

M.G.S. UNIVERSITY, BIKANER SYLLABUS

FACULTY OF SCIENCE

M.Sc. BOTONY
M.Sc. Previous Examination - 2020
M.Sc. Final Examination - 2021



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Maharaja Ganga Singh University, Bikaner

M.Sc. PREVIOUS BOTANY—2020

Scheme

Total marks of Msc Previous : 450

Four papers of three hours duration. 3 hrs.

Maximum marks of each paper : 75

Minimum Passing Marks of each Paper : 19

Total Passing Marks of all four papers : 108

Max. marks of Practical : 150

I Practical include Paper-I and IV of maximum : 75 marks

Minimum Passing Marks : 27 marks

II Practical include Paper-II and III of maximum : 75 marks

Minimum Passing Marks : 27 marks

Duration of each practical : 5 hours

Pattern of Theory Paper

Each paper is divided into 3 sections

Section A : Consists of 10 compulsory Questions of 2 (two) mark each.

Word limit Max 50 words. Selection of question of Examiner- Maximum 2 from each unit (10X2=20)

Section B : Consists of 5 Questions of 5 (five) mark each with internal choice. Students are required to Attempt all five questions. Word limit Max 200 words. Selection of question of Examiner- Maximum 2 from each unit (5X5=25)

Section C : Consists of 5 Essay type Questions of 10 (ten) marks each. Students are required to Attempt any 3 questions. Word limit Max 500 words. Selection of question of Examiner- Maximum one from each unit (3X10=30)

PAPER I : MICROBIOLOGY, PHYCOLOGY, MYCOLOGY AND PLANT PATHOLOGY

Duration : 3 Hrs. 75 Marks

Unit- I

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

Cyano bacteria- Salient features and biological importance.

Viruses: Characteristics and ultra structure of virions, chemical nature, replication, transmission of viruses, economic importance.

Phytoplasma; general characteristics and role in causing plant diseases.

General account of immunity, types of immunity, allergy and types of allergies, properties of antigens and antibodies, serology, types of vaccines.

Unit- II

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, classification, salient features of Protochlorophyta, Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta with reference to following genera:—

Cyanophyta—Anabaena, Rivularia
 Chlorophyta—Gonium, Nitella, Bulbochaete, Closterium, Acetabularia
 Xanthophyta—Botrydium, Bacillariophyta—Cyclotella, Navicula
 Phaeophyta—Padina, Sargassum Rhodophyta—Liagora, Ceramium

Unit- III

General characteristics of Euglenophyta, Dinophyta, Chrysophyta and Cryptophyta.

Nitrogen fixation in algae, algal biofertilizers, algal blooms, fossil algae, algae as food, feed and uses in industry.

Mycology: Present criteria used in classification of fungi with reference to vegetative and reproductive structures. Comparative study of following divisions and subdivisions:

Plasmodiogymnomycotina: Stemonitales, Physarum
 Haplomastigomycotina: Synchytrium, Plasmodiophora
 Diplomastigomycotina: Peronospora, Plasmopara

Zygomycotina: Syncephalastrum, Pilobolus

Unit- IV

Ascomycotina: Taphrina, Phyllactinia, Chaetomium

Basidiomycotina: Puccinia, Melampsora, Ustilage Deuteromycotina:

Fusarium, Cercospora, Colletotrichum Heterothallism, Heterokaryosis,

Parasexual cycle

Role of fungi in industries with reference to production of alcohol, organic acids, antibiotics, food and fodder. Mushroom cultivation, Mycorrhiza application in agriculture and plant growth.

Plant Pathology: Symptomatology and identification of diseases with reference to fungal, bacterial and viral infections.

Unit- V

Etiology and control of the following crop diseases:-Paddy: Blast,

Bacterial leaf blight, Tungro virus Wheat: Bunt., Tundu disease

Bajra: Ergot and Smut Sugarcane: Red rot

Potato: Early blight, Virus-X, Y Cotton: Angular leaf spot

Grapes: Downy mildew, Powdery mildew Groundnut: Tikka

Tomato: Tomato Mosaic Virus

Disease control by physical, chemical and biological methods, resistant varieties, crop rotations, plant quarantine.

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.

Pteridophytes: Life cycle with reference to alternation of generation, colonization of terrestrial environment, soral evolution, Apomictic life cycle: Apogamy, apospory, vegetative apomixis. Evolution of stele, Heterospory and seed habit.

