

MAA VINDHYAVASINI UNIVERSITY

MIRZAPUR (U.P.)



Syllabus

For

Botany

Master of Science (M.Sc.) Two Year Programme

(NEP-2020 Based Curriculum)

Effective from session 2026-27

Dean

Faculty of Science And Technology
Maa Vindhyavasini University, Mirzapur

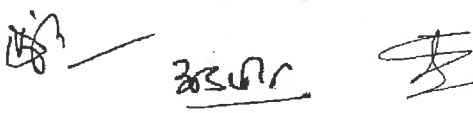
Department of Botany

Faculty of Science and Technology

Semester-wise Titles of the Papers in M.Sc. Botany

Year	Semester	Paper/Course Code	Paper Title	Theory/Practical	Credit
First Year	I	Paper I (BOT 101)	Microbiology, Plant Virology and Bacteriology	Theory	4
		Paper II (BOT 102)	Mycology	Theory	4
		Paper III (BOT 103)	Phycology and Lichens	Theory	4
		Paper IV (BOT 104)	Bryophytes	Theory	4
		Practical (BOT 105)	Based on Paper 101-104	Practical	4
	II	Paper I (BOT 201)	Pteridophyta	Theory	4
		Paper II (BOT 202)	Gymnosperms and Paleobotany	Theory	4
		Paper III (BOT 203)	Angiosperms: Taxonomy, Morphology and Economic Botany	Theory	4
		Paper IV (BOT 204)	Anatomy, Embryology and Morphogenesis	Theory	4
		Practical (BOT 205)	Based on Paper 201-204	Practical	4
Second Year	III	Paper I (BOT 301)	Plant Physiology and Biochemistry	Theory	4
		Paper II (BOT 302)	Genetics, Plant Breeding and Biostatistics	Theory	4
		Paper III (BOT 303)	Ecology and Plant Soil Relationship	Theory	4
		Practical (BOT 304)	Based on Paper 301-304	Practical	4
		Research Project (BOT 305 R)	Research Project/Dissertation	Research Project	4
	IV	Paper I (BOT 401)	Cell Biology	Theory	4
		Paper II (BOT 402)	Molecular Biology and Plant Biotechnology	Theory	4
		Paper III (BOT 403)	Special Papers 403 A: Environmental Botany 403 B: Plant Pathology 403 C: Advanced Plant Physiology	Theory	4
		Practical (BOT 404)	Based on Paper 301-304	Practical	4
		Research Project (BOT 405 R)	Research Project/Dissertation	Research Project	4

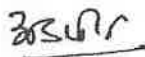
*Research Projects include industrial training/internship/survey work etc. (100 Marks) for both IIIrd and IVth Semester.



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Syllabus Prepared By

Sr. No.	Name and Designation	Department	College/University
1.	Dr. Devendra Pandey Dean and Professor	Science and Technology	K.B.P.G. College, Mirzapur
2.	Dr. Om Kishor Singh Assistant Professor	Department of Botany	Narottam Singh Padam Singh Government Post Graduate College Magaraha, Mirzapur
3.	Dr. Indrajeet Kumar Assistant Professor	Department of Botany	Government Degree College, Pawanikala, Sonbhadra
4.	Dr. Shikha Tiwari Assistant Professor	Department of Botany	Swatantrata Sangram Senani Vishram Singh Government Post Graduate College, Chunar, Mirzapur
5.	Dr. Anil Kumar Dwivedi Professor (External Expert)	Department of Botany	Deen Dayal Upadhyay Gorakhpur University
6.	Dr. Pankaj Kumar Professor (External Expert)	Department of Botany	Udai Pratap Autonomous College, Varanasi



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M.Sc.
Semester-I

Semester -I: Paper I

Maximum Marks: 100 (75+25)

BOT 101: Microbiology, Plant Virology and Bacteriology

UNIT I

Plant virus classification, structure, transmission, detection

- ❖ Nomenclature and classification of plant viruses.
- ❖ Range of plant virus particles and their genome 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.

UNIT II

Plant virus replication, sub-viral pathogens, and techniques

- ❖ Infection and replication of plant viruses.
- ❖ Modern methods of plant virus disease control.
- ❖ Structure, replication and pathogenicity of viroids
- ❖ Structure and replication of viruses infecting bacteria.
- ❖ MLO structure and multiplication.

UNIT III

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.
- ❖ Bacterial genome: Structure, replication, expression and recombination. Plasmids: Structure, Types and their application as biotechnological tool.

UNIT IV

Bacterial metabolism, microbiological applications

- ❖ Bacterial nutrition and metabolism, including Nitrogen fixation.
- ❖ Antibiotics and their mode of action.
- ❖ Decomposition of organic matter in soil, cycling of essential elements in nature, biofertilizers.
- ❖ Microorganisms in food processing-Cheese, butter, milk, bread.
- ❖ Microorganisms in relation to biotechnology: Production of alcohol, beverages, organic acid, vitamins and enzymes.


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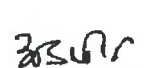


- ❖ Water-borne pathogenic microbes, role of microorganism in sewage disposal

Suggested readings:

1. Madigan MT, Martinko JM, Bender KS, Buckley DH, Stahl DA (2014) Brock Biology of Microorganisms, 14th edition, Benjamin Cummings, New York.
2. J.R. Grant, 2023. Proksee: In depth characterization and visualization of bacterial genomes, Nucleic Acid Research.
3. Willey JM, Sherwood L, Woolverton CJ (2013) Prescott's Microbiology, 9th editions, McGraw-Hill, New York.
4. T.M. Schmidt, 2019. Encyclopedia of Microbiology, Academic Press.
5. Stanier RY, Ingraham JL, Wheelis ML, Painter PR (1987) General Microbiology, 5th edition, MacMillan, Press Ltd, New Jersey.
6. Atlas, RM. 1995. Principles of Microbiology. Mobsy.
7. Lim, DV. 2003. Microbiology. Kendall/Hunt.
8. Boundless. 2013. Microbiology. Boundless Learning, Incorporated.
9. Comelissen, CN, Harvey, RA and Fisher, BD. 2012. Microbiology. Lippincott Williams & Wilkins.
10. Talaro, K.P., Chess, B. 2011, Foundations in Microbiology. 8th edition. McGraw-Hill.


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Semester -I: Paper II

Maximum Marks:100 (75+25)

BOT 102: Mycology

UNIT I

- ❖ Status of fungi
- ❖ 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 and their physical and chemical requirement for growth.
- ❖ Reproduction, hormonal mechanism of sexual reproduction.

UNIT II

- ❖ Heterokaryosis, parasexuality, heterothallism.
- ❖ Methods of isolation and culturing of fungi.
- ❖ Fossil fungi.
- ❖ Mycorrhizae.
- ❖ Fungi as a biocontrol agent.
- ❖ Economic importance of fungi: Utilization of fungi by man as food, in food processing, in production of organic acid, vitamins and enzymes. Harmful activities: Deterioration of material by fungi, fungi as an agent of plant and human diseases.

