondary metabolites with special reference to Phenolic compounds, Polyketides, Isoprenoids and Nitrogen containing compounds.

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 50

(10 internal assessments & 40 practical exams.)

Minimum Passing Marks =18 (04 Internal assessments & 14 Written exam.)

1. Phycology	5
2. Mycology	5
3. Plant Biochemistry	
(a) Major	7
(b) Minor	3
4. Spot (6): Three-Paper-Bot 101; Three-Paper-Bot 104.	12
5. <i>Viva-voce</i>	4
6. Records	4
7. Internal assessments (Excursion Report/ Seminar/ Regularity/Discipline/Term Test)	10
Total	50

(Practical exercises will be based on the theory papers)

II Practical (Paper- Bot 102 and Bot 103)

Time 4 hours

Max. Marks 50

(10 internal assessments & 40 practical exams.)

Minimum Passing Marks=18 (04 Internal assessments & 14 Written exam.)

1. Bryophytes	5
2. Pteridophytes	5
3. Ecology (Field study-Quantitative and Analytical characters)	4
4. Ecological Anatomy-Adaptation	3
5. Phytogeography India / Word	3
6. Spot (6) Three-Paper-Bot 102; Three-Paper-Bot 103.	12
7. <i>Viva-voce</i>	4
8. Records	4
9. Internal assessments (Excursion Report/ Seminar/Regularity/ Discipline/Term Test)	10
Total	50

(Practical exercises will be based on the theory papers)

SEMESTER - II

PAPER- Bot201: MICROBIOLOGY AND PLANT PATHOLOGY

3 Hrs.

50 Marks

UNIT- I

Microbiology: Archaeobacteria and Eubacteria: General account, ultra structure, nutrition, reproduction, biology and economic importance. Cyanobacteria: Salient features and biological importance.

UNIT- II

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.

UNIT- III

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

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: -

Paddy: Blast, Bacterial leaf blight

Wheat: Rust, Tundu disease

Bajra: Ergot and Smut

Sugarcane: Red rot, Smut

Potato: Early blight, Late blight

PSTV (Potato Spindle Tuber Viroid)

UNIT- V

Etiology and control of the following crop diseases:-

Grapes: Downy mildew, Powdery mildew

Groundnut: Tikka

Tomato: Tomato Mosaic Virus

Brinjal: Little leaf

Okra: Yellow Vein Mosaic of Bhindi

Cotton: Angular leaf spot.

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 – Agrios, Academic Press, London.
4. Plant Pathology – Mehrotra, Tata McGraw Hill, New Delhi.
5. Microbiology and Pathology – P.D. Sharma, Rastogi Publication, Meerut.
6. Fundamentals of Plant Pathology – V.N. Pathak Agro Botanica, Jodhpur.
7. Microbiology and Pathology – S.S. Purohit, Agro Bot. Jodhpur.
8. Microbiology – Palezar, Chand and King, McGraw Hills, London.
9. A text book of modern Plant Pathology – Bilgrami and Dubey, Vikas Publication, New Delhi.

PAPER- Bot 202: GYMNOPERMS AND PALAEOBOTANY

3 Hrs.

50 Marks

UNIT- I

Gymnosperms: General account, classification of Gymnosperms. Morphology, anatomy, reproduction and interrelationship of - Pteridospermales:

Glossopteris.

Bennettitales : *Cycadioidea*, *Williamsonia*.

Pentoxylales: General account

UNIT- II

General accounts and phylogenetic position of:

Cyadales (Cycas), Ginkgoales (Ginkgo), Coniferales (Pinus) and Taxales (Taxus).

UNIT- III

Morphology, anatomy, reproduction of Ephederales (Ephedra), Welwitschiales (Welwitschia) and Gnetales (Gnetum).

UNIT- IV

Palaeobotany: Fossils; their types, process of fossilization, techniques of study of fossils. Applied aspects of palaeobotany.

UNIT- V

Geological time scale, Distribution of living and fossil Gymnosperm in India.

