

**MAHAKAUSHAL UNIVERSITY,
JABALPUR M.P.**

**Approved by Higher Education
And the Governor of M.P.**



**Faculty of Science
Scheme & Syllabus
For
Subject – Botany
M.Sc. Programme
(1 Year PG Diploma/ 1 Year PG/ 2Year PG)
Programme
I to IV Semester
2025-26**

For 2year PG programme having Major practicum component

Class: M.Sc Botany Semester-I Session:2025-2026

Course code	Course title	Total
MBOT0101-T	Biology and diversity of Fungi ,Algae and Bryophyta	60 + CCE 40=100
MBOT0102-T	Biology and Diversity of Pteridophyta and Gymnosperms	60+CCE 40=100
MBOT0101-P	Practical based o MBOT0101-T	60+ CCE 40=100
MBOT0102-P	Practical based on MBOT0102-T	60+ CCE 40=100

Part A: Introduction

1	Course code	MBOT0101-T
2	Course Title	Biology and diversity of Fungi ,Algae and Bryophyta.
3	Coursetype	Core course
4	Prerequisite	To study this course, a student may be admitted to a 2 year PG programme after completing 3 year Bachelor Degree, subject to eligibility conditions of that PG programme
5	Course Learning outcome(CLOs)	The students will be able to identify and classify fungi and algae,bryophyta . They will be acquainted with algal and fungal

		technology and its application in various industries.
6	Credit value	6credits
7	Total marks	Max marks(40+ 60=100) Minimum passing marks=40

Part B: Content of the course

Units	Topics	No. of Lectures
I.	<p>Algae and Bryophyta in Indian traditional knowledge. Contributions of Indian scientists M O P Iyenger and TV Desikachari in Algae, K C, Mehata in Fungi, Shiv Ram Kashyap in Bryophyta, Microbes in Indian Gyan parampara, Brief account of Virus and bacteria. Traditional fermented food beverages.</p> <p>Activity: Preparation of chart for ancient work on lower plants.</p>	15
II.	<p>Mycology I: General characters, and thallus organization, mode of nutrition (saprophytic, parasitic, symbiotic) and reproduction. Modern Classification of fungi, Economic importance of fungi in Industry.</p> <p>Fungal diseases in plants: Wart disease of Potato, Green ear disease of Bajra. Black rust of Wheat.</p> <p>Activity: Industrial visit for mushroom cultivation</p>	15
III.	<p>Mycology 2:</p> <p>General account of Mastigomycotina and Zygomycotina.</p> <p>Diagnostic features and general account of Ascomycotina, Basidiomycotina and Deuteromycotina.</p> <p>Morphology and anatomy of Mycorrhiza, importance of</p>	15

	mycorrhizae in agriculture, Parasexual cycle in fungi. Activity: Group discussion on parasexual cycle of fungi	
IV.	Algae 1: General characters, diversified habitats (terrestrial, freshwater, marine); thallus organization, cell ultra-structure; criteria of classification(pigments, reserve food, flagella); economic importance (as food, feed, industry, algal blooms and bio-fertilizer,bio-fuel). Activity : Visit to various Lake ,ponds to know the diversified habitats of Algae.	15
V.	Algae2: Salient features, classification, reproduction and economic importance of Chlorophyta, Charophyta and Xanthophyta. Salient features, classification, reproduction and economic importance of Bacillariophyta, Phaeophyta and Rhodophyta. Techniques in commercial cultivation of Algae Activity: Collection and preservation of locally available Algae	15
VI.	Bryophyta: General characters, distribution, classification of bryophytes. Ecological importance of Bryophytes. General account of Marchantiales ,Jungermanniales, Sphagnales Funariales and Polytrichales. Activity: Group discussion on Industrial application of bryophytes.	

Part C: Learning Resources

(Textbooks,Reference books, other resources)

1. Alexopoulos, C.J. Mims, C. W, and Blackwel, M: 1996: Introductory Mycology, Thon Wiley and Sons Inc.
2. Clifton, A; 1958: Introduction to Bacteria, McGraw- Hills Book Co. New Delhi.
3. Madigan, M T. Martinko, J. M and Parker Jack; 1 997: Brock Biology of Microorganisms, (8th edition) Prentice Hall, N,J. U.S.A

4. Mandahar, C. L.; 1978: Introduction to Plant Viruses. Chand and Co.Ltd. Delhi.
Mehrotra, RS. and Aneja, RS.; 1998: An Introduction to Mycology. New Age Intermediate Press.
5. Rangaswamy, G. and Mahadevan, A; 1999: Diseases of Crop Plants in India (4th edition). Prentice Hall of India Ltd. New Delhi.
6. Webster, J.; 1985: Introduction to Fungi Cambridge University Press.
7. Dubey, R. C. and Maheshwari, D. K.; 2005: A Text Book of Microbiology, S. Chand Publisher, New Delhi
8. Smith G. M., Cryptogamic Botany Voll (2nd edition)-Tata McGraw-Hill Publishing Company Ltd. Bombay - New Delhi.
9. Kumar H. D. 1988., Introductory Phycology. Affiliated East-West Press Ltd. New Delhi.
10. Parihar, N.S. 1991., Bryophyta. Central Book Depot. Allahabad
11. Kashyap, 1972., Liver worts of Western Himalayas and Punjab. Research Co Publication.
12. Kumar H. D. 1988., Introductory Phycology. Affiliated East-West Press Ltd. New Delhi.
13. Chopra and Kumar, 1988., Biology of Bryophyta: Wiley Eastern Ltd.

Suggestive digital platforms web links

<https://www.ncbi.nlm.nih.gov/books>

<https://bio.libretexts.org/Bookshelves/>

Suggested equivalent online courses:

<https://nptel.ac.in/>

<https://swayam.gov.in/>

<https://www.mooc.org> MOOC.org

Part-D Assessment and Evaluation

Pattern of Marks Distribution THEORY PAPER for NEP PG courses

<p>Recommended Continuous Assessment Methods-: (It may vary for respective course subject but TOTAL marks distribution will remain same)</p> <p>Maximum Marks: 100</p> <p>Continuous Comprehensive Evaluation (CCE): 40 Marks</p> <p>University Examination: 60 Marks</p>		
<p>Internal Assessment: Continuous Comprehensive Evaluation (CCE):</p>	<p>Class Test Assignment/Presentation</p>	<p>20 Marks 20 Marks Total Marks = 40</p>
<p>External Assessment: University Examination: Time: 3 Hours</p>	<p>Section (A)- Five very short answer question (20 words each) Section (B)- Five short answer question (200 words each) Section (C)- Two long answer question (500 words each)</p>	<p>02 Marks x 05 Questions = 10 Marks <i>(All 5 Questions to be attempted)</i> 06 Marks x 05 Questions = 30 Marks <i>(5 Questions to be attempted out of total 8 Questions)</i> 10 Marks x 02 Questions = 20 Marks <i>(2 Questions with each having internal choice)</i> Total Marks = 60</p>

Part A: Introduction Theory paper

1	Course code	MBOT0102-T
2	Course Title	Biology and Diversity of Pteridophyta and Gymnosperms
3	Coursetype	Core course
4	Prerequisite	To study this course, a student may be admitted to a 2 year PG programme after completing 3 year Bachelor Degree, subject to eligibility conditions of that PG programme
5	Course Learning outcome(CLOs)	The students will be able to identify and classify Bryophyta, Pteridophyta, Gymnosperm Comprehend concepts in the evolution of plants Identify the economic importance of plants
6	Credit value	6credits
7	Total marks	Max marks(40+ 60=100) Minimum passing marks=40

Part B: Content of the course

Units	Topics	No of lectures
I.	History and evolution of pteridophytes Contribution of Indian scientists D D Pant and Birbal Sahni General introduction of pteridophytes . Peculiar features, similarities and	15

	<p>dissimilarities with bryophytes and gymnosperms.</p> <p>Origin and evolution of Pteridophytes</p> <p>Activity: Chart and models in origin and Evolution of Pterodophyta</p>	
II.	<p>Pteridophyta-1: Evolution of stele, Heterospory and origin of seed habit.</p> <p>General account of Psilophytopsida, Psilopsida, Lycopsida</p> <p>Activity: Quiz on homosporous and heterosporous Pterodophyta</p>	15
III.	<p>Pteridophyta-2. Morphology, anatomy, reproduction and phylogeny of Lycopsida, Sphenopsida and Pteropsida.</p> <p>Brief study of the following form genera Rhynia, Lepidodendron and calamites.</p> <p>Apospory and Apogamy in pteridophyta</p> <p>Activity: Group discussion on Paleobotany</p>	15
IV.	<p>Gymnosperms1: General characters, morphology, anatomy and reproduction of Gymnosperms. Diversity and distribution of Gymnosperm.</p> <p>Classification of gymnosperms (D D Pant, 1957, Sporne, 1965, Stewart, 1983, Christenhusz, 2011), Economic importance of Gymnosperm.</p> <p>Activity: Chart preparation on distribution of gymnosperm</p>	15
V.	<p>Gymnosperm2: Geological time scale, Types of fossil and fossilization process. Fossil gymnosperms.</p> <p>General account of order Pteridospermales, Cordaitales and Cycadeoidales</p> <p>Activity: Group discussion on Fossil gymnosperms</p>	15
VI.	<p>Gymnosperm 3: General account of Cycadales , Ginkgoales and Coniferales.</p> <p>Morphology, anatomy, reproduction and inter relationship of, Ephedrales, Welwitschiales and Gnetales</p> <p>Evolution of Gymnosperms</p> <p>Activity : Comparative Chart preparation on similarities and dissimilarities of</p>	15

living orders of gymnosperms

PartC: Learning Resources

(Textbooks, Reference books, other resources)