Systematic, Reproduction and Phylogeny of the following: Rhyniopsida-Rhynia, Horneophyton

Zosterophylloids - Zosterophyllum Trimerophytopsida – Psilophyton

Unit- III

Systematic, Reproduction and Phylogeny of the following: Psilopsida-Tmesipteris

Lycopside- Isoetes, Lepidodendron Sphenopsida- Sphenophyllum

Pteropsida- Ophioglossum Osmundales - Osmunda Gleicheniales-

Gleichenia Polypodiales- General account Salviniales – Salvinia, Azolla

Unit- IV

Gymnosperms: Introduction, classification of Gymnosperms

Morphology, anatomy, reproduction and interrelationship of:

Pteridospermales – Glossopteris

Bennettitales – Cycadioidea, Williamsonia Pentoxylales – General

account Ginkgoales – Ginkgo

Unit- V

Coniferales – General account Taxales, – Taxus, Welwitschiales –

Welwitschia Gnetales – Gnetum

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

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. Paleobotany and the evolution of Plants – Stewart and Roth Well, Cambridge Univ. Press.
7. Gymnosperms – Bhatnagar and Moitra, New Age International Pvt. Ltd., New Delhi.
8. Gymnosperms – O.P. Sharma, Pragati Prakshan, Meerut.
9. The interrelationships of the Bryophyta-Frank Cavers, Folkestone, Kent England.
10. Morphology of Gymnosperms – Coulter and Chamberlain; Central Book Depot., Allahabad.
11. Gymnosperms Structure and Evolution - C.J. Chamberlain Dover Pub., New York.

Starch and Sugar- Potato, Sugarcane, Sugar beet	2.Minor Exercise	7
Species and Condiments- Cinnamomum, Clove, Fennel, Cumin,	3. Spot(5)	15
Coriander, Saffron, Cardamom, Fenugreek, Akarkara.	4. Viva-voce	8
Unit- V	5.Records	5
Industrial Plant: Gwar, Rubber, Tea, Coffee Narcotics: Cannabis, Opium,	6.Project Report /Dessertation	20
Tobacco	Total	75

General account of local plants of medicinal importance along with *Digitalis*, *Terminalia*, *Commiphora*, *Ocimum*, *Convolvulus* (Sankh Pushpi), *Catharanthus roseus*, *Aloe*, *Centella* (Brahmi Booti), *Chlorophytum* (Safed musli), *Tylophora indica*. Unexploited plants of potential economic value with reference to Rajasthan.

Reference Books-

1. Ecology and Field Biology - R.L. Smith, Harper Collins, New York
2. Fundamentals of Ecology - Odum, Saunders, Philadelphia
3. Basic Ecology— Odum, Saunders, Philadelphia
4. Ecology, Principles and Applications Chapman and Reiss, Cambridge Univ. Press, Cambridge, U.K.
5. Concepts of Ecology - Kermondy, Prentice Hall of India Pvt. Ltd., New Delhi.
6. Modern Concepts of Ecology - H.D. Kumar, Vikas Publishing House.
7. Aims and Methods of Vegetation Ecology-Muller Dombois and Ellenberg.
8. Economic Botany- Hill, Mac Graw Hill Book Comp.
9. Economic Botany- Pandey, S. Chand and Com., New Delhi.
10. Ecology- Ambushta, CBS Publication.
11. Global Environmental agreements- Asha Joshi, Gunilla Reisch Pub.
12. Forest Ecology in India- Neena Ambre, Foundation Books.

II Practical (Paper-VIIb and VIIIb)	Time 5 hours	Max. Marks 75
1.Plant Community Study		10
2.Soil/Water Analysis(Physical/Chemical Characters)		5
3.Phytogeographical Regions(World/India/Rajasthan)		6
4.Morphological and Anatomical Adaptation		6
5.Spot(5)		15
6. Viva-voce		8
7.Records		5
8.Project Report /Dessertation		20
Total		75

PAPER-IV: BIOCHEMISTRY AND PLANT PHYSIOLOGY
Duration : 3 Hrs. 75 Marks

Unit-I **Total 75**

Biochemistry : Carbohydrates : Classification, occurrence, structure and functions of monosaccharides, oligosaccharides, polysaccharides including starch, cellulose, pectin and chitin.
Proteins : Occurrence, structure-primary, secondary, tertiary and quaternary, properties and functions.
Lipids : Structure, synthesis of saturated and unsaturated fatty acids, lipid biosynthesis, α and β oxidations.
Enzymes : Structure, classification and mode of action.

Unit-II

Secondary metabolites : Definition, distribution and classification. Biosynthesis and functions of secondary metabolites with special reference to alkaloids, tannins and steroidal compounds.

