K.K. UNIVERSITY

NALANDA, BIHAR - 803115

SCHOOL OF APPLIED SCIENCES

Master of Science (M.Sc.)

(Two Year Full Programme)

2023-2024

PROGRAMME STRUCTURE & SYLLABUS

M.SC. BOTANY

K.K. UNIVERSITY 803115 NALANDA

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M.SC. Botany 2 Years Course Structure

Year	Semester	Course Code	Course Title	L	T	P	C
1	1	MSBT 1101	Microbiology, Fungi & Plant Diseases	4	1	0	5
		MSBT 1102	Algae and Bryophyta	4	1	0	5
		MSBT 1103	Pteridophtya, Phytogeography & Limnology	4	1	0	5
		MSBT 1104	Practical I (Based on MSBT 1101, 1102 & 1103)	0	0	2	1
			Total	**12**	**3**	**2**	**16**
	2	MSBT 1201	Gymnosperms and Reproductive Biology	4	1	0	5
		MSBT 1202	Cell Biology, Genetics & Breeding	4	1	0	5
		MSBT 1203	Plant Physiology & Biochemistry	4	1	0	5
		MSBT 1204	Practical II (Based on MSBT 1201, 1202 & 1203)	0	0	2	1
			Total	**12**	**3**	**2**	**16**
2	3	MSBT 2101	Molecular biology and Biotechnology	4	1	0	5
		MSBT 2102	Plant Ecology & Plant Anatomy	4	1	0	5
		MSBT 2103	Angiosperm Taxonomy, Plant Resource, Utilization & Conservation	4	1	0	5
		MSBT 2104	Practical III (Based on MSBT 2101, 2102 & 2103)	0	0	2	1
			Total	**12**	**3**	**2**	**16**
	4	MSBT 2201	Environmental Biology	4	1	0	5
		MSBT 2202	Plant Pathology	4	1	0	5
		MSBT 2203	Practical: Plant Pathology	0	0	2	1
		MSBT 2204	Project /Dissertation	0	0	24	12
			Total	**8**	**2**	**26**	**23**
			Total Credits				**71**

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K. K. UNIVERSITY

School Of Applied Sciences

Master Of Science In Botany

SYLLABUS

Semester – I

Year	Semester	Course Code	Course Title	L	T	P	C
1	1	MSBT 1101	Microbiology, Fungi & Plant Diseases	4	1	0	5
		MSBT 1102	Algae and Bryophyta	4	1	0	5
		MSBT 1103	Pteridophtya, Phytogeography & Limnology	4	1	0	5
		MSBT 1104	Practical I (Based on MSBT 1101, 1102 & 1103)	0	0	2	1
			Total	**12**	**3**	**2**	**16**

Objective of the Program:

The M.Sc. Botany program aims to provide advanced knowledge and understanding of plant biology, including their physiology, ecology, genetics, and evolution. The objective is to develop expertise in plant taxonomy, molecular biology, and biotechnology, with an emphasis on their applications in conservation, agriculture, and environmental sustainability. Students are trained in laboratory techniques, fieldwork, and research methodologies, preparing them for careers in research, teaching, environmental consultancy, and various biotechnological industries. The program also focuses on fostering critical thinking, problem-solving, and independent research skills in the field of plant sciences.

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PROGRAMME OUTCOME

PO1: Demonstrate Advanced Knowledge of Botany: Graduates will have a thorough understanding of key concepts, theories, and principles in botany, including plant anatomy, physiology, ecology, genetics, and evolution.

PO2: Apply Research Methods: Graduates will be proficient in applying scientific research methods, including experimental design, data collection, statistical analysis, and interpretation of results, to investigate botanical questions.

PO3: Conduct Independent Research: Graduates will be able to plan, execute, and present original research projects in botany, demonstrating autonomy, creativity, and critical thinking.

PO4: Interpret and Communicate Scientific Findings: Graduates will be able to effectively communicate scientific information through oral presentations, written reports, and scientific publications, tailored to both scientific and lay audiences.

PO5: Analyze Plant Diversity and Function: Graduates will be able to identify and classify plants, analyze their ecological roles, and understand their adaptations to various environments.

MSBT 1101: Microbiology, Fungi & Plant Diseases

COURSE OUTCOME

CO1: Demonstrate Understanding of Microbial Diversity and Structure

CO2: Understand the Diversity and Importance of Fungi

CO3: Apply Laboratory Techniques in Microbiology and Mycology

CO4: Analyze Fungal Pathogenesis and Diseases

CO5: Evaluate Strategies for Microbial Control

COURSE OBJECTIVE

This course will introduce the core concepts of microbial world, world of fungi and several plant diseases. The goal of the above mentioned paper is to make the learners understand about the basics of core classical botany.

L	T	P	Cr
4	1	0	5

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UNITS	CONTENTS	Contact Hrs.	No. Of Weeks
I	General introduction; History and scope of microbiology; theory of spontaneous generation Methods of microbiology: Sterilization-Different types of sterilization (moist heat, dry heat, filtration, radiation and chemicals) Diversity of microorganisms: Archaea, Bacteria, Cyanobacteria, Phytoplasma, Rickettsia,	4	1,2
II	Structure of bacteria: Ultra structure of Gram positive and Gram negative bacteria; reproduction (vegetative, asexual and genetic recombination); Nutritional classification of bacteria; economic importance of bacteria. Viruses: Nature, characteristics and ultrastructure of Virions (TMV and Bacteriophages), multiplication (Lytic and Lysogenic cycles) and transmission of viruses; economic importance; a brief account of Viroids and Prions.	6	3,4,5
III	Introduction to fungi and their significance to humans, general characteristics of fungi, Fungal Cell, fungal cell walls and fungal organelles, systematics, molecular methods of fungal taxonomy, reproduction and spores in fungi, heterothallism, parasexual cycle and sex hormones in fungi. Biology, general characteristics and importance of Plasmodiophora, acrasiomycota and myxomycota. Biology, general characteristics, classification and brief introduction of Ascomycotina, Basidiomycotina, Deuteromycotina. Phylogeny of fungi, Fungi in industry, medicine and as food, Fungi as bio-control agents.	10	6,7,8,9
IV	General introduction to Plant disease, History of Plant disease, Classification of Plant Diseases, Kinds and amount of losses, chemical weapons of pathogens – Enzymes and toxins; Role of growth hormones in plant diseases, Pre-existing structural and chemical defense, induced structural and chemical	12	10,11, 12,13
	defense, hypersensitive reaction, role of phytoalexins and other phenolic compound., how the pathogen affects plant physiological functions. Parasitism and disease development, symptoms, effect of environmental factors on the plant disease development, plant disease epidemiology. Some important diseases caused by fungi, bacteria, viruses and mycoplasma (as per location).		

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	Control of plant diseases, quarantines and inspection, physical, chemical, cultural and biological methods of disease control, integrated pest management.		
V	Revision Week	8	14

RECOMMENDED BOOKS:

- Prescott's Microbiology, 9th edition
- Agrios, G.N. (1997) Plant pathology, 4th edition, academic Press, U.K
- Text Book of Fungi and their Allies, Macmillan Publishers

RECOMMENDED ONLINE RESOURCES:

https://www.youtube.com/watch?v=7wWY9FC5biQ&list=PLb0WW0k29aHq7anfNEH7FQ08iVvw0neEP
https://www.youtube.com/watch?v=vMGRD94R3RU&pp=ygUbcGxhbnQgcGF0aG9sb2d5IG0uc2MgYmFzaWNz
https://onlinelibrary.wiley.com/doi/abs/10.1034/j.1399-302X.1999.140510.x
https://link.springer.com/content/pdf/10.1007/978-1-4939-9861-6.pdf
https://www.youtube.com/watch?v=DHJ92FqVfLA&list=PL71l-mCkqvOzSiJPkVCR2w8n5U0wcPlmo

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MSBT 1102: Algae and Bryophyta

COURSE OUTCOMES

CO1: Understanding of Taxonomy and Classification

CO2: Recognition of Economic and Environmental Importance

CO3: Awareness of Ecological Roles and Adaptations

CO4: Appreciation of Diversity and Evolutionary Relationships

CO5: Development of Practical Skills

COURSE OBJECTIVE

This course provides an in-depth exploration of algae and bryophytes, focusing on their taxonomy, morphology, physiology, ecology, and significance in various ecosystems. Students will engage in theoretical learning as well as practical exercises to understand the diversity and ecological roles of these important plant groups.