1. Bhatnagar, S.P. and Moitra, A; 1996: Gymnosperms. New Age International Pvt. Ltd., New Delhi. Singh H.; 1978: Embryology of Gymnosperms, Encyclopedia of Plant Anatomy
 2. X. Gebruder Bortraeger, Berlin. Sporne K R; 1991: The Morphology of Gymnosperms; Hutchinson Univ. Library; London.
 3. Foster A S. and Gifford E. M; Comparative morphology of vascular Plants; Vakils, feffer, and Simons Private Ltd. Bombay.
 4. Chamberlain; Gymnosperms -Structure and Evolution; CBS Publishers and Distributors Delhi.
 5. Shukla A C. and Mishra S. P.; Essentials of Paleobotany; Vikas Publishing House Pvt. Ltd. Delhi-Bombay-6angalore-Calcutta-Kanpur.
 6. Sporne K.R..1991: The morphology of Pteridophyta
 - 7.. <https://www.ebookselibrary.com>
Suggestive digital platforms web links
 1. https://archive.org/details/fundamentalsofbo0000unse_z7a4/page/58/mode/2up
 2. <https://www.unanijournal.com/articles/94/3-1-11-206.pdf>
- Suggested equivalent online courses:
- <https://www.mooc.org>
<https://swayam.gov.in>
<https://nptel.ac.in>

Part-D Assessment and Evaluation

Pattern of Marks Distribution THEORY PAPER for NEP PG courses

<p>Recommended Continuous Assessment Methods:- (It may vary for respective course subject but TOTAL marks distribution will remain same)</p> <p>Maximum Marks: 100</p> <p>Continuous Comprehensive Evaluation (CCE): 40 Marks</p> <p>University Examination: 60 Marks</p>		
<p>Internal Assessment: Continuous Comprehensive Evaluation (CCE):</p>	<p>Class Test Assignment/Presentation</p>	<p>20 Marks 20 Marks Total Marks = 40</p>
<p>External Assessment: University Examination: Time: 3 Hours</p>	<p>Section (A)- Five very short answer question (20 words each) Section (B)- Five short answer question (200 words each) Section (C)- Two long answer question (500 words each)</p>	<p>02 Marks x 05 Questions = 10 Marks <i>(All 5 Questions to be attempted)</i> 06 Marks x 05 Questions = 30 Marks <i>(5 Questions to be attempted out of total 8 Questions)</i> 10 Marks x 02 Questions = 20 Marks <i>(2 Questions with each having internal choice)</i> Total Marks = 60</p>

For 2 years PG programme

(Scheme B-1)

Botany Core (Practicum) Syllabus

M.Sc.I Sememester

Part A :Introduction			
Program 2 years PG	Class- M.Sc.	Sem I	Session 2025-2026
1	Course code	MBOT0101-P	
2	Course Title	Biology and diversity of Fungi ,Algae and Bryophyta.	
3	Coursetype	Practicum course	
4	Course Learning outcome(CLOs)	<p>The students will be able to identify and classify fungi and algae, bryophyta.</p> <p>By engaging in these practical exercises students can gain a deeper understanding of unique characteristics, life cycle, and ecological roles and economic importance of algae, bryophyta and fungi.</p>	
5	Credit value	Practical-04	
6	Total marks	Max marks:100) University Exam:60 CCE:40	Minimum passing marks=40

Part:B:Content of the course

Total No of Lectures-Tutorial-practicals(08 Hours per week

L-T_P;0-0-120(Total hours)

A. Assgnments/Practice/Survey/Fieldwork

No of
Hours:120

B.List of practicals to be performed in the laboratory

1. Study of Algal material with suitable examples
2. Study of Mycological material with suitable examples
- 3 Study on Bryophyta material with suitable examples
4. Study of fungal plant diseases.
5. Exercise on cultivation of algae.
6. To isolate, pure culture and identify common fungal species.
7. Preparation of fungal culture media .
8. Study of bryophytes as bioindicators of air and water pollution.
9. Study on economic importance of bryophytes.
10. To study diferent types of pigments present in algae.
11. Microscopic observation and identification of algal specimens.

Part C: Learning Resources

(Textbooks, Reference books, other resources)

Suggested Readings:

- Bendre, Ashok and Kumar, Ashok (1981) Practical Botany-2, Rastogi Publications,

Meerut

- Alexopoulos, C.J. Mims, C. W. and Blackwel, M: 1996: Introductory Mycology, Thon Wiley and Sons Inc.
- Melhotra R S and K Raneja, An introduction to mycology, 1990
- Pandey B P, College botany Volume I, 2014, S Chand publication
- Vaishshita B R, Sinha Ak, Kumar A. Botany for degree students: Bryophyta, S. Chand
- Goutam A, Avasthi S. Methods in fungal biology : A manual of Laboratory protocols, Scientific publishers, 2019
- Gupta V, Tuohy M. Laboratory Protocols in Fungal biology, Springer, 2nd edn.
- Sundara Rajan . Practical manual of Algae, Anmol Publication, 2000

Suggestive digital platforms web links

<https://www.ncbi.nlm.nih.gov/books>

<https://bio.libretexts.org/Bookshelves/>

Suggested equivalent online courses:

<https://nptel.ac.in/>

<https://swayam.gov.in/>

<https://www.mooc.org> MOOC.org

Part-D Assessment and Evaluation

Pattern of Marks Distribution PRACTICAL PAPER for NEP PG courses

Suggested Continuous Evaluation Methods: (It may vary for respective course subject but TOTAL marks distribution will remain same)			
Internal Assessment	Marks	External Assessment	Marks
Class Interaction /Quiz	15	Viva Voce on Practical	10
Attendance in the lab	10	Practical Record File	10
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	15	Table work / Experiments	40
TOTAL	40		60

For 2 years PG programme
(Scheme B-1)
Botany Core (Practicum) Syllabus
M.Sc.I Sememester

Part A :Introduction				
Program 2 years PG		Class- M.Sc.	Sem 1	Session 2025-2026
1	Course code	MBOT0102-P		
2	Course Title	Biology and Diversity of Pterodophyta and Gymnosperms		
3	Coursetype	Practicum course		
4	Course Learning outcome(CLOs)	After completing the course students will able to identify and classify the Pteridophyta and gymnosperms. They can understand their morphology, anatomy, and reproduction, and appreciate their evolutionary significance and economic importance. Students will also develop skills in practical techniques like slide preparation, microscopy, and fossil analysis. .		
5	Credit value	Practical-04		
6	Total marks	Max marks:100) University Exam:60 CCE:40	Minimum passing marks=40	

Part:B:Content of the course

Total No of Lectures-Tutorial-practicals(08 Hours per week

L-T_P:0-0-120(Total hours)

B. Assgnments/Practice/Survey/Fieldwork

No of
Hours:120

B.List of practicals to be performed in the laboratory

- 1.Monographic study of Pteridophyta material with suitable examples
2. Monographic study of Gymnosperm material with suitable examples
3. Exercise on study of fossils pteridophyta.
4. Exercise on study of fossils gymnosperms.
- 5.Study of male and female cone of Pteridophyta
6. Study of male and female cone of Gymnosperms.
7. To observe pollengrains of gymnosperms and their role in pollination.
8. To study the wood samples of gymnosperms.
9. Study the distribution and habitat of different pteridophytes in a local area.
10. To identify different types of vascular tissue (Xylem and Phloem) in the stem.
11. To study different types of stele in Pteridophytes.

Part C: Learning Resources

(Textbooks,Reference books, other resources)

Suggested Readings:

- Parihar N S .Biology and morphology of Pteridophytes Central Book Depo
- Rashid A. An introduction to pteridophytes: Diversity and differentiation Vikas publishing House
- Vaishishta PC. Botany for degree of Gymnosperms, S Chand publication.
- Mosisa Daba. Cryptogamic Botany Laboratory Manual, Lap Lambert Academic press, 2020
- Dhaka TS, Chouhan R, Mourya SS. Pteridophyta, Gymnosperms and angiosperms, Pragati Prakashan, 2020
- Singh Sanjay .Gymnosperm and Paleobotany ,Campus Book International, 2008

Suggestive digital platforms web links

<https://www.ncbi.nlm.nih.gov/books>

<https://bio.libretexts.org/Bookshelves/>

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<https://www.mooc.org/MOOC.org>

Part-D Assessment and Evaluation

Pattern of Marks Distribution PRACTICAL PAPER for NEP PG courses

Suggested Continuous Evaluation Methods: (It may vary for respective course subject but TOTAL marks distribution will remain same)			
Internal Assessment	Marks	External Assessment	Marks
Class Interaction /Quiz	15	Viva Voce on Practical	10
Attendance in the lab	10	Practical Record File	10
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	15	Table work / Experiments	40
TOTAL	40		60

For 2year PG programme having Major practicum Class: M.Sc Botany Semester-2

Session:2025-2026

Course code	Course title	Total
MBOT0201-T	Taxonomy of Angiosperms	60+ CCE 40=100
MBOT0202-T	Morphology, Anatomy and Embryology of Angiosperms	60+CCE 40=100
MBOT0201-P	Practical based on MBOT0201-P	60+ CCE 40=100
MBOT0202-P	Practical based on MBOT0202-P	60+ CCE 40=100

PartA:Introduction

1	Course code	MBOT0201-T
2	Course Title	Taxonomy of Angiosperms
3	Coursetype	Core course
4	Prerequisite	To study this course, a student may be admitted to a 2 year PG programme after completing 3 year Bachelor Degree, subject to eligibility conditions of that PG programme
5	Course Learning outcome(CLOs)	After completion of the course on Taxonomy of Angiosperms, students would be able to identify, classify, and describe angiosperms; understand the principles of taxonomy and classification systems; and understand the origin, evolution, and phylogeny of angiosperms. They should also be able to apply taxonomic tools and techniques, including herbarium preparation and plant identification.