Reference Books	Physiology : Water relations of plants : Unique physicochemical properties of water, solute potential, water potential in the plant, apparent free space, bulk movement of water. Soil Plant Atmosphere Continuum (SPAC). Stomatal regulation of transpiration, anti transpirants, internal water deficit and its physiological implications.
1. Introduction to Biotechnology –W.J.Thieman and M. A. Palladino, Publisher Benjain Cummings.	Unit-III
2. Plant Biotechnology –Randheer Singh, ISBN.	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.
3. Plant Biotechnology Methods in tissue culture and gene transfer – R.Keshav Chand & K.V.Peter,ISBN	Photosynthesis : Energy pathway in photosynthesis, chloroplast as an energy transducing organelle, composition and characterization of photosystems I and II, electron flow through cyclic, non cyclic and pseudocyclic photophosphorylations, pathway of CO ₂ fixation, difference between C ₃ and C ₄ photosynthesis, different kinds of C ₄ pathways, CAM pathway, regulation of photorespiration.
4.Plant conservation Biotechnology –Ranjeet Kaur Bhalla, ISBN.	Unit –IV
5. Plant Biotechnology and Biodiversity Conservation –U.Kumar & A. K.Kumar, Agrobios Jodhpur.	Respiration : Concepts of free energy and entropy. 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.
6. Advances in Applied Biotechnology –P.Parihar & L.Parihar, Agrobios, Jodhpur.	Nitrogen Metabolism : Sources of nitrogen to plants. Biological nitrogen fixation, reduction of nitrates, synthesis of amino acids by reductive and transamination, Glutamate Oxaloacetate Transaminase (GOT) and Glutamate Pyruvate Transaminase (GPT) system.
7. Text Book of Biotechnology –Preeti Gupta, ISBN.	Unit- V
8. Introduction to Plant Biotechnology –H.S.Chawla, Amazon.	Growth Regulators :Auxins, Gibberellins, Cytokinins, Abscissic acid and ethylene, their chemical nature, biosynthesis, bioassay, physiological effects and mode of action.
9. Recent Advances in Plant Biotechnology –A.Kirakosyan & P.B.Kaufman.	Physiology of Flowering : Photoperiodism and Vernalization.
10. Biotechnology fundamentals and applications –S.S.Purohit, Agrobios Jodhpur.	Reference Books
11. Biotechnology –S.R. Barnum, Brooks Cole.	1. Introduction to Plant Physiology - Hopkins, John Wiley and Sons, New York, USA.
12. PlantBiotechnology-P.K.Gupta,Rastogi Publication Meerut.	2. Plant Physiology. Salisbury and Ross, Wadsworth Publ. Co., California, USA.
13. Laboratory Manual of Biotechnology –P.K.Gupta, Rastogi Publication Meerut.	3. Plant metabolism Dennis, Turpin, Lefebure and Layzell, Longman Essex, England.
	4. Plant Physiology Taiz and Zeiger, Sinauer Associates, Inc Pub. Massachusetts, USA.
	5. Biochemistry and Physiology of Plant Hormones Moore, Springer, Verlag, New York, U.S.A.
	6. Biochemistry. Lubert Stryer, W.H. Freeman and Comp., New York.
	7. Plant Physiology, Devlin. Yan Nostrand Reinhold Comp. New York. Affiliated East West Press Pvt. Ltd., New Delhi.
Practical marking scheme	
I Practical (Paper-V and VI)	
Time 5 hours	Max. Marks 75
1. Taxonomy	10
2. Anatomy	5
3. Morphology	4
4. Embryology	5
5. Genetics	10
6. Molecular Biology	4
7. Biotechnology	3
8. Plant Breeding	2
9. Biometry	4
10. Spot (6) three-Paper-V three-Paper-VI	12
11. Viva-voce	8
12. Records	5
13. Excursion Report	3
Total	75
II Practical (Paper-VIIa and VIIb)	
Time 5 hours	Max. Marks 75
1. Major Exercise	20