L	T	P	Cr
4	1	0	5

UNITS	CONTENTS	Contact Hrs.	No. Of Weeks
I	Introduction to Phycology, Principles and systems of classification of algae, Comparative account of algal pigments, food reserves, cell wall, flagellation, chloroplasts and eye-spots, their phylogenetic and taxonomic importance.	**4**	**1,2**
II	Cell structure and thallus organization, heterocyst and akinete development and their role; chromatic adaptations and reproduction in Cyanophyta, distribution and ecology of cyanobacteria.	**4**	**3,4**
III	Range of thalli and methods of reproduction in Chlorophyta, evolutionary tendencies in Chlorophyta. A brief account of Bacillariophyta, Pyrrophyta, Haplophyta, Crysophyta, Xanthophyta, Euglenophyta and Prochlorophyta, and other related and recent new groups. Thallus organization and reproduction in Phaeophyta and Rhodophyta.	**6**	**5,6**

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IV	General introduction including broad outline of classification and evolutionary trends of Bryophyta. Distribution of the group in India, general features and adaptation to land habit. Origin and evolution of gametophyte and sporophyte generation. Endemism and endemic liverwort genera of India. Bryophyte ecology.	**6**	**7,8,9**
V	Regeneration in bryophytes. Economic uses, chemistry of bryophytes, distribution: Global and Indian. General characteristics, morphology, anatomy and life history of Marchantiales: *Riccia*, *Marchantia*, *Cyathodium*; Metzgeriales: *Riccardia*, *Metzgeria*, *Pallavicinia*; Jungermanniales: *Radula*, *Herberta*, *Porella*.	**8**	**10,11,12**
VI	Anthocerotophyta: distribution: Global and Indian, general features, Morphology, anatomy and life history of Anthocerotales: Anthoceros, Notothylas. Bryopsida/Musci: distribution: Global and Indian, general features, morphology and anatomy, life history of Sphagnales: *Sphagnum*, Polytrichales: *Polytrichum*, *Pogonatum*; Bryales: *Bryum*, *Rhodobryum*, *Funaria*.	**6**	**13,14**
VII	Revision Week	**8**	**15**

RECOMMENDED BOOKS:

- "Algae: Anatomy, Biochemistry, and Biotechnology" by Laura Barsanti and Paolo Gualtieri.
- "Bryophyte Biology" by Bernard Goffinet and A. Jonathan Shaw.
- Odum, E.P(2005). 'Fundamentals of Ecology'

RECOMMENDED ONLINE RESOURCES:

https://www.youtube.com/watch?v=UbxNCG8xEy0&list=PLgrPoGl4jGdoYfkcMnTsP8Aj5EDOE7Rk

https://www.youtube.com/watch?v=f38OfQ2xPh0&list=PLz-yxFzpe5VHoPwqVOycSYORWC5Npc0mE

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MSBT 1103: Pteridophtya, Phytogeography & Limnology

COURSE OUTCOMES

CO1: Understanding of Pteridophyta, phytogeography & limnology in modern scenario.

CO2: Apply knowledge and analytical skills to solve practical problems in plant ecology and freshwater science.

CO3: Analyze how environmental factors influence the distribution and abundance of pteridophytes in different aquatic habitats.

CO4: Interpret geographical and limnological data using appropriate statistical and spatial analysis techniques.

COURSE OBJECTIVE

The course on Pteridophyta, Phytogeography, and Limnology aims to provide students with a comprehensive understanding of these specialized areas of botany. The Pteridophyta section focuses on the biology, evolution, diversity, and ecological significance of ferns and their allies, highlighting their reproductive strategies and phylogenetic relationships.

L	T	P	Cr
4	1	0	5

UNITS	CONTENTS	Contact Hrs.	No. Of Weeks
I	General Introduction of Pteridophytes, their peculiar features and similarities and dissimilarities with bryophytes and gymnosperms, Pteridophytes classification based on molecular data by Smith et al. 2006. World distribution of Pteridophytes with special reference to India, Endangered Pteridophytes their conservation.	4	1,2
II	Origin and Evolution of Pteridophytes, Gametophytes of Pteridophytes, ecology of Pteridophytes. Stomatal structures in Pteridophytes, Spores of Pteridophytes. Apogamy, Apospory and parthenogenesis. Sex organs and embryogeny in Pteridophytes. Ecology of Pteridophytes, Economic importance of the Pteridophytes.	6	3,4,5

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III	Comparative morphology, anatomy, reproductive biology and evolutionary | studies of the following groups: Early land plant and their evolutionary significance, Psilopsida, Lycopsida, Sphenopsida, Filicopsida. Coenopteridales, Ophioglosales, Marattiales, Osmundales and filicales; Monographic study of § Marsilea, Isoetes, Psilotum, Ophioglossum, Osmunda, Lygodium, Cyathea, q Gleichenia, Adiantum, Pteris, Christella ; and aquatic ferns.	**6**	**6,7,8**
IV	Environmental impact assessment threatened and endangered plant species, role of diversity in ecosystem stability, general account of remote sensing and its application, sustainable development. Major terrestrial biomes, biogeographically area of India, major vegetations.	**5**	**8,9**
V	Introduction to Limnology, Properties of water, Lake ontogeny, morphometry, Physical factors: Light Temperature, Heat, and Stratification. Chemical factors: Co2, Oxygen in lakes, profiles, seasonal effects, primary production, effect of COD and BOD.	**8**	**10,11,12**
VI	Redox reactions in the water column and sediment, Size spectrum of plank tonic organisms, Size efficiency hypothesis, Food webs: benthic-pelagic coupling, pale limnology, Human impact on lack ecosystem.	**5**	**13,14**
VII	Revision Week	**8**	**15**

RECOMMENDED BOOKS:

- “Pteridophytes and Gymnosperms" by A.C. Dutta.
- "Phytogeography: Concepts and Applications" by A. Mark Smith.
- “Limnology: Lake and River Ecosystems" by Robert G. Wetzel.

RECOMMENDED ONLINE RESOURCES:

https://www.youtube.com/watch?v=rySC4NUdw1o&list=PLIdO_1ysznhca6qu6lnZuXm02KzFWQs2M
https://www.youtube.com/watch?v=kL4G8y0xG8E&list=PLKwxjdxIgO9XnpEq30wkO_pLOZC3HiIn0
https://www.youtube.com/watch?v=WyLc6ekPlOw&list=PLqNpXWX2YnD3up8Jxx9ZRj3gYa_XV_hly

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https://www.tandfonline.com/doi/abs/10.1080/00837792.1982.10670221
https://link.springer.com/article/10.1007/BF02870310
https://onlinelibrary.wiley.com/doi/abs/10.1002/aqc.507

MSBT 1104: Practical I

COURSE OUTCOME

CO 1: Laboratory Techniques Proficiency

CO 2: Fieldwork Competence

CO 3: Experimental Design and Execution

CO 4: Data Analysis and Interpretation

COURSE OBJECTIVE

- **Hands-on Experience:**

Provide students with practical, hands-on experience in various aspects of botany, reinforcing theoretical knowledge gained in lectures.

- **Skill Development:**

Develop and enhance practical skills necessary for conducting botanical research and experiments, including laboratory techniques and fieldwork.

- **Species Identification:**

Train students in the identification and classification of plant species based on morphological, anatomical, and reproductive characteristics.

- **Experimental Design and Execution:**

Enable students to design and conduct botanical experiments, including planning, execution, and data collection.

- **Laboratory Techniques:**

Familiarize students with a range of laboratory techniques used in botany, such as microscopy, tissue culture, DNA extraction, and biochemical assays.