6	Credit value	6 credits
7	Total marks	Max marks(40+ 60=100) Minimum passing marks=40

Part B: Content of the course

Unit	Topics	No of lectures
I.	<p>History and Principles of plant taxonomy:</p> <p>Ancient Indian system classifying and naming plants(Rigveda,Manusmriti,Charak samhita,Samhita,Susruta samhita,Parasaras Vrikshayurveda).</p> <p>Herbs and plants in Vedic literature.</p> <p>History, Aims and principles of taxonomy</p> <p>Relationships of various disciplines with taxonomy. Taxonomic hierarchy, species, genus, family and other categories, Species concept.</p> <p>Activity: Group discussion on traditional system of plant taxonomy</p>	15
II.	<p>Plant nomenclature: Binomial nomenclature,Principles and rules of ICN(International Code of Nomenclature for algae,funghi, and plants). Author citation,Rules of priority,Effective and valid publication,Nomenclatural type.</p> <p>Taxonomic tools: Herbaria, Botanical garden,Taxonomic literature,Monographs and revision.,Image comarison,Expert determination ,Preparation and uses of keys</p> <p>Activity: Field visit to Botanical garden</p>	15
III.	<p>Taxonomic evidences and Phylogeny</p> <p>Morphology, Plant anatomy. Palynology, Embryology, Cytology,</p>	15

	<p>Phytochemistry in relation to taxonomy.</p> <p>Plant molecular systematics and its importance.</p> <p>Origin and evolution of angiosperms.</p> <p>Activity: Group discussion on Origin and evolution of angiosperm</p>	
IV.	<p>Plant classification and identification:</p> <p>Bentham and Hooker's system of classification, Hutchinson and Cronquist system of classification</p> <p>APG -IV system of classification.</p> <p>Cladistic analysis</p> <p>Activity: Group discussion on Artificial ,natural and phylogenetic system of classification</p>	15
V.	<p>Diversity of angiosperm 1</p> <p>Study of plants with respect to systematic position, general characters, morphological variations ,economic importance and affinities of families Magnoliaceae, Ranunculaceae, Meliaceae, Rosaceae, Myrtaceae, Apiaceae, Cucurbitaceae, Cactaceae.</p> <p>Activity: Collection and preparation herbarium on locally available plants</p>	15
VI.	<p>Diversity of angiosperm 2:</p> <p>Study of plants with respect to systematic position, general characters, morphological variations , economic importance and affinities of families Rubiaceae, Asteraceae, Solanaceae, Santalaceae, Orchidaceae, Zingiberaaceae and Alismataceae, Poaceae.</p> <p>Activity: Local field survey and prepare list of rare and threatened plants in plants</p>	15

Part C: Learnings Resources

(Textbooks, Reference books, other resources)

1. Heywood and Moore, D.M, 1984: *Concept in Plant Taxonomy*, Academic Press.
2. Davis, P.R and Heywood, V.H 1973: *Principles of Angiosperms and Taxonomy*,
3. Judd WS, Cambell C.S, Kellog F A, Stevens P.F. 2016. *Plant Systematic: A phylogenetic approach*. Fourth edition, Macmillan publication.
4. Lawrence, G .H.M. · 1951: *Taxonomy of Vascular Plants* Macmillan, New York.
5. Naik V. N.; 1984: *Taxonomy of Angiosperms*: Tata Mc-Graw .Hill Pub. Co. Ltd. New Delhi
6. Pandey A K and Kasana S, 2021. *Plant systematics*, Jaya Publishing House New Delhi.
6. Patil D A. 2021. *Plant taxonomy: Theory, Principles and practices*, Scientific publisher, Jodhpur
7. Porter, C L. 1959. *Taxonomy of Flowering Plants*. WH Freeman and Company
8. Simpson Michael. 2006. *Plant Systematics*, Elsevier academic press.
9. <https://www.ebookselibrary.com>
10. Mishra, P.K. 2016 *Botany in Vedas*, Write and print Publications, New Delhi

Suggested Website Links:

1. Agricultural Astronomy. Website: https://en.wikipedia.org/wiki/Agricultural_astrology
2. Das A. Concepts of Botany in Vedic India. Campus Chronical.
Website: <http://www.campuschronicle.in/concepts-of-botany-in-vedic-india-2/>
3. Tiwari L. Ancient Indian Botany and Taxonomy. Website:
https://www.infinityfoundation.com/mandala/t_es/t_es_tiwari_botany_fra_meset.htm

Part-D Assessment and Evaluation

Pattern of Marks Distribution THEORY PAPER for NEP PG courses

<p>Recommended Continuous Assessment Methods:- (It may vary for respective course subject but TOTAL marks distribution will remain same)</p> <p>Maximum Marks: 100</p> <p>Continuous Comprehensive Evaluation (CCE): 40 Marks</p> <p>University Examination: 60 Marks</p>		
<p>Internal Assessment: Continuous Comprehensive Evaluation (CCE):</p>	<p>Class Test Assignment/Presentation</p>	<p>20 Marks 20 Marks Total Marks = 40</p>
<p>External Assessment: University Examination: Time: 3 Hours</p>	<p>Section (A)- Five very short answer question (20 words each) Section (B)- Five short answer question (200 words each) Section (C)- Two long answer question (500 words each)</p>	<p>02 Marks x 05 Questions = 10 Marks <i>(All 5 Questions to be attempted)</i> 06 Marks x 05 Questions = 30 Marks <i>(5 Questions to be attempted out of total 8 Questions)</i> 10 Marks x 02 Questions = 20 Marks <i>(2 Questions with each having internal choice)</i> Total Marks = 60</p>

PartA:Introduction

1	Course code	MBOT0202-T
2	Course Title	Morphology , anatomy and embryology of angiosperms
3	Coursetype	Core course
4	Prerequisite	To study this course, a student may be admitted to a 2 year PG programme after completing 3 year Bachelor Degree, subject to eligibility conditions of that PG programme
5	Course Learning outcome(CLOs)	On completion of the course, students would be able to identify and describe different plant parts, understand the functional roles of various tissues, and comprehend the mechanisms of secondary growth and reproduction in angiosperms. They will able to understand the structure and internal organisation of flowering plants. Students will be able to connect plant morphology and anatomy to various industries, such as agriculture (crop development), medicine (pharmaceutical plants), and forestry (timber production).
6	Credit value	5 credits
7	Total marks	Max marks(40+ 60=100) Minimum passing marks=40

Part B: Content of the course

Unit	Topics	No of lectures
I.	Floral morphology: Morphology ,anatomy and classification of plants in veda Morphological nature of different plant parts; Morphology of stipule and their types ;Morphology of stamen and carpel and their evolution;Types, origin and evolution of Inflorescence; Flower:is a modified shoot; A,B,C models of floral development, Inferior Ovary; Fruit types and its evolution.	15

	<p>Activity: Field visit to study various types of Flowers and Inflorescence</p>	
II.	<p>Shoot Apical Meristem: Apical, lateral and intercalary meristems- their ultra structure and histochemistry of Shoot development. Organization of shoot apical meristem (SAM), secretory ducts and laticifers, Nodal Anatomy and its evolution..</p> <p>Root Apical Meristem: Organization of root apical meristem (RAM), cell fate and lineages, lateral roots, root hairs, secondary growth and root stem transition. Root-microbe interactions</p> <p>Activity:Group discussion on Root microbes interaction</p>	15
III.	<p>. Leaf histogenesis, leaf meristem, differentiation of epidermis (with special reference to types of stomata and trichomes), mesophylls and vascular system of dicot and monocot leaf.</p> <p>Secondary growth and anomalies: Secondary growth of stem and activity of cambium.</p> <p>Anomalous secondary growth: Nyctanthes, Boerhaavia, Bignonia, Leptadenia, Salvadoria, Tinospora and Draccana stems..</p> <p>Wood properties ,wood identification.</p> <p>Wood development in relation to environmental factors. Dendrochronology and its application.</p> <p>Activity: Field study on morphological variation of leaf/Venation pattern</p>	15
IV.	<p>Microsporogenesis and development of male</p>	15

	gametophyte, Megasporogenesis and development of female gametophyte, Placentation and its types,	
V.	<p>Pollination and sexual Incompatibility</p> <p>Self-pollination: Contrivances for self pollination, merit and demerit. Pollen tube greet and guidance.</p> <p>Cross pollination: Types of cross pollination, Contrivances for cross pollination, merit and demerit.</p> <p>Agents of pollination: Abiotic pollinators and biotic pollinators.</p> <p>Floral adaptation of pollinations. Pollen stigma interactions.</p> <p>Self-Incompatibility: Sporophyte self-incompatibility(ssi) and gametophyte self-incompatibility(gsi). Genetic basis of self-incompatibility. Physiological and biochemical basis of incompatibility.</p> <p>Activity: Field visit to study Pollinators</p>	15
VI.	<p>Fertilization and seed development :</p> <p>Process, mechanism and significance of double fertilization.</p> <p>Endosperm development and its morphological nature.</p> <p>Storage proteins of endosperm and embryo, Development of dicot and monocot embryo. Formation of seed and its structure.</p> <p>Experimental Embryology:</p> <p>Polyembryony, Parthenocarpy, Apomixis, pollen allergy, pollen storage.</p> <p>In vitro fertilization,</p> <p>Invitro pollination and its application. application of pollens in forensic science</p> <p>Activity: Group discussion on experimental embryology</p>	
<p>PartC: Learning Resources</p> <p>(Textbooks, Reference books, other resources)</p>		