UNIT III

Characteristic features, systematic position, thallus organization, reproduction, phylogeny and Inter relationships of the principal classes of fungi with special reference to following genera:

- ❖ Myxomycota:
 - Myxomycetes-*Stemonitis*.
 - Plasmodiophormycetes-*Plasmodiophora*.
- ❖ Eumycota:
- ❖ Mastigomycotina:
 - Chytridiomycetes- *Synchytrium*, *Allomyces*
 - Oomycetes- *Saprolegnia*, *Achlya*, *Phytophthora*, *Pythium*, *Peronospora*, *Sclerospora*.
- ❖ Zygomycotina:
 - Zygomycetes: *Pilobolus*, *Entomophthora*, *Choanophora*

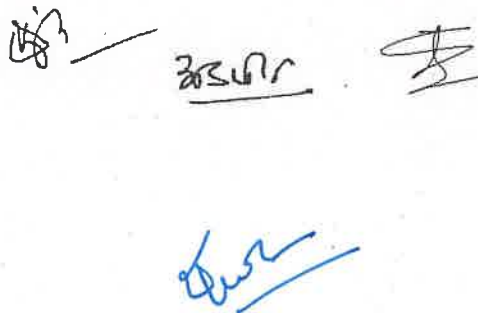
UNIT IV

- ❖ Ascomycotina:
 - Ascomycetes: Yeasts, *Taphrina*, *Penicillium*, *Protomyces*, *Erysiphe*, *Phyllactinia*, *Uncinula*, *Xylaria*, *Claviceps*, *Morchella*.
- ❖ Basidiomycotina:
 - Basidiomycetes: *Puccinia*, *Uromyces*, *Melampsora*, *Ustilago*, *Lycoperdon*, *Geaster*, *Cyathus*.
- ❖ Deuteromycotina:
 - Deuteromycetes:

Fusarium, Colletotrichum, Helminthosporium, Alternaria, Cercospora, Rhizoctonia

Suggested Readings:

1. Webster, John, 1980, Introduction to Fungi, Cambridge University Press
2. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 1996, Introductory Mycology, Wiley
3. Carlile, M.J., Watkinson S. C. and Booday, G.W., 2001, The Fungi, Academic Press
4. Deacon, J.W., Blackwell, M, 1997, Introduction to Modern Mycology, Oxford
5. Webster, John and Roland, W.S., 2007, Introduction to Fungi, Cambridge University Press.
6. Hale, M.E. (1983), The biology of lichens (3rd ed.). Edward Arnold.

Handwritten signatures and initials in black and blue ink, including a signature that appears to be 'Zsolt' and another that appears to be 'Luis'.

Semester -I: Paper III

MM.100 (75+25)

BOT 103: Phycology and Lichens

UNIT I

- ❖ Study of important systems of classifications, criteria used in algal classifications including recent trends up to order.
- ❖ Range of thallus structure and organization.
- ❖ Algal Pigment.
- ❖ Nature of reserved food products.
- ❖ Reproductive diversity, life history patterns and alternation of generations.
- ❖ Economic and environmental aspects of algae.

UNIT II

Characteristics features, systematic position, thallus organization, reproduction, phylogeny and interrelationships of the principal classes of algae with special reference to-

- ❖ Cyanophyceae: *Microcystis*, *Oscillatoria*, *Lyngbya*, *Gloeotrichia*, *Stigonema*.
- ❖ Chlorophyceae: *Pandorina*, *Eudorina*, *Chlorella*, *Hydrodictyon*, *Scenedesmus*, *Microspora*, *Enteromorpha*, *Ulva*, *Sphaeroplea*, *Cladophora*, *Stigeoclonium*, *Fritschella*, *Zygnema*, *Draparnaldiopsis*, *Odeogonium*, *Bulbochaete*, *Mougeotia*, *Caulerpa*, *Valonia*, *Chara*, *Nitella*.
- ❖ Xanthophyceae: *Botrydium*.
- ❖ Bacillariophyceae: *Navicula*, *Melosira*.

UNIT III

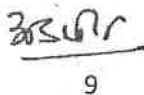
- ❖ Phaeophyceae: *Ectocarpus*, *Dictyota*, *Laminaria*, *Fucus*.
- ❖ Rhodophyceae: *Batrachospermum*, *Gelidium*, *Gracilaria*, *Polysiphonia*.

UNIT IV

Lichens

- ❖ 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.
- ❖ Culture Techniques:
- ❖ Isolation and culture of algal groups.



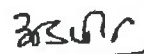

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Suggested Readings:

1. Dodson, S. (2005). Introduction to Limnology. New York. McGraw-Hill.
2. Bronmark, C. and L.A. Hansson (2005). The biology of lakes and ponds. 2nd Edition. New York, Oxford University Press.
3. Moss, B. (1998). Ecology of freshwaters: man, and medium, past to future. Oxford, Blackwell Science.
4. Horne, A.J. and C.R. Goldman (1994). Limnology. Toronto, McGraw-Hill.
5. Wetzel, R.G. (2001). Limnology: lake and river ecosystems. San Diego, Academic Press.
6. Barsanti L, Gualtieri P (2006) Algae: Anatomy, Biochemistry and Biotechnology, CRC Press, Taylor and Francis, Boca Raton.
7. Bold HC, Wynne MJ (1985) Introduction to the Algae; 2nd edition, Prentice-Hall Inc, New Jersey.
8. Kumar HD (1999) Introductory Phycology, 2nd edition, Affiliated East-West Press Pvt. Ltd., New Delhi
9. Fritsch FE (1935) The Structure and Reproduction of the Algae, Vol I, Cambridge University Press, Cambridge.
10. Fritsch FE (1945) The Structure and Reproduction of the Algae, Vol II, Cambridge University Press, Cambridge.
11. Hoek, C., Mann, D. G & Jahns, H. M. (1995) Algae: An Introduction to Phycology; Cambridge University Press, Cambridge.
12. Lee RE (2008) Phycology, 4th edition, Cambridge University Press, Cambridge.
13. Morris, I. (1967) *An Introduction to the Algae*. Hutchinson University Library, London. Pandey A, Chisti Y, Lee D J, Soccol CR (2013) Biofuels from Algae, 1st edition, Elsevier Publishing Group, USA.
14. Rossini GP, (2014) Ed: Toxins and Biologically active Compounds from Microalgae, Vol 2, Biological Effects and Risk Management, CRC Press, Taylor and Francis Group, Boca Raton.
15. South GR, Whittick A (1998) Introduction to Phycology, Blackwell Scientific Publication, London.
16. Tebbani S, Filali R, Lopes F, Dumur D, Pareau D (2014) CO₂ Biofixation by Microalgae: Modelling, Estimation and Control, Wiley-ISTE, New York.



Semester -I: Paper IV

MM.100 (75+25)

BOT 104: Bryophytes

UNIT I

- ❖ General characteristics, life-cycle and broad outline classification of bryophytes.
- ❖ Ecology, Physiology and Reproductive biology of Bryophytes.
- ❖ Geographic distribution of bryophytes with special reference to India.
- ❖ Bryophytes as indicators of mineral enrichment and environmental pollution.
- ❖ Economic importance of bryophytes.
- ❖ Peristome structure and its significance in the classification of mosses.
- ❖ Evolution of sporophyte in bryophyte.