Origin & evolution of Gymnosperms.

Economic importance of Gymnosperms.

Reference Books:

1. Economic importance of Gymnosperms & 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. Chamberlain Dover Pub., New York.
7. Paleobotany and Plant evolution- Iqbal Hussain ABD Publ., Jaipur.

PAPER- Bot 203: PLANT RESOURCE UTILIZATION AND ETHNOBOTANY

3Hrs.

50 Marks

UNIT- I

Economic Botany: Centers of origin of cultivated plants and gene diversity. Utilization of cereals. Cultivation and improvement of Wheat, Rice, Maize and Bajra.

Pulses and forage legumes.

A general account of oil seeds – Mustard, Sesame, Groundnut, Soybean, and Sunflower.

Fiber- Cotton, jute, Coir.

UNIT- II

A general account of following:

Starch and Sugar- Potato, Sugarcane, Sugar beet.

Spices and Condiments- Cinnamon, Clove, Fennel, Cumin, Coriander, Saffron, Cardamom, Fenugreek, Akarkara.

Industrial Plant: Gwar, Rubber, Tea, Coffee.

UNIT- III

Narcotics: Cannabis, Opium, Tobacco

General account of local plants of medicinal importance along with

Digitalis, Terminalia, Commiphora, Ocimum, Convolvulus (Sankh Pushpi).

UNIT- IV

General account of local plants of medicinal importance along with *Catharanthus roseus*, *Aloe*, *Centella* (Brahmi Booti), *Chlorophytum* (Safed musli), *Tylophora indica*.

Unexploited Plants of Potential Economic Value with reference to Rajasthan.

UNIT- V

Ethnobotany: Aims, objective and scope. Methods of study of ethno botany. Ethno botany of Rajasthan and India. Ethnic groups of Rajasthan, major tribes and their life styles. 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 Farnsworth, N. 1989. Economic and Medicinal Plant Research, Vols. 1-3, Academic Press, London.

PAPER- Bot 204: PLANT PHYSIOLOGY

3 Hrs.

50 Marks

UNIT-I

Physiology: Plant Water relations: water potential and its components- solute potential, pressure potential, matric potential, Intercellular water transport, bulk movement of water. Soil Plant Atmosphere Continuum (SPAC). Stomatal regulation of transpiration, anti-transparent, 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. Biological nitrogen fixation, reduction of nitrates, reductive amination and transamination, Glutamate Oxaloacetate Transaminase (GOT) and Glutamate Pyruvate Transaminase (GPT) system.

UNIT-IV

Growth: Growth Curve, Growth Regulators: Auxins, Gibberellins, Cytokinins, Abscissic acid and ethylene, their chemical nature, biosynthesis, bioassay, physiological effects and mode of action.

UNIT-V

Physiology of Flowering: Photoperiodism and role of phytochrome in flowering, Circadian Rhythm, Vernalization, Seed dormancy. Fruit ripening, Plant movement, 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 50

(10 internal assessments & 40 practical exams.)

Minimum Passing Marks=18 (04 Internal assessments & 14 Written exam.)

1. Microbiology	5
2. Plant Pathology	5
3. Plant Physiology	
(a) Major	7
(b) Minor	3
4. Spot (6) Three-Paper-I;	
Three-Paper-IV	12
5. <i>Viva-voce</i>	4
6. Records	4
7. Internal assessments (Excursion Report/ Seminar/Regularity/ Discipline/Term Test)	10
Total	50

(Practical exercises will be based on the theory papers)

II Practical (Paper- Bot 202 and Bot 203)

Time 4 hours

Max. Marks 50

(10 internal assessments & 40 practical exams.)

Minimum Passing Marks=18 (04 Internal assessments & 14 Written exam.)