1. A C Datta, 2007. Botany for degree student, Oxford university Press
2. Burgess, J. 1985. An introduction to Plant Cell Development. Cambridge University Press, Cambridge.
3. Eames A and MacDaniels 1947 Plant anatomy, McGraw hills publication
4. Eames A. 1961. Morphology of the angiosperms, McGraw Hill publication
5. Fahne, A 1982. Plant Anatomy. (3rd edition). Pergamon Press, Oxford.
6. Fosket, D.E. 1994. Plant Growth and Development. A Molecular Approach. Academic Press, San Diego.
7. Lyndon, R.F. 1990. Plant Development The Cellular Basis. Unin Hyman. Lon.
8. Vashishitha, P.C., 1999. Plant Anatomy, Pragati publication, New Delhi
- Haupt, A.W., 1953. Plant Morphology., Legare street Press
9. Banerji, S.C. 1980. Flora and Fauna in Sanskrit Literature. Naya Prokash, 206 Bidhan Sarani Calcutta 700006.
10. Bhojwani SS, Bhatnagar SP, Dantu PK. The embryology of angiosperms, 6th Edn. S Chand publication

Suggestive digital platforms web links

<https://www.eshiksha.mp.gov.in/>

Part-D Assessment and Evaluation

Pattern of Marks Distribution THEORY PAPER for NEP PG courses

<p>Recommended Continuous Assessment Methods-: (It may vary for respective course subject but TOTAL marks distribution will remain same)</p> <p>Maximum Marks: 100</p> <p>Continuous Comprehensive Evaluation (CCE): 40 Marks</p> <p>University Examination: 60 Marks</p>		
<p>Internal Assessment: Continuous Comprehensive Evaluation (CCE):</p>	<p>Class Test Assignment/Presentation</p>	<p>20 Marks 20 Marks Total Marks = 40</p>
<p>External Assessment: University Examination: Time: 3 Hours</p>	<p>Section (A)- Five very short answer question (20 words each) Section (B)- Five short answer question (200 words each) Section (C)- Two long answer question (500 words each)</p>	<p>02 Marks x 05 Questions = 10 Marks <i>(All 5 Questions to be attempted)</i> 06 Marks x 05 Questions = 30 Marks <i>(5 Questions to be attempted out of total 8 Questions)</i> 10 Marks x 02 Questions = 20 Marks <i>(2 Questions with each having internal choice)</i> Total Marks = 60</p>

For 2 years PG programme

(Scheme B-1)

Botany Core (Practicum) Syllabus

M.Sc.II Sememester

Part A :Introduction			
Program 2 years PG	Class- M.Sc.	Sem II	Session 2025-2026
1	Course code	MBOT0201-P	
2	Course Title	Taxonomy of Angiosperms	
3	Coursetype	Practicum course	
4	Course Learning outcome(CLOs)	On completion of this course students will typically develop the ability to identify, classify, and understand the diversity of flowering plants. This includes learning about plant morphology, anatomy, and reproductive structures, as well as the principles of plant nomenclature and classification systems. Students also gain experience with taxonomic tools like herbaria and botanical gardens and learn about the economic importance of various plant families.	
5	Credit value	Practical-04	
6	Total marks	Max marks:100) University Exam:60 CCE:40	Minimum passing marks=40
Part:B:Content of the course			

Total No of Lectures-Tutorial-practicals(08 Hours per week L-T_P:0-0-120(Total hours)	
A.Assignments/Practice/Survey/Fieldwork	No of Hours:120
B.List of practicals to be performed in the laboratory	
<ol style="list-style-type: none"> 1. Exercise based on description and identification of plants up to species level 2. Description of various species of a genus:location of key characters and preparation of keys at generic level 3. Exercise based on nomenclatural notes. 4.Exercise on similarity and dissimilarities of plant species 5. Comparison of different species of a genus or different genera of a family to calculate similarity coefficients and preparation of dendrograms. 6. Description of a species based on various specimens to study interspecific variation a collective exercise. 7.Field trips:compilation of field notes and preparation of herbarium sheets 8. Training in using floras and herbaria for identification of specimens described in the class. 	
Part C: Learning Resources	
(Textbooks,Reference books, other resources)	
<p>Suggested Readings:</p> <ul style="list-style-type: none"> ➤ Sinha R.K.Practical Taxonomy of Angiosperms,I K Internationalpublishing house ➤ Subramanyan NS.Modern plant Taxonomy,Vikas publishing Houses ➤ Sharma OP.Plant Taxonomy,Mcgraw Hill ➤ Tyagi and Kshetrapal.Practical Taxonomy of angiosperms ➤ Sundararajan S.Practical Manual of angiosperm taxonomy.Shriyanshi publication ➤ Upadhaya and Solanki, Introduction to Practical Botany, Anil publication. 	

- Pandey BP. Taxonomy of angiosperms, S Chand
- Sambamurty A. V. S. S. Taxonomy of angiosperms., Willey

Suggestive digital platforms web links

<https://www.ncbi.nlm.nih.gov/books>

<https://bio.libretexts.org/Bookshelves/>

Suggested equivalent online courses:

<https://nptel.ac.in/>

<https://swayam.gov.in/>

<https://www.mooc.org> MOOC.org

Part-D Assessment and Evaluation

Pattern of Marks Distribution PRACTICAL PAPER for NEP PG courses

Suggested Continuous Evaluation Methods: (It may vary for respective course subject but TOTAL marks distribution will remain same)			
Internal Assessment	Marks	External Assessment	Marks
Class Interaction /Quiz	15	Viva Voce on Practical	10
Attendance in the lab	10	Practical Record File	10
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	15	Table work / Experiments	40
TOTAL	40		60

For 2 years PG programme

(Scheme B-1)

Botany Core (Practicum) Syllabus

M.Sc.II Semester

Part A :Introduction				
Program 2 years PG		Class- M.Sc.	Sem II	Session 2025-2026
1	Course code	MBOT0202-P		
2	Course Title	Morphology , anatomy and embryology of angiosperms		
3	Coursetype	Practicum course		
4	Course Learning outcome(CLOs)	<p>On completion of this course students will be able identify and understand the various plant parts (roots, stems, leaves), their internal structures (tissues, cells), and reproductive processes (from gametophyte development to seed formation).</p> <p>Students will able to Understand the organization of vascular bundles and other specialized structures,the development of the embryo and endosperm and the processes of microsporogenesis and megasporogenesis.</p>		
5	Credit value	Practical-04		
6	Total marks	Max marks:100) University Exam:60 CCE:40	Minimum passing marks=40	

Part:B:Content of the course

Total No of Lectures-Tutorial-practicals(08 Hours per week)

L-T_P:0-0-120(Total hours)

E. Assgnments/Practice/Survey/Fieldwork

No of

Hours:120

B.List of practicals to be performed in the laboratory

- 1 Exercise on Morphology of Stem, Leaf, Flower, Inflorescence
2. Exercise based on anomalies of stem anatomy.
3. Exercise based on RAM / SAM
4. Study of complex tissue viz. xylem,Phloem
5. Study of different types of trichomes.
6. To study diferent types of stomata and calculate stomatal index.
7. Maceration techniques to isolate individual cells of xylem and phloem.
8. Study of normal secondary growth in dicot and monocot stem .
9. Study on different types of placentation
10. To dissect out endosperm haustoria from plant ovule.
11. To dissectout embryo from plant ovule.

Part C: Learning Resources

(Textbooks,Reference books, other resources)

Suggested Readings:

- Pandey BP.Botany for degree students.Plant anatomy and Emryology,S Chand
- Ragland Annie and Kumerasan V.Developmental embryology and experimental

embryology, Saras publication.

- Sundarajan. Practical manual of plant morphology, Anmol publication pvt Ltd.
- Mukherjee S, College botany vol , New central book agency
- Datta AC. Botany for degree students, Oxford university press
- Bhojwani SS , Bhatnagar SP, Dantu PK. The embryology of angiosperms, 6th Edn.
S Chand publication

Suggestive digital platforms web links

<https://www.ncbi.nlm.nih.gov/books>

<https://bio.libretexts.org/Bookshelves/>

Suggested equivalent online courses:

<https://nptel.ac.in/>

<https://swayam.gov.in/>

<https://www.mooc.org> MOOC.org

Part-D Assessment and Evaluation

Pattern of Marks Distribution PRACTICAL PAPER for NEP PG courses

Suggested Continuous Evaluation Methods: (It may vary for respective course subject but TOTAL marks distribution will remain same)			
Internal Assessment	Marks	External Assessment	Marks
Class Interaction /Quiz	15	Viva Voce on Practical	10
Attendance in the lab	10	Practical Record File	10
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	15	Table work / Experiments	40
TOTAL	40		60

For 2 –year PG Programme having Major practicum Session:2025-2026

M.SC. Botany Sem -III

Course code	Course title	Total
MBOT0301-T	Plant physiology and Biochemistry	60+ CCE 40=100
MBOT0302-T	Cytology, Genetics and Biostatistics	60+ CCE 40=100
MBOT0301-P	Practical based on MBOT0301-P	60+ CCE 40=100
MBOT0302-P	Practical based on MBOT0302-P	60+ CCE 40=100

Part A: Introduction

1	Course code	MBOT0301-T
2	Course Title	Plant physiology and Biochemistry
3	Coursetype	Core course
4	Prerequisite	. To study this course, a student may be admitted to a 2 year PG programme after completing 3 year Bachelor Degree, subject to eligibility conditions of that PG programme
5	Course Learning outcome(CLOs)	Students will gain a comprehensive understanding of plant processes at the molecular and cellular level. They'll learn about key metabolic pathways, including photosynthesis and respiration, and how plants respond to environmental stresses. Students

		will also develop practical skills in experimental techniques and data analysis, enabling them to conduct research in plant science. Upon completion, students will be able to apply this knowledge to address real-world challenges in agriculture, conservation, and biotechnology
6	Credit value	6credits
7	Total marks	Max marks(40+ 60=100) Minimum passing marks=40

