

one year P.G.

Detailed Syllabus for PG degree

Or

M.Sc. Botany


Dean
Faculty of Science And Technology
Maa Vindhyavasini University, Mirzapur

Semester-wise Titles of the Papers in M.Sc. (Botany)					
Year	Sem	Course Code	Paper Title	Theory/ Practical	Credits
FIRST YEAR	IX	B040901T	Microbial Diversity	Theory	4
		B040902T	Archegoniate and Plant Diversity	Theory	4
		B040903T	Gymnosperm, Paleobotany and Angiosperm	Theory	4
		B040904P	Practical based on Paper 901-903	Practical	4
		B040905R	Research Project/Dissertation	Theory	4
	X	B041001T	Plant Cell, Molecular Genetics and Biotechnology	Theory	4
		B041002T	Plant Physiology and Biochemistry	Theory	4
		B041003T (a)	Environmental Botany	Theory	4
		B041003T (b)	Plant Pathology		
		B041003T (c)	Advanced Plant Physiology		
		B041004P	Practical based on Paper 1001-1003	Practical	4
		B041005R	Research Project/Dissertation	Theory	4

Syllabus Prepared by				
S. N	Name & email	Designation	Department	College/ University
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2.	Dr. Devendra Pandey	Dean & Professor	Science and Technology	K.B.P.G. College, Mirzapur
3.	Dr. Maya mavabhuem@gmail.com	Head & Professor	Department of Botany	Dr. Shyama Prasad Mukharjee, Govt. Degree College, Bhadohi
4.	Dr. Ranjit Singh ranjeet14nov1975@gmail.com	Assistant Professor	Department of Botany	Kashi Naresh Govt. P G College, Gyanpur, Bhadohi
5.	Dr. Anil Kumar Dwivedi (External Expert)	Professor	Department of Botany	Deen Dayal Upadhyay, Gorakhpur University
6.	Dr. Pankaj Kumar (External Expert)	Professor	Department of Botany	Uday Pratap Autonomous College, Varanasi

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Ranjit

Pankaj

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PG in Botany (1 year)

Subject prerequisites:

1. To study PG in Botany, a student must have had the degree of B.Sc Hons.in Botany.
2. Keen interest in plants and plant-related research, Potential in mathematics, biology and chemistry
3. Skills and aptitude for scientific study and research
4. Creativity and good comprehension while working on scientific procedures and research
5. Computer aptitude.

COURSE INTRODUCTION

The M.Sc. Botany programme is designed to provide advanced knowledge and practical understanding of plant sciences with special emphasis on microbial diversity, plant taxonomy, ecology, genetics, biotechnology, physiology, biochemistry, environmental biology and plant pathology. The programme integrates classical and modern aspects of botany to develop scientific temperament, analytical skills, laboratory competency and research aptitude among students. It emphasizes theoretical concepts along with practical training in microscopy, molecular techniques, tissue culture, ecological analysis, plant identification and experimental methods. The curriculum also focuses on biodiversity conservation, sustainable utilization of plant resources, environmental management and recent advances in biological sciences to prepare students for higher research, teaching, industry and allied professional fields.

PO9	Develop comprehensive knowledge of microbial diversity, algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms along with taxonomy, palaeobotany, structural botany and ecology. Students acquire understanding of plant diversity, evolutionary relationships, biodiversity conservation and environmental management while also gaining practical skills in microbial techniques, herbarium preparation, plant identification, anatomical studies and ecological analysis.
PO10	Advanced understanding of plant cell biology, molecular genetics, biotechnology, plant physiology, biochemistry, environmental botany and plant pathology. Students develop knowledge of modern molecular and biotechnological techniques, plant metabolism, stress physiology, environmental conservation and disease management along with practical competency in cytology, tissue culture, molecular analysis, biochemical estimations, physiological experiments and plant pathology techniques for research and professional applications.

Programme Specific Outcome**PG in Botany
(One Year Programme)**

Students completing the M.Sc. Botany PG programme gain advanced theoretical knowledge and practical skills in plant sciences, microbiology, biotechnology, ecology, genetics, physiology, taxonomy and plant pathology. The course develops laboratory competence, field study techniques, scientific observation, analytical thinking and research aptitude. Students become skilled in modern biological techniques such as tissue culture, molecular analysis, microbial culturing, ecological assessment and plant identification. The programme also enhances understanding of biodiversity conservation, environmental management and sustainable utilization of plant resources, preparing students for careers in teaching, research, biotechnology industries, environmental organizations, agriculture, forestry and higher academic studies such as Ph.D. and competitive examinations.

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Programme/Class: 1 Year PG degree	Year: V	Semester: IX Paper-I
Subject: Botany		
Course Code: B040901T	Course Title: Microbial Diversity	
Course Outcome: After successful completion of the course, students will understand the classification, structure, transmission, detection, and control of plant viruses, viroids, and bacteria; explain bacterial genetics, metabolism, and antibiotics; describe fungal classification, thallus organization, nutrition, reproduction, and culturing methods; identify important fungal genera and their pathogenic significance; and develop practical knowledge of microbial diversity and modern microbiological techniques.		
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0		
Unit	Topic	No. of Lectures (60 hrs)
I	Nomenclature and classification of plant viruses, Range of plant virus particle and its genomic organization, Nature of plant viruses, Morphological, anatomical, and biochemical changes in virus infected plants, Transmission of plant viruses and their relationship with vectors. Purification and electron microscopy of viruses, Virus detection by serological and nucleic acid hybridization methods. Modern methods of plant virus disease control. Structure, replication and pathogenicity of viroids, MLOs, Prions Structure and replication of viruses infecting bacteria.	15
II	Bacteria- History, classification, structure and genetics History of microbiology. Classification of Bacteria and Archaeobacteria based on Bergey's Manual of Systematic Bacteriology. Bacterial cell structure. function of cell components.	15