UNIT II

Characteristic features, classification, range of gametophytic and sporophytic organization (morphology, anatomy and their distribution in India) of the principal classes of bryophytes with special reference to following genera:

- ❖ MUSCI: *Sphagnum*, *Polytrichum*

UNIT III

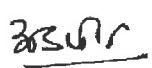
- ❖ HEPATICAE: *Takakia*, *Calobryum*, *Porella*, *Plagiochasma*

UNIT IV

- ❖ ANTHOCEROTAE: *Anthoceros*, *Notothylas*, *Dendroceros*
- ❖ Origin, evolution, fossil history, phylogeny of principal classes: Hepaticae, Anthocerotae and Musci.

Suggested Readings:

1. Schofield, W.B., 2023, Bryophyte plant, Encyclopedia Britannica.
2. Blackstock, T.H., 2023, Sporophyte frequency in British dioecious liverworts, Journal of Bryology (Volume 45 (45-56)).
3. Gangulee, H.C. and Kar, A.K., 2011, College Botany Vol. II (Algae+Fungi+Bryophyta+Pteridophyta), New Central Book Agency, Kolkata
4. Singh, Pande, Jain, 2010, A Text Book of Botany (Algae+Fungi+Bryophyta+Pteridophyta), Pub. Rastogi Publication, Meerut
5. Parihar N.S. 1965, An Introduction to Embryophyta-Bryophyta. Central Book Depot. Allahabad.

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BP-105 M. Sc. Ist Semester Practical

MM.100 (75+25)

Paper I- Microbiology, Plant Virology and Bacteriology

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. Bacteriological examination of water, milk and milk product
6. Identification of symbiotic Bacteroides of *Rhizobia*
7. Symptomatology, mechanical and vector transmission of virus
8. Measurement of microbial activity in soil by respiration method.

Paper II- Mycology

1. Study of following genera of fungi *Stemonitis*, *Synchytrium*, *Saprolegnia*, *Achlya*, *Phytophthora*, *Pythium*, *Peronospora*, *Sclerospora*, *Pilobolus*, *Yeast*, *Taphrina*, *Penicillium*, *Protomyces*, *Erysiphe*, *Phyllactinia*, *Uncinula*, *Xylaria*, *Claviceps*, *Morchella*, *Puccinia*, *Melampsora*, *Ustilago*, *Lycoperdon*, *Geaster*, *Cyathus*, *Fusarium*, *Colletotrichum*, *Heminthosporium*, *Alternaria*, *Cercospora*, *Rhizoctania*
2. Isolation and culture of fungi

Paper III- Phycology and Lichen

1. Study of following genera
Chlorophyceae- *Pandorina*, *Eudorina*, *Chlorella*, *Hydrodictyon*, *Scenedesmus*, *Enteromorpha*, *Ulva*, *Sphaeroplea*, *Cladophora*, *Stigeoclonium*, *Pithophora*, *Frittschiella*, *Zygonema*, *Draparnaldiopsis*, *Oedogonium*, *Bulbocheate*, *Mougeotia*
Cyanophyceae- *Microcystis*, *Lyngbya*, *Gleotrichia*, *Stigonema*
Xanthophyceae- *Botrydium*
Bacillariophyceae- *Navicula*
Phaeophyceae- *Ectocarpus*, *Dictyota*, *Laminaria*
Rhodophyceae- *Batrachospermum*, *Gelidium*, *Polysiphonia*
2. External morphology and preparation of slides of Lichen

Paper IV- Bryophytes

1. Study and Identification of following genera with suitable preparation
Sphagnum, *Polytrichum*, *Takakia*, *Calobryum*, *Porella*, *Plagiochasma*, *Anthoceros*, *Notothylas*, *Dendroceros*.

M.Sc.
Semester-II

Semester -II: Paper I

MM.100 (75+25)

BOT 201: Pteridophytes

UNIT I

- ❖ Pteridophytes.
- ❖ Distribution of ferns.
- ❖ Origin and evolution of pteridophytes.
- ❖ Telome theory and evolution of stelar system.
- ❖ Heterospory and seed habit.
- ❖ Apogamy and Apospory.
- ❖ Physiology of germination of spores and development of fern prothallus.

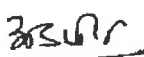
UNIT II

Classification, distribution, morphology, life history and phylogeny of the following classes with special reference to following genera:

- ❖ Rhyniopsida-*Rhynia*, *Horneophyton*.
- ❖ Psilotopsida-*Psilotum*
- ❖ Lycopsidea-
 - *Selaginella*-*Selaginella*.
 - *Lepidodendrales*-*Lepidodendron*
 - *Isoetales*-*Isoetes*
- ❖ Equisetopsida:
 - *Sphenophyllales*-*Sphenophyllum*
 - *Calamitales*-*Calamites*

UNIT III

- ❖ Primofilices:
 - *Zygopteridales*-*Botryopteris*
 - *Cladolyales*-*Cladoxylon*
- ❖ Filicopsida
 - *Eusporangiatae*:
 - *Ophioglossales*-*Ophioglossum*
 - *Protileptosporangiatae*:
 - *Osmundales*-*Osmunda*

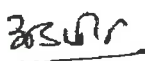


UNIT IV

- ❖ Leptosporangiateae:
 - Schizaeales–*Lygodium*
 - Pteridales–*Pteris*, *Adiantum*
 - Dicksoniales–*Pteridium*
 - Hymenophyllales–*Hymenophyllum*
 - Gleicheniales–*Gleichenia*
 - Cyatheaales–*Cyathea*
 - Marsileales–*Marsilea*
 - Salviniales–*Azolla*

Suggested Readings:

1. Rashid, A, 2011, An Introduction to Pteridophyta, 2nd edition, (Reprint), Pub. Vikas Publishing House Pvt. Ltd., Noida.
2. Gifford, Ernest, M., Foster, Adriance. S., 1989, Morphology and Evolution of vascular plant. W.H. Freeman; Third Edition.
3. Ogura, Yuzuru., 1972, Comparative Anatomy of Vegetative Organs of The Pteridophytes. Gebr. Borntraeger; 2nd edition.
4. Rashid, A. 1999, An Introduction to Pteridophyta: Diversity, Development, Differentiation.
5. Singh, Pande, Jain, 2010, A Text Book of Botany (Algae+Fungi+Bryophyta+Pteridophyta+Gymnosperms), Pub. Rastogi Publication, Meerut



Semester -II: Paper II

(MM.100 75+25)

BOT 202: Gymnosperms and Palaeobotany

UNIT 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.