PartB: Content of the course

Unit	Topic	No of lecture
I.	<p>Introduction and Plant Water relation :History and contribution of Rishi Parashar and Indian Scientist in the field of Plant Physiology and Biochemistry.</p> <p>Contribution of J.C. Bose, P. Maheshwari, Govindjee, S.M. Sircar, Shri Ranjan in plant physiology.</p> <p>Water Potential and its Components; Intercellular Water and solute (ions, Nutrient and macromolecules) transport and membrane transport system; Water and solute absorption by Roots from soil; Water and solute transport through xylem; Mechanism of Transport across xylem; Transpiration, mechanism and regulation of stomatal opening and its closing; Guttation. Photo assimilates: translocation and mechanisms of its loading and unloading.</p> <p>Activity: Role play on Indian scientists in the field of Plant physiology.</p>	15

II.	<p>Photosynthesis: General concept, evolution of photosynthetic apparatus; Photosynthetic pigments and photo-system; Photo-oxidation of water; mechanism of electron and proton transport. Carbon assimilation: Calvin Cycle and its regulation, Photorespiration and its significance, C4 Cycle and its evolutionary significance and CO₂ fixation in Dark (CAM Pathways); Factors affecting Photosynthesis; Concept of Artificial Photosynthesis.</p> <p>Activity: Group discussion on History of Photosynthesis</p>	15
III.	<p>Respiration and Lipid metabolism: Glycolysis; Oxidative Pentose Phosphate Pathway (PPP) and importance; TCA Cycle; Mitochondrial electron transport and ATP synthesis; Significance of ATP, FADH₂, NADH₃; Glyoxylate Cycle and its significance. Structure and function of lipids; synthesis of membrane lipid; structural and storage lipid; Fatty acid biosynthesis and oxidation.</p> <p>Activity: Chart preparation on TCA cycle/PPP/Glyoxylate cycle</p>	15
IV.	<p>Nitrogen Metabolism and secondary metabolites: Nitrogen uptake and Nitrogen metabolism over view; Nitrogen fixation mechanism, Nodule formation; Ammonium assimilation; amino acid biosynthesis. Introduction, synthesis and role of plant secondary metabolites: terpenes, phenols and nitrogenous compounds</p> <p>Activity: Group discussion on secondary metabolites</p>	15
V.	<p>Plant Hormone and Sensory Photobiology: Biosynthesis, storage, breakdown, transport, physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, Jasmonic acid and salicylic acid. Structure, Function and Mechanisms of action of Phytochromes, Cryptochromes and Phototropins; Photoperiodism and Biological clocks.</p> <p>Activity: Chart preparation on structure, history and role of different types of plant hormone</p>	15
VI.	<p>Seed Science and Stress Physiology: Structure, development and</p>	15

maturation of Seed, Synthesis of storage reserves in seed; Physiology and Biochemistry of seed germination; Factor affecting seed germination, Metabolic aspects of seed germination; Mechanism, regulation and breakdown of seed dormancy. Plant responses to biotic and abiotic stress; Water deficit and drought resistance. Salinity stress and resistance, Concept of freezing, heat and oxidative stresses

Activity: Experimental study on various factors affecting seed germination

Part C: Resources Learning

(Textbooks, Reference books, other resources)

- 1) Narayana, P.S. and Pullaiah, T. 2010. Eminent Indian Botanists: Past and Present (Biographies and Contributions). Regency Publication, Delhi.
- 2) Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (2nd Ed.) Springer-Verlag, New York USA.
- 3) Heldt, H.W. and Piechulla, B. 2011. Plant Biochemistry (4th Ed.) Academic Press, London, UK.
- 4) Buchanan, B.B., Gruissem, W. and Jones, R. 2015. Biochemistry and Molecular Biology of Plants (2nd Ed.) John Wiley and Sons, Ltd. USA.
- 5) Shevela, D., Bjorn, L.O., Govindjee. 2019. Photosynthesis: Solar Energy for Life. World Scientific Publishing Co. Pvt. Ltd. Singapore
- 6) Pessarakli, M. (2024) Handbook of Photosynthesis (4th Ed.) CRC Press, Taylor and Francis Group, LLC.
- 7) Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A., Martin, K.C. 2021. Molecular Cell Biology (9th Ed.). W.H. Freeman and Company, New York USA.
- 8) Nobel, P.S. 1999. Physiochemical and environmental plant physiology (2nd Ed) Academic Press, San Diego, USA.
- 9) Salisbury F.B. and Ross, C.W. 1991. Plant Physiology (4th Ed) Wdswort Publishing CO California USA.
- 10) Taiz, L., Zeiger, E., Moller, I.M., Murphy, A. 2018. Plant Physiology and Development. (6th Edition). Sinauer Associates Inc, Oxford University Press, NY.
- 11) Baskin, C.C. and Baskin, J.M. 2014. Seeds: Ecology, Biogeography, and Evolution of Dormancy and Germination (2nd Ed.) Elsevier Inc.
- 12) Bradford, K. and Nonogaki, H. 2007. Seed Development, Dormancy and Germination (Vol.27.) Blackwell Publishing Ltd.
- 13) Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (2ed). Springer-

Verg, New York USA.

- 14) Nobel, P.S. 1999. Physiochemical and environmental plant physiology (2ed). Academic Press, San Diego, USA
- 15) Salisbury, F.B. and Ross, C.W. 1991. Plant physiology 4th edition. Wdsworth Publishing Co. California USA.
- 16) Dennis, D.T., Terpin, D.H., Lefervere, D.D. and Layzell, D.V. 1997. Plant Metabolism. 2nd Edition. Longman England.
- 17) <https://www.ebookselibrary.com/book-detail/higher-education/botany/PLANT-PHYSIOLOGY-110>

Suggestive digital platforms web links:

https://archive.org/details/fundamentalsofbo0000unse_z7a4/page/58/mode/2up

Suggested equivalent online courses:

<https://www.mooc.org>

<https://swayam.gov.in>.

<https://nptel.ac.in>

Remarks/Suggestions:

- 1 .Assessment mode for internal evaluation will be based on the guidelines issued by UGC on: Evaluation reforms in higher educational Institutions Nov 2019, and pedagogical Approaches and evaluation reforms 2021.
2. Internal assessment will be further distributed as per table given in Appendix 3 of 14(2), as applicable from time to time.
- 3 .The pass percentage will be 40 %(Grade P) both for theory and practicum. A student has to obtain 40% marks in internal as well as in End term examination separately to pass a course.

Part-D Assessment and Evaluation

Pattern of Marks Distribution THEORY PAPER for NEP PG courses

<p>Recommended Continuous Assessment Methods-: (It may vary for respective course subject but TOTAL marks distribution will remain same) Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 40 Marks University Examination: 60 Marks</p>		
<p>Internal Assessment: Continuous Comprehensive Evaluation (CCE):</p>	<p>Class Test Assignment/Presentation</p>	<p>20 Marks 20 Marks Total Marks = 40</p>
<p>External Assessment: University Examination: Time: 3 Hours</p>	<p>Section (A)- Five very short answer question (20 words each) Section (B)- Five short answer question (200 words each) Section (C)- Two long answer question (500 words each)</p>	<p>02 Marks x 05 Questions = 10 Marks <i>(All 5 Questions to be attempted)</i> 06 Marks x 05 Questions = 30 Marks <i>(5 Questions to be attempted out of total 8 Questions)</i> 10 Marks x 02 Questions = 20 Marks <i>(2 Questions with each having internal choice)</i> Total Marks = 60</p>

Part A: Introduction

1	Course code	MBOT0302-T
2	Course Title	Cytology, Genetics and Biostatistics
3	Coursetype	Core course3
4	Prerequisite	To study this course, a student may be admitted to a 2 year PG programme after completing 3 year Bachelor Degree, subject to eligibility conditions of that PG programme
5	Course Learning outcome(CLOs)	Student will enable to gain knowledge on various components of nuclear and organellar genome, with special reference to their regulatory role. They can understand the principal mechanisms of genome replication, maintenance, function and regulation of expression. Students can be able to apply statistical methods to biological data, understand the principles of experimental design, and interpret statistical results in the context of plant biology research.
6	Credit value	6 credits

Part B: Content of the Course

Units	Topics	No of Lectures
I.	Discovery of cell and cell theory The Vedic period and the early texts (Gotra and Pravaras) on genetics. Prokaryotic vs Eukaryotic cells Structural organization and function of intracellular organelles Activity: Chart preparation on cell organelles	15

II.	<p>Chromosomes and cell cycle :</p> <p>Characteristics of chromosomes in different plant groups. Chromosome :structures and components .Specialized chromosomes, Numerical and structural changes in Chromosome.</p> <p>Cell division and cell cycle, Cycline , Cycline -dependent kinases(Cdks),Anaphase Promoting Complex(APC/C),Apoptosis</p> <p>Activity: Group discussion on diseases due to abnormalitie in chromosomes</p>	15
III.	<p>Mendelian Inheritance : Monohybrid cross and Law of segregation, dihybrid crosses and Law of independent assortment, Gene interaction, co- dominance and lethal allele; extra nuclear inheritance, chloroplast DNA and mitochondrial DNA. Crossing over, mechanism of genetic recombination. Molecular basis of mutation</p> <p>Activity: Chart preparation on interaction of genes</p>	15
IV.	<p>Genome organisation</p> <p>Genome organization, Nuclear DNA content, C-value paradox, Cot curve and its Significance DNA packaging, unique and repetitive DNA,Satellite DNA , <i>in situ</i> hybridization of satellite DNA ,Introns and their significance.</p> <p>Activity:Group discussion on evolution of genes</p>	15
V	<p>Gene structure and expression</p> <p>Gene structure and expression: Fine structure of gene, Cis-trans test, RNA splicing, regulation of gene expression in prokaryotes and eukaryotes.</p> <p>Activity:Group discussion on Gene expression</p>	15
VI	<p>Biostatistics:</p> <p>Graphical representation of data</p> <p>Measurement of central tendencies, Standard deviation, standard error,</p>	15

Probability rules, Chi-square test, correlation, regression analysis,
Analysis of variance.