1. Gymnosperms	5
2. Palaeobotany	5
3. Economic Botany	5
4. Ethnobotany	5
5. Spot (6) Three-Paper-II;	
Three-Paper-III	12
6. <i>Viva-voce</i>	4
7. Records	4
1. Internal assessments (Excursion Report/ Seminar/Regularity/ Discipline/Term Test)	10
Total	50

(Practical exercises will be based on the theory papers)

M. Sc. Final: 2024-25

(Two Semesters: III & IV)

Total Marks of M. Sc. Final = 600 (400 Theory+200 Practical)

Four papers of three hours duration.

Maximum Marks of each paper = 50 (10 Internal assessments & 40 Written exam.)

Minimum Passing Marks of each Paper = 13 (03 Internal assessments & 10 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 =100 of each Semester

Semester III: I Practical include Paper-Bot 301 and Bot 302 of Maximum 50 mark (10 internal assessments & 40 practical exam.).

II Practical includes Paper- Bot 303 and Bot 304 of Maximum 50 marks (10 internal assessments & 40 practical exam.).

Minimum Passing Marks=18 (04 Internal assessments & 14 Written exam.).

Semester II: I Practical include Paper-Bot 401 and Bot 402 of Maximum 50 mark (10 internal assessments & 40 practical exam.).

II Practical includes Paper- Bot 403 and Bot 404 of Maximum 50 marks (10 internal assessments & 40 practical exam.).

Minimum Passing Marks=18 (04 Internal assessments & 14 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 1 (one) mark each.

Word limits: Max 50 words.

Selection of question of Examiner- Maximum 2 from each unit (10X1=10)

Section B: - Consists of 5 Questions of 4 (four) marks each with internal choice. Students are required to attempt all five questions. Word limits:

Max 200 words.

Selection of question of Examiner- Maximum 2 from each unit (5X4=20)

Section C: - Consists of 5 Essay type Questions of 7 (seven) marks each of first two questions and last one would be 6 (six) marks. Students are required to attempt any 3 questions from out of five. Word limits: Max 500 words.

Selection of question of Examiner- Maximum one from each unit (2X7=14; 1x6=6)

SEMESTER- III

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

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, Icones, floras and important periodicals with emphasis on Indian floristic. Effective and valid publications. Red Data Book

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, Columbia Univ. 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. House Pvt. Ltd., New Delhi.

**PAPER-Bot 302: GENETICS, PLANT BREEDING
AND BIOMETRY**

3 Hrs.

50 Marks

UNIT-I

Mendel's inheritance, Genes and their interaction, non Mendelian inheritance, polygenic inheritance, Cytoplasmic inheritance and Sex determination in plants.

UNIT-II

Molecular mechanism of crossing over, chromosomal evidence of crossing over, genetic factors which affect the frequency of crossing over, genetic control of meiosis, linkage and chromosomal mapping

UNIT-III

Plant breeding: Introduction, Objectives, Basic steps; Breeding methods in self, cross pollinated and vegetatively propagated crops. Pedigree analysis

UNIT-IV

Polyploidy: its role in evolution and plant breeding. Heterosis and inbreeding depression, Genetic basis of hybrid vigour. Production and application of hybrid vigour in plant breeding.

UNIT-V

Biometry: Mean, Mode & Median, standard deviation, co-efficient of variation, skewness and kurtosis. Probability, distribution binominal, positiveneegative binominal. 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 – Gunning and Steer, Jones and 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) Verghese Comp., 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 Hrs.

50 Marks

UNIT- I

Principles: History of plants pathology. The nature, origin and evolution of parasitism. Interaction of pathogen, soil, other soil micro-organism and the host. Biotrophic parasites in culture.

UNIT- II

Role of plant tissue culture in studies on host parasite relationship. Phenomenon of plant infection, penetration, infection, post infection development, factors affecting infection and defense mechanism.

UNIT- III

Host pathogen interaction: The response of the host, pathogenicity and virulence, host specific toxins in relation to pathogenesis and disease resistance, hypersensitivity reactions.

UNIT- IV

Histopathology: Calibration of microscopes and measurements. Use of electron microscope in histopathological investigations. Plant disease control: Physical control, chemical control and plant quarantines.