8. Plant Physiology C.P. Malik, Kalyani Publishers, New Delhi.	UNIT- III
9. A Text book of Plant Physiology and Biochemistry S.K. Verma, S Chand & Comp., New Delhi.	Somatic embryogenesis- concepts, prospects and uses. Hybrid embryo rescue technique, production of rare hybrids, invitro pollination. Use of somatic embryogenesis in crop improvement.
10. Physiology of Plant Growth and Development Edited M.B. Wilkins McGraw Hill, London.	UNIT- IV
11. Plant Biochemistry - Bonner and Varner, Academic Press, New York.	Somatic hybridization and cybridization techniques and uses. Concepts about male sterility and their uses in crop improvement. Selection and characterization of mutant cell lines, auxotrophic mutants.
12. Introduction to Plant Physiology - G.R. Noogle & G.J. Fritz Prentice Hall of India Pvt. Ltd., New Delhi.	UNIT- V
13. Introduction to Plant Physiology. Mayer, Anderson, Bohning, Frantianne D. Van Nostrand Camp.	Tissue culture as a source of genetic variability. Somaclonal variations, basic concepts and its applications. Protoplast production- concepts and applications. Role of plant biotechnology in crop improvement, horticulture, forestry and conservation of biodiversity.
14. Biochemistry –Lehringer, Freman & Co. Ltd.	
15. Biochemistry –A.K.Bery Plant Biochemistry –edited P.M.Dey, J.B.Harborne, Academic Press, New York.	PAPER VIII d : ADVANCED PLANT BIOTECHNOLOGY- II
	3 Hrs. Duration 75 Marks
Practical marking scheme	
I Practical (Paper-I and IV)	UNIT- I
Time 5 hours	Max. Marks 75
1. Phycology	6
2. Mycology	6
3. Plant Pathology	5
4. Microbiology	4
5. Plant Physiology	10
6. Plant Biochemistry	8
7. Spot (6) three-Paper-I	12
three-Paper-IV	8
8. Viva-voce	8
9. Records	8
10. Excursion Report	8
Total	75
II Practical (Paper-II and III)	UNIT- II
Time 5 hours	Max. Marks 75
1. Gymnosperms	10
2. Pteridophytes	6
3. Bryophytes	6
4. Ecology(Field study-Quantitative and Analytical characters)	10
5. Ecological Anatomy-Adaptation	6
6. Phytogeography(India/world)	5
7. Economic Botany	4
8. Spot (6) three-Paper-II	10
	UNIT- III
	Southern, Northern and Western blotting technique. PCR: its principles and uses. Gene concepts and molecular biology of gene. Transcription and translation in prokaryotes and eukaryotes. Nitrogen fixing and genes and their genetic manipulation.
	UNIT- IV
	Ant sense –RNA, principles and applications. Male sterility: types and uses.Molecular farming.
	Secondary metabolites and strategies to increase their production in tissue culture
	UNIT-V
	Biotechnology and society, socio-economic aspects. Uses of cloned genes in agriculture, medicine and industry. Transgenic plants: Production and applications. Plant biotechnology and Intellectual Property rights(IPR).

Reference book	three-Paper-III	12
1. Introduction to plant physiology –W.G. Hopkins, John Wiley & Sons, Inc. New York USA.	9. Viva-voce	8
2. Biochemistry and physiology of plant hormones –T.C. Moore, Springer and Verlag, New York, USA.	10. Records	8
3. Plant physiology –L. Taiz and E. Zeiger, 2nd edition, Sinauer Associates. In. Publisher, Massachusetts, USA.	Total	75
4. Plant physiology –F.B. Salisbury and C. W. Ross, 4th edition, Wadsworth publishing Co., California.	M.Sc. FINAL BOTANY—2021 Scheme	
5. Photoperiodism in plants –B. Thomas and D. Vince pure, 2nd edition Academic press, Sandiego, USA.	Total marks of M.sc Final = 450	
6. Plant Physiology—S. Mukharji and A.K. Gosh	Four papers of three hours duration(2 compulsory+2 special)	
7. Plant Physiology –D. Hess, Springer Berlin.	Maximum marks of each paper = 75	
8. Plant Physiology –F.C. Steward, Academic Press, New York.	Minimum Passing Marks of each paper = 19	
9. Introduction to Plant Physiology - Hopkins, John Wiley and Sons, New York, USA.	Total Passing Marks of all four papers= 108	
10. Plant Physiology. Salisbury and Ross, Wadsworth Publ. Co., California, USA.	Maximum marks of Practical = 150	
11. Plant metabolism Dennis, Turpin, Lefebure and Layzell, Longman Essex, England.	I Practical include Paper-V and VI of maximum 75 marks (compulsory) Minimum Passing Marks= 27	
12. Plant Physiology Taiz and Zeiger, Sinauer Associates, Inc Pub. Massachusetts, USA.	II Practical include Paper-VII and VIII of maximum 75 marks(special) Minimum Passing Marks= 27	
13. Plant Physiology, Devlin. Yan Nostrand Reinhold Comp. New York. Affiliated East West Press Pvt. Ltd., New Delhi.	II Practical include 20 marks of PROJECT/DESSERTATION	
15. Plant Physiology C.P. Malik, Kalyani Publishers, New Delhi.	Duration of each practical = 5 hours	
16. A Text book of Plant Physiology and Biochemistry S.K. Verma, S. Chand & Comp., New Delhi.	Pattern of Theory Paper	
17. Physiology of Plant Growth and Development Edited M.B. Wilkins McGraw Hill, London.	Each paper is divided into 3 sections	
	Section A :- Consists of 10 compulsory Questions of 2 (two) mark each.	
	Word limit - Max 50 words.	
	Selection of question of Examiner- Maximum 2 from each unit (10X2=20)	
	Section B :- Consists of 5 Questions of 5 (five) mark each with internal choice. Students are required to Attempt all five questions.	
	Word limit - Max 200 words.	
	Selection of question of Examiner- Maximum 2 from each unit (5X5=25)	
	Section C :- Consists of 5 Essay type Questions of 10 (ten) marks each. Students are required to Attempt any 3 questions.	
	Word limit - Max 500 words.	
	Selection of question of Examiner- Maximum one from each unit (3X10=30)	
	COMPULSORY PAPERS	
	Paper V : Angiosperms: Taxonomy, Mophology, Anatomy and Embryology	
	Paper VI : Molecular Biology, Biotechnology, Genetics, Plant Breeding and Biometrics	