Activity: Chart preparation on Graphical representation of data.

Part C: Learning Resources

(Textbooks, Reference books, other resources)

1. Atherly, A.G. Girton, J.R. and Mc Donald, J.E.1999. The Science of Genetics: SaPosts college publishing, Fort Worth, USA.
2. Burnham, C.R. 1962. Discussions in Cytogenetics, Burgess publishing Co. Minnesota.
3. Busch. H. and Rothblum. L.1982. Volume X. The cell nucleus rDNA part A. Academic press.
4. Hartl, D.L. and Jones, E.W.1998. Genetics: Principles and Analysis(4th edition). Jones and Bartlett publishers, Massachusetts, USA.
5. Hattl, D.L.and Jones, E. W.2006. Genetics:Principles and Analysis(5th edition). Jones and Bartlett publishers, Massachusetts, USA.
6. Khush, G.S.1973. Cytogenetics of Aneuploids. Academic press, New York, London.
7. Lewis, B.2000 Gene7. Oxford University Press, ew York, USA.
8. Lewis,R.1997, Human, Genetics: Concepts and Application (2nd edition). WCB McGraw, Hill, USA.
9. Wiley and Sons Inc.,USA.
10. Lewin, B.2006, Genes 7, Oxford University press, New York.
11. Albetis, S., Bray, D., Lewis, J., Ratf, M., Robetis, K., and Watson, J.D.
Molecular Biology of the Cell. Garland Publishing: Inc., New York.
12. Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA
13. Sen S and Kar Dipak.2005.Cytology and Genetics.Narosa Publication House,NewDelhi ,
14. Mukherjee Pranab.2016.Introduction to Biostatistics. SChand &Co Pvt. Ltd.
15. Sharma Archana and Sen Sumitra,2002,Chromosome botany,Oxford and IBH publication
12. <https://www.esp.org/mol-bio.pdf>

Part-D Assessment and Evaluation

Pattern of Marks Distribution THEORY PAPER for NEP PG courses

<p>Recommended Continuous Assessment Methods-: (It may vary for respective course subject but TOTAL marks distribution will remain same) Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 40 Marks University Examination: 60 Marks</p>		
<p>Internal Assessment: Continuous Comprehensive Evaluation (CCE):</p>	<p>Class Test Assignment/Presentation</p>	<p>20 Marks 20 Marks Total Marks = 40</p>
<p>External Assessment: University Examination: Time: 3 Hours</p>	<p>Section (A)- Five very short answer question (20 words each) Section (B)- Five short answer question (200 words each) Section (C)- Two long answer question (500 words each)</p>	<p>02 Marks x 05 Questions = 10 Marks <i>(All 5 Questions to be attempted)</i> 06 Marks x 05 Questions = 30 Marks <i>(5 Questions to be attempted out of total 8 Questions)</i> 10 Marks x 02 Questions = 20 Marks <i>(2 Questions with each having internal choice)</i> Total Marks = 60</p>

For 2 years PG programme

(Scheme B-1)

Botany Core (Practicum) Syllabus

M.Sc.III Sememester

Part A :Introduction				
Program 2 years PG		Class- M.Sc.	Sem III	Session 2025-2026
1	Course code	MBOT0301-P		
2	Course Title	Plant physiology and Biochemistry		
3	Coursetype	Practicum course		
4	Course Learning outcome(CLOs)	On completion of this course students will able to explain and apply knowledge of plant processes like photosynthesis, respiration, and mineral nutrition. Students should also be able to understand water and solute transport, and how plants respond to environmental stresses. Practical skills in conducting experiments, analyzing data, and interpreting results related to plant physiologyand biochemistry.		
5	Credit value	Practical-04		
6	Total marks	Max marks:100) University Exam:60 CCE:40	Minimum passing marks=40	
Part:B:Content of the course				

Total No of Lectures-Tutorial-practicals(08 Hours per week)

L-T_P:0-0-120(Total hours)

G. Assignments/Practice/Survey/Fieldwork

No of
Hours:120

B.List of practicals to be performed in the laboratory

Suggested Laboratory Exercise:

- 1) Effect of time and enzyme concentration on the rate of reaction of enzyme C e.g. acid phosphatase, nitrate reductase.
- 2) Effect of substrate concentration on activity of any enzyme C (Catalase, amylase).
- 3) Demonstration of the substrate inducibility of the enzyme nitrate reductase.
- 4) Determination of succinate dehydrogenase activity, its kinetics and sensitivity to inhibitors.
- 5) Separation of isoenzyme of esterase, peroxidase by native polyacrylamide gel electrophoresis.
- 6) To demonstrate photophosphorylation in intact chloroplast, resolve the photoproteins by SDS-PAGE and perform autoradiography desalting of proteins by gel filtration chromatography employing Sephadex G-25.
- 7) Extraction of seed proteins depending upon the solubility.
- 8) Desalting of proteins by gel filtration chromatography employing Sephadex G-25.
- 9) Preparation of standard curve of protein and estimation of protein contents in extracts of plant material by Lowry's Bradford's method.
- 10) Fraction of proteins using gel filtration chromatography by Sephadex G-100 or Sephadex G-200.
- 11) Radioisotope methodology, autoradiography, instrumentation (GM counter and scintillation counter) and principles involved.
- 12) Principles of colorimetry, spectrophotometry, and fluorimetry / calorimetry.
- 13) Determine rate of transpiration by Ganong's photometer.
- 14) Determine rate of respiration in germination/young buds by Gannong's respirometer.

- | | |
|---|--|
| <p>15) Determination of Osmotic Potential by incipient plasmolysis.</p> <p>16) Determination of DPD by Schardakov's method.</p> <p>17) Effect of light intensity on the rate of Photosynthesis.</p> <p>18) Separation of chlorophyll pigment by paper chromatography.</p> | |
|---|--|

Part C: Learning Resources

(Textbooks, Reference books, other resources)

Suggested Readings:

- Heldt, H.W. and Piechulla, B. 2011. Plant Biochemistry (4th Ed.) Academic Press, London, UK.
- Chitra K Y A practical manual of ecology, cytology, genetics, plant physiology, biochemistry, M/S Agrobios (India), 2019
- Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (2nd Ed.) Springer-Verlag, New York USA.
- Verma SK and Verma M.A text book of plant physiology, Biochemistry and Biotechnology
- Shingote Prashant. A practical manual for plant physiology and biochemistry, Lap Lambert Academic press, 2017.

Suggestive digital platforms web links

<https://www.ncbi.nlm.nih.gov/books>

<https://bio.libretexts.org/Bookshelves/>

Suggested equivalent online courses:

<https://nptel.ac.in/>

<https://swayam.gov.in/>

<https://www.mooc.org/MOOC.org>

Part-D Assessment and Evaluation

Pattern of Marks Distribution PRACTICAL PAPER for NEP PG courses

Suggested Continuous Evaluation Methods: (It may vary for respective course subject but TOTAL marks distribution will remain same)			
Internal Assessment	Marks	External Assessment	Marks
Class Interaction /Quiz	15	Viva Voce on Practical	10
Attendance in the lab	10	Practical Record File	10
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	15	Table work / Experiments	40
TOTAL	40		60

For 2 years PG programme

(Scheme B-1)

Botany Core (Practicum) Syllabus

M.Sc. III Sememester

Part A :Introduction				
Program 2 years PG		Class- M.Sc.	Sem III	Session 2025-2026
1	Course code	MBOT0302-P		
2	Course Title	Cytology,Genetics and Biostatistics		
3	Coursetype	Practicum course		
4	Course Learning outcome(CLOs)	On completion of this course students will able to understand cell structure and function, apply genetic principles, and analyze biological data using statistical methods. They will learn in identifying cell organelles, understanding cell division, analyzing inheritance patterns, and interpreting statistical results from biological experiments.		
5	Credit value	Pratical-04		
6	Total marks	Max marks:100)	Minimum passing marks=40	
		University Exam:60	CCE:40	
Part:B:Content of the course				
Total No of Lectures-Tutorial-practicals(08 Hours per week)				
L-T_P:0-0-120(Total hours)				

H. Assignments/Practice/Survey/Fieldwork	No of Hours:120
B.List of practicals to be performed in the laboratory	
<ol style="list-style-type: none"> 1. Collection and growth of plant materials for study of Mitosis / Meiosis. 2. To study different stages of Mitosis. 3. To determine the mitotic index of given plant material. 4. Study of Meiosis in given plant material. 5.Effect of Mutation on germination of seed eg. <i>Trigonella</i>. 6. To prove Mendel's law of Segregation. 7. To prove Mendelian Monohybrid ratio. 8. Numerical exercise on Mendel's dihybrid crosses, gene interaction and genetical mapping. 9. To calculate the value of X^2 to test the goodness fit of experimental results. 10. Exercise on Laws of probability (single coin toss and double coin toss) 11.Numerical problem on mean ,mode and medium 12. To determine the standard deviation and standard error 	
Part C: Learning Resources	
(Textbooks,Reference books, other resources)	
<p>Suggested Readings:</p> <ul style="list-style-type: none"> ➤ Sen S and Kar Dipak.2005.Cytology and Genetics,Narosa Publication House,NewDelhi ➤ Mukherjee Pranab.2016.Introduction to Biostatistics, SChand &Co Pvt. Ltd. ➤ Hariprasad N and henna BP .Cellbiology and genetics Lab manual. ➤ Satguruprasad.Fundamentals of biostatistics ,Emkay publication. ➤ Raghuvanshi R K. and Siddique Practical exercise in Cytology ,Genetics plant breeding and biostatistics,CBS publishers 	

➤ Practical Cytology ,Applied Genetics and Biostatistics,Himalaya publishing House
pvt.Ltd.