UNIT- V

Plant disease resistance and breeding of resistance varieties. Seed transmission diseases, factors affecting transmission of seed borne pathogens, control of seed borne diseases and types of seed treatments (physical, chemical and biological). Testing of efficacy of fungicides.

PAPER-Bot 304 A: ADVANCED PLANT PATHOLOGY -II

3 Hrs.

50 Marks

UNIT- I

Classification and nomenclature of bacterial pathogens. Symptomatology, Methods of identification of bacterial pathogens: (i) Morphology (ii) Physiology (iii) Serology (iv) Pathogenicity.

UNIT- II

Physiological and cytological aspects of bacterial infection process and disease development. Mechanism of infection of bacterial pathogens.

UNIT- III

Bacterial disease: Brown rot, ring rot of potato, Fire blight of stone fruits. Tundu disease of wheat, Stalk rots of maize and bacterial blight of rice.

UNIT- IV

Soft rot of vegetables. Red strip of sugarcane, Crown gall disease. Angular leaf spot of cotton, Citrus canker.

UNIT- V

Non parasitic diseases: Disease due to deficiency of Nitrogen. Zinc, Boron and Oxygen, Ozone, PAN (peroxy acetyl nitrate), SO₂, Sulphur and Hydrogen fluoride.

PAPER-Bot 303 B: ADVANCED PLANT ECOLOGY – I

3 Hrs.

50 Marks

UNIT- I

Fundamentals of Ecology, Definition, history and scope.

Environment: Holistic environment, factors (Climatic, Edaphic, Topographic and Biotic) and their interactions with plants.

UNIT- II

Population and community ecology. Succession in plant communities. Plant interaction with other organisms within community.

UNIT- III

Ecosystem: concept, structure and function, 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- IV

Ecosystem restoration. Ecology of plant invasion. Ecological management; concept of sustainable development and sustainability indicators.

UNIT- V

Types of Ecosystem: Forest, grassland, desert, fresh water, marine water, wetland, natural, manmade, urban and rural ecosystem.

PAPER-Bot 304 B: ADVANCED PLANT ECOLOGY – II

3 Hrs.

50 Marks

UNIT - I

Desert, their formation, topography and distribution characteristics of desert with special reference to water economy. The hot and cold deserts and other similar habitats.

UNIT - II

Introduction to World Desert Biome: Origin, characters and geomorphology of Thar Desert. Vegetation and floral composition of Rajasthan desert:

UNIT - III

Adaptations of plants and animals matching the desert environment. Effect of abiotic and biotic factors on desert vegetation and distribution.

UNIT - IV

Arid regions of India with particular reference to Rajasthan. Thar Desert resources: forest energy, minerals, live stock and rangeland conditions.

UNIT - V

Ecology of grazing land and impact of overgrazing, Threatened plants of Rajasthan desert and conservation strategies.

PAPER-Bot 303 C: ADVANCED PLANT PHYSIOLOGY – I

3 Hrs.

50 Marks

UNIT- I

Carbohydrates: Classification and synthesis: Respiration: Anaerobic, aerobic, pentose phosphate cycle (HMP), Photo respiration and fermentation,

UNIT- II

Photosynthesis: Pigments (Chlorophylls, carotenoids) structure, synthesis functions, polyamines, Photophosphorylation, Calvin cycle and C₄ dicarboxylic acid cycle.

UNIT- III

Protein: Chemistry, Classification and synthesis. Enzymes: Classification, structure, mechanism of action inhibition, promotion, activation.

Water soluble pigments (anthocyanins) synthesis and function (Genetic role).

UNIT- IV

Nitrogen fixation, nitrogen and sulphur metabolism: Overview biological nitrogen fixation, nodule formation and nod factor mechanism of nitrate uptake and reduction. Ammonium assimilation, sulphate uptake, transport and assimilation, amino acid synthesis.

Lipid metabolism: Classification of fats and oils, saturated and unsaturated fatty acids, fatty acid oxidation.