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	Bacterial genome structure, replication, expression and recombination, and plasmids. Bacterial nutrition and metabolism, including Nitrogen fixation. Antibiotics and their mode of action.	
III	Principle of important system of classification of fungi up to the rank of classes. Detailed fungal Classification of Alexopoulos and Mims. Thallus organization, phylogeny and cell structure. Mode of nutrition of fungi Reproduction, hormonal mechanism of sexual reproduction. Heterosis, parasexuality, heterothallism. Methods of isolation and culturing of fungi	15
IV	Characteristic features, systematic position, thallus organization, reproduction, disease and interrelationships of the principal classes of fungi with special reference to following genera: <i>Stemonitis, Plasmodiophora, Synchytrium, Allomyces, Saprolegnia, Achlya, Phytophthora, Pythium, Peronospora, Sclerospora, Pilobolus, Entomophthora, Yeasts, Taphrina, Penicillium, Protomyces, Erysiphe, Puccinia, Uromyces, Melampsora, Ustilago, Fusarium, Colletotrichum, Helminthosporium, Alternaria, Cercospora, Rhizoctonia.</i>	15
Suggested Readings 1. Prescott's Microbiology by Joanne M. Willey, Linda M. Sherwood and Christopher J. Woolverton – for fundamentals of microbiology, bacterial structure, metabolism, genetics, and antibiotics. 2. Microbiology by Michael J. Pelczar, E. C. S. Chan and Noel R. Krieg – comprehensive reference for bacterial diversity and microbial physiology. 3. Plant Virology by Roger Hull – detailed account of plant viruses, viroids, transmission, diagnosis, and control methods. 4. Introduction to Modern Virology by Nigel Dimmock, Andrew Easton and Keith Leppard – useful for virus structure, replication, and pathogenicity. 5. Bergey's Manual of Systematic Bacteriology edited by George M. Garrity – standard reference for bacterial and archaeal classification. 6. Introductory Mycology by C. J. Alexopoulos, Charles W. Mims and M. Blackwell – authoritative text on fungal classification, thallus organization, and reproduction. 7. The Fungi by Ainsworth and Bisby – important reference for fungal diversity and taxonomy. 8. Textbook of Fungi by B. P. Pandey – useful for Indian university curricula and fungal genera studies. 9. Plant Pathology by George N. Agrios – standard text for fungal diseases, pathogen interactions, and disease management. 10. Microbial Diversity by D. P. Dubey and D. K. Maheshwari – covers microbial diversity, ecology, and applied microbiology. 11. Laboratory Manual in Microbiology by P. Gunasekaran – practical guide for microbial isolation, culturing, staining, and laboratory techniques. 12. Dictionary of the Fungi by P. M. Kirk, P. F. Cannon and J. A. Stalpers – reference source for fungal nomenclature and taxonomy.		

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Programme/Class: 1 Year PG degree	Year: V	Semester: IX Paper-II
Subject: Botany		
Course Code: B040902T	Course Title: Archegoniate and Plant Diversity	
Course Outcome: After successful completion of the course, students will understand the classification, structure, reproduction, life cycles, and economic importance of algae, lichens, bryophytes, and pteridophytes; explain their phylogeny, evolution, ecology, and distribution; identify important genera and their characteristic features; and develop knowledge of plant diversity and evolutionary relationships among archegoniate plants.		
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0		
Unit	Topic	No. of Lectures (60 hrs)
I	Phycology: Distribution of Algae, Study of important systems of classifications, criteria used in algal classifications including recent trends up to order Range of thallus structure and organization Reproductive diversity, life history patterns and alternation of generations. Economic Importance Characteristics features, systematic position, thallus organization, reproduction, phylogeny and interrelationships of the principal classes of algae with special reference to- <i>Microcystis, Oscillatoria, Gloeotrichia, Chlorella, Hydrodictyon, Odeogonium, Bulbochaete, Chara, Nitella. Botrydium, Navicula Ectocarpus, Laminaria, Fucus Batrachospermum, Polysiphonia.</i>	20

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II	A general account of lichens and its symbionts, thallus structure, reproduction, physiology, classification and distribution. Chemistry of lichens, Isolation of symbionts and synthesis of thallus. Economic importance of lichens.	10
III	General characteristics and Distribution, life cycle and broad outline classification of bryophytes, Ecology, Physiology and Reproductive biology of Bryophytes, Evolution of sporophyte in bryophyte, Characteristic features, classification, range of gametophytic and sporophytic organization (morphology, anatomy and their distribution in India) of the principle classes of bryophytes with special reference to following genera: <i>Takakia, Calobryum, Porella, Plagiochasma, Anthoceros, Notothylas, Sphagnum, Polytrichum</i>	15
IV	Classification, distribution and origin of pteridophytes, Telome theory and evolution of stelar system, Heterospory and seed habit, Apogamy and Apospory. Classification, distribution, morphology, life history and phylogeny of the following classes with special reference to following genera: <i>Rhynia, Psilotum, Selaginella, Isoetes, Ophioglossum, Osmunda, Pteris, Adiantum, Azolla</i>	15

Suggested Readings

1. College Botany Volume II by H. C. Gangulee, A. K. Kar and P. K. Datta – useful for algae, bryophytes, pteridophytes, and plant diversity studies.
2. Algae by V. D. Desikachary – standard reference for algal classification, morphology, and diversity.
3. Textbook of Algae by O. P. Sharma – comprehensive coverage of phycology, life cycles, and economic importance of algae.
4. Introductory Phycology by H. D. Kumar – important text for algal taxonomy, ecology, and reproduction.
5. The Biology of Lichens by Mason E. Hale – detailed account of lichen structure, physiology, chemistry, and economic importance.
6. Lichens by S. Ahmadjian – useful reference for lichen symbiosis and thallus organization.
7. Bryophyta by B. R. Vashishta – widely used text for bryophyte classification, morphology, ecology, and reproduction.
8. Morphology of Bryophytes by K. S. Parihar – authoritative work on bryophyte evolution and sporophyte development.
9. Pteridophyta by B. R. Vashishta – comprehensive treatment of pteridophyte morphology, stelar evolution, and heterospory.
10. An Introduction to Pteridophyta by Rashid – useful for phylogeny, life cycles, and classification of pteridophytes.
11. Plant Morphology by Katherine Esau – important reference for evolutionary trends and plant structure.
12. Cryptogamic Botany by G. M. Smith – classic reference for algae, bryophytes, and pteridophytes.
13. A Textbook of Botany by Pandey – suitable for Indian university syllabi and competitive examinations.
14. Plant Evolution and Paleobotany by K. R. Sporne – valuable for understanding phylogeny and evolutionary relationships among archegoniate plants.

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Programme/Class: 1 Year PG degree	Year: V	Semester: IX Paper-III
Subject: Botany		
Course Code: B040903T	Course Title: Gymnosperm, Paleobotany and Angiosperm	
Course Outcome: After successful completion of the course, students will understand the classification, morphology, anatomy, reproduction, phylogeny, and economic importance of gymnosperms; explain fossil types, fossil flora, and the role of palaeobotany in evolutionary studies; acquire knowledge of plant taxonomy, herbarium techniques, botanical gardens, and modern taxonomic approaches; identify distinguishing features of important angiosperm families; and develop understanding of economically important plants and plant products used in forestry, textiles, medicines, and industries.		
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0		
Unit	Topic	No. of Lecturs (60 hrs)
I	General characteristics of Gymnosperms. Classification of Gymnosperms Distribution of Gymnosperms with special reference to India. Economic importance of Gymnosperms, Origin and evolutionary tendencies in Gymnosperm A study of their morphology, structure, life history, interrelationship and phylogeny of the following classes with special reference to the following genera: Glossopteris, Zamia, Williamsonia, Pentoxylon Ginkgo, Araucaria, Thuja, Ephedra Gnetum, Welwitschia	15
II	Palaeobotany Types of Fossils, their methods of preservation and methods of study. Applied Palaeobotany: Carbon dating, palaeobotany of coal and petroleum, palynology. Study of Indian Fossil Flora: Gondwana Flora, The Rajmahal Flora, Deccan Intertrappean Flora. Theory of continental drift.	10
III	History of plant taxonomy. ICBN (History, Principles and Application.) Systems of Classification: outlines, basis, merits and demerits of following classifications- Bentham and Hooker, Hutchinson, Takhtajan, Cornquist and APG system. Field and herbarium techniques. Herbaria and Botanical Gardens of India and World. Organisation and activities of BSI. Modern trends of taxonomy: Morphology, Cytology,	10