UNIT II

A study of their morphology, structure, life history, Interrelationship and phylogeny of the following classes with special reference to the following genera:

- ❖ Cycadopsida
- ❖ Pteridospermales: *Glossopteris*
- ❖ Cycadales: *Zamia*
- ❖ Cycadeoideales(Bennettitales): *Williamsonia*, *Cycadeoidea* (Bennittites).
- ❖ Pentoxylales: with special reference to *Pentoxylon*

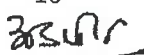
UNIT III

- ❖ Coniferopsida
- ❖ Cordaitales: *Cordaites*
- ❖ Ginkgoales: *Ginkgo*. Coniferales: *Araucaria*, *Cryptomeria*, *Cupressus*, *Thuja*
- ❖ Taxales: *Taxus*

UNIT IV

- ❖ Gnetopsida
 - Ephedrales: *Ephedra*
 - Gnetales: *Gnetum*
 - Welwitschiales: *Welwitschia*
- ❖ 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.



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Suggested Readings:

1. Sporne KR (1967) Morphology of Gymnosperms, BI Publication, New Delhi.
2. Bhatnagar SP, Moitra A (1996) Gymnosperms, New Age international Ltd Publication, New Delhi
3. Sambamurty AVSS (2005) A Textbook of Bryophytes, Pteridophytes, Gymnosperm and Palaeobotany, IK International Pvt Ltd, New Delhi.
4. Singh, Pande, Jain, 2010, A Text Book of Botany (Algae+Fungi+Brophyta+Pteridophyta+Gymnosperms), Pub. Rastogi Publication, Meerut.

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Semester -II: Paper III

MM.100 (75+25)

BOT 203: Angiosperms: Plant Taxonomy, Morphology and Economic Botany

UNIT I

Taxonomy: A general account

- ❖ History of plant taxonomy
- ❖ Systems of Classification: History, outlines, basis, merits and demerits of following classifications, Bentham and Hooker, Hutchinson, Takhtajan, Cornquist
- ❖ ICBN (History, Principles and Application)

UNIT II

- ❖ Field and herbarium techniques
- ❖ Herbaria and Botanical Gardens of India and World
- ❖ Organization and activities of BSI
- ❖ Taxonomy as a synthetic discipline, Modern trends of taxonomy:
- ❖ Morphology, Cytology, Nucleic Acid Hybridization, Chemotaxonomy, numerical taxonomy and serotaxonomy.

UNIT III

General knowledge of the distinguishing features of the following families with special reference to best flora:

- ❖ Dicots: Ranunculaceae, Caryophyllaceae, Capparaceae, Tiliaceae, Fabaceae, Mimosaceae, Caesalpiniaceae, Rosaceae, Apiaceae, Amaranthaceae, Asclepiadaceae, Rubiaceae, Asteraceae, Acanthaceae, Verbenaceae, Lamiaceae, Scrophulariaceae, Polygonaceae, Euphorbiaceae, Moraceae.
- ❖ Monocots: Cyperaceae, Poaceae, Lilaceae, Orchidaceae, Arecaceae, Commelinaceae, Zingiberaceae.

UNIT IV

Economic botany:

- ❖ Scope of economic botany, study of economically important plants and plant products.
- ❖ Forest Products (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.

Morphology:

- ❖ Phylogeny and interrelationship of Angiosperm.
- ❖ Morphology of flower with special reference to the morphology of carpel and inferior ovary.

Suggested Readings:

1. Singh G (1999) Plant Systematics- Theory and Practices, Oxford and IBH Publishing Co, New Delhi.
2. Simpson MG (2006) Plant Systematics, Elsevier Academic Press, Amsterdam.
3. Sharma O. P., (2009). Plant taxonomy. New Delhi: McGraw Hill Education.
4. Alexander P. Sukhorukov, Mariana S. Sousa-Baena, M. S. Romanov, X. Wang, 2023, Editorial: Fruit and seed evolution in angiosperms, Front. Plant Sci., Sec. Plant Development and Evo Devo (Volume 14).
5. Sambamurty, A.V.S.S.2005. Taxonomy of Angiosperms. I.K. International Pvt. Ltd., New Delhi.
6. APG III 2009. An update of the Angiosperm Phylogeny Group Classification for the Orders and Families of Flowering Plants: APG III. Bot. J.Linn.Soc.161:105-121.
7. Bhattacharyya, B .and B.M. Johri. 1998. Flowering Plants-Taxonomy and Phylogeny. Narosa Publishing House, New Delhi.
8. Heywood, V.H .and Moore, D.M. 1984. Current Concepts in Plant Taxonomy. Oxford University Press.
9. Verma BK (2011) Introduction to Taxonomy of Angiosperms, PHI Learning, New Delhi.

Verma

18/3

20/3/21

21

Semester-II: Paper IV

MM. 100 (75+25)

BOT 204: Anatomy, Embryology and Morphogenesis

UNIT I

- ❖ Shoot development: Organization of shoot apical meristem (SAM), Leaf (Marginal meristem).
- ❖ The cambium, its derivative tissues, differentiation of secondary phloem and xylem.
- ❖ Structure of woods in relation to its weight, strength, durability and taxonomic significance.
- ❖ Anomalous secondary growth in roots and stems.
- ❖ Cork cambium and its derivatives.

UNIT II

- ❖ Abscission layers.
- ❖ Origin of lateral and adventitious roots, root-stem transition.
- ❖ Anatomy in relation to taxonomy.
- ❖ Structure of microsporangium, microsporogenesis and development to female gametophyte.
- ❖ Structure of ovule, megasporogenesis and development to female gametophyte.
- ❖ Pollen-Pistil interaction.
- ❖ Fertilization and its control.

UNIT III

- ❖ Endosperm: Development, types, haustoria, ruminant endosperm, xenia, meta-xenia.
- ❖ Embryogenesis in dicot and monocot.
- ❖ Apomixis, causes and significance.
- ❖ Parthenocarpy.
- ❖ Polyembryony and its induction.
- ❖ Embryology in relation to taxonomy.

UNIT IV

- ❖ Polarity: Polarity in isolated cells, plasmodia and coenocytes. Expression of polarity in external and internal structure of plants. Role of polarity in developmental pattern.
- ❖ Correlation: Physiological and genetically correlations.
- ❖ Symmetry: Inorganic and organic symmetries. Radial, bilateral and dorsiventral symmetries in plant body. Development of symmetry.
- ❖ Morphogenesis in *Acetabularia*.