PAPER VII d :**ADVANCED PLANT BIOTECHNOLOGY-I**

3 Hrs.

75 Marks

UNIT-I

Concept and scope of plant Biotechnology Plant tissue culture: A historical perspective. The phenomenon of morphogenesis, morphogenetic factors for in vitro regeneration. Organogenesis and somatic embryogenesis.

UNIT-II

Micro propagation technology, meristem culture, haploids, anther-pollen culture and their uses. Management of micro propagated plants in laboratory and net houses. Commercial feasibility and advantages of micro propagation.

<p>SPECIAL PAPERS</p> <p>Paper VII : (a) Advanced Plant Pathology I</p> <p>Paper VIII : (a) Advanced Plant Pathology II</p> <p>Paper VII : (b) Advanced Plant Ecology I</p> <p>Paper VIII : (b) Advanced Plant Ecology II</p> <p>Paper VII : (c) Advanced Plant Physiology I</p> <p>Paper VIII : (c) Advanced Plant Physiology II</p> <p>Paper VII : (d) Advanced Plant Biotechnology I</p> <p>Paper VIII : (d) Advanced Plant Biotechnology II</p>	<p>Cardiac glycosides: structure and functions</p> <p>Structure, synthesis & functions of flavonoids.</p> <p>UNIT-V</p> <p>Tools and techniques :Principle and application of spectrophotometry, chromatography ,partition chromatography , thin layer chromatography, ion exchange chromatography, gas liquid chromatography, high performance liquid chromatography, gel filtration , electrophoresis, ultra-Centrifugation, isoelectric focusing , immobilized pH gradient , ELISA and RIA</p>
<p>PAPER V :</p> <p>ANGIOSPERM TAXONOMY, MORPHOLOGY, ANATOMY AND EMBRYOLOGY</p>	<p>PAPER VIII c :</p> <p>ADVANCED PLANT PHYSIOLOGY-II</p>
<p>3 Hrs 75 Marks</p>	<p>3 Hrs. Duration 75 Marks</p>
<p>UNIT – I</p> <p>Taxonomy: Botanical exploration: B.S.I., its organization and role, modern tools of plant taxonomy, e10/Syllabus/Botany.</p> <p>Systems of plants classification: Bentham and Hooker, Cronquist, Takhtajan and Thorne. Phylogeny of angiosperm. Origin , evolution and inter-relationships in dicots and monocots.</p>	<p>UNIT- I</p> <p>Plant growth regulators: Auxins, discovery, structure, biosynthesis, mode of action and function.</p> <p>Gibberellins- discovery, physiological effects, and response of plants, biosynthesis and mode of action.</p> <p>Cytokinins- discovery, structure, biosynthesis, physiological effect on seed plants and mode of action.</p>
<p>UNIT-II</p> <p>Phylogeny of Ranales, Amentiferae, Centrospermae, Tubiflorae, and Helobiales. Families of heterotrophic nature (parasitic, saprophytic and insectivorous.) Botanical nomenclature: ICBN rules, articles, recommendations and amendments of code. Botanical literature: Monographs, Icones, floras and important periodicals with emphasis on Indian floristics</p>	<p>UNIT- II</p> <p>Synthetic growth retardants, their physiological effect and biochemistry.</p> <p>Growth inhibitors- Abscissic acid and related compounds: discovery, natural occurrence, physiological effects, biosynthesis, mode of actions.</p> <p>Ethylene- History, biological effects, biosynthesis, mode of actions.</p>
<p>UNIT – III</p> <p>Morphology : General concept of plant morphology: Origin and evolution of flower. Stamen- Origin and evolution from foliar to reduced condition , extension of connective beyond anthers, mono di polyadelph, nectaries and nectar. Carpel evolution : Conduplicate, involute, appendicular and receptacular concepts, specialized carpels, poly and syncarpy, semi-inferior and inferior ovary. Evolution and types of placentation. Role of floral anatomy in interpreting the origin and evolution of flower and floral parts.</p> <p>Anatomy: Ultrastructure 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.</p>	<p>UNIT-III</p> <p>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.</p> <p>Phytochromes— History and discovery, occurrence and distribution of phytochromes, cryptochromes and phototropins, their photochemical and biochemical properties.</p>
<p>UNIT-IV</p> <p>Embryology: 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. Megasporangium (ovule) – types and evolution, megasporogenesis, embryosac types, structure of egg, synergids, antipodal cells.</p>	<p>UNIT- IV</p> <p>Photophysiology of light induced responses, cellular localization. Brief account of molecular mechanism of action of photomorphogenic receptors.</p> <p>Photoperiodism, vernalization, chemical: control of flowering. Circadian rhythms in plants.</p> <p>Seed germination and dormancy. Juvenility and senescence.</p> <p>UNIT- V</p> <p>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. 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.</p>