Suggestive digital platforms web links .

<https://www.ncbi.nlm.nih.gov/books>

<https://bio.libretexts.org/Bookshelves/>

Suggested equivalent online courses:

<https://nptel.ac.in/>

<https://swayam.gov.in/>

<https://www.mooc.org>MOOC.org

Part-D Assessment and Evaluation

Pattern of Marks Distribution PRACTICAL PAPER for NEP PG courses

Suggested Continuous Evaluation Methods: (It may vary for respective course subject but TOTAL marks distribution will remain same)			
Internal Assessment	Marks	External Assessment	Marks
Class Interaction /Quiz	15	Viva Voce on Practical	10
Attendance in the lab	10	Practical Record File	10
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	15	Table work / Experiments	40
TOTAL	40		60

For 2 –year PG Programme having minor practicum Session:2025-2026

M.SC. Botany Sem -IV

Course code	Course title	Total
MBOT0401-T	Molecular Biology, Biotechnology and genetic engineering	60+ CCE 40=100
MBOT0402-T	Plant ecology and environment	60+ CCE 40=100
MBOT0401-P	Practical based on MBOT0401-P	60+ CCE 40=100
MBOT0402-P	Practical based on MBOT0402-P	60+ CCE 40=100

PartA: Introduction

1	Course code	MBOT0401-T
2	Course Title	Molecular Biology, Biotechnology and genetic engineering
3	Coursetype	Core course
4	Prerequisite	To study this course, a student may be admitted to a 2 year PG programme after completing 3 year Bachelor Degree, subject to eligibility conditions of that PG programme
5	Course Learning outcome(CLOs)	After completion of course students will gain a comprehensive understanding of plant systems at the molecular level, including their responses to environmental cues and developmental processes. Students will have knowledge on nuclear organization, DNA structure, replication and repair,

		transcription, translation and protein sorting. They will Get an insight into Recombinant DNA technology and Methods of gene transfer and plant tissue culture.
6	Credit value	6 credits
7	Total marks	Max marks(40+ 60=100) Minimum passing marks=40

Part B:Content of the course

Units	Topics	No of lectures
I.	<p>Molecular structure and replication of DNA:</p> <p>DNA structure, chemical nature of DNA, Molecular structure of DNA and RNA, B –DNA and Z – DNA. Identification of genetic materials. Replication of DNA ,Mechanism of DNA replication in Prokaryotes and Eukaryotes. Replication errors and their repairs. DNA damage and repair. Transposable genetic elements .</p> <p>Activity:Chart preparation on different types of DNA</p>	15
II.	<p>Expression of Genome and Gene regulation:</p> <p>Fine structure of Gene, Split gene, overlapping gene, Mechanism of transcription in Prokaryotes and Eukaryotes. The Genetic code. Regulation of transcription. Processing of mRNA. Translation in prokaryotes and Eukaryotes.</p> <p>Activity:Group discussion on Gene regulation</p>	15
III.	<p>Protein targeting and sorting:</p> <p>Physical, chemical properties of genome, types and strategies for genome analysis. Gene mapping .Protein profiling. Targeting of proteins to organelles, mechanism of sorting and regulation of target transport.</p> <p>Activity:Chart preparation on gene mapping</p>	15

IV.	<p>Plant Tissue Culture: General introduction, History and scope and basic concepts, laboratory organization; media preparation and sterilization techniques,</p> <p>Nutrition of plant tissue Growth limiting factors, Concept of cellular differentiation and totipotency, Types of culture, Embryo and endosperm culture, Induction and maintenance of callus and suspension culture. Somatic embryogenesis,</p> <p>Activity: Visit to plant tissue culture laboratory</p>	15
V.	<p>Protoplast and somatic hybridization</p> <p>Isolation, fusion, culture, hybrid selection and regeneration of Protoplast and possibilities with special reference to crop plants, Limitation of protoplast research, Somatic hybridization and selection mechanism for hybrids and cybrids, cell line selection through callus/suspension culture for the production of stress resistant plants, their application in crop Improvement</p> <p>Activity: Group discussion on application of plant tissue culture</p>	15
VI.	<p>Genetic engineering: Recombinant DNA technology and its Tools Restriction enzymes and others-Types and applications.</p> <p>Transgenic plants: Agrobacterium mediated gene transfer</p> <p>Molecular techniques- Basic concept, principles, technique and application. Gel electrophoresis. In situ hybridization, Southern blotting technique, Northern blotting technique, Western blotting technique and Dot blots technique.</p> <p>Immunological techniques: Enzyme Linked Immunosorbent Assay (ELISA).</p> <p>Activity: Group discussion on Genetically modified crops or bioengineered crops and ethical issue</p>	15
<p>Part C: Learning Resources</p>		

(Textbooks, Reference books, other resources)

I. Brown, T.A. (2018) Genome (4th ed.) Garland Science, Taylor and Francis Group, LLC.

1. Primrose, S.B. and Twayman, R.M. (200) Principles of Genome Analysis and Genomics (3rd Ed.). Blackwell Publication.
2. Rappole, R. and Walker, J.M. (2007) Molecular Biomethods Handbook. Humana Press, Totowa, New Jersey.
3. Watson, J.D., Gann, A., Baker, T.A., Levine, M., Bell, S.P., Losic, R., Harrison, S. 2014. Molecular Biology of the Gene. (7th Ed.) Pearson Education, Inc.
4. Krebs, J., Goldstein, E., Kilpatrick, S. 2014. Lewins Genes XI. Jones and Barlett Learning.
5. Hartl, D. and Jone, E.W. 2001. Genetics: Analysis of Genes and Genomes. Jones and Bartlet Publishers.
6. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
7. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
9. 10. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
10. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.
11. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.
12. .P. K. Gupta.(2008). Molecular Biology and Genetic Engineering , Rastogi Publications, New Delhi
13. 15. Anil kumar and Priti Maheshwari(2003)Text book of biotechnology, Agritech publishing Academy.
14. <https://acrobat.adobe.com/id/urn:aaid:sc:AP:54d2c4a8-7437-4208-9946-3a1a72d18389>

Part-D Assessment and Evaluation

Pattern of Marks Distribution THEORY PAPER for NEP PG courses

<p>Recommended Continuous Assessment Methods:- (It may vary for respective course subject but TOTAL marks distribution will remain same)</p> <p>Maximum Marks: 100</p> <p>Continuous Comprehensive Evaluation (CCE): 40 Marks</p> <p>University Examination: 60 Marks</p>		
<p>Internal Assessment: Continuous Comprehensive Evaluation (CCE):</p>	<p>Class Test Assignment/Presentation</p>	<p>20 Marks</p> <p>20 Marks</p> <p>Total Marks = 40</p>
<p>External Assessment: University Examination: Time: 3 Hours</p>	<p>Section (A)- Five very short answer question (20 words each) Section (B)- Five short answer question (200 words each) Section (C)- Two long answer question (500 words each)</p>	<p>02 Marks x 05 Questions = 10 Marks <i>(All 5 Questions to be attempted)</i></p> <p>06 Marks x 05 Questions = 30 Marks <i>(5 Questions to be attempted out of total 8 Questions)</i></p> <p>10 Marks x 02 Questions = 20 Marks <i>(2 Questions with each having internal choice)</i></p> <p>Total Marks = 60</p>

PartA: Introduction

1	Course code	MBOT0402-T
2	Course Title	Plant ecology and environment
3	Coursetype	Core course
4	Prerequisite	To study this course, a student may be admitted to a 2 year PG programme after completing 3 year Bachelor Degree, subject to eligibility conditions of that PG programme
5	Course Learning outcome(CLOs)	Students will gain a comprehensive understanding of plant interactions with their environment, including biotic and abiotic factors, and their role in ecosystems. They will also learn about plant distribution, diversity, conservation, and adaptation to changing conditions, including climate change. Additionally, students will develop skills in ecological research, data analysis, and critical thinking.
6	Credit value	6 credits
7	Total marks	Max marks(40+ 60=100) Minimum passing marks=40

Part B : Content of the course

Unit	Topics	No of lectures
I.	Ecology and Ecosystem: Types of forest described by Rishi parasar Contribution of Indian Scientist in the field of Ecology and Environment (Prof. Ramdeo Mishra). Environment and Ecology: Climate and Topographic factors;	15

	<p>Edaphic Factors; Biotic Factors; Concept of Freshwater Ecology; Marine Ecology; Estuarine Ecology; Terrestrial Ecology; Desert Ecology;</p> <p>Activity: Group discussion on relationship on Ecology and Environment</p>	
II.	<p>Plants-Environment relations: Adaptions and evolutions in plants for abiotic factor (light, Temperature, Water, minerals) biotic factors (herbivory, interspecies competitions.</p> <p>Activity:Field observation on plants due to climatic changes</p>	15
III.	<p>Population Ecology: Characteristics of a population (Size, Density, Natality, Mortality, Abundance, Dispersion patterns, Age structure etc.); Factors affecting population growth (density-dependent factors and Density-independent factors) and population growth curves; population regulation; life history strategies (r and K selection); Concept of metapopulation – demes and dispersal, interdemec extinctions</p> <p>Activity: Field study on Density and abundance and frequency of plants.</p>	15
IV.	<p>Species interactions and Community Ecology: Influence of vegetation on climatic condition, weathering and topography, soil; Interaction among plants; Interaction between plant and animal (Herbivory, Carnivory, Pollination, Seed dispersal by animals, mycorrhizal symbiosis). Nature of communities; community structure (in space – biodiversity; and in time – Succession) and attributes: levels of species diversity and its measurements; community dynamics and factors affecting it; concept of Ecads, Ecotypes, Ecological niche, edges and ecotones.</p> <p>Activity:Field study on different morphotypes in a population</p>	15
V.	<p>Ecosystem Ecology: Ecosystem structure; ecosystem function; energy flow and mineral cycling (C,N,P); Primary Production and decomposition; Structure and function of some Indian ecosystem: terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine).</p>	15