Suggested readings:

1. The Embryology of Angiosperms, 6th Edition. By Bhojwani S.S/Bhatnagar S.P. & Dantu P.K
2. Carlquist, S. (1961), Comparative Plant Anatomy, Holt, Rinehart and Winston, New York Press
3. Cutter, Elizabeth (1969), Plant Anatomy part-I Cells and Tissues IInd edition, Edward Arnold, London
4. Cutter, Elizabeth (1971), Plant Anatomy Part-II Organs, Edward Arnold London
5. Dickison William C. (2000), Integrative Plant Anatomy. Academic Press

 2020/11 



BP-205 M. Sc. IInd Semester Practical

MM. 100 (75+25)

Paper I- Pteridophytes

1. Monographic study of the sporophyte body of the following
Cladoxylon, Selaginella, Lepidodendron, Isoetes, Sphenophyllum, Calamites, Botryopteris, Hymenophyllum, Ophioglossum, Osmunda, Lygodium, Pteris, Adiantum, Pteridium, Gleichenia, Cyathea, Marsilea, Azolla

Paper II- Gymnosperms and Palaeobotany

1. A study of representative types
2. Study: *Zamia, Ginkgo, Araucaria, Cryptomeria, Thuja, Taxus, Ephedra, Gnetum, Cupressus* of fossils and fossils slides

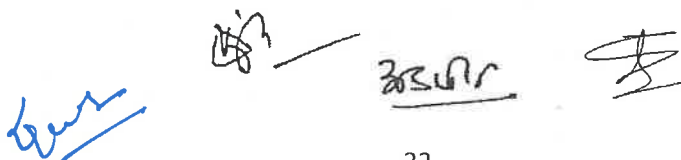
Paper III- Angiosperms, Taxonomy, Morphology and Economic Botany

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 50 plants properly pressed and mounted on herbarium sheets by excursion

Paper IV- Anatomy, Embryology and Morphogenesis

1. Study of the plants and its parts (root, stem and leaves) by sectioning and staining
2. Prepare of smear for the study of gametophyte
3. Micro- dissection techniques for embryo and embryo sac
4. Elementary techniques for pollen germination
5. Study for various stages in reproduction from permanent slides, pre and post fertilization in embryo sac
6. Preparation of permanent slides.



M.Sc.
Semester-III

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Semester-III: Paper I

MM. 100 (75+25)

BOT 301: Plant Physiology and Biochemistry

Unit-I

Plant Water relations:

- ❖ Osmosis, osmotic potential, water potential.
- ❖ Mechanism of water absorption, root pressure, phloem loading and unloading.
- ❖ Transpiration mechanism and its regulation.

Photosynthesis:

- ❖ Organization of photosynthetic apparatus, pigments, absorption spectra, action spectra and light harvesting complexes.
- ❖ Mechanism of electron transport-structure and functions of components of Photosystem I and Photosystem II, Photophosphorylation.
- ❖ Proton transport and ATP synthesis in chloroplast- ATP synthetase
- ❖ Carbon assimilation: Calvin cycle, C₄ cycle and their regulation, CAM pathway, photorespiration and its regulation, Factors affecting photosynthesis.

Respiration:

- ❖ Aerobic and anaerobic respiration Glycolysis, Krebs' Cycle and their regulation, substrate level phosphorylation, Electron Transport System and ATP Synthesis
- ❖ Pentose Phosphate Pathway and factors affecting respiration

Unit-II

Mineral Nutrition:

- ❖ Micro and Macro elements, Role and deficiency effects of essential nutrient elements.
- ❖ Stress physiology: Plant responses to abiotic stress, Stress proteins (HSP, LEA); Water deficit and drought, heat, chilling and freezing, salinity, light and anoxia stress.

Growth regulators:

- ❖ Auxin, Cytokinin, Gibberellin, Ethylene.

Flowering:

- ❖ Florigen concept, circadian rhythms, photoperiodism and its regulation.
- ❖ Vernalization, phytochrome and its functions.
- ❖ Abscission, dormancy, seed germination and senescence.

Unit-III

Amino acids, Peptides and Proteins:

- ❖ Biosynthesis of amino acid.
- ❖ Chemical and enzymatic hydrolysis of protein to peptides, amino acid sequencing.
- ❖ Secondary structure of proteins forces responsible for holding secondary structure α -helix and β -sheet. Super secondary structure, tertiary and Quaternary structure of proteins.
- ❖ Denaturation, degradation and renaturation of proteins.

Carbohydrates:

- ❖ Structure, Function and Metabolism of Carbohydrates

Lipid metabolism:

- ❖ Synthesis of fatty acids and their degradation.

Unit-IV

Nucleic Acids

- ❖ Biosynthesis of nucleotides.
- ❖ Denaturation, degradation and renaturation of nucleic acids.

Enzymes:

- ❖ General aspects, nomenclature and classification.
- ❖ Mode of action, active sites, reversible and irreversible enzyme inhibition.
- ❖ Enzyme kinetics and Michaelis-Menten equation.
- ❖ Factors affecting enzymatic reactions.
- ❖ Structure and function of co-enzymes, Isozyme, abzymes.
- ❖ Uses of Basic Instruments:

Microscopy:

- ❖ Compound microscopy (bright and dark field), phase contrast, fluorescence, ultraviolet and infrared microscopy.
- ❖ Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM).

Biochemical Methods:

- ❖ Chromatography, electrophoresis, centrifugation, X-ray diffraction.
- ❖ Methods of quantitative analysis
- ❖ Radioisotopic methods counter, autoradiography. Geiger-Muller counter, liquid scintillation
- ❖ Spectrophotometry
- ❖ DNA chip technology, microarrays and biosensors

Suggested Readings:

1. Taiz and Zeiger, 2010, Plant Physiology, 5th Edition, Sinurer Associates
2. Hopkins, W.G. and Huner N.P.A., 2009, Introduction to Plant Physiology, 4th Edition Wiley International Edition, John Wiley & Sons, USA
3. Jones, Russell L. Buchanan, Bob B. Guissem, Wilhelm., 2002, Biochemistry and Molecular Biology.
4. Cox MM, Nelson DL (2011) Lehninger Principles of Biochemistry, 5th edition, Freeman, WH & Company, New York.
5. Voet D, Voet JG, Pratt CW (2013) Principles of Biochemistry, 4th edition, John Wiley & Sons Pvt Ltd, Singapore.
6. Berg JM, Tymoczko JL, Stryer L (2002) Biochemistry, 7th edition, Freeman, WH & Company, New York.
7. Saba Ahmed, Parini Shah, Owais Ahmed. 2023. Biochemistry, Lipids. Treasure Island (FL): Stat Pearls Publishing.
8. Wilson, K. and Walker, J., 2000, Practical Biochemistry: principles & techniques. Cambridge University Press. ISBN 0521799651.
7. Buchanan, B., Gruissem, W., & Jones, R.L., 2002, Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists, USA.

Semester-III: Paper II

MM.100 (75+25)

BOT 302: Genetics, Plant Breeding and Biostatistics

UNIT I

- ❖ Principles of Mendelian inheritance and Interaction of genes: Complementary, epistasis, Inhibitory, Duplicate, Polymeric, Lethal genes.
- ❖ Cytoplasmic inheritance involving chloroplast (*Mirabilis jalapa*, *Zea mays*),
- ❖ Population genetics: Gene and genotype frequencies, Hardy-Weinberg Law,
- ❖ Structural changes in chromosomes: Origin, meiosis and breeding behavior of duplication, deficiency, inversion and translocation heterozygotes. Cytological consequences of crossing over in Inversion and translocation heterozygotes Genetics of structural heterozygotes, complex translocation heterozygotes,

UNIT II

- ❖ Numerical Changes in chromosomes: aneuploidy and euploidy, cytology and genetics, their role in crop improvement.
- ❖ Recombination and Linkage: -Gene mapping in Fungi Neurospora.
- ❖ Sex Determination in plants, mutation, DNA damage and repair mechanism, transposable elements in prokaryotes and eukaryotes and its mechanism.