6. Readings in conservation ecology –G.W. Cox, Appleton Century Crofts, Michigan.
7. Plant ecology– E. Weaver, Ecological Society of America.
8. Forest ecology of India –G.B.Singh, Rawat Publications.
9. Ecology of natural resources –Francois Ramade, John Wiley & Sons Ltd.
10. Plants and environment –Daubenmire,
11. Environmental bioloy–K.C. Agarwal, Agrobotanical Pub..
12. Environmental pollution–Timmy Katyal, Anmol Pub...
13. Environment and pollution—Ambasht, CBS Publications.
14. Environmental pollution and health hazard in India –R. Kumar, Anish publication home.
15. Indian forest ecology –G.S.Puri, Oxford IBH.
- 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 embryosac. Endosperm: Development types, haustoria, cytology and function of endosperm. Embryo : embryogenic types and embryo culture. Polyembryony: types, natural, induced, importance.
- Apomixis : Type and importance. Role of embryology in plant breeding.
- Reference Books:**
1. Diversity and classification of Flowering Plants- Takhtajan, Columbia Univ. Press, New York.
 2. An introduction to Embryology of Angiosperm - P. Maheshwari, New Delhi.
 3. Recent Advances in the Embryology of Angiosperms-P. Maheshwari, New Delhi.
 4. The embryology of Angrosperms - Bhajwani and Bhatnagar, Vikas Pub. House, New Delhi.
 5. Taxonomy of Angiosperms - V.N. Nair, TMH Publishing Comp. Ltd., New Delhi.
 6. Taxonomy of Angiosperms - Kshetrapal and Tyagi, RBD Pub., Jaipur.
 7. Introduction to Principles of Plant Taxonomy-Sivarajan, Oxford & IBH Publishing Co., New Delhi.
 8. Plant Systematics - Gurcharan Singh, Oxford & IBH Publishing Co. New Delhi.
 9. Morphology of Vascular Plants - A.J. Eames, Tata McGraw Hill Publ. Co. Ltd., New Delhi.
 10. An introduction to Taxonomy of Angiosperms - Shukla and Mishra, Vikas Publ. House Pvt. Ltd., New Delhi.
 11. Modern Plant Taxonomy- N.S. Subranmanyam, Vikas Publ. House Pvt. Ltd., New Delhi.
 12. Morphology of Angiosperms -A J Eames, McGraw Hill Book Comp.Ltd., New York.
 13. The Morphology of Angiosperms - Sporne, K.P. Churamani for B.I. Publications, New Delhi.
 14. Morphology of Vascular Plants-D.W. Bierhorst Macmillan Comp., New York.
 15. Morphology of Angiosperms - A.J. Eames, Mc Graw Hill Book Comp., New York.

PAPER VII c :**ADVANCED PLANT PHYSIOLOGY - I**

3 Hrs. Duration 75 Marks

UNIT- I

Carbohydrates: Classification and synthesis:Respiration: Anaerobic, aerobic, pentose phosphate cycle HMP) Photo respiration, fermentation, Photosynthesis: Pigments (Chlorophylls, carotenoids) structure, synthesis functions, polyamines, Photophosphorylation, Calvin cycle, C4 dicarboxylic acid cycle.

