DEPARTMENT OF BOTANY

COURSE CURRICULUM & MARKING SCHEME

M.Sc. BOTANY

Semester – I, II, III, IV

SESSION : 2025-26

ESTD: 1958

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A^+, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

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GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE, DURG
Department of Botany
Session – 2025-2026

Objective of the Course:

M.Sc. Botany Degree Programme (2025-26 Academic year onwards) M.Sc. Botany Programme is a two-year post-graduate programme, which deals with basic and advanced study on plants. It is one of the multi-disciplinary fields with great demand in various fields of research and development. The programme envisages developing understanding and knowledge for applying into sectors like agriculture, horticulture, floriculture, biotechnology, genomics, forest and environment.

The programme is divided across 4 semesters. These are exciting times in Biology. The world of Biology has been transformed in the last few decades. There was too much to select from. However, the Board of studies designed the programme envisioning the following objectives:-

1. To encourage a clear, comprehensive and advance mastery in the field of botany.
2. To provide basic principles of biological sciences with special reference to Botany and its applied branches.
3. Enabling the students to explore the intricacies of life form at cellular, molecular and nano level