L	T	P	Cr
0	0	10	5

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UNITS	CONTENTS	CONTACT Hrs.	No. Of Weeks
1	1) Determination of physical characteristics of inland (lentic and lotic) waters. 2) Estimation of Primary Productivity in freshwater bodies. 3) Collection and identification of aquatic plnats from different freshwater bodies. 4) Temporary slide preparation and study of common Algae.	6	1,2,3
II	1) Principles and use of different sterilization instruments like autoclave, overn. Laminar air flow system etc. 2) Preparation of media (potato Dextrose Agar) 3) Identification of algal isolates. 4) Isolation of fungi from soil. 5) Identification of fungal isolates. 6) Counting of fungal spore by haemocytometer. 7) Temporary slide preparation and study of common Fungi.	10	4,5,6,7
III	1) Study of common fungal diseases – Rust of linseed, Blight of potato, Rust of wheat, Stem gall of coriander, Downy mildew, Powdery mildew etc.	6	8,9
IV	1) Study of vegetative habit, anatomy and reproductive morphology of common Bryophyta (Marchantia, Anthoceros, Riccia, Funaria etc.) 2) Study of vegetative habit, anatomy and reproductive morphology of common	10	10,11,12
V	Pteridophyta (Psilotum Lycopodium, Ophioglossum, Marsilea, Selaginela, Equisetum, Azolla, Salvinia etc.)	4	13,14
VI	Revision Week	8	15

RECOMMENDED BOOKS:

- A Text Book Of Practical Botany- I & II By Dr. Ashok M Bendre & Dr. Ashok Kuma

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SEMESTER- II

M.SC. Botany 2 Years Course Structure

Year	Semester	Course Code	Course Title	L	T	P	C
1	1	MSBT 1101	Microbiology, Fungi & Plant Diseases	4	1	0	5
		MSBT 1102	Algae and Bryophyta	4	1	0	5
		MSBT 1103	Pteridophtya, Phytogeography & Limnology	4	1	0	5
		MSBT 1104	Practical I (Based on MSBT 1101, 1102 & 1103)	0	0	2	1
			Total	**12**	**3**	**2**	**16**
	2	MSBT 1201	Gymnosperms and Reproductive Biology	4	1	0	5
		MSBT 1202	Cell Biology, Genetics & Breeding	4	1	0	5
		MSBT 1203	Plant Physiology & Biochemistry	4	1	0	5
		MSBT 1204	Practical II (Based on MSBT 1201, 1202 & 1203)	0	0	2	1
			Total	**12**	**3**	**2**	**16**
2	3	MSBT 2101	Molecular biology and Biotechnology	4	1	0	5
		MSBT 2102	Plant Ecology & Plant Anatomy	4	1	0	5
		MSBT 2103	Angiosperm Taxonomy, Plant Resource, Utilization & Conservation	4	1	0	5
		MSBT 2104	Practical III (Based on MSBT 2101, 2102 & 2103)	0	0	2	1
			Total	**12**	**3**	**2**	**16**
	4	MSBT 2201	Environmental Biology	4	1	0	5
		MSBT 2202	Plant Pathology	4	1	0	5
		MSBT 2203	Practical: Plant Pathology	0	0	2	1
		MSBT 2204	Project /Dissertation	0	0	24	12
			Total	**8**	**2**	**26**	**23**
			Total Credits				**71**

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K. K. UNIVERSITY

School Of Applied Sciences

Master Of Science In Botany

SYLLABUS

Semester – II

Year	Semester	Course Code	Course Title	L	T	P	C
1	2	MSBT 1201	Gymnosperms and Reproductive Biology	4	1	0	5
		MSBT 1202	Cell Biology, Genetics & Breeding	4	1	0	5
		MSBT 1203	Plant Physiology & Biochemistry	4	1	0	5
		MSBT 1204	Practical II (Based on MSBT 1201, 1202 & 1203)	0	0	2	1
			Total	**12**	**3**	**2**	**16**

Objective of the Program:

The M.Sc. Botany program aims to provide advanced knowledge and understanding of plant biology, including their physiology, ecology, genetics, and evolution. The objective is to develop expertise in plant taxonomy, molecular biology, and biotechnology, with an emphasis on their applications in conservation, agriculture, and environmental sustainability. Students are trained in laboratory techniques, fieldwork, and research methodologies, preparing them for careers in research, teaching, environmental consultancy, and various biotechnological industries. The program also focuses on fostering critical thinking, problem-solving, and independent research skills in the field of plant sciences.

PROGRAMME OUTCOME

PO1: Demonstrate Advanced Knowledge of Botany: Graduates will have a thorough understanding of key concepts, theories, and principles in botany, including plant anatomy, physiology, ecology, genetics, and evolution.

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PO2: Apply Research Methods: Graduates will be proficient in applying scientific research methods, including experimental design, data collection, statistical analysis, and interpretation of results, to investigate botanical questions.

PO3: Conduct Independent Research: Graduates will be able to plan, execute, and present original research projects in botany, demonstrating autonomy, creativity, and critical thinking.

PO4: Interpret and Communicate Scientific Findings: Graduates will be able to effectively communicate scientific information through oral presentations, written reports, and scientific publications, tailored to both scientific and lay audiences.

PO5: Analyze Plant Diversity and Function: Graduates will be able to identify and classify plants, analyze their ecological roles, and understand their adaptations to various environments.

MSBT 1201: Gymnosperms and Reproductive Biology

COURSE OUTCOME

CO1: Knowledge of Gymnosperm anatomy

CO2: Understanding Gymnosperm Diversity in present days

CO3: Apply knowledge to compare with angiosperms

CO4: Human Uses and Economic Importance

CO5: Critical Thinking and Research Skills

COURSE OBJECTIVE

This course provides a comprehensive understanding of gymnosperms, a group of seed-producing plants with unique reproductive strategies. Through lectures, laboratory sessions, and fieldwork (if applicable), students will explore the diversity, anatomy, reproduction, and ecological significance of gymnosperms. Special emphasis is placed on reproductive biology, including pollination mechanisms, fertilization, seed development, and life cycles.

MSBT 1201: Gymnosperms and Reproductive Biology

L	T	P	Cr
4	1	0	5

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UNITS	CONTENTS	CONTACT Hrs.	No. Of Weeks
1	General introduction of gymnosperms with special reference to its salient features, similarities and dissimilarities with other groups like Pteridophytes and angiosperms. Classifications of gymnosperms. Origin and Evolution of gymnosperms with special reference to Pro-gymnosperms, Devonien pre ovules and origin of seed.	6	1,2
II	Comparative morphology, anatomy, reproductive biology and phylogenetic Studies of the following groups: Pteridospermopsida-Lyginopteridales, Medullosales, Callistophytales, Glossopteridales, Peltaspermales Corystospermales and Caytoniales. Cycadopsida, Pentoxylopsida, Bennettiopsida, Ginkgopsida Coniferopsida and Gnetopsida	8	3,4,5
III	Global distribution of gymnosperms with special reference to Indian plants. Endangered gymnosperms, their conservation and present status. Cytogenetic of Gymnosperms; Economic importance and biotechnology of gymnosperms.	8	6,7
IV	Introduction to life history of angiosperms, brief history of plant embryology; Anther: Structure and development wall layers and their role; Micro-sporogenesis: Cytoplasmic reorganization during microsporogenesis, Pollen wall morphogenesis and anther dehiscence; Pollen morphogenesis, Development of male gametophyte, ultra structure, abnormal male gametophyte, Pollen germination	8	8,9,10
V	Ovule: Ontogeny, structure, integuments and nucleolus specialized structures, megasporogenesis; Development of embryo sac, sub cellular details of constituent cells and their function, major types. Pollen-pestle interaction: Role of pollen wall proteins and stigma surface proteins, pollen tube growth in pistil, fertilization and apomixes; Endosperm: Major types, ultra structure and histochemistry; Embryo: major types, polyembryony; Embryology in relation to Taxonomy.	10	11,12,13,14
VI	Revision Week	8	15

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RECOMMENDED BOOKS:

- Gymnosperms: Structure, Reproduction, Evolution by Dennis Wm. Stevenson.
- Embryology of Angiosperms: Bhojwani, S.S. and Bhatnagar, S.P.(1985), Vikash Publishing House, New Delhi

RECOMMENDED ONLINE RESOURCES:

https://www.youtube.com/watch?v=OwiMVODeCIw&list=PLIdO_1ysznheBfK1laKSU0Xxmquh8P8YH
https://www.youtube.com/watch?v=gncjiVlKnrs&pp=ygUgcmVwcm9kdWN0aXZlIGJpb2xvZ3kgbS5zYyBiYXNpY3M%3D
https://www.researchgate.net/profile/Ak-Sreekala/publication/314364124_IMPORTANCE_OF_PLANT_REPRODUCTIVE_BIOLOGY_IN_CONSERVATION/links/58c0f9d292851c2adfece899/IMPORTANCE-OF-PLANT-REPRODUCTIVE-BIOLOGY-IN-CONSERVATION.pdf

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MSBT 1202: Cell Biology, Genetics & Breeding

COURSE OUTCOMES

CO1: Understand the impact of several breeding phenomena on societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

CO2: Apply the knowledge of genetics & cell biology, to the solution of complex genetical problems.

CO3: Identify, formulate, review research literature, and analyze complex problems related to genetics, cell biology & breeding to reach substantiated conclusions using first principles of genetics, cell biology, and breeding.