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	Nucleic Acid Hybridization, Chemotaxonomy, numerical taxonomy and serotaxonomy. Morphology: Phylogeny and interrelationship of Angiosperm. Morphology of flower with special reference to the morphology of carpel and inferior ovary.	
IV	Distinguishing features of the following families with special reference to local flora: Dicots: Ranunculaceae, Caryophyllaceae, Capparaceae, Fabaceae, Mimosaceae, Caesalpiniaceae, Rosaceae, Apiaceae, Amaranthaceae, Asclepiadaceae, Rubiaceae, Asteraceae, Acanthaceae, Verbenaceae, Lamiaceae, Scrophulariaceae, Euphorbiaceae, Moraceae. Monocots: Cyperaceae, Poaceae, Lilaceae, Orchidaceae, Arecaceae, Commelinaceae, Zingiberaceae.	15
V	Economic botany: Scope of economic botany, study of economically important plants and plant products. Forest Products: a) Wood Timber and Lumber. b) Resins, gum, tanning, material and cork. c) Rubber and other latex products. Textile plants and products: A general account. Fumitories and masticatories: A general account. Narcotics and Insecticide as plant products.	10

Suggested Readings

1. Gymnosperms by B. P. Pandey – comprehensive text on morphology, anatomy, classification, and evolution of gymnosperms.
2. The Gymnosperms by C. J. Chamberlain – classic reference for gymnosperm phylogeny and reproductive biology.
3. Morphology of Gymnosperms by K. R. Sporne – important book on structure and evolutionary tendencies of gymnosperms.
4. Paleobotany by Birbal Sahni – valuable reference for fossils, fossilization, and Indian fossil flora.
5. An Introduction to Paleobotany by Arnold – useful for fossil study methods, continental drift, and palaeobotanical applications.
6. Plant Taxonomy by O. P. Sharma – detailed coverage of classification systems, nomenclature, and modern taxonomy.
7. Taxonomy of Angiosperms by V. Singh and D. K. Jain – standard text for angiosperm classification and family characteristics.
8. Plant Systematics by Gurcharan Singh – modern reference for phylogeny, APG system, herbarium techniques, and biosystematics.
9. An Introduction to Taxonomy of Angiosperms by P. K. Verma and V. K. Agarwal – useful for university-level taxonomy studies.
10. Economic Botany by S. L. Kochhar – comprehensive account of useful plants, forest products, fibres, and plant-based industries.
11. Economic Botany in the Tropics by S. L. Kochhar – important reference for medicinal, narcotic, and commercial plant products.
12. College Botany Volume III by Gangulee and Kar – useful for gymnosperms, palaeobotany, taxonomy, and economic botany.

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Programme/Class: 1 Year PG degree	Year: V	Semester: IX Paper IV
Subject: Botany		
Course Code: B040904P	Course Title: Practical based on paper 901-903	
Course Outcome: Students will acquire practical skills in microbiological techniques, identification and study of fungi, algae, bryophytes, pteridophytes, gymnosperms and angiosperms through microscopic observations and specimen preparation. The course enables students to develop competency in herbarium preparation, plant identification using floras, anatomical studies, ecological analysis, soil and water examination, and field-based assessment of vegetation and environmental factors for biodiversity and ecological studies.		
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4		
Unit	Topic	No. of Lecturs (60 hrs)
I	1.Preparation of Nutrient media (NAM, LB, PDA) and sterilization technique 2.Gram's staining and Antibiotic susceptibility test of bacteria 3.Inoculation techniques for growth of bacterial population 4.Isolation of microorganisms from different natural sources- soil, water and sewage 5.Study of following genera of fungi- <i>Synchytrium, Phytophthora, Pythium, Peronospora, Sclerospora, Yeast, Taphrina, Penicillium, Protomyces, Erysiphae, Claviceps, Puccinia, Melampsora, Ustilago, Lycoperdon, Fusarium, Colletotrichum, Heminthosporium, Alternaria, Cercospora, Rhizoctania</i>	15
II	Study and Identification of following genera with suitable preparation Algae: Chlorophyceae- <i>Chlorella, Hydrodictyon,, Ulva, Cladophora, Stigeoclonium, Pithphora, Frittschiella, Zygonema, Oedogonium, Bulbocheate,</i> Cyanophyceae- <i>Microcystis, Lyngbya, Gleotrichia, Stigonema</i> Xanthophyceae- <i>Botrydium</i> Bacillariophyceae- <i>Navicula</i> Phaeophyceae- <i>Ectocarpus, Laminaria</i>	15

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	Rhodophyceae- <i>Batrachospermum</i>, , <i>Polysiphonia</i> Bryophyta Study and Identification of following genera with suitable preparation <i>Sphagnum</i>, <i>Polytrichum</i>, <i>Takakia</i>, <i>Calobryum</i>, <i>Porella</i>, <i>Plagiochasma</i>, <i>Anthoceros</i>, <i>Notothylas</i>, <i>Dendroceros</i>	
III	Monographic study of the sporophyte body of the following: <i>Selaginella</i>, <i>Isoetes</i>, <i>Ophioglossum</i>, <i>Osmunda</i>, <i>Pteris</i>, <i>Adiantum</i>, <i>Pteridium</i>, <i>Gleichenia</i>, <i>Cyathea</i>, <i>Marsilea</i>, <i>Azolla</i> A study of representative types <i>Pinus</i>, <i>Ginkgo</i>, <i>Araucaria</i>, <i>Thuja</i>, <i>Taxus</i>, <i>Ephedra</i>, <i>Gnetum</i>, Study of fossils and fossils slides	15
IV	1. Description of local plant in semi technical language 2. Identification of Angiospermic plants up to the level of family 3. Identification of Angiospermic plants of known family up to the level of genus and species with the help of flora Note: - Students have to collect and submit at least 100 plants properly pressed and mounted on Herbarium sheets by excursion 4. Study of the plants and its parts (root, stem and leaves) by sectioning and staining 5. Prepare of smear for the study of gametophyte	15