UNIT III

- ❖ Introduction to plant breeding; Domestication; plant introduction and acclimatization, kinds of germplasm, Methods of selection and hybridization; Techniques of selfing and crossing.
- ❖ Cytoplasmic male-sterility; Heterosis and hybrid seed production; Mutant breeding; Polyploidy in plant breeding; Breeding for nutritional quality.

UNIT IV

- ❖ Relevance of biostatistics to biological interpretation, elementary idea of probability, combination and permutations, continuous and discontinuous variables;
- ❖ Measures of central tendency: Mean, Median and Mode; Measures of dispersion: Standard deviation, Standard error, Mean deviation. Significance of Chi-Square, t-test, analysis of variance, Correlation and regression.

Suggested Readings:

1. Clark, M.S. and Wall, W.J. 1996, Chromosomes: The Complex Code. Chapman & Hall, London.
2. Swanson, C. P., Mertz, T.F. and Young, W.J. Cytogenetics: The Chromosomes in Division, Inheritance and Evolution (2nd Edn). Englewood Cliff, Prentice-Hall, New Jersey.
3. Sharma, A.K. and Sharma, Archana. 1985. Advances in Chromosome and Cell Genetics. Oxford & IBH Publishing Co., Calcutta.
4. Gupta, P.K., Cytogenetics, Rastogi Publication, Meerut
5. Gardner EJ, Simmons MJ, Snustad DP (2006) Principles of Genetics, 8th edition, John Wiley & Sons, Wiley India Edition, New Delhi.
6. Forthofer RN, Sullee E, Hernandez M (2006) Biostatistics: A guide to design, analysis & discovery, Academic Press, USA

Semester-III: Paper III

MM.100 (75+25)

BOT 303: Ecology, Plant- Soil Relationship

UNIT I

- ❖ Plant Ecology and its scope.
- ❖ Auto-ecological studies, gene ecology with emphasis on Indian work
- ❖ Plant communities: characteristics and its classification.
- ❖ Life-forms and biological spectrum.
- ❖ Plant community dynamics and development: succession and climax.
- ❖ Study of plant communities (Analytical and Synthetic characters)
- ❖ Population ecology. Ecological niche.

UNIT II

- ❖ Study of different types of ecosystems.
- ❖ Ecological energetic.
- ❖ Biogeochemical cycles of nutrients in ecosystem.
- ❖ Production ecology, measurement of primary productivity.
- ❖ Ecological adaptation of plants in different ecosystems.

UNIT III

- ❖ Biodiversity and its conservation:
- ❖ Introduction to Biodiversity.
- ❖ Levels of Biodiversity: Genetic species community and Ecosystem.
- ❖ Megadiversity Zones and Hotspots.
- ❖ Threats to Biodiversity: Causes of Biodiversity loss species extension.
- ❖ Red Data Book. IUCN threat categories.
- ❖ Strategies for Biodiversity conservation: Principles of Biodiversity conservation in- situ and ex-situ conservation strategies.

UNIT IV

- ❖ Environmental pollution and its consequences.
- ❖ Soil properties in relation to plant growth: Physical texture, density, porosity, permeability.
- ❖ Soil water, energy concept of soil, water, soil water quantities and their measurement.
- ❖ Soil: Its origin and development.
- ❖ Process of soil formation and soil profile.
- ❖ Soil erosion: its causes and effects on environment.
- ❖ Methods of soil conservation.

Suggested Readings:

1. Odum, E.P. and Barret G.W. 2005. Fundamentals of Ecology. Cengage publication
2. Odum, E.P., 1983. Basic Ecology., Saunders College Publishing
3. Singh, J.S., Singh S.P. and Gupta S.R. 2006. Ecology Environment and Resource Conservation. Anamaya Publishers
4. Schulze ED, Beck E., Hohenstein K., 2005. Plant Ecology Springer- Verlag Berlin Heidelberg, New York.
5. Pungnaire FI, Valladares F, 2007. 2nd Edition, Functional Plant Ecology CRC Press/Taylor & Francis

BP-304 M. Sc IIIrd Semester Practical

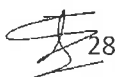
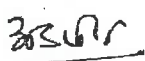
MM.100 (75+25)

Paper 1- (A) Plant Physiology

1. To determine the Osmotic pressure of vacuolar sap of Rhen discolor er Tradescantia leaves by plasmolytic method (50% plasmolysis)
2. To determine the diffusion pressure deficit (water potential) of potato tuber tissue by weighing method
3. To determine the structure, size and frequency of stomata in mesophytic and xerophytic leaves
4. To determine the rate of transpiration of plant
 - I. Weight
 - II. Potometer method
5. To determine the rate of transpiration by Cobalt Chloride paper method and to calculate transpiration index (TI). Transpiration efficiency (TE) of various leaves
6. To measure the rate of photosynthesis in aquatic plants by Willmotts bubble Counting method
7. To study the effect of (i). CO₂ (ii) Light quality and intensity
8. To extract the major plant pigments from leaves by different solubility method
9. To study the effect of (i) Injury, (ii) Temperature, (iii). Light; On the rate of photosynthesis in leaves of an aquatic/terrestrial plant

(B) Plant Biochemistry

1. To separate the major plant pigments (i) Paper chromatography and to calculate Rf values of the pigment
2. To extract the free amino acid from germinating seed of mung bean/ black gram and separate them by two-dimensional paper chromatography
3. To determine the Rf values of a given mixture of amino acids using Paper chromatography
4. To determine the Rf values of a some given reducing sugar using Paper chromatography
5. To measure the activity of enzyme catalase and to study the effect of (i) Substrate concentration and (ii) pH on enzyme activity
6. To extract proteins from germinating seeds of moong bean/ black gram and to estimate them by the Biuret test
7. To extract and test the presence of Reducing sugar by Benedict's test
8. Effect of enzyme concentration on the activity of Urease
9. Effect of substrate concentration on urease activity



Paper II- Genetics, Plant breeding and Biostatistics

1. Chromosomal Technique - Pretreatment, fixation, staining techniques Acetocarmine Fuelgen, Banding Technique-G Banding
2. Karyotypic studies-Preparation of mitotic metaphase plates and to draw Camera Lucida drawing of chromosome and study of chromosome morphology, Calculation of armratios, chromosome formula and symmetry of karyotype, preparation of ideograms and drawing photograph
3. Emasculation Techniques
4. Statistical analysis of seed samples and applying suitable statistical test for interpretation as desired
5. Numerical problem and design

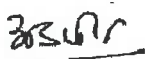
Paper III- Ecology and Plant soil Relationship

1. Autecology observations on selected plant species
2. Study of the vegetation by
 - a. Transect method
 - b. Quadrat method
 - c. Point method
3. Study of the environmental factors
 - a. Climatic factors and their measurement
 - b. Edaphic factors, mineral composition of soil, pH, soil profile, moisture content, nitrate, calcium, carbonate
 - c. Water Analysis
4. Ecological anatomy of hydrophytes, halophytes and xerophytes
5. To measure the photosynthetic rate (A) and the specific leaf area of five tree species and observe relation between them.

RESEARCH (BOT 305R)

M.M.: 100

Research Projects- include Industrial training/ Internship/ Survey work.