UNIT- V

Coumarins & lignins: Structure and synthesis, chemistry, distribution and function. Vitamins: Structure and function. Metabolism of secondary metabolites: Tannins: Distribution, synthesis and functions.

PAPER-Bot 304 C: ADVANCED PLANT PHYSIOLOGY – II

3 Hrs.

50 Marks

UNIT- I

Plant growth regulators: Auxins, discovery, structure, biosynthesis, mode of action and function.

UNIT- II

Gibberellins- discovery, physiological effects, and response of plants, biosynthesis and mode of action.

Cytokinins- discovery, structure, biosynthesis, physiological effect on seed plants and mode of action.

UNIT- III

Synthetic growth retardants, their physiological effect and biochemistry.

UNIT- IV

Growth inhibitors- Abscisic acid and related compounds: discovery, natural occurrence, physiological effects, biosynthesis, mode of actions. Ethylene- History, biological effects, biosynthesis, mode of actions.

UNIT-V

Role of Growth regulators on 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 Hrs.

50 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 Hrs.

50 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: endo nucleases 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, ballistic methods used for gene transfer. Herbicide, insect resistance 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 50

(10 internal assessments & 40 practical exams.)

Minimum Passing Marks=18 (04 Internal assessments & 14 Written exam.)

Max. Marks 50

1. Taxonomy	
(a) Major	7
(b) Minor	3
2. Genetics	5
3. Plant Breeding	2
4. Biometry	3
5. Spot (6) three-Paper-Bot 301	
Three-Paper-Bot 302	12
6. <i>Viva-voce</i>	4
7. Records	4
8. Internal assessments (Excursion Report/ Herbarium of Local Flora/ Seminar/Regularity/ Discipline/Term Test)	10
Total	50

(Practical exercises will be based on the theory papers)

II Practical (Paper- Bot 303 A and Bot 304 A)

Advance Plant Pathology

Time 4 hours

Max. Marks 50

(10 internal assessments & 40 practical exams.)

Minimum Passing Marks=18 (04 Internal assessments & 14 Written exam.)

Max. Marks 50

1. Tissue culture technique	5
2. Bacterial staining	3
3. Bordeaux mixture	2
4. Media preparation	5
5. Plant Diseases	5
6. Spot (6) three-Paper-Bot 303	12
Three-Paper-Bot 304	
7. <i>Viva-voce</i>	4
8. Records	4
9. Internal assessments (Excursion Report/ Seminar/Regularity/ Discipline/Term Test)	10

Total

50

II Practical (Paper- Bot 303 B and Bot 304 B)

Advance Plant Ecology

Time 4 hours

Max. Marks 50

(10 internal assessments & 40 practical exams.)

Minimum Passing Marks=18 (04 Internal assessments & 14 Written exam.)

	Max. Marks 50
1.Plant Community Study	8
2.Soil/Water Analysis(Physical/Chemical Characters)	5
3.Phytogeographical Regions(World/India/Rajasthan)	2
4.Morphological and Anatomical Adaptation	5
5. Spot (6) three-Paper-Bot 303 Three-Paper-Bot 304	12
6. <i>Viva-voce</i>	4
7.Records	4
8. Internal assessments (Excursion Report/ Seminar/Regularity/ Discipline/Term Test)	10
Total	50

(Practical exercises will be based on the theory papers)

II Practical (Paper- Bot 303 C and Bot 304 C)

Advance Plant Physiology

Time 4 hours

Max. Marks 50

(10 internal assessments & 40 practical exams.)

Minimum Passing Marks=18 (04 Internal assessments & 14 Written exam.)

	Max. Marks 50
1.Biochemistry	
(Major)	7
(Minor)	3
2.Plant Physiology	
(Major)	7
(Minor)	3
3. Spot (6) three-Paper-Bot 303 Three-Paper-Bot 304	12
4. <i>Viva-voce</i>	4
5.Records	4
6. Internal assessments (Excursion Report/ Seminar/Regularity/ Discipline/Term Test)	10
Total	50

SEMESTER- IV

PAPER-Bot 401: PLANT DEVELOPMENT AND REPRODUCTION BIOLOGY

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 receptacular 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.