Suggested Readings

1. Practical Botany — Bendre, A.M. and Kumar, A. *Practical Botany*. Rastogi Publications.
2. Laboratory Manual of Microbiology — Cappuccino, J.G. and Sherman, N. *Microbiology: A Laboratory Manual*. Pearson Education.
3. Introductory Mycology — Alexopoulos, C.J. *Introductory Mycology*. Wiley Eastern Ltd.
4. College Botany Practical — Gangulee, H.C. et al. *College Botany Practical*. New Central Book Agency.
5. Plant Anatomy — Esau, K. *Plant Anatomy*. Wiley Eastern Pvt. Ltd.
6. Practical Plant Ecology — Misra, R. *Ecology Workbook and Laboratory Manual*. Oxford and IBH Publishing Co.
7. Taxonomy of Angiosperms — Pandey, B.P. *Taxonomy of Angiosperms*. S. Chand & Company.
8. Plant Systematics — Singh, G. *Plant Systematics: Theory and Practice*. Oxford & IBH Publishing.
9. Morphology of Pteridophytes — Sporne, K.R. *The Morphology of Pteridophytes*. Hutchinson University Library.
10. Morphology of Gymnosperms — Coulter, J.M. and Chamberlain, C.J. *Morphology of Gymnosperms*. Central Book Depot.
11. Economic and Environmental Botany — Shukla, R.S. and Chandel, P.S. *Plant Ecology and Soil Science*. S. Chand & Company.
12. Manual of Herbarium Techniques — Jain, S.K. and Rao, R.R. *A Handbook of Field and Herbarium Methods*. Today & Tomorrow Publishers.

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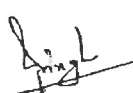
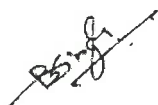
Programme/Class: 1 Year PG Degree	Year: IV	Semester: IX Paper-V
Subject: Botany		
Course Code: B040905R	Course Title: Dissertation/Research Project	
Course Outcome The Research Project/Dissertation is designed to ensure that the student is able to apply the knowledge gained in the previous semesters in specific areas of interest in a problem solving environment, gaining bench-experience, to serve as a springboard for a professional future.		
Credits: 04		
Research Project/Dissertation Research Project/Dissertation for Semester X will be carried out by the students in various recognized/established labs of Parent/Other Universities, of Institutes under CSIR, ICMR, IIT, ICAR, DST, DBT, Industry, Government Departments etc. (to be arranged by the students themselves, including whatever expenses become due in this regard).		

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Programme/Class: 1 Year PG degree	Year: V	Semester: X Paper-I
Subject: Botany		
Course Code: B041001T	Course Title: Plant Cell, Molecular Genetics and Biotechnology	
Course Outcome: Students will develop comprehensive understanding of plant cell structure, cell organelles, cell division, cell signaling and programmed cell death. The course provides knowledge of genome organization, chromosome structure, nucleic acids, gene interaction, mutation, recombination and gene expression. Students will also gain understanding of modern biotechnological tools including genetic engineering, plant tissue culture, molecular markers, transgenic technology, biofertilizers, biopesticides and applications of biotechnology in agriculture and plant improvement.		
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0		



Unit	Topic	No. of Lecturs (60 hrs)
I	Microscopy and Structural organization of cell, organization of microtubules and microfilaments, plasmodesmata. Cell organelles (micro bodies, Golgi apparatus, Lysosomes, endoplasmic reticulum, vacuole, ribosomes, nucleus, chloroplast, mitochondria). Cell wall, Plasma membrane and their structural models and functions. Active and Passive uptake of ions- ion channels and type of transport Cell Division, Cell Cycle, Mitosis and Meiosis, Control of cell division Apoptosis and Programmed Cell Death (PCD) in plants. Cell Signaling	15
II	Genome-Basic concept and organization. Chromosome structure, nucleosome and packaging of DNA, molecular organization of centromere and telomere, nucleolus and ribosomal RNA genes, euchromatin and heterochromatin, karyotype analysis, banding patterns. Specialized chromosomes—Polytene chromosomes, lampbrush chromosomes, chromosomes. C-value paradox, sex determination in plants Structure and Properties of Nucleic acids: Structure, Chemical, Physical and thermal properties of nucleic acids. Dissociation and reassociation kinetics of DNA, Cot curves, Cot ½ values and its significance. Unique, moderately repetitive and highly repetitive DNA, conformation of nucleic acids. (A, B, Z DNA, t-RNA, m- RNA). Chromosomal abberations (Numerical & Structural)	15
III	Mendelian Laws and physical basis of inheritance, Gene interaction, cis-trans-test and complementation test, lethal genes, polygenic traits, linkage and gene maps DNA double helix: structure and organization of prokaryotic and eukaryotic genomes, supercoiling, repetitive DNA 5. DNA replication: Mechanism of replication of Prokaryotic & Eukaryotic Chromosome 6. Mutation: Types and molecular mechanisms of mutations, mutagens, DNA Repair 7. Transposition: Mechanisms of transposition, transposon mutagenesis 8. Recombination: Homologous and site - specific recombination 9. Gene expression in eukaryotes: Transcription and translational, Post translational modifications	15
IV	Principles and methods of Genetic Engineering, Cloning vectors, Gene libraries and cDNA libraries, Polymerase chain reaction, DNA fingerprinting, Methods of direct and indirect gene transfer in plants, Agrobacterium, Ti and Ri plasmids, application of genetic engineering, transgenic plants for pest and disease resistance, abiotic stress tolerance, production of useful products Plant Cell and Tissue culture, Micropropagation-Organogenesis and embryogenesis. Somaclonal variation Somatic hybridization –protoplast culture, cybrids. Production and uses of haploids, Applications of plant tissue culture, Biopesticides and integrated pest management, Biofertilizers, Organic farming.	15

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Suggested Readings

1. Molecular Biology of the Cell — Alberts, B. et al. *Molecular Biology of the Cell*. Garland Science.
2. Cell and Molecular Biology — De Robertis, E.D.P. and De Robertis, E.M.F. *Cell and Molecular Biology*. Lea & Febiger.
3. Plant Cell Biology — Verma, P.S. and Agarwal, V.K. *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*. S. Chand & Company.
4. Principles of Genetics — Snustad, D.P. and Simmons, M.J. *Principles of Genetics*. John Wiley & Sons.
5. Molecular Biology of the Gene — Watson, J.D. et al. *Molecular Biology of the Gene*. Pearson Education.
6. Genes — Lewin, B. *Genes*. Jones and Bartlett Publishers.
7. Genetics — Strickberger, M.W. *Genetics*. Macmillan Publishing Company.
8. Principles of Gene Manipulation — Old, R.W. and Primrose, S.B. *Principles of Gene Manipulation and Genomics*. Blackwell Publishing.
9. Plant Biotechnology — Slater, A., Scott, N. and Fowler, M. *Plant Biotechnology: The Genetic Manipulation of Plants*. Oxford University Press.
10. Plant Tissue Culture — Bhojwani, S.S. and Razdan, M.K. *Plant Tissue Culture: Theory and Practice*. Elsevier.
11. Introduction to Plant Biotechnology — Chawla, H.S. *Introduction to Plant Biotechnology*. Science Publishers.
12. Biotechnology — Kreuzer, H. and Massey, A. *Recombinant DNA and Biotechnology*. ASM Press.