UNIT- II

Protein: Chemistry, Classification and synthesis. Enzymes: Classification, structure, mechanism of action inhibition, promotion, activation. Water soluble pigments (anthocyanins) synthesis and function (Genetic role) . 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- III

Coumarins & lignins: Structure and synthesis, chemistry, distribution and function. Vitamins: Structure and function. Metabolism of secondary metabolities Tannins : Distribution, synthesis and functions. Hallcuiinogens: distribution, chemistry and functions, Alkaloids : pyrrole and pyrrolidine, pyridine, polyacetyl, isoquinoline, tropane and indole alkaloids, their distribution synthesis and function.

UNIT- IV

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

PAPER VI :	PAPER VIII b :
MOLECULAR BIOLOGY, GENETICS, BIOTECHNOLOGY, PLANT BREEDING AND BIOMETRY	ADVANCED PLANT ECOLOGY-II
3 Hrs. Duration	75 Marks
75Marks	75 Marks
UNIT I	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 Replicaton: mechanism, enzymes, evidences in favour of semi conservative replication.	Desert, their formation, topography and distribution characteristics of desert with special reference to water economy. The hot and cold deserts and other similar habitats vegetations.
UNIT-II	Unit - II
Gene structure and function , lac operon, tryptophan operon. Genetics: Mendalism versus meiosis: Mendal's inheritance, Genes and their interaction, Polygenic- inheritance. Cytoplasmic inheritance, Sex determination-XXX. Linkage , crossing over chromosomal mapping, Polyploidy and its role in evolution. Mutation -types, chemical and physical mutagens.	Introduction to World Desert Biome : Origin, characters and geomorphology of thar desert . Vegetation and floral composition of Rajasthan desert : Adaptations of plant matching the desert environment Effect of abiotic and biotic factors on desert vegetation and distribution. Thar desert resources : forest energy , minerals, live stock and rangeland conditions, Ecology of grazing land and impact of overgrazing, Threatened plants of Rajasthan desert and conservation srtagaties .Arid regions of India with particular reference to Rajasthan.
UNIT-III	Unit - III
Biotechnology : concept and scope of biotechnology, Plant tissue-culture, anther and pollen culture, callus-culture and protoplast culuture: Isolation, purification, culture and fusion: Cybrids and hybrids, 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 . Genetic engineering and its principles.gene -transfer. Transgenic plants and methods, production ,applicatrion and use, importance of genetic engineering.	Ecology of grazing land and impact of overgrazing, Threatened plants of Rajasthan desert and conservation srtagaties .Arid regions of India with particular reference to Rajasthan. The seline tracts and their vegetation (Halophytes) with their reference to Rajasthan, Mangrove vegetation!
UNIT-IV	Unit - IV
Plant breeding: Introduction, Breeding methods in self and cross pollinated and vegetatively propagated crops. Polyploids and mutations and their uses in breeding. Characterization of polyploids and mutants; uses in plant breeding . Hetercsis and inbreeding depression and causes of hybrid vigour. Production and application of hybrid vigour in plant breeding.	Rajasthan - Geology, Physiography, Climate, Soil and Water problem in Rajasthan particularly underground water resources and its change. Desert as an ecosystem, biological productivity, cycles and balances in desert ecosystem.
UNIT- V	Unit - V
Biometry: Mean, Mode & Median, standard deviation and SB experimental errors, hypothesis testing, reliability and validity of results and inferences from experiments. Variance, Standard deviation, co-efficient of variation,skewness and kurtosis. Probability distribution binominal,positive negative binominal. Chi square test hypothesis. Correlation : simple partial and multiple correlation, concept and uses.	Vegetation of Rajasthan desert and plant communities. Soil erosion and reclamation of soil, stabilization of sand dunes. Adaptation of plants and animals to arid conditions. Habit studies and Phenology of the desert. Plants, root investigation, reproduction capacity seed output, Germination, Dormancy and Viability
	Reference books –
	1. Terrestrial plant ecology –M.G.Barbour,J.H. Burk and W.D.Pitts, Benjamin/Cumming Publication Compony, California.
	2. Ecology – M. Begon,J.L.Harper and C.R.Townsend ,Blackwell science, Cambridge.
	3. Population, environment and development – R.K. Pachausri and L.F. Qureshy,Tyeri, New delhi.
	4. Population biology of plants – J.L. Harper, .Academic press, London and New York.
	5. Introduction to plant ecology – Maurice Ashby, Mac Millan Uni.
	Of Wisconsin

PAPER VII b :**ADVANCED PLANT ECOLOGY - I**

3 Hrs. Duration

75 Marks

Unit-I

Fundamentals of Ecology, Definition, history and scope. Environment : Holistic environment, factors (Climatic, Edaphic, Topographic and Biotic) and their interactions with plants. Population and community ecology. Succession in plant communities. Plant interaction with other organisms within community.