CO4: Design solutions for complex genetical problems and design specific solutions that meet the specified needs with appropriate consideration forthe public health and safety, and the cultural, societal, and environmental considerations.

CO5: Create, select, and apply appropriate techniques, resources, and modern bioinformatics tools including prediction and modeling to complex phenomenon of cell biology & genetics with an understanding of the limitations.

COURSE OBJECTIVE

This course provides a comprehensive understanding of fundamental concepts in cell biology, genetics, and their applications in plant breeding. Students will explore the structure and function of cells, principles of genetics, and breeding techniques used to develop improved plant varieties.

MSBT 1202: Cell Biology, Genetics & Breeding

L	T	P	Cr
4	1	0	5

UNITS	CONTENTS	CONTACT Hrs.	No. Of Weeks
1	Cell theory and organization of the cell (Prokaryotic and Eukaryotic) Ultra structure chemical composition of the following: Cell wall, Plasma membrane, Cytoplasm and cytoplasmic organelles (origin, ultra structure & function: Plastids, Mitochondria, Endoplasmic reticulum, ribosomes, Golgi complex, Lysosomes, Peroxisomes and Centrosomes	6	1,2

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II	Nucleus: Nuclear membrane, nuclear pore, nucleolus and karyolymph Cell division, Cell cycle and apoptosis, Control mechanism, cytokinesis and cell plate formation, physical and chemical properties of DNA and RNA, extra chromosomal DNAprofile, function and evolution; Chromosome: Organization and special types, Mendelian genetics, Gene interaction, Sex determination; DNA replication, damage and repair, spontaneous and induced mutation, reversion of mutation. Transposition: Structure of transposons, replicative and non-replicative transposition, transposon mutagenesis. Genetic recombination; Molecular models & and mechanism, Gene conversion. Gene expression and regulation: Operons and regulons, repression and activation of Lac operon, feed back inhibition and & regulation of virulence genes in pathogenic bacteria. Signal transduction in - microbes. Use of microbes in genetic engineering	12	3,4,5,6
III	Cytoplasmic inheritance involving chloroplast and mitochondria, interaction between nuclear and cytoplasmic genes, Sex determination in_ plants, Cytogenetics and Induced Variations: Linkage and recombination: Concept of	6	7,8
	Linkage, evolution of linkage concept, cis and trans arrangement of linked gene, kinds of linkage, germinal and somatic crossing over, detection of crossing over, kinds of crossing over.	6	9,10
IV	Mutation: Spontaneous and induced mutations, point mutation, transitions, transversions, physical and chemical mutagens, molecular basis of mutations. Numerical alterations in chromosomes: Euploidy, polyploidy and its significance, aneuploidy, Structural changes in chromosomes: Deficiency, duplication, inversion, translocation heterozygotes.	8	11,12,13
V	Plant Breeding: Breeding systems, methods, selection in self and cross pollinated crops, male sterility, self-incompatibility, heterosis and hybrid vigour.	4	14
VI	Revision Week	6	15

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RECOMMENDED BOOKS:

- Gardner, E.J, Simmons, D.P (1991). Principles of Genetics, John wiley & sons, India, 8th edition
- Karp, G.(2010), Cell Biology, John Wiley & Sons, USA 6th edition
- Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition

RECOMMENDED ONLINE RESOURCES:

https://www.youtube.com/watch?v=uO53zq9DBIg&list=PL8bZZHwl4U14r5EilcCXtIvHLGsSnXx8n
https://www.youtube.com/watch?v=pCFEyj5IBqk&list=PLlKzSfxkzkL2V--87kULfkQ09Rt4Od3j2
https://www.youtube.com/watch?v=OGfuWsb9nFw&list=PLwW4X2V1pV_204k358sYTXVgmlw_ey_YS
https://academic.oup.com/cardiovascres/article-abstract/98/1/7/312286
https://www.sciencedirect.com/science/article/pii/S037842909601012X

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MSBT 1203: Plant Physiology & Biochemistry

COURSE OUTCOMES

CO1: Knowledge of Plant Structure

CO2: Understanding Plant Functioning

CO3: Describe how plants uptake, transport, and utilize water, as well as the factors influencing water movement within plants, such as transpiration and osmosis.

CO4: Explain the mechanisms and regulation of photosynthesis and respiration in plants, including the role of enzymes, energy carriers, and environmental factors.

COURSE OBJECTIVE

The course on "Plant Physiology and Biochemistry" aims to provide a deep understanding of the functional and biochemical processes that govern plant life. It explores key physiological mechanisms, including photosynthesis, respiration, water and nutrient transport, growth, and development, along with hormonal regulation and stress responses in plants. The biochemistry component focuses on the molecular and chemical basis of these processes, emphasizing metabolic pathways, enzyme function, and the synthesis of essential biomolecules. The course objective is to equip students with knowledge of how plants interact with their environment at both the cellular and molecular levels, preparing them for advanced research or applications in agriculture, biotechnology, and environmental management.

MSBT 1203: Plant Physiology & Biochemistry

L	T	P	Cr
4	1	0	5

UNITS	CONTENTS	CONTACT Hrs.	No. Of Weeks
1	Osmotic relations; Transport phenomenon in plants: Transport of water and organic solutes, mechanism of xylem transport, mechanism of phloem transport, phloem loading and unloading. Photosynthesis: Difference between two pigment systems, Light reaction and dark reaction, carbon fixation in C3 and C4 plants; N2 fixation: Non-symbiotic and Symbiotic.	8	1,2,3
II	Plant growth and development: Growth hormones and growth regulators, mode of action of auxin, transport of auxin,	8	3,4,5

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	physiological role of auxin, Gibberellin: Mode of action and physiological role, Cytokinin: Physiological role and mode of action. Enzymology: Enzymes: structure and classification, cofactors, coenzymes, prosthetic groups, isoenzymes, allosteric enzymes, multi-enz mes, mechanism of enz me action, Properties of enzyme.		
III	Biochemical Energetics: Glycolysis, TCA cycle, ETS, oxidative phosphorylation, | photorespiration; Difference between oxidative shossholation and Photophosphorylation.	6	6,7
IV	Amino acids and proteins: Structure and physiochemical properties of amino acids; Proteins: Primary, secondary, tertiary and quaternary structure of proteins, physical and chemical properties of proteins and biological significance. Enzymes: Classification, physico-chemical nature, enzyme kinetics, mechanism of action and regulation, allosteric enzyme, isoenzyme, zymogen.	8	8,9,10
V	Carbohydrates: Structure and physico-chemical properties of carbohydrates, biological significance, important, glycoprotein, Lipids: Classification, structure and properties of important lipids, biological significance of glycolipids, fatty acid biosynthesis and storage lipids and their catabolism, Vitamins and Coenzymes: Structure and general biochemistry.	8	11,12,13
VI	Revision Week	6	14

RECOMMENED BOOKS:

- "Plant Physiology" by Lincoln Taiz and Eduardo Zeiger: This is a comprehensive and widely-used textbook covering all aspects of plant physiology.
- "Biochemistry & Molecular Biology of Plants" by Bob B. Buchanan, Wilhelm Gruissem, and Russell L. Jones: This book covers plant biochemistry at a molecular level.
- "Plant Biochemistry" by Hans-Walter Heldt and Fiona Heldt: It provides a detailed understanding of plant biochemistry with a focus on metabolism.
- "Principles of Plant Physiology" by Frank B. Salisbury and Cleon W. Ross: Another classic text covering plant physiology principles.

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RECOMMENDED ONLINE RESOURCES:

https://www.youtube.com/watch?v=BeOHxNBPHTM&list=PLUPRY2FTQD5OtOuaWr58HO8OkSn9cSFlh

https://www.youtube.com/watch?v=OaM9FV0nZcA&list=PLMwQyDnbQLRW9s-GpqIn4WIpNyD1V167b

https://www.jstor.org/stable/2845499

https://books.google.com/books?hl=en&lr=&id=yZC9EAAAQBAJ&oi=fnd&pg=PR1&dq=plant+physiology+paper&ots=Fgpcf1_nr8&sig=o--K9zsAMVtT_klU1G0KDWyM6dk

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MSBT 1204: Practical II

COURSE OUTCOME

CO 1: Laboratory Techniques Proficiency

CO 2: Fieldwork Competence

CO 3: Experimental Design and Execution

CO 4: Data Analysis and Interpretation

COURSE OBJECTIVE

- **Hands-on Experience:**

Provide students with practical, hands-on experience in various aspects of botany, reinforcing theoretical knowledge gained in lectures.