Programme/Class: 1 Year PG degree	Year: V	Semester: X Paper-II
Subject: Botany		
Course Code: B041002T	Course Title: Plant Physiology and Biochemistry	
Course Outcome: Students will gain knowledge of water relations, mineral nutrition, photosynthesis, respiration and stress physiology in plants. The course develops understanding of plant growth regulators, flowering mechanisms, seed dormancy, germination and senescence. Students will also acquire knowledge of biomolecules, protein structure and function, enzymology, enzyme kinetics, coenzymes and biochemical processes essential for plant metabolism and physiological regulation.		
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0		
Unit	Topic	No. of Lecturs (60 hrs)

I	Water metabolism: Cell osmotic quantities: Osmosis, osmotic potential, water potential. Mechanism of water uptake and translocation: Phloem loading and unloading. Transpiration and its regulation: Stomatal opening and closing. Photosynthesis :General aspects and historical background, Action spectra, organization of photosynthesis apparatus, pigments and light harvesting complexes, photolysis of water. Mechanism of electron transport- structure and functions of components of Photosystem I and II, Photophosphorylation, Proton transport and ATP synthesis in chloroplast- ATP synthetase, Carbon assimilation: Calvin cycle and its regulation.	
II	Photorespiration (C 2 Cycle) and C4 cycle and their regulation, CAM pathway, Factors affecting Photosynthesis Respiration, Aerobic and anaerobic respiration. Glycolysis, Kreb's Cycle and their regulation. Substrate level Phosphorylation. Alternate Glycolytic reaction (Gluconeogenesis), Pentose phosphate Pathway, Glyoxylate cycle. Electron Transport System and ATP synthesis	
III	Essential and Beneficial elements, Role and deficiency effects of essential nutrient elements. Stress Physiology: Water deficit and drought, heat, chilling and freezing, salinity, light and anoxia stress, Auxin, Cytokinin, Gibberellin, Ethylene. Flowering: Floral evocation, florigen concept, circadian rhythms, photoperiodism and its regulation. Vernalization, phytochrome and its functions. Abscission, dormancy (bud and seed), seed germination and senescence.	
IV	Chemical and enzymatic hydrolysis of protein to peptides, amino acid sequencing. Secondary structure of proteins, forces responsible for holding of secondary structure. α-helix, β- sheet, super secondary structure. Tertiary structure of protein-folding and domain structure. Quaternary structure, Denaturation, degradation and renaturation of protein. Enzymes: General aspects, nomenclature and classification. Mode of action, Active sites, reversible and irreversible enzyme inhibition. Enzyme kinetics and Michaelis- Menton equation. Factors affecting enzymatic reactions. Structure and function of co-enzymes	

Suggested Readings

1. Plant Physiology — Taiz, L. and Zeiger, E. *Plant Physiology and Development*. Sinauer Associates.
2. Plant Physiology — Salisbury, F.B. and Ross, C.W. *Plant Physiology*. Wadsworth Publishing Co.
3. Introduction to Plant Physiology — Hopkins, W.G. and Hüner, N.P.A. *Introduction to Plant Physiology*. John Wiley & Sons.
4. Plant Physiology — Jain, V.K. *Fundamentals of Plant Physiology*. S. Chand & Company.
5. Biochemistry — Nelson, D.L. and Cox, M.M. *Lehninger Principles of Biochemistry*. W.H. Freeman & Company.
6. Biochemistry — Voet, D. and Voet, J.G. *Biochemistry*. John Wiley & Sons.
7. Outlines of Biochemistry — Conn, E.E. and Stumpf, P.K. *Outlines of Biochemistry*. Wiley Eastern Ltd.
8. Plant Biochemistry — Bonner, J. and Varner, J.E. *Plant Biochemistry*. Academic Press.
9. Enzymes — Dixon, M. and Webb, E.C. *Enzymes*. Academic Press.
10. Biochemistry and Molecular Biology of Plants — Buchanan, B.B., Gruissem, W. and Jones, R.L. *Biochemistry and Molecular Biology of Plants*. American Society of Plant Biologists.

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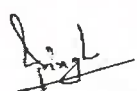
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11. Stress Physiology in Plants — Pessarakli, M. *Handbook of Plant and Crop Stress*. CRC Press.
12. Plant Growth and Development — Wareing, P.F. and Phillips, I.D.J. *Growth and Differentiation in Plants*. Pergamon Press.

Programme/Class: 1 Year PG degree	Year: V	Semester: X Paper-III
Subject: Botany		
Course Code: B041003T(a)	Course Title: Environmental Botany	
Course Outcome: Students will develop understanding of environmental components, ecosystems, environmental pollution and their impact on living organisms. The course provides knowledge of water, air, radioactive and noise pollution, environmental management practices, waste treatment, soil conservation and pollution control strategies. Students will also gain awareness about biodiversity conservation, renewable energy resources, environmental laws, environmental education and phytogeographical distribution of vegetation with special reference to India.		
Credits: 4	Core Elective	
Max. Marks: 25+75	Min. Passing Marks:	
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0		






Unit	Topic	No. of Lecturs (60 hrs)
I	➤ Introduction: Relation of man with environment, National and International effects on environmental problems, applied aspects of environmental Botany. ➤ Ecosystem: Classification, general idea of different ecosystems. ➤ Environment: concept of environment, environmental segments, Biosphere. ➤ Biodegradable substances: Classification of pesticides, A brief history of use of synthetic pesticides, ecological effects of pesticide pollution, Bio-accumulation and biomagnifications of pesticide.	15
II	➤ General idea about pollution, Pollutants. ➤ Water pollution: Physico-chemical and biological characteristics of polluted and drinking water. ➤ Air pollution :Air pollutants, PAN, Ozone, Ozone layer and Ozone hole ,Green house effects ; Consequences of climate change (global warming, Sea level rise). ➤ Radioactive pollution: General ideas about hazardous impacts of radiations and radioactive fallouts. ➤ Noise Pollution: General idea about various levels of noise pollution and human response.	15
III	Environmental management: Control of environmental pollution: ➤ Water management of aquatic ecosystem. ➤ Purification of water sewage treatment. ➤ Air methods for monitoring air pollutants air quality management and air pollution control device, role of plants in air pollution abatement. ➤ Soil conservation: Solid waste and their disposal, waste collection, reclamation and cycling processes. ➤ Radioactive waste treatment. Noise abatement	
IV	➤ Conservation: (Forest, Forestation, deforestation and social forestry). ➤ Renewable energy sources. ➤ Non – conventional energy sources. ➤ Environmental education in India , international summits and treaties related to environment. ➤ Control of environmental pollution through law. ➤ Phytogeography: Distribution patterns, barriers and Age area hypothesis, vegetation & floristic regions of India.	