M.Sc.

Semester-IV

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Semester-IV: Paper I

MM.100 (75+25)

BOT 401: Cell & Molecular Biology

UNIT-I

Cell structure & function:

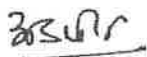
- ❖ Cell wall, Plasma membrane and their structural models and functions; Cell organelles.
- ❖ Active and Passive uptake of ions facilitated diffusion, primary and secondary active transport, ion carriers, channel proteins and pumps (Na/K^+ and Ca^{2+} pumps).
- ❖ Membrane transport proteins: Plasma membrane H^+ -ATPase, Vacuolar H^+ -ATPase and H^+ -pyrophosphatases (H^+ -PPase).
- ❖ Organization of microtubules & microfilaments.
- ❖ Cell Division, Cell Cycle, Mitosis and Meiosis, Control of cell division.
- ❖ Cell cycle check points, Apoptosis and Programmed Cell Death (PCD) in plants.
- ❖ Cell Signaling

UNIT-II

- ❖ Genome Basic concept and organization.
- ❖ Chromosome structure, nucleosome, solenoid 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.
- ❖ Nuclear DNA content, C-value paradox.
- ❖ Structure and Properties of Nucleic acids: Structure, chemical, physical and thermal properties of nucleic acids.
- ❖ Dissociation and reassociation kinetics of DNA, Cot curves, Cot values and its significance.
- ❖ Unique, moderately repetitive and highly repetitive DNA, conformation of nucleic acids (A, B, Z DNA, l-RNA, m-RNA).

UNIT-III

- ❖ DNA amplification, molecular genetic maps, genome projects.
- ❖ Allele concept, multiple alleles, isoalleles, pseudoalleles.
- ❖ Genetic Code
- ❖ Gene Structure: Organization and structure of prokaryotic and eukaryotic genes; structure and role of promoters, exons, introns, terminators and enhancers.



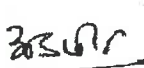
- ❖ DNA Replication: Mechanism of prokaryotic and eukaryotic DNA replication, replication apparatus, origins of replication, priming and DNA polymerases.
- ❖ Transcription: RNA polymerases and their role, transcription apparatus, transcription in prokaryotes and eukaryotes, initiation, elongation and termination, RNA processing. reverse transcription, ribonucleoproteins.

UNIT-IV

- ❖ Regulation of Transcription in prokaryotes and eukaryotes: Operon concept (Lac, Tryptophan, cAMP) positive and negative regulation of prokaryotic genes, eukaryotic transcription factors. Transcriptional and translational control.
- ❖ Translation in prokaryotes and eukaryotes.

Suggested Readings:

1. Lodish H, Berk A, Kaiser CA, et al. (2013) Molecular Cell Biology, 7th edition, WH Freeman and Comp, New York.
2. Cooper GM, Hausman RE (2016) The Cell: A Molecular Approach, 7th edition, Sinauer Associates Inc Sunderland.
3. Karp G (2009) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Willey & Sons, New York.
4. Q. Zhong, Q. Nie, R. Wu and Y. Huang, 2023. Exosomal miR-18a-sp promotes EMT and metastasis of NPC Cells via targeting BTG3 and activating the Wnt β -Catenin signaling pathway. Cell Cycle, Vol. 22, Issue 13, 1544-1562.
5. De Robertis E.D.P., 2017. Cell and Molecular Biology, 8th Edition, Lea & Febiger, U.S.
6. Clark, M.S. and Wall, W.J. 1996, Chromosomes: The Complex Code. Chapman & Hall, London.
7. J. Schnabel, W. Cornell, 2023. DNA shapes itself to execute new functions. Cornell Chronicle, 1
8. S Audibert, 2023. Guiding DNA repair at the nuclear periphery. Nature Cell Biology, 928-930.
9. Buchanan, B., Gruissem, W., & Jones, R.L., 2002, Biochemistry and Molecular Biology of Plants. Americ and Society of Plant Biologists, USA.




Semester-IV: Paper II

MM.100 (75+25)

BOT 402: Plant Biotechnology

UNIT-I

Plant cell and tissue culture techniques:

- ❖ Plant Cell and Tissue culture: Introduction, history, scope, concept of cellular differentiation, totipotency
- ❖ Culture media and laboratory requirements
- ❖ Micropropagation- Organogenesis and embryogenesis
- ❖ Endosperm and nucellus culture
- ❖ Soma clonal variations- Applications and reasons for generation

UNIT II

- ❖ Somatic hybridization–protoplast culture, regeneration and somatic hybridization, cybrids.
- ❖ Production and uses of haploids
- ❖ Applications of plant tissue culture

Genetic Engineering:

- ❖ Cloning vectors (plasmid and bacteriophage vectors, cosmids, BAC and YACs) and Enzymes (Restriction endonucleases, polymerases, reverse transcriptase, alkaline phosphatase, polynucleotidekinase (PNK), ligases, terminal transferases).
- ❖ DNA cloning, preparation of plasmid DNA, Restriction and electrophoresis, ligation.

UNIT III

- ❖ 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.
- ❖ Principles and methods of Genetic Engineering, Gene libraries and cDNA libraries, Polymerase chain reaction, DNA fingerprinting, DNA Synthesis.

UNIT IV

- ❖ DNA Sequencing, Southern blotting, RAPD, RFLP, Restriction mapping.

Biotechnology and Human welfare:

- ❖ Applications of genetically engineered bacteria in crop production and protection, biodegradation of xenobiotics and toxic wastes, production of chemicals, fuels and medicines.
- ❖ Biopesticides and integrated pest management, Biofertilizers, Organic farming.

- ❖ Restoration of degraded land–Development of stress tolerant plants, microbes for improving soil fertility.

Suggested Readings:

1. Dr. A Nair, 2009. Principles of Biotechnology and Genetic Engineering: Laxmi Publishers.
2. Dwivedi Padmanath, 2004. Plant Tissue Culture, Scientific Publishers.
3. J.D. Watson, T.A. Baker, S.P. Bell, A. Gann, M. Levine & R. Losick Molecular Biology of the Gene, Cold Spring Harbor Laboratory
4. Bernard R. Glick and Jack J. Pasternak, Molecular Biotechnology: Principles and application of recombinant DNA ASM Press, Washington, D.C
5. T.A. Brown, Genomes-Garland Science (Taylor & Francis Group), New York & London
6. Singh, B.D. (1993) Plant Breeding. 5th Edition, Kalyani Publishers, Ludhiana









Semester-IV: Paper IIIA

MM.100 (75+25)

BOT 403A: Environmental Botany

UNIT-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.

UNIT 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, Greenhouse effects; Consequences of climate change (global warming, Sea level rise).
- ❖ Radioactive pollution: General ideas about hazardous impacts of radiations and radio-active fallouts.
- ❖ Noise Pollution: General idea about various levels of noise pollution and human response.

UNIT 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.
- ❖ Radio-active waste treatment.
- ❖ Noise abatement.

UNIT IV

- ❖ Conservation: (Forest, Forestation, de-forestation 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.