- **Skill Development:**

Develop and enhance practical skills necessary for conducting botanical research and experiments, including laboratory techniques and fieldwork.

- **Species Identification:**

Train students in the identification and classification of plant species based on morphological, anatomical, and reproductive characteristics.

- **Experimental Design and Execution:**

Enable students to design and conduct botanical experiments, including planning, execution, and data collection.

- **Laboratory Techniques:**

Familiarize students with a range of laboratory techniques used in botany, such as microscopy, tissue culture, DNA extraction, and biochemical assays.

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MSBT 1204: Practical II

L	T	P	Cr
0	0	10	5

UNITS	CONTENTS	CONTACT Hrs.	No. Of Weeks
1	1) Study of vegetative habit, anatomy and reproductive morphology of common Gymnosperms (Cycas, Pinus, Ginkgo, Gnetum, Araucaria, Thuja, Junipers, Casuarina, Zamia etc.)	4	1,2
II	1) Study of stigma by squash method. 2) Study of pollen germination. 3) Mounting and study of embryo and endosperm. 4) Study of Mitosisi of Onion, Vicia, Lathyrus.	8	3,4,5
III	1) Separation of Chlorophyll pigment by paper chromatography. 2) Determination of water potential using plasmolyic method. 3) Estimation of protein by Lowry method. 4) Study of alpha-amylase in germinating seedings. 5) Separation of amino acids by TLC.	8	6,7,8
IV	1) Principle and use of different modern instruments used in Botany. 2) Cytological techniques: Preparation of cytological stains, fixation of sample etc. 3) Mitotic slide preparation of common plant. 4) Meiotic slide preparation of common plant. 5) Karyotype analysis. 6) Calculation of chiasma frequency. 7) Isolation of antibiotic resistant mutant by auzanography technique. 8) Isolation of genomic DNA from cauliflower. 9) Spectrophotometric estimation of DNA by diphenyl	10	9,10,11,12

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	method. 10) Separation of DNA by agarose gel electrophoresis. 11) Demonstaration of amplification of DNA using PCR.		
V	Carbohydrates: Structure and physico-chemical properties of carbohydrates, biological significance, important, glycoprotein, Lipids: Classification, structure and properties of important lipids, biological significance of glycolipids, fatty acid biosynthesis and storage lipids and their catabolism, Vitamins and Coenzymes: Structure and general biochemistry.	6	13,14
VI	Revision Week	8	15

RECOMMENDED BOOKS:

- A Text Book Of Practical Botany- I & II By Dr. Ashok M Bendre & Dr. Ashok Kumar

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SEMESTER- III

M.SC. Botany 2 Years Course Structure

Year	Semester	Course Code	Course Title	L	T	P	C
1	1	MSBT 1101	Microbiology, Fungi & Plant Diseases	4	1	0	5
		MSBT 1102	Algae and Bryophyta	4	1	0	5
		MSBT 1103	Pteridophtya, Phytogeography & Limnology	4	1	0	5
		MSBT 1104	Practical I (Based on MSBT 1101, 1102 & 1103)	0	0	2	1
			Total	**12**	**3**	**2**	**16**
	2	MSBT 1201	Gymnosperms and Reproductive Biology	4	1	0	5
		MSBT 1202	Cell Biology, Genetics & Breeding	4	1	0	5
		MSBT 1203	Plant Physiology & Biochemistry	4	1	0	5
		MSBT 1204	Practical II (Based on MSBT 1201, 1202 & 1203)	0	0	2	1
			Total	**12**	**3**	**2**	**16**
2	3	MSBT 2101	Molecular biology and Biotechnology	4	1	0	5
		MSBT 2102	Plant Ecology & Plant Anatomy	4	1	0	5
		MSBT 2103	Angiosperm Taxonomy, Plant Resource, Utilization & Conservation	4	1	0	5
		MSBT 2104	Practical III (Based on MSBT 2101, 2102 & 2103)	0	0	2	1
			Total	**12**	**3**	**2**	**16**
	4	MSBT 2201	Environmental Biology	4	1	0	5
		MSBT 2202	Plant Pathology	4	1	0	5
		MSBT 2203	Practical: Plant Pathology	0	0	2	1
		MSBT 2204	Project /Dissertation	0	0	24	12
			Total	**8**	**2**	**26**	**23**
			Total Credits				**71**

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School Of Applied Sciences
Master Of Science In Botany

SYLLABUS
Semester – III

Year	Semester	Course Code	Course Title	L	T	P	C
2	3	MSBT 2101	Molecular biology and Biotechnology	4	1	0	5
		MSBT 2102	Plant Ecology & Plant Anatomy	4	1	0	5
		MSBT 2103	Angiosperm Taxonomy, Plant Resource, Utilization & Conservation	4	1	0	5
		MSBT 2104	Practical III (Based on MSBT 2101, 2102 & 2103)	0	0	2	1
			Total	**12**	**3**	**2**	**16**

Objective of the Program:

The M.Sc. Botany program aims to provide advanced knowledge and understanding of plant biology, including their physiology, ecology, genetics, and evolution. The objective is to develop expertise in plant taxonomy, molecular biology, and biotechnology, with an emphasis on their applications in conservation, agriculture, and environmental sustainability. Students are trained in laboratory techniques, fieldwork, and research methodologies, preparing them for careers in research, teaching, environmental consultancy, and various biotechnological industries. The program also focuses on fostering critical thinking, problem-solving, and independent research skills in the field of plant sciences.

PROGRAMME OUTCOME

PO1: Demonstrate Advanced Knowledge of Botany: Graduates will have a thorough understanding of key concepts, theories, and principles in botany, including plant anatomy, physiology, ecology, genetics, and evolution.

PO2: Apply Research Methods:

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Graduates will be proficient in applying scientific research methods, including experimental design, data collection, statistical analysis, and interpretation of results, to investigate botanical questions.

PO3: Conduct Independent Research: Graduates will be able to plan, execute, and present original research projects in botany, demonstrating autonomy, creativity, and critical thinking.

PO4: Interpret and Communicate Scientific Findings: Graduates will be able to effectively communicate scientific information through oral presentations, written reports, and scientific publications, tailored to both scientific and lay audiences.

PO5: Analyze Plant Diversity and Function: Graduates will be able to identify and classify plants, analyze their ecological roles, and understand their adaptations to various environments.

MSBT 2101: Molecular Biology and Biotechnology

COURSE OUTCOME

CO1: Students will demonstrate a comprehensive understanding of the fundamental principles of molecular biology, including DNA structure, replication, transcription, translation, and gene regulation.

CO2: Students will be able to apply a range of molecular biology techniques, such as polymerase chain reaction (PCR), gel electrophoresis, DNA cloning, and gene expression analysis, to address scientific questions and solve practical problems.

CO3: Students will develop the ability to critically analyze experimental data and scientific literature in the field of molecular biology and biotechnology, and to evaluate the strengths and limitations of different methodologies and approaches.

CO4: Students will gain practical laboratory skills through hands-on experience with molecular biology techniques, including DNA isolation, manipulation, and analysis, as well as protein expression and purification.

CO5: Students will develop problem-solving skills by applying molecular biology concepts and techniques to address real-world challenges in areas such as medicine, agriculture, and environmental science.

COURSE OBJECTIVE

This course provides a comprehensive understanding of the principles and applications of molecular biology and biotechnology. Students will explore the molecular mechanisms underlying biological processes and learn how these principles are applied in various biotechnological applications, including genetic engineering,

recombinant DNA technology, and genomics.