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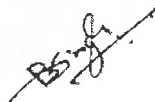
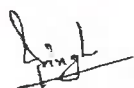
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Suggested Readings

1. Environmental Biology — Agarwal, K.C. *Environmental Biology*. Nidi Publishers.
2. Ecology and Environment — Sharma, P.D. *Ecology and Environment*. Rastogi Publications, Meerut.
3. Fundamentals of Ecology — Odum, E.P. *Fundamentals of Ecology*. Saunders College Publishing.
4. Concepts of Ecology — Kormondy, E.J. *Concepts of Ecology*. Prentice Hall of India.
5. Environmental Science — Cunningham, W.P. and Cunningham, M.A. *Principles of Environmental Science*. McGraw Hill.
6. Environmental Chemistry — De, A.K. *Environmental Chemistry*. New Age International Publishers.
7. Air Pollution — Rao, M.N. and Rao, H.V.N. *Air Pollution*. Tata McGraw Hill Publishing Company.
8. Environmental Pollution and Control — Trivedi, R.K. and Goel, P.K. *An Introduction to Air Pollution*. Techno Science Publications.
9. Biodiversity — Wilson, E.O. *Biodiversity*. National Academy Press.
10. Phytogeography — Good, R. *The Geography of Flowering Plants*. Longman Group Ltd.
11. Plant Geography — Chatterjee, S.P. *Plant Geography*. Central Book Depot.
12. Environmental Education — Asthana, D.K. and Asthana, M. *Environment: Problems and Solutions*. S. Chand & Company.

Programme/Class: 1 Year PG degree	Year: V	Semester: X Paper-III
Subject: Botany		
Course Code: B041003T(b)	Course Title: Plant Pathology	
Course Outcome: Students will acquire knowledge of the history, scope and classification of plant diseases along with symptoms, disease development and host–pathogen interactions. The course provides understanding of plant defence mechanisms, epidemiology, disease forecasting and various methods of disease management including integrated pest management. Students will also gain detailed knowledge of important fungal, bacterial, viral, nematode and phytoplasma diseases of crop plants, their etiology, symptoms, dissemination and control measures.		

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Credits: 4		Core Elective
Max. Marks: 25+75		Min. Passing Marks:
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0		
Unit	Topic	No. of Lecturs (60 hrs)
I	Historical development and present status of phytopathology. Classification of plant diseases General symptoms of plant diseases caused by fungi, bacteria and virus. Concept of disease, Koch's postulates. Mode of infection and development of pathogen in plants. Role of enzymes and toxins in pathogenesis.	15
II	Defence mechanism in host, effect of infection on host physiology. Dissemination of phytopathogens, plant disease forecasting and management Principle methods of plant disease control: Regulatory, cultural and biological, physical, chemical methods, resistant varieties. Mycotoxins and storage diseases. Integrated pest management	15
III	Epidemiology, symptoms, etiology, perennation and control of following diseases: Diseases caused by Fungal Pathogens: Fruit and stem rot of papaya, Red rot of sugarcane, Damping off of seedling of crop plants, Downy mildew of bajra, crucifer and pea, Powdery mildew of barley and cucurbits, Rust of linseed, Cover and loose smut of barley, Wilt of Arhar, Leaf spot of crucifer, rice and turmeric, Blast of rice, Late blight of potato, Stem gall of coriander, Peach leaf curl, Tikka disease of groundnut	15
IV	Diseases caused by nematodes: • Ear cockle of wheat. • Root knot of vegetables. Abiotic/Non pathogenic diseases: • Black tip of mango. • Black heart of potato. Disease caused by plant bacteria: ➤ Citrus canker. ➤ Blight of rice. ➤ Tundu disease of wheat. ➤ Soft rot of carrot/onion. Disease caused by plant viruses: ➤ Mosaic of apple, papaya, tobacco and potato. ➤ Leaf curl of tobacco, chilly and tomato. ➤ Tungro of paddy. ➤ Yellow vein of mosaic. ➤ Bunchy top of banana. Disease caused by plant MLO:	15

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	➤ Sesame phyllody ➤ Little leaf of brinjal. - Grassy shoot of sugarcane	
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Suggested Readings

1. Plant Pathology — Agrios, G.N. *Plant Pathology*. Academic Press.
2. Introduction to Principles of Plant Pathology — Singh, R.S. *Introduction to Principles of Plant Pathology*. Oxford & IBH Publishing Co.
3. Plant Diseases — Rangaswami, G. and Mahadevan, A. *Diseases of Crop Plants in India*. Prentice Hall of India.
4. Essentials of Plant Pathology — Bilgrami, K.S. and Dube, H.C. *A Textbook of Modern Plant Pathology*. Vikas Publishing House.
5. Fundamentals of Plant Pathology — Sharma, P.D. *Plant Pathology*. Rastogi Publications.
6. Plant Pathology and Plant Pathogens — Lucas, J.A. *Plant Pathology and Plant Pathogens*. Blackwell Science.
7. Physiological Plant Pathology — Wood, R.K.S. *Physiological Plant Pathology*. Blackwell Scientific Publications.
8. Principles of Plant Infection — Walker, J.C. *Plant Pathology*. McGraw Hill Book Company.
9. Plant Virology — Matthews, R.E.F. *Plant Virology*. Academic Press.
10. Diseases of Field Crops — Butler, E.J. and Jones, S.G. *Plant Pathology*. Macmillan & Co.
11. Integrated Pest Management — Dhaliwal, G.S. and Arora, R. *Integrated Pest Management: Concepts and Approaches*. Kalyani Publishers.
12. Plant Nematology — Sasser, J.N. and Freckman, D.W. *A World Perspective on Nematology*. Society of Nematologists.

Programme/Class: 1 Year PG degree	Year: V	Semester: IX Paper-III
Subject: Botany		
Course Code: B041003T(b)	Course Title: Advanced Plant Physiology	
Course Outcome: Students will develop advanced understanding of photosynthesis, respiration, nitrogen metabolism, lipid metabolism and plant energetics. The course provides detailed knowledge of biosynthesis and functions of secondary metabolites, vitamins and plant growth regulators. Students will gain insight into stress physiology, plant defence mechanisms, photobiology, phytochrome-mediated responses, circadian rhythms and the physiological and biochemical regulation of flowering and plant development.		