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 Embryology 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 Hrs.

50 Marks

UNIT-I

Molecular Biology: The discovery of DNA, evidences indication, DNA as the genetic material, DNA and its types (A, B and Z DNA), closed super coiled DNA, denaturing and renaturing of DNA, hybridization. DNA Replication: mechanism, enzymes, evidences in favour of semi conservative replication.

UNIT-II

RNA: Structures, types, transcription, control at initiation, control at termination, attenuation, heterogenous RNA processing, capping and tailing. Techniques employed in recombination DNA technology, isolation and purification of DNA gel electrophoresis (Gel, Agarose), DNA sequencing, Southern and Northern blotting, PCR and its application. Gene structure and function, lac operon, tryptophan operon.

UNIT-III

Biotransformation; Production of useful compounds through cell-culture vectors; plasmids and cosmids, cloning strategies. Basic concepts about C-DNA, gene and genomic-library. Application of recombinant DNA technology.

UNIT-IV

Genetic engineering and its principles, gene-transfer. Transgenic plants and methods, production, applications and use, importance of genetic engineering.

UNIT-V

Biotechnology: concept and scope of biotechnology, Plant tissue-culture, anther and pollen culture, callus-culture and protoplast culture: micro propagation, Isolation, purification, culture and fusion: Cybrids and somatic hybrids. Fermenter.

Reference Books:

1. Molecular Biology of the Cell-Albert, Lewis, Raff, Robert and Watson, Garland Publishing Inc., New York.
2. Molecular Biology of the Gene - J.D. Watson,
3. Molecular Biology and Biotechnology, Nidhi Publisher, Bikaner
4. Molecular Cell Biology- Lodish, Berk, Zipursky, Matsudaira, Baltimore and 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. Elsevier Science Publ., New York, USA.
7. Plant Tissue Culture : Applications and limitations-Elsevier Sci. Publ., 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 Hrs.

50 Marks

UNIT- I

Nucleic acids in host parasitic interaction, phytoalexins, Inoculum potential, epiphytotics and disease forecasting.

Methods: Techniques of isolation, purification, culture and inoculation of pathogens. Techniques of tissue culture and its application in plant pathology. Raising virus free plants in culture.

UNIT- II

Fungi Diseases: Symptomatology and disease identification.

Some important disease of cereals: Smuts, rusts, leaf blights, spots mildew, karnal bunt and flag smut of wheat, covered smut and stripe disease of barley;

UNIT- III

Brown spot and blast of paddy, Brown spot, downy mildew and Drechslera (Heiminthosporium). Blights of Maize: ergot and smut of Bajra, leaf spots and smuts of jowar, green ear disease of Bajra.

UNIT- IV

Diseases: Red root and smut of sugarcane, fusarium wilt of cotton flax and pigeon pea; flax rust, Asochyta blight of gram.

UNIT- V

Early blight of tomato and potato; late blight of potato; Tikka disease of groundnut and downy and powdery mildew of grapes.

PAPER-Bot 404 A: ADVANCED PLANT PATHOLOGY - II

3 Hrs.

50 Marks

UNIT- I

Virology- Symptomatology, isolation, purification and culturing of viruses. Viral infection, nutrition, synthesis and utation. Transmission of viral disease.

UNIT- II

Mycoplasma, Acquired immunity, Interference and Synergism.

Viral Diseases: Potato virus X and Y, Potato yellow dwarf.

Tomato mosaic and Tomato ring mosaic, Tobacco necrosis, Cucumber-mosaic, Bunchy top of Banana, Bhindi yellow mosaic.

UNIT- III

Nematolog: Classification and identification of plant pathogenic nematodes. Morphology and anatomy of nematodes.

UNIT- IV

Methods and use in nematology. Nematode disease: Ear cockle of wheat, Root knot of vegetables, Molya disease of wheat.