MSBT 2101: Molecular Biology & Biotechnology

L	T	P	Cr
4	1	0	5

UNITS	CONTENTS	CONTACT Hrs.	No. Of Weeks
1	Structure and conformation of nucleic acids; Replication of DNA; DNA damage and repair; Gene structure; Transcription of gene; Structure of mRNA, rRNA and tRNA, Regulation of transcription, Posttranscriptional modification of RNA, RNA editing; Transport of RNA.	6	1,2
II	Protein synthesis: Genetic code, Mechanism of translation (initiation, elongation and termination); Posttranslational modification; Protein sorting in the cell, Regulation of protein synthesis in prokaryotes and eukaryotes.	6	3,4
III	A brief introduction to Biotechnology; Recombinant DNA technology: Restriction end nucleases, DNA Modifying enzymes, DNA _ polymerases; Vectors, Markers and reporter genes, Cloning, Screening of recombinant clone; Polymerase chain reaction: Principle, method, variants and _ practical applications; cDNA.	8	5,6,7
IV	Gene cloning and identification: Genomic and cDNA library, Hybridization techniques: Southern, northern and western hybridization; FISH; Molecular markers: RFLP, RAPD, AFLP, SSR, SNP; Functional genomics: Quantitative Real Time PCR, Microarray, RNA interference, Mutagenesis and Genome editing, Protein Production strategies in Expression System; Met genomics.	10	8,9,10
V	Methods of gene transfer, Agro bacterium mediated genetic transformation of plants, Regeneration methodologies and Screening of transform ants; Genetic engineering and its applications in Agriculture: Genetic manipulation of pest	8	11,12,13

	resistance, biotic and biotic stress tolerance, Molecular farming; Transformation of chloroplast genome and its advantage; Biosafety concerns in Plant Biotechnology.		
VI	Revision Week	6	14

RECOMMENDED BOOKS:

- "Molecular Biology of the Cell" by Bruce Alberts et al.
- "Principles of Gene Manipulation and Genomics" by Sandy B. Primrose and Richard Twyman.

RECOMMENDED ONLINE RESOURCES:

https://www.youtube.com/watch?v=hR9IpioKkGE&list=PLBUibmA0dbhvjcuVRSUZiIb4NJNUlPzIg

https://www.youtube.com/watch?v=-rLWfLzB6vI&list=PL4Jtm4XoqYZkHrK7HFRJndcS0BuLQiykr

https://www.sciencedirect.com/science/article/pii/S0960852406006043

https://journals.physiology.org/doi/abs/10.1152/ajprenal.1988.255.4.F563

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MSBT 2102: Plant Ecology and Plant Anatomy

COURSE OUTCOMES

CO1: Knowledge of Ecological Processes

CO2: Understanding of Plant Ecology

CO3: Appreciation of Plant Adaptations

CO4: Proficiency in Plant Anatomy and Morphology

CO5: Skills in Analyzing Plant-Environment Interactions

COURSE OBJECTIVE

This course provides an in-depth exploration of plant ecology and plant anatomy, focusing on the structure, function, and interactions of plants within their ecological contexts. Students will gain a comprehensive understanding of how plants are adapted to their environments and the ecological processes that shape plant communities.

MSBT 2102: Plant Ecology & Anatomy

L	T	P	Cr
4	1	0	5

UNITS	CONTENTS	CONTACT Hrs.	No. Of Weeks
1	Introduction to ecology, and environmental terminology, population dynamics, vegetation organization and development: population characteristics, population growth forms, density dependent and density independent controls, population structure (distribution, aggregation, isolation territoriality) energy partitioning , r - and k selection, concept of carrying capacity. Wild life sanctuaries, botanical gardens.	8	1,2,3
II	Concepts of community and continuum, analysis of communities (analytical and synthetic characters), community coefficients, competition, ecological niche, succession, mechanism of ecological succession (relay floristic and initial floristic	6	4,5

	composition facilitation, tolerance and inhibition models), concept of climax.		
III	Introduction of morphology and anatomy including brief historical account; External and internal organization of higher plants; Morphology of root and stem and their modifications, Ergastic substances; Microscopic and submicroscopic structure and organization of cell wall. Meristems: Organization of root apical meristem (RAM) and shoot apical meristem (SAM) differentiation; Quiescent center, Xylem and phloem: Ontogeny and structure of components and phylogeny, transfer cells.	8	6,7,8
IV	Secretary and excretory structures; Primary structure of root and stem, Origin of lateral roots, root-stem transition, nodal anatomy and its evolutionary significance; Leaf ~structure and function with special reference to epidermis. Systematic significance of trichomes and stomata.	8	9,10,11
V	Vascular cambium and its derivatives, Primary anomalies in stem and anomalous secondary growth, Floral morphology and anatomy, fruits and seeds; Periderm, Wood structure, Sapwood and Heartwood, Growth rings.	6	12,13
VI	Revision Week	8	14

RECOMMENDED READINGS:

- "Plant Ecology" by Ernst-Detlef Schulze, Erwin Beck, Nina Buchmann.
- "Plant Anatomy" by Katherine Esau.

RECOMMENDED ONLINE RESOURCES:

https://www.youtube.com/watch?v=nmVOZx-SUyc&list=PL3iTl9IGUE7EbE66anA7i7yyppEOucy4Y
https://www.youtube.com/watch?v=gKJmNKDqh_g&list=PLz-yxFzpe5VEFxwP09V2J0OTk6fUOKkhr
https://www.jstor.org/stable/1931718

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https://academic.oup.com/botlinnean/article-abstract/195/3/249/6106223

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MSBT 2103: Angiosperm Taxonomy, Plant Resource, Utilization & Conservation

COURSE OUTCOMES

CO1: Demonstrate a comprehensive understanding of angiosperm taxonomy, including the principles, methods, and significance of plant classification.

CO2: Identify and classify major families, genera, and species of flowering plants using taxonomic keys and morphological characteristics.

CO3: Analyze the evolutionary history and diversification of angiosperms, recognizing key evolutionary innovations and their implications.

CO4: Evaluate the utilization of plants as valuable resources for food, medicine, materials, and ecological services.

CO5: Critically assess the ecological, economic, and cultural importance of plants in human societies.

COURSE OBJECTIVE

This course provides an in-depth study of angiosperm taxonomy, focusing on the classification, identification, and evolutionary relationships of flowering plants. Additionally, it explores the utilization of plants as valuable resources and the conservation strategies employed to safeguard plant diversity and ecosystems.

MSBT 2103: Angiosperm Taxonomy & Plant Recourse utilization & Conservation

L	T	P	Cr
4	1	0	5

UNITS	CONTENTS	CONTACT Hrs.	No. Of Weeks
1	Latin diagnosis, definition and use of Taxonomic terms, History of Plant Taxonomy, in India, History of Plant Classification, Need and aim of classification, Units of classification, delimitations of taxa and their practical consideration, Artificial, Natural and Phylogenetic system classification, a critical study of Takhtajan, Modern system of classification, An introduction of angiosperm Phylogeny Group (APG), Characteristics and phylogeny of orders.	8	1,2,3
II	Need and aim of nomenclatures, International rules of Botanical Nomenclature, Concept of species, genus and family with	6	4,5

	special reference to the type concept; Numerical taxonomy: Principles, concepts, operational taxonomic units (OTUs), data processing and taxonomic studies.		
III	Inter-relationship of plant taxonomy with morphology, anatomy, embryology, palynology, cytology, genetics, Biosystematics, biochemical and molecular systematics, Numerical taxonomy, Phytogeography and phytochemistry.	8	6,7,8
IV	Indigenous flora of India with special reference to local flora (Bihar), A general knowledge of Herbarium, and Botanical garden of the world and India, Identification keys.	6	9,10
V	An introduction to plant utilization, Economic importance of plant for food (cereals, pulses, vegetables, fruits, oils sugar, spices and condiments), nonalcoholic beverages (Tea, coffee, cocoa), medicines, fiber, timber, rubber, tannins and dyes, masticatories, fumicatories, contribution of plants in the development of industries. Conservation of Biodiversity (Phytodiversity) Distinctions between preservation and conservation, Conservation potential index, Protocols for conservations, Traditional conservation practices In-situ and ex-situ conservation Patenting, Intellectual property right, Biosafety protocols People's movements for biodiversity conservation.	8	11,12,13
VI	Revision Week	8	14

RECOMMENDED BOOKS:

- Singh(2012). Plant systematics: Theory and Practice
- Maheshwari, J.K(1963). Flora of Delhi. CSIR. New Delhi
- Odum, E.P(2005). Fundamentals of Ecology
- Kormondy, E.J(1996). Concepts of Ecology

RECOMMENDED ONLINE RESOURCES:

https://www.youtube.com/watch?v=po2Qe6gOcLs&list=PL4m_gOeQ128tz5yjVb4-IJvSndHltjQhZ

https://www.youtube.com/watch?v=iUG4uCWvAVI&list=PLKlDmF-iIyAlR0RFTe7GMkRSWWF-0z4-5

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MSBT 2104: Practical III

COURSE OUTCOME

CO 1: Laboratory Techniques Proficiency

CO 2: Fieldwork Competence

CO 3: Experimental Design and Execution

CO 4: Data Analysis and Interpretation

COURSE OBJECTIVE

- **Hands-on Experience:**

Provide students with practical, hands-on experience in various aspects of botany, reinforcing theoretical knowledge gained in lectures.