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Credits: 4		Core Elective
Max. Marks: 25+75		Min. Passing Marks:
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0		
Unit	Topic	No. of Lecturs (60 hrs)
I	➤ Photosynthesis and chemosynthesis: • Quantasomes, biosynthesis of chlorophylls, heme compounds, role and biosynthesis of accessory pigments, photo oxidation. • Biochemical pathways of conversion of solar energy into chemical energy and its utilization in CO₂ reduction cycle. • Efficient and inefficient plants, bacterial photosynthesis and its utility in nature. ➤ Organic acid metabolism: Succulents, CAM pathway and its significance. ➤ Plant Energetics : As controlled by photosynthesis, respiration and photorespiration ➤ Respiration: Biological oxidation of carbohydrates and interconversions of the products, terminal oxidation, electron transport, role of cytochromes and other heme compounds.	15
II	Nitrogen metabolism: Synthesis and activation of amino acids, transcription and translation of genetic code, the template. • Chemical regulation and biosynthesis of proteins and enzymes. • Biochemistry of biological nitrogen fixation and its significance. ➤ Phosphorus metabolism: Metabolism of phosphorylated compounds and their role. ➤ Lipid metabolism: Classification of fat and fatty Acids, biosynthesis and breakdown of fats and lipids, its significance. Unsaturated fatty acids. ➤ Vitamins : Water and fat-soluble vitamins, biochemical function of thiamine, riboflavin, nicotinic acid, pantothenic acid, pyridoxin, biotin, folic acid, vitamin B₁₂, ascorbic acid, vitamin A and vitamin D.	15
III	➤ Secondary metabolites : • Coumarins and lignins : Structure and synthesis. • Tannins : Distribution synthesis and function. • Flavonoids and water-soluble pigments: Synthesis and function. • Hallucinogens: Distribution, chemistry and function. • Alkaloids : Pyrrole, pyrrolidine, pyridine, polyacetyl isoquinoline, tropane and indole alkaloids - their distribution, synthesis and function. • Saponins and sapogenins : Sterols, steroids, steroidal alkaloids - their distribution, synthesis and function. Plant growth regulators: Natural and synthetic, biochemistry and physiological effects of auxins, gibberellins, cytokinins, brassinosteroids, jasmonic acid; salicylic acid, polyamines, morphactins and cyanogenic compounds	15

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IV	➤ Stress physiology : Plant responses to biotic and abiotic stresses, mechanism of biotic and abiotic stress resistance, plant defence mechanisms against water stress, salinity stress, metal toxicity, freezing and heat stress and oxidative stress. ➤ Photobiology: Photoreceptors, Phytochrome : history, discovery, physiological properties, interaction between hormones, and phytochrome, role of different phytochromes in plant development and flowering, mechanism of phytochrome signal transduction. Cryptochromes and phototropins. Circadian rhythms in plants: Nature of oscillator, rhythmic outputs, entrainments (inputs) and adaptive significance ➤ Flower Initiation and Floral Expression	15
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Suggested Readings

1. Plant Physiology — Taiz, L. and Zeiger, E. *Plant Physiology and Development*. Sinauer Associates.
2. Plant Physiology — Salisbury, F.B. and Ross, C.W. *Plant Physiology*. CBS Publishers & Distributors.
3. Introduction to Plant Physiology — Hopkins, W.G. and Hüner, N.P.A. *Introduction to Plant Physiology*. John Wiley & Sons.
4. Biochemistry and Molecular Biology of Plants — Buchanan, B.B., Gruissem, W. and Jones, R.L. *Biochemistry and Molecular Biology of Plants*. American Society of Plant Biologists.
5. Plant Biochemistry — Bonner, J. and Varner, J.E. *Plant Biochemistry*. Academic Press.
6. Outlines of Biochemistry — Conn, E.E. and Stumpf, P.K. *Outlines of Biochemistry*. Wiley Eastern Ltd.
7. Biochemistry — Nelson, D.L. and Cox, M.M. *Lehninger Principles of Biochemistry*. W.H. Freeman & Company.
8. Stress Physiology in Crop Plants — Levitt, J. *Responses of Plants to Environmental Stresses*. Academic Press.
9. Photomorphogenesis in Plants — Kendrick, R.E. and Kronenberg, G.H.M. *Photomorphogenesis in Plants*. Kluwer Academic Publishers.
10. Plant Hormones — Davies, P.J. *Plant Hormones: Physiology, Biochemistry and Molecular Biology*. Kluwer Academic Publishers.
11. Secondary Metabolism in Plants — Harborne, J.B. *Introduction to Ecological Biochemistry*. Academic Press.
12. Plant Stress Biology — Hirt, H. and Shinozaki, K. *Plant Responses to Abiotic Stress*. Springer Verlag.

Programme/Class: 1 Year PG degree	Year: V	Semester: X
Subject: Botany		
Course Code: B041004P	Course Title: Practical based on 1001-1004	

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Course Outcome:		
Students will acquire practical skills in cytology, tissue culture techniques, staining methods, plant physiology, molecular biology and biochemical analysis. The course enables students to perform experiments related to DNA isolation, chromatography, enzyme activity, water relations, photosynthesis and transpiration. Students will also develop competency in environmental analysis, plant pathology techniques, disease identification, microbial culture methods, and advanced biochemical estimations using modern laboratory instruments and statistical tools.		
Credits: 4		Core Compulsory
Max. Marks: 25+75		Min. Passing Marks:
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0		
Unit	Topic	No. of Lecturs (60 hrs)
I	Preparation of squash for the study of mitosis and meiosis Preparation of MS (Murashige and Skoog) basal medium for tissue culture Preparation of various stains- Safranin, Fast green, Haematoxylin and carmine Study of fixation of botanical materials Emasculation Techniques Statistical analysis of seed samples and applying suitable statistical test for interpretation as desire Numerical problem and design	15
II	Isolation and purification of DNA from various sample using Agarose gel electrophoresis To separate the major plant pigments (i)Paper chromatography and to calculate Rf values of the pigment Estimation of protein, reducing and non-reducing sugar Effect of enzyme and substrate concentration on the activity of Urease Use of spectrophotometer in biochemical estimations- chloroplastic pigments, proteins, carbohydrates etc. Demonstration of instruments: Gel Electrophoresis, Microtome, pH meter, oven, incubator, autoclave and centrifuge	15
III	To determine the Osmotic pressure of vacuolar sap of Rheo discolor or Tradescantia leaves by plasmolytic method (50% plasmolysis) To determine the diffusion pressure deficit (water potential) of potato tuber tissue by weighing method To determine the structure, size and frequency of stomata in mesophytic and xerophytic leaves To determine the rate of transpiration of plant i. Weight ii. Potometer method To determine the rate of transpiration by Cobalt Chloride paper method and to calculate transpiration index (TI), Transpiration efficiency (TE) of various leaves To measure the rate of photosynthesis in aquatic plants by Wilmott's bubble counting method	15