Suggested Readings:

1. Odum, E.P. and Barret G.W. 2005. Fundamentals of Ecology. Ceng age publication
2. Odum, E.P., 1983. Basic Ecology., Saunders College Publishing
3. Singh, J.S., Singh S.P. and Gupta S.R. 2006. Ecology Environment and Resource Conservation. Anamay
1. A Publishers
4. Schulze ED, Beck E., Hohenstein K., 2005. Plant Ecology Springer- Verlag Berlin Heidelberg,
2. New York.
5. Pungnaire FI, Valladares F, 2007. 2nd Edition, Functional Plant Ecology CRC Press/Taylor &
3. Francis Group, Boca Raton, Florida









Semester-IV: Paper IIIB

MM.100 (75+25)

BOT 403B: Advanced Plant Physiology

UNIT-I: Plant Metabolism

- ❖ 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 Energetic: As controlled by photosynthesis, respiration and photorespiration
- ❖ Respiration: Biological oxidation of carbohydrates and inter conversions of the products, terminal oxidation, electron transport, role of cytochromes and other heme compounds.

UNIT 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.

UNIT 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, polyacetylisquinoline, 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.

UNIT IV

- ❖ Stress physiology: Plant responses to biotic and abiotic stresses, mechanism of biotic and abiotic stress resistance, plant defense mechanism 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

Suggested Readings:

1. Taiz and Zeiger, 2010, Plant Physiology, 5th Edition, Sinauer Associates
2. Hopkins, W.G. and Huner N.P.A., 2009, Introduction to Plant Physiology, 4th Edition Wiley International Edition, John Wiley & Sons, USA
3. Jones, Russell L. Buchanan, Bob B. Guissem, Wilhelm., 2002, Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists.
4. Peter Scott, Physiology and Behaviour of Plants. Wiley-Blackwell.
5. Frank Boyer Salisbury and Cleon Ross, 1991, Plant Physiology, CA



Semester-IV: Paper IIIC

MM.100 (75+25)

BOT 403C: Plant Pathology

Unit-I

- ❖ Historical development and present status of phyto-pathology. 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.

UNIT II

- ❖ Defense 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.

UNIT 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.

UNIT IV

- ❖ Diseases caused by nematodes: • Earcockle 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 root 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:

- Sesame phyllody; • Little leaf of brinjal; • Grassy shoot of sugarcane.

Suggested Readings:

1. S. Avasthi, A.K. Gautam, M. Niranjana, R.K. Verma, S.C. Karunaratna, A. Kumar, N. Suwannarah, 2023. Insights into Diversity, Distribution and Systematic Rust Genus Puccinia. Journal of Fungi (9), 638-639.
2. Willey, J.M., Sherwood, L., Woolverton, C.J., 2010. Prescott's Microbiology. 8th edition, McGraw-Hill.
3. Agrios, G.N., 1988. Plant Pathology, Academic Press.
4. John A Lucas, 1998. Plant Pathology and Plant Pathogens, Wiley-Blackwell, CRC Press.
5. Dickinson, C.M., 2003. Molecular Plant Pathology, Bios Scientific Publisher



BP 404 M. Sc. IVth Semester Practical

MM.100 (75+25)

Paper 1- Cell Biology and Molecular Biology

1. Preparation of squash for the study of mitosis
2. Preparation of squash for the study of meiosis
3. Meiotic studies Studies of various stages of meiosis, study of diakinesis and or metaphase bivalent, drawing diagrams and calculations of chiasma frequency and terminalisation coefficient
4. Preparation of various stains- Safranin, Fast green, Haematoxylin and carmine
5. Study of fixation of botanical materials
6. Method for preparation of permanent slides section cutting by the use of Microtome
7. To study the use of ocular and stage micrometers for the measurement of pollen grains and stomata
8. To extract and to detect nucleic acid from cauliflower or any floral tissue: (i) DNA by Diphenylamine test, (ii) RNA by Orcinol test
9. Isolation and purification of DNA from various electrophoresis
10. Estimation of protein by Bradford reagent sample using Agarose gel
11. Use of spectrophotometer in biochemical estimations- chloroplastic pigments, proteins, carbohydrates etc.
12. Demonstration of instruments: Gel Electrophoresis, Microtome, pH meter, oven, incubator, autoclave and centrifuge

Paper II- Plant Biotechnology

1. Preparation of MS (Murashige and Skoog) basal medium for tissue culture
2. Preparation of medium for regeneration of *Bryophyllum*
3. To prepare medium for Anther culture *Datura innoxia* using IAA, MS medium

BP 404 Paper IV- Special Papers Environmental Botany

1. 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
2. Biological examinations of polluted water- microscopic and culturing method (Density count)
3. Physico chemical analysis of polluted soil, pH, Electric conductivity, soluble cations, anions heavy metals (base deficiency)
4. To analyse distribution pattern of selected species in an ecosystem

5. To measure the photosynthetic rate (A) and the specific leaf area of five tree species and observe relation between them

OR

Advanced Plant Physiology

1. 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
2. Estimate the percentage of total free amino acids in any plant material spectrophotometrically by using Ninhydrin
3. To estimate the amount of Total Nitrogen in dry leaves by Micro- Kjeldahl method
4. To estimate total protein of fresh moong, bean seedlings by biuret reagent
5. To estimate the percentage of soluble protein of fresh moong, bean seedling by Lowry's method
6. To estimate the percentage of reducing sugar in any plant material by Somogy Nelson's method
7. To estimate the percentage of total soluble sugar in plant tissue using anthrone reagent
8. To estimate ascorbic acid in plant tissue
9. 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
10. To study the effect of any stress (temperature, water) on germination in barley seed
11. To estimate the percentage of fatty acid in castor, bean, mustard by Soxhlet's extraction method
12. To test the presence of fatty acid in castor seed
13. 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
14. To study the effect of various Plant Growth Regulators (IAA, GA3, Kinetin Brassins and polyamines) on germination of bean seeds
15. To study the effect of GA3 on flower initiation and expression in any plant
16. To study the phenomenon of Apical Dominance
17. To study the in Coleus and Tulsi phenomenon of Phototropism in plants
18. To study the phenomenon of Geotropism in plants

OR

Plant Pathology

1. A study of symptomology, histopathology, and identification of pathogen of various fungal diseases:
1. 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

2. 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, Leafcurl of tobacco, chilly and tomato, Tungro of paddy, Yellow vein mosaic and Bunchy top of banana) and MLO (Sesame phyllody, Little leaf of brinjal, and Grassy shoot of sugarcane) disease
3. Preparation of culture media and sterilization
4. Isolation of fungi and bacteria from diseased plant
5. Inoculation experiment with fungal and bacterial plant pathogens
6. Measurement of fungal spores
7. Transmission experiments (mechanical and insect transmission) of plant virus
8. Use of fungicides and plant protection appliances
9. Field collection of 50 diseased plant specimens (fungal, viral and bacterial)

RESEARCH (BOT 405R)

M M: 100

Research Projects – This includes any Industrial training/ Internship/ Survey work related to some or other innovative aspects of Modern Botany


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