- **Skill Development:**

Develop and enhance practical skills necessary for conducting botanical research and experiments, including laboratory techniques and fieldwork.

- **Species Identification:**

Train students in the identification and classification of plant species based on morphological, anatomical, and reproductive characteristics.

- **Experimental Design and Execution:**

Enable students to design and conduct botanical experiments, including planning, execution, and data collection.

- **Laboratory Techniques:**

Familiarize students with a range of laboratory techniques used in botany, such as microscopy, tissue culture, DNA extraction, and biochemical assays.

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MSBT 2104: Practical III

L	T	P	Cr
0	0	2	1

UNITS	CONTENTS	CONTACT Hrs.	No. Of Weeks
1	1) Principle and use of different modern instruments used in Botany. 2) Cytological techniques: Preparation of cytological stains, fixation of sample etc. 3) Mitotic slide preparation of common plant. 4) Meiotic slide preparation of common plant. 5) Karyotype analysis. 6) Calculation of chiasma frequency. 7) Isolation of antibiotic resistant mutant by auxanography technique. 8) Isolation of genomic DNA from cauliflower. 9) Spectrophotometric estimation of DNA by diphenyl method. 10) Separation of DNA by agarose gel electrophoresis. 11) Demonstration of amplification of DNA using PCR.	12	1,2,3,4
II	1) Family description of some locally available plants. 2) Taxonomy and significance of some important medicinal plant of Rajgir. 3) Herbarium Techniques: Plant collection, Preservation, Identification and making local floa. 4) Field trips within and around the campus, compilation of field notes	10	5,6,7
III	1) Anamalous secondary growth of some common plants (Tinospora, Boerhaavia, Nyctanthes, Aristolochia, Amaranthus).	10	8,9,10

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	2) Staining of Xylem and Phloem elements. 3) Study of different types of stomata (Stomatal index) 4) Study of different types of epidermal hairs.		
IV	1) Study of local vegetation by quadrate method. 2) Study of ecological adaptations. (Morphological and anatomical)in plants. 3) Water analysis for pollution studies (Dissolved Oxygen, BOD, and Dissolved Carbon dioxcide, Chloride, Alkalinitv etc.) 4) Identification of common aquatic plants, common planktons and bio- Indicator species	10	11,12,13
V	Revision Week	10	14,15

RECOMMENDED BOOKS:

- A Text Book Of Practical Botany- I & II By Dr. Ashok M Bendre & Dr. Ashok Kumar

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SEMESTER- IV

M.SC. Botany 2 Years Course Structure

Year	Semester	Course Code	Course Title	L	T	P	C
1	1	MSBT 1101	Microbiology, Fungi & Plant Diseases	4	1	0	5
		MSBT 1102	Algae and Bryophyta	4	1	0	5
		MSBT 1103	Pteridophtya, Phytogeography & Limnology	4	1	0	5
		MSBT 1104	Practical I (Based on MSBT 1101, 1102 & 1103)	0	0	2	1
			Total	**12**	**3**	**2**	**16**
	2	MSBT 1201	Gymnosperms and Reproductive Biology	4	1	0	5
		MSBT 1202	Cell Biology, Genetics & Breeding	4	1	0	5
		MSBT 1203	Plant Physiology & Biochemistry	4	1	0	5
		MSBT 1204	Practical II (Based on MSBT 1201, 1202 & 1203)	0	0	2	1
			Total	**12**	**3**	**2**	**16**
2	3	MSBT 2101	Molecular biology and Biotechnology	4	1	0	5
		MSBT 2102	Plant Ecology & Plant Anatomy	4	1	0	5
		MSBT 2103	Angiosperm Taxonomy, Plant Resource, Utilization & Conservation	4	1	0	5
		MSBT 2104	Practical III (Based on MSBT 2101, 2102 & 2103)	0	0	2	1
			Total	**12**	**3**	**2**	**16**
	4	MSBT 2201	Environmental Biology	4	1	0	5
		MSBT 2202	Plant Pathology	4	1	0	5
		MSBT 2203	Practical: Plant Pathology	0	0	2	1
		MSBT 2204	Project /Dissertation	0	0	24	12
			Total	**8**	**2**	**26**	**23**
			Total Credits				**71**

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K. K. UNIVERSITY

School Of Applied Sciences

Master Of Science In Botany

SYLLABUS

Semester – IV

Year	Semester	Course Code	Course Title	L	T	P	C
	4	MSBT 2201	Environmental Biology	4	1	0	5
		MSBT 2202	Plant Pathology	4	1	0	5
		MSBT 2203	Practical: Plant Pathology	0	0	2	1
		MSBT 2204	Project /Dissertation	0	0	24	12
			Total	**8**	**2**	**26**	**23**

Objective of the Program:

The M.Sc. Botany program aims to provide advanced knowledge and understanding of plant biology, including their physiology, ecology, genetics, and evolution. The objective is to develop expertise in plant taxonomy, molecular biology, and biotechnology, with an emphasis on their applications in conservation, agriculture, and environmental sustainability. Students are trained in laboratory techniques, fieldwork, and research methodologies, preparing them for careers in research, teaching, environmental consultancy, and various biotechnological industries. The program also focuses on fostering critical thinking, problem-solving, and independent research skills in the field of plant sciences.

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PROGRAMME OUTCOME

PO1: Demonstrate Advanced Knowledge of Botany: Graduates will have a thorough understanding of key concepts, theories, and principles in botany, including plant anatomy, physiology, ecology, genetics, and evolution.

PO2: Apply Research Methods: Graduates will be proficient in applying scientific research methods, including experimental design, data collection, statistical analysis, and interpretation of results, to investigate botanical questions.

PO3: Conduct Independent Research: Graduates will be able to plan, execute, and present original research projects in botany, demonstrating autonomy, creativity, and critical thinking.

PO4: Interpret and Communicate Scientific Findings: Graduates will be able to effectively communicate scientific information through oral presentations, written reports, and scientific publications, tailored to both scientific and lay audiences.

PO5: Analyze Plant Diversity and Function: Graduates will be able to identify and classify plants, analyze their ecological roles, and understand their adaptations to various environments.

MSBT 2201: Environmental Biology

COURSE OUTCOME

CO1: Knowledge of Conservation Strategies

CO2: Understanding of ecological Principles in daily life

CO3: Identification of environmental issues and apply conservation strategies to solve them

CO4: Appreciation of Biodiversity & conservation of biodiversity

CO5: Awareness of human Impacts in the field of environmental issues

COURSE OBJECTIVE

This course explores the interactions between living organisms and their environment, focusing on ecological principles, biodiversity, conservation, and human impacts on the environment. Students will gain an understanding of the complexity of ecosystems, the importance of biodiversity, and the challenges and solutions related to environmental conservation and sustainability.

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MSBT 2201: Environmental Biology

L	T	P	Cr
4	1	0	5

UNITS	CONTENTS	CONTACT Hrs.	No. Of Weeks
1	Ecosystem organization, structure and function: primary production (methods of measurement), energy dynamics (tropic organization, energy flow pathway, energy quality, ecological efficiencies), biogeochemical cycles.	6	1,2
II	Pollution and climate change: kinds, sources and effects of pollution, heavy metals (Pb, Cd, Hg), green house gases (CO2, CH4, N20, CFCs), green house effect and global warming, ozone layer depletion and ozone hole, acid rain. Concept of Succession, Nudation, Invasion, Competition and reaction, Stabilization and Climax, Xerosere and Hydrosere and their seral stage. Ecosystem: Abiotic and biotic components; Ecological pyramids; Structural organization of grassland, forest and aquatic ecosystem energetic: laws of thermodynamics, Productivity, energy food chain and ecosystem budget; Bio geochemical cycles.	8	3,4,5
III	Environmental impact assessment threatened and endangered plant species, role of diversity in ecosystem stability, sustainable development. Major terrestrial biomes, bio-geographical area of India, major vegetations. Environmental Pollutions: Air, Water, Soil, waste radioactive and noise pollution; Global warming; green house effect; ozone de selection Climate change.	8	6,7,8