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	To study the effect of (i) CO ₂ ii. Light quality and intensity On the rate of photosynthesis in leaves of an aquatic / terrestrial plant	
choose any one section from IV a, IV b and IV c as per your IIIrd Theory Paper		
IV (a)	Physico chemical analysis of polluted water- colour, acidity, alkalinity, taste, turbidity, total solids, total dissolved solids, conductivity, hardness, pH, Biological oxygen demand, Dissolved oxygen, Chemical oxygen demand Biological examinations of polluted water- microscopic and culturing method (Density count) Physico chemical analysis of polluted soil, pH, Electric conductivity, soluble cations and anions, heavy metals (base deficiency) To analyse distribution pattern of selected species in an ecosystem To measure the photosynthetic rate (A) and the specific leaf area of five tree species and observe relation between them	15
IV (b)	A study of symptomology, histopathology, and identification of pathogen of various fungal diseases : Fruit and stem rot of Papaya, Red rot of sugarcane, Damping off of seedling of crop plants, Downy mildew of bajra, crucifer and pea, Powdery mildew of barley and cucurbits, Rust of linseed Cover and loose smut of barley, Wilt of Arhar, Leaf spot of crucifer, rice and turmeric, Blast of rice, Late blight of potato, Peach leaf curl, Ergot of bajra, Tikka disease of ground nut A study of symptomology in bacterial (Citrus canker, Blight of rice, Tundu disease of wheat, Soft rot of carrot/ onion), viral (Mosaic of apple, papaya, tobacco and potato, Leaf curl of tobacco, chilly and tomato, Tungru of paddy, Yellow vein mosaic and Bunchy top of banana) and M.L.O. (Sesame phyllody, Little leaf of brinjal, and Grassy shoot of sugarcane) disease Preparation of culture media and sterilization Isolation of fungi and bacteria from diseases plant Inoculation experiment with fungal and bacterial plant pathogens Measurement of fungal spores Transmission experiments (mechanical and insect transmission) of plant virus Use of fungicides and plant protection appliances Field collection of 50 diseased plant specimens (fungal, viral and bacterial)	15
IV (c)	To extract the pigment from green leaf and to estimate quantitatively the percentage of Chl a, Chl b and total chlorophyll and the carotenoids spectrophotometrically Estimate the percentage of total free amino acids in any plant material spectrophotometrically by using Ninhydrin To estimate the amount of Total Nitrogen in dry leaves by Micro- Kjeldahl method To estimate total protein of fresh moong, bean seedlings by biuret reagent To estimate the percentage of soluble protein of fresh moong, bean seedling by Lowry's method To estimate the percentage of reducing sugar in any plant material by Somogy-Nelson's method To estimate the percentage of total soluble sugar in plant tissue using anthrone reagent To estimate ascorbic acid in plant tissue	15

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	To measure the activity of amylase in germinating barley and moong seeds and to study the effect of : (1) substrate concentration, (2) pH, (3) Temperature, and (4) any Heavy metal on amylase activity To study the effect of any stress (temperature, water) on germination in barley seed To estimate the percentage of fatty acid in castor, bean, mustard by Soxhlet's extraction method To test the presence of fatty acid in castor seed To measure the activity of the enzyme nitrate reductase (NR) in the leaves of Vigna mungo and to study the effect of : (1) substrate concentration, and (2) pH, on enzyme activity To study the phenomenon of Apical Dominance in Coleus and Tulsi To study the phenomenon of Phototropism in plants To study the phenomenon of Geotropism in plants	
Suggested Readings 1. Practical Plant Physiology — Plummer, D.T. <i>An Introduction to Practical Biochemistry</i>. Tata McGraw Hill Publishing Co. 2. Experiments in Plant Physiology — Noggle, G.R. and Fritz, G.J. <i>Introductory Plant Physiology</i>. Prentice Hall. 3. Laboratory Manual in Biochemistry — Jayaraman, J. <i>Laboratory Manual in Biochemistry</i>. New Age International Publishers. 4. Practical Botany — Bendre, A.M. and Kumar, A. <i>Practical Botany</i>. Rastogi Publications. 5. Plant Tissue Culture — Bhojwani, S.S. and Razdan, M.K. <i>Plant Tissue Culture: Theory and Practice</i>. Elsevier. 6. Molecular Cloning — Sambrook, J. and Russell, D.W. <i>Molecular Cloning: A Laboratory Manual</i>. Cold Spring Harbor Laboratory Press. 7. Methods in Plant Biochemistry — Harborne, J.B. <i>Methods in Plant Biochemistry</i>. Academic Press. 8. Practical Plant Ecology — Misra, R. <i>Ecology Workbook and Laboratory Manual</i>. Oxford and IBH Publishing Co. 9. Plant Pathology — Agrios, G.N. <i>Plant Pathology</i>. Academic Press. 10. Laboratory Guide for Plant Pathology — Singh, R.S. <i>Plant Disease Management</i>. Oxford & IBH Publishing Co. 11. Biochemical Methods — Sadasivam, S. and Manickam, A. <i>Biochemical Methods</i>. New Age International Publishers. 12. Plant Physiology Laboratory Manual — Srivastava, H.S. <i>Plant Physiology and Biochemistry Laboratory Manual</i>. Rastogi Publications.		

Programme/Class: 1 Year PG Degree	Year: V	Semester: X Paper-V
Subject: Botany		
Course Code: B041005R	Course Title: Dissertation/Research Project	

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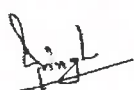
Course Outcome

The Research Project/Dissertation is designed to ensure that the student is able to apply the knowledge gained in the previous semesters in specific areas of interest in a problem solving environment, gaining bench-experience, to serve as a springboard for a professional future.

Credits: 04

Research Project/Dissertation

Research Project/Dissertation for Semester X will be carried out by the students in various recognized/established labs of Parent/Other Universities, of Institutes under CSIR, ICMR, IIT, ICAR, DST, DBT, Industry, Government Departments etc. (to be arranged by the students themselves, including whatever expenses become due in this regard).


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Faculty of Science And Technology
Maa Vindhyavasini University, Mirzapur

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The first part of the report is a general introduction to the project. It describes the purpose of the study and the objectives that were set at the beginning. The second part is a literature review, which looks at what other people have said about the topic. This helps to put the current study in context and shows what is already known. The third part is the methodology, which explains how the data was collected and how it was analysed. This is important for understanding the reliability of the findings. The fourth part is the results, which present the data that was collected. The final part is the conclusion, which summarises the findings and discusses their implications.

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