UNIT- V

Cecidology: Classification and anatomy of galls. Some insect induced plant galls of Rajasthan (*Pongamia* leaf gall, Cordial leaf gall, *Ziziphus* stem gall, *Prosopis* stem gall), mechanism and physiology of insect galls.

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. Tritics 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, Academic Press, New York.

PAPER-Bot 403 B: ADVANCED PLANT ECOLOGY - I

3 Hrs.

50 Marks

UNIT- I

Production ecology: Organic production in different types of ecosystems, process and magnitude of production, primary and secondary productivity and methods of estimations of productivity.

UNIT- II

Natural Resources: Types, exploitation and conservation of forest, soil, water, air and energy. Biodiversity of India, Hot spots, threats to biodiversity (endangered flora and fauna), biodiversity indices and biodiversity gradient.

UNIT- III

Factors affecting species diversity, edge effect,

Biodiversity–ecosystem stability relationship, conservation of biodiversity: *ex-situ* and *in-situ*. Introduction to world Biomes. Wild life protection act 1972, Forest Conservation Act 1980 and Earth submit, 1992.

UNIT- IV

Pollution: Air, Water, Soil, Noise and Thermal. Global warming and climatic change. Effect of green house gases; CO₂, CH₄, N₂O, CFCs, Ozone layer and hole, CBD (Convention on Biological Diversity).

UNIT- V

Role of international organizations (IUCN, UNEP, UNESCO). Red Data Book, Water Prevention and Control of Pollution Act 1974, Environmental Protection Act, 1986, Prevent and Control of Pollution Act, 1981, Environmental Impact Assessment (EIA), Environment Education, Awareness and Ethics.

PAPER-Bot 404 B: ADVANCED PLANT ECOLOGY - II

3 Hrs.

50 Marks

UNIT - I

The saline tracts and their vegetation (Halophytes) with their reference to Rajasthan, Classification and Adaptations of plants in saline conditions of Rajasthan. Mangrove vegetation.

UNIT - II

Rajasthan - Geology, Physiography and Climate. Water problem in Rajasthan particularly underground water resources and its change.

UNIT - III

Desert as an ecosystem: biotic and abiotic components, biological productivity, cycles and balances in desert ecosystem.

UNIT - IV

Vegetation of Rajasthan desert and plant communities. Desert Soils and Soil erosion, reclamation of soil and stabilization of sanddunes.

UNIT – V

Habit studies and Phenology of the desert Plants. Root investigation, Reproduction Capacity: Seed output, Germination, Dormancy and Viability.

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/Cumming Publication Company, 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, London and New York.
6. *Introduction to plant ecology* – Maurice Ashby, Mac Millan Uni. Of Wisconsin
7. *Readings in conservation ecology* –G.W. Cox, Appleton 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 & Sons Ltd.
11. *Plants and environment* –Daubenmire,
12. *Environmental biology* –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 Hrs.

50 Marks

UNIT- I

Hallucinogens: distribution, chemistry and functions. Alkaloids: pyrrole and pyrrolidine, pyridine, polyacetyl, isoquinoline, tropane and indole alkaloids, their distribution synthesis and function.

UNIT- II

Saponins and saponogenins, sterols, steroids, steroid alkaloids, their distribution, synthesis and function.

UNIT- III

Cardiac glycosides: structure and functions, Structure, synthesis and functions of flavonoids.

UNIT- IV

Tools and techniques: Principle and application of spectrophotometry, chromatography, partition chromatography, thin layer chromatography, ion exchange chromatography and gas liquid chromatography.

UNIT- V

High performance liquid chromatography, gel filtration, electrophoresis, ultra-Centrifugation, isoelectric focusing, immobilized pH gradient, ELISA and RIA.

PAPER-Bot 404 C: ADVANCED PLANT PHYSIOLOGY – II

3 Hrs.

50 Marks

UNIT- I

Phytochromes— History and discovery, occurrence and distribution of phytochromes, cryptochromes and phototropins, their photochemical and biochemical properties.

UNIT- II

Photophysiology of light induced responses, cellular localization. Brief account of molecular mechanism of action of photomorphogenic receptors.