	Activity: Chart preparation on Energy flow and mineral cycling	
VI.	<p>Pollution Ecology and Conservation:</p> <p>Types, causes and effects of pollution; Greenhouse effect; major effects of Climate change. Utilization of Resources from forest, grassland and aquatic habitat; World centers of primary diversity of domesticated plants; Secondary Centers of origin. Principles of Conservation; <i>In-situ</i> conservation: Sanctuaries, National parks, Habitat conservation practices, conservation for forests, range, soil and water; <i>Ex-situ</i> conservation- Botanical gardens, gene bank and cryo-banks</p> <p>Activity: Visit to Sanctuaries or National park.</p>	

Part C: Learning Resources

(Textbooks, Reference books, other resources)

- 1) Sharma, P.D. 2009. Ecology and Environment. Rastogi Publication. Meerut.
- 2) Krebs. C.J. 2014. Ecology: The experimental Analysis of Distribution and abundance (6th Ed.). Pearson Education Ltd. America.
- 3) Gurevitch, J., Scheiner, S., Fox, G.A. 2021. The ecology of Plants (3rd Ed.). Oxford University Press.
- 4) Singh, V. 2024. Textbook of Environment and Ecology. Springer Nature Singapore.
- 5) Bowman, W.D., Hacker, S.D., Cain, M.L. 2017. Ecology (4th Ed.) Sinauer Associates. USA.
- 6) Sher, A.A., Manuel, C., Molles, J.R. Ecology: Concepts and Application (9th Ed.). McGraw Hill, New York.
- 7) Begon, M., Harper, J.L., Townsend, C.R. 1996. Ecology. Blackwell Science. Cambridge.
- 8) Odum, E.P. 1971. Fundamentals of Ecology. Saunders, Philadelphia.
- 9) Odum, E.P. 1983. Basic Ecology, Saunders, Philadelphia.
- 10) Kormondy, E.J. 1996. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd., New Delhi.

Part-D Assessment and Evaluation

Pattern of Marks Distribution THEORY PAPER for NEP PG courses

<p>Recommended Continuous Assessment Methods-: (It may vary for respective course subject but TOTAL marks distribution will remain same)</p> <p>Maximum Marks: 100</p> <p>Continuous Comprehensive Evaluation (CCE): 40 Marks</p> <p>University Examination: 60 Marks</p>		
<p>Internal Assessment: Continuous Comprehensive Evaluation (CCE):</p>	<p>Class Test Assignment/Presentation</p>	<p>20 Marks 20 Marks Total Marks = 40</p>
<p>External Assessment: University Examination: Time: 3 Hours</p>	<p>Section (A)- Five very short answer question (20 words each) Section (B)- Five short answer question (200 words each) Section (C)- Two long answer question (500 words each)</p>	<p>02 Marks x 05 Questions = 10 Marks <i>(All 5 Questions to be attempted)</i> 06 Marks x 05 Questions = 30 Marks <i>(5 Questions to be attempted out of total 8 Questions)</i> 10 Marks x 02 Questions = 20 Marks <i>(2 Questions with each having internal choice)</i> Total Marks = 60</p>

For 2 years PG programme

(Scheme B-1)

Botany Core (Practicum) Syllabus

M.Sc. IV Sememester

Part A :Introduction				
Program 2 years PG		Class- M.Sc.	Sem IV	Session 2025-2026
1	Course code	MBOT0401-P		
2	Course Title	Molecular Biology, Biotechnology and genetic engineering		
3	Coursetype	Practicum course		
4	Course Learning outcome(CLOs)	Practical Molecular Biology, Biotechnology, and Genetic Engineering courses aim to equip students with the foundational knowledge and hands-on skills to understand and manipulate biological systems at the molecular level. Key learning outcomes include mastering techniques like DNA/RNA isolation, PCR, gel electrophoresis, and transformation, as well as understanding gene expression, cloning, and genetic engineering principles		
5	Credit value	Practical-04		
6	Total marks	Max marks:100) University Exam:60 CCE:40	Minimum passing marks=40	

Part:B:Content of the course	
Total No of Lectures-Tutorial-practicals(08 Hours per week)	
L-T_P:0-0-120(Total hours)	
K. Assgnments/Practice/Survey/Fieldwork	No of Hours:120
B.List of practicals to be performed in the laboratory	
<ol style="list-style-type: none"> 1. To visit Biotechnology Lab. 2. Principle working & uses of instruments. Laminar air flow, Autoclave, Incubator, Hot air oven, Gel Electrophoresis. 3. Preparation of culture media, Nutrient Agar, Nutrient Broth, Eosin Methylene Blue Agar, MacConkey Agar media. 4. Isolation of bacteria by streak plate method. 5. Isolation of bacteria by pour plate method. 6. To determine the growth characteristics of E. coli using plating technique. 7. To determine the growth characteristics of E. coli using turbidimetric method. 8. Demonstration of gel for electrophoresis. 9. Isolation of Rhizobium from root nodules 10. To study the effect of antibiotic on growth of micro organism. 11. To demonstrate fermentation technique. 12. To demonstrate fermentation technique. 13. Preparation of Plant Tissue Culture Media. 14. Sterilization techniques- Sterilization of glassware, tissue culture, media and explant. 15. Demonstration of callus culture Technique. 16. Demonstration of Androgenesis in Datura. 17. Demonstration of Organogenesis. 18. Demonstration of Somatic embryogenesis. 	
Part C: Learning Resources	
(Textbooks,Reference books, other resources)	

Suggested Readings:

- De Kalyan kumar. An introduction to plant tissue culture, New central book agency
- Nagar S and Adhav, Cytology and Molecular biology, Agrobios
- Ried Noel R and Holt John G. Begeys manual of systematic Bacteriology vol 1, William and Wilkins
- Narayan swami S. plant tissue culture, Tata McGraw hills 2002
- Rapley Ralph and John M Walker. Molecular biotechnology Handbook, Humana press

Suggestive digital platforms web links .

<https://www.ncbi.nlm.nih.gov/books>

<https://bio.libretexts.org/Bookshelves/>

Suggested equivalent online courses:

<https://nptel.ac.in/>

<https://swayam.gov.in/>

<https://www.mooc.org> MOOC.org

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Pattern of Marks Distribution PRACTICAL PAPER for NEP PG courses

Suggested Continuous Evaluation Methods: (It may vary for respective course subject but TOTAL marks distribution will remain same)			
Internal Assessment	Marks	External Assessment	Marks
Class Interaction /Quiz	15	Viva Voce on Practical	10
Attendance in the lab	10	Practical Record File	10
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	15	Table work / Experiments	40
TOTAL	40		60

For 2 years PG programme

(Scheme B-1)

Botany Core (Practicum) Syllabus

M.Sc. IV Sememester

Part A :Introduction			
Program 2 years PG	Class- M.Sc.	Sem IV	Session 2025-2026
1	Course code	MBOT0402-P	
2	Course Title	Plant ecology and environment	
3	Coursetype	Practicum course	
4	Course Learning outcome(CLOs)	On completion of this course students will understand of plant-environment interactions, ecological principles, and practical skills related to plant identification, data collection, and environmental analysis. Students will learn to analyze plant distributions, assess ecosystem health, and understand the impact of environmental factors on plant life	
5	Credit value	Practical-04	
6	Total marks	Max marks:100) University Exam:60 CCE:40	Minimum passing marks=40
Part:B:Content of the course			
Total No of Lectures-Tutorial-practicals(08 Hours per week)			
L-T_P:0-0-120(Total hours)			

L. Assgnments/Practice/Survey/Fieldwork	No of Hours:120
B.List of practicals to be performed in the laboratory	
<ol style="list-style-type: none"> 1) Determination of density of different plant species by Quadrate method. 2) Determination of abundance of different plant species by Quadrate method. 3) Determination of % frequency of different plant species. 4) Determination of minimum size of quadrate. 5) Determination of LAI of a few dicot and monocot species. 6) Determination of IVI of 5 plant species. 7) Determination of soil water holding capacity of soil samples provided. 8) Determination of dissolved oxygen (D.O.). 9) Determination of pH of polluted water. 10) Determination of L/B ratio and leaf injury index 11) Determination of Chloride content in water. 	
Part C: Learning Resources	
(Textbooks, Reference books, other resources)	
<p>Suggested Readings:</p> <ul style="list-style-type: none"> ➤ Sharma, P.D. 2009. Ecology and Environment. Rastogi Publication. Meerut. ➤ Krebs. C.J. 2014. Ecology: The experimental Analysis of Distribution and abundance (6th Ed.). Pearson Education Ltd. America. ➤ Odum, E.P. 1971. Fundamentals of Ecology. Saunders, Philadelphia. ➤ R Mishra. Ecology workbook, Scientific publishers, Jodhpur ➤ Pranav kumar and Usha Mina. Fundamentals of Ecology and environment , Pathfinder 	

Part-D Assessment and Evaluation

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Suggested Continuous Evaluation Methods: (It may vary for respective course subject but TOTAL marks distribution will remain same)			
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Attendance in the lab	10	Practical Record File	10
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	15	Table work / Experiments	40
TOTAL	40		60