Unit- II

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

Unit- III

Types of Ecosystem : Forest, grassland, desert, fresh water, marine water, wetland, natural and man made ecosystems, urban and rural ecosystem. 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- IV

Natural Resources : Types, exploitation and conservation (forest, soil, water, air and energy). Biodiversity of India. Hot spots, threats to biodiversity (endangered flora and fauna), biodiversity indices, biodiversity gradient, 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, Earth submit 1992.

Unit- V

Pollution : Air, Water, Soil, Noise, Thermal, Global warming and climatic change, effect of green house gases :CO₂,CH₄,N₂O,CFCs, ozone layer and hole, CBD (Convention on Biological Diversity) 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, Environment Education, Awareness and Ethics.

Reference Books-

1. Molecular Biology of the Cell-Albert, Lewis, Raff, Robert and Watson, Garland Publishing Inc., New York.
2. Gene VII - Lewis, Oxford Univ. Press, New York, USA.
3. Genetics - Russel, The Benjamin Publ. Comp. Ltd., USA.
4. Cell and Molecular Biology - P.K. Gupta, Rastogi Publications, Meerut.
5. Molecular Biology of the Gene - J.D. Wastson,
6. Cell Biology and Genetics K.C. Agarwal, Nidhi Publisher, Bikaner.
7. Molecular Biology and Biotechnology, Nidhi Publisher, Bikaner
8. Principles of Cell and Molecular Biology- Klein Smith Harper Collins College Publ., New York, USA.
9. Molecular Cell Biology- Lodish, Berk, Zipursky, Matsudaira, Baltimore and Darnell, Freeman and Co., New York, USA.
10. Methods in Plant Molecular Biology and Biotechnology, CRC Press, Boca Raton, Florida.
11. Plant Cell Biology : Structure and Function – Gunning and Steer, Jones and Barlett Publ. Boston, Massachusetts.
12. Plants tissue Culture-Bhojwani and Rajdan. Theory and practice. Elsevier Science Publ., New York, USA.
13. Plant Tissue Culture : Applications and limitations-Elsevier Sci. Publi., New York, USA.
14. Plant Cell and Tissue Culture-Vasil and Thorpe, Kluwer Academic Publishers, Netherland.
15. Genetics- A.M. Winchester, Oxford and IBH Publishing Co. New Delhi.
16. Cell and Molecular Biology- De Robertis (Indian Edition) Verghese Comp., Bombay.
17. Elements of Biotechnology – P.K. Gupta, Rastogi Publication, Meerut.
18. Plant Breeding -V.L Chopra, Oxford & BH Pub. Co. Pvt. Ltd.
19. Elementary principles of Plant Breeding - H .K. Chaudhary Oxford & IBH Pub. Co. Pvt. Ltd.

PAPER VII a :**ADVANCED PLANT PATHOLOGY - I**

3 Hrs.

75 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. Role of plant tissue culture in studies on host parasite relationship. Phenomeon of plant infection, penetration, infection, post infection development, factors affecting infection, defence mechanism.

UNIT-II

Host pathogen interaction: The response of the host, pathogenicity and virulence, host specific toxins in relation to pathogenesis and disease resistance, hypersensitivity reactions. Nucleic acids in host parasitic interaction, phytoalexins, inoculum potential, epiphytotic 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- III

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

UNIT-IV

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; 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- V

Other diseases: Red root and smut of sugarcane, fusarium wilt of cotton flax and pigeon pea; flax rust, Ascochyta blight of gram; early blight of tomato and potato; late blight of potato; Tikka disease of groundnut and downy and powdery mildew of grapes.

PAPER VIII a :**ADVANCED PLANT PATHOLOGY- II**

3Hrs. Duration

75 Marks

UNIT-I

Classification and nomenclature of bacterial pathogens. Symptomatology, Methods of identification of bacterial pathogens. (i) Morphology (ii) Physiology (iii) Serology (iv) Pathogenicity. Physiological and cytological aspects of bacterial infection process and disease development. Mechanism of infection of bacterial pathogens.

UNIT- II

Bacterial disease: Brown rot, ring rot of potato, Fire blight of stone fruits. Tundu disease of wheat, Stalk rots of maize. Bacterial blight of rice. Soft rot of vegetables. Red strip of sugarcane, Crown gall disease. Angular leaf spot of cotton, Citrus canker.

UNIT- III

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

Nematology: Classification and identification of plant pathogenic nematodes. Morphology and anatomy of nematodes. Methods and use in nematology.

Nematode disease: Ear cockle of wheat, Root knot of vegetables, Molya disease of wheat.

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.

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 G.S.U. 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, Academic Press, New York.