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IV	Organism and population concept; Natality; Mortality; Density; Rate of population increase; r and k selection; Age and sex ratio; Aggregation Interactions among populations: Commensalism, Amensalism, Mutualism, proto-cooperation and Symbiosis, predation and parasitism, competition Intraspecific and inter-specific Plant ada Organism and population concept; Natality; Mortality; Density; Rate of population increase; r and k selection; Age and sex ratio; Aggregation Interactions among populations: Commensalism, Amensalism, Mutualism, proto-cooperation and Symbiosis, predation and parasitism, competition Intra specific and inter-specific Plant adaptation	10	9,10,11
V	Environmental Awareness: Man and Biosphere (MAB); International Union for Conservation of Nature and Natural Resources (IUCN); United Nations Environment Programme (UNEP): World Environmental Day; Wildlife Preservation Act(1972);Indian Forest Conservation Act (1989). Biodiversity concept: origin of the term, themes of biodiversity concept Benefits of Biodiversity: Direct economic benefits to mankind, genetic resources, essential ecosystem services Types of Biodiversity: Genetic, species and ecosystem diversity. Biodiversity conventions and Biodiversity Act2002 Patterns of loss of Biodiversity: Red lists, Red Data Book and Green Book Red™ Data categories: Extinct, endangered, vulnerable and threatened species. Causes of biodiversity loss and extinction: Natural, genetic and ecological causes; human impacts including development pressure; Habitat loss, encroachments and overexploitation of resources Repercussions of loss biodiversity including future climate change.	14	12,13,14,15

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RECOMMENDED BOOKS:

- Environmental Biology by Matthew R. Fisher
- Environmental Biology by Dr. Ashwani Kumar Dubey & Prof. Rashmi Sharma

RECOMMENDED ONLINE RESOURCES:

https://www.youtube.com/watch?v=KdlbjoXz7sE&list=PLeb3ZIuIVVHYyGNa3_Pa7Enl2DEt7zLuV

https://www.publish.csiro.au/FP/FP02020

MSBT 2202: Plant Pathology

COURSE OUTCOMES

CO1: Knowledge of Pathogens and their impact on ecosystem

CO2: Comprehensive Understanding of the principles, concepts, and theories of plant pathology

CO3: Epidemiological Awareness

CO4: Students will learn about various methods and strategies for managing plant diseases

CO5: Students will develop critical thinking and problem-solving skills to address challenges related to plant disease identification, management, and prevention.

COURSE OBJECTIVE

Plant pathology is the study of plant diseases, their causes, interactions, and management strategies. This course provides a comprehensive understanding of the principles and practices of plant pathology, covering various aspects of plant diseases, including their etiology, epidemiology, diagnosis, and control methods.

MSBT 2202: Plant Pathology

L	T	P	Cr
4	1	0	5

UNITS	CONTENTS	CONTACT Hrs.	No. Of Weeks
1	General introduction to Plant Pathology, History of Plant Pathology, Classification of Plant Diseases, Kinds and amount of losses, chemical weapons of pathogens — Enzymes and toxins; Role of growth hormones in plant diseases, Preexisting structural and chemical defense, induced structural and chemical defense, hypersensitive reaction, role of phytoalexins and other phenolic compound., how the pathogen affects plant physiological functions. Parasitism and disease development, symptoms, effect of environmental factors on the plant disease development, plant disease epidemiology.	10	1,2,3,4
II	Classification of Plant disease and appearance of symptoms due to different microbes Role of enzyme and toxin in pathogenesis Effect of infection on the physiology of host with special reference to photosynthesis, respiration, nitrogen metabolism and osmo-regulation Host defense mechanism with special reference to structural and biochemical defense	8	5,6,7
III	Some important diseases caused by fungi, bacteria, viruses and mycoplasma. Control of plant diseases, quarantines and inspection, physical, chemical, cultural and biological methods of disease control, integrated pest management.	6	8,9
IV	Structure of bacteria: Ultra structure of Gram positive and Gram negative bacteria; reproduction (vegetative, asexual and genetic recombination); Nutritional classification of bacteria; economic importance of bacteria. Viruses: Nature, characteristics and ultrastructure of Virions (TMV and	12	10,11,12,13

	Bacteriophages), multiplication (Lytic and Lysogenic cycles) and transmissio of viruses; economic importance; a brief account of Viroids and Prions.		
VI	Revision Week	8	14

RECOMMENDED READINGS:

- Agrios, G.N. (1997) Plant pathology, 4th edition, academic Press, U.K
- Sharma, P.D. (2011), Plant Pathology, Rastogi Publication

RECOMMENDED ONLINE RESOURCES:

https://www.youtube.com/watch?v=84WfzG5duR0&list=PL2HIbkt5pdp3a5VkeLBes_B0PXdXmWWTK

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MSBT 2203: Practical: Plant Pathology

COURSE OUTCOMES

CO1: Laboratory Techniques Proficiency

CO2 Fieldwork Competence

CO3: Experimental Design and Execution

CO4: Data Analysis and Interpretation

COURSE OBJECTIVE

- **Hands-on Experience:**

Provide students with practical, hands-on experience in various aspects of botany, reinforcing theoretical knowledge gained in lectures.

- **Skill Development:**

Develop and enhance practical skills necessary for conducting botanical research and experiments, including laboratory techniques and fieldwork.

- **Species Identification:**

Train students in the identification and classification of plant species based on morphological, anatomical, and reproductive characteristics.

- **Experimental Design and Execution:**

Enable students to design and conduct botanical experiments, including planning, execution, and data collection.

- **Laboratory Techniques:**

Familiarize students with a range of laboratory techniques used in botany, such as microscopy, tissue culture, DNA extraction, and biochemical assays.

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MSBT 2203- Practical: Plant Pathology

L	T	P	Cr
0	0	24	12

UNITS	CONTENTS	CONTACT Hrs.	No. Of Weeks
I	Preparation of culture media, nutrient slants, and petri plates.	8	1,2,3
II	Study of common fungal diseases- Rust of linseed, Blight of potato, Rust of whet, Stem gall of coriander, Downy mildew, Powdery mildew etc.	10	4,5,6,7
III	Study of host- parasite interaction of common plant disease and identification of the pathogens.	8	8,9,10
IV	Isolation of Plant Pathogens from disease specimens and culture	6	11,12
V	Camera lucida drawing of fungal spores.	6	13,14
VI	Revision Class	8	15

RECOMMENDED BOOKS:

- Plant Pathology: Concepts and Laboratory Exercises: Robert N. Trigiano, Mark T. Windham, Alan S. Windham, CRC Press, ISBN: 020350657X
- Plant Physiology experimental protocols: Department of Plant Physiology, Tamil Nadu Agricultural University

MSBT 2204: Project/ Dissertation

COURSE OUTCOME

CO 1: Knowledge Acquisition and Contribution

CO 2: Research Skills Development

CO 3: Professional and Academic Development

CO 4: Personal Growth and Fulfillment

COURSE OBJECTIVE

The M.Sc. dissertation course in Botany is designed to provide students with the opportunity to conduct independent research in a specialized area of botany under the guidance of a faculty advisor. The course aims to develop students' research skills, critical thinking abilities, and scientific writing proficiency. Students will engage in original research, contribute to the advancement of knowledge in their chosen field, and produce a substantial written thesis.

MSBT 2204: Dissertation/Project

L	T	P	Cr
0	0	10	5

	TOPICS
I	1) Experiments based on phytosocialogical characters (Frequency, Density, Abundance). 2) Identification of common aquatic plants, common planktons and bio-indicator species. 3) Determination of Biomass of of primary producer. 4) Study of disease symptoms of local crop area. 5) Pollen study through Melissopalynology. 6) Preparation of ecological monographs of Hydrophytes and Epiphytes. 7) Study of effect of drought on the seed germination and Plant growth vigour. 8) Lichen collection, preservation, identification of local flora (Pant wildlife sanctuary, Rajgir, Nalanda, Bihar). 9) Exploration of Medicinal Plants of Rajgir Hills. 10) Effect of different selective micro/macro nutrients on lesser known leguminous crops.

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SUGGESTED READINGS:

FOR PRACTICALS		
1	Plant Pathology: Concepts and Laboratory Exercises	Robert N. Trigiano, Mark T. Windham, Alan S. Windham, CRC Press, ISBN: 020350657X.
2	Plant pathology: techniques and protocols	Isla A. Browning (auth.), Robert Burns (eds.), Humana Press, ISBN: 9781597450621.
3	Plant Physiology experimental protocols	Department of Plant Physiology, Tamil Nadu Agricultural University,
4	A text book of practical botany 1 & 2.	Ashok Bendre, Dr. Ashok Bendre & Dr. Ashok Kumar, Rastogi Publications, ISBN: 9788171339235.

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