UNIT- III

Photoperiodism, vernalization, chemical: control of flowering.Circadian rhythms in plants. Seed germination and dormancy. Juvenility and senescence.

UNIT- IV

Stress physiology :Plant responses to biotic and abiotic stress , plant defence mechanisms against water stress ,salinity stress ,metal toxicity ,freezing and heat stress and oxidative stress.

UNIT- V

Photoinhibition and other physiological activities affected by stress. 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, New 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, WadsworthP ublishing Co. , California.
5. Photoperiodism 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 Hrs.

50 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 Hrs.

50 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 their genetic manipulation.

UNIT- III

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

UNIT- IV

Secondary metabolites and strategies to increase their production in tissue culture.

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, Agrobios Jodhpur.
11. Biotechnology –S.R. Barnum, Brooks Cole.
12. Plant Biotechnology –P.K. Gupta, Rastogi Publication Meerut.
13. Laboratory Manual of Biotechnology –P.K.Gupta, Rastogi Publication Meerut.

PRACTICAL MARKING SCHEME: SEMESTER IV

I Practical (Paper- Bot 401 and Bot 402)

Time 4 hours Max. Marks 50

(10 internal assessments & 40 practical exams.)

Minimum Passing Marks=18 (04 Internal assessments & 14 Written exam.)

Max. Marks 50

1. Anatomy	5
2. Morphology	4
3. Embryology	4
4. Molecular Biology	4
5. Biotechnology	3
6. Spot (6) three-Paper-Bot 401	
Three-Paper-Bot 402	12
7. <i>Viva-voce</i>	4
8. Records	4
9. Internal assessments (Excursion Report/ Herbarium of Local Flora/ Seminar/Regularity/ Discipline/Term Test)	10
Total	50

(Practical exercises will be based on the theory papers)

II Practical (Paper- Bot 403 A and Bot 404 A)

Advance Plant Pathology

Time 4 hours Max. Marks 50

(10 internal assessments & 40 practical exams.)

Minimum Passing Marks=18 (04 Internal assessments & 14 Written exam.)

Max. Marks 50

1. Meristem Tip Culture	4
2. Fungal Disease	4
3. Viral Disease	4
4. Nematode Disease	4
5. Cecidology	4
6. Spot (6) three-Paper-Bot 403	
Three-Paper-Bot 404	12
7. <i>Viva-voce</i>	4
8. Records	4
9. Internal assessments (Excursion Report/ Seminar/Regularity/ Discipline/Term Test)	10

Total

50

II Practical (Paper- Bot 403 B and Bot 404 B)

Advance Plant Ecology

Time 4 hours

Max. Marks 50

(10 internal assessments & 40 practical exams.)

Minimum Passing Marks=18 (04 Internal assessments & 14 Written exam.)

	Max. Marks 50
1.Plant Community Study	10
2.Soil/Water Analysis(Physical/Chemical Characters)	5
3. .Morphological and Anatomical Adaptation	5
4. Spot (6) three-Paper-Bot 403 Three-Paper-Bot 404	12
6. <i>Viva-voce</i>	4
7.Records	4
8. Internal assessments (Excursion Report/ Seminar/Regularity/ Discipline/Term Test)	10
Total	50

(Practical exercises will be based on the theory papers)

II Practical (Paper- Bot 403 C and Bot 404 C)

Advance Plant Physiology

Time 4 hours

Max. Marks 50

(10 internal assessments & 40 practical exams.)

Minimum Passing Marks=18 (04 Internal assessments & 14 Written exam.)

	Max. Marks 50
1.Biochemistry (Major)	7
(Minor)	3
2.Plant Physiology (Major)	7
(Minor)	3
3. Spot (6) three-Paper-Bot 303 Three-Paper-Bot 304	12
4. <i>Viva-voce</i>	4
5.Records	4
6. Internal assessments (Excursion Report/ Seminar/Regularity/ Discipline/Term Test)	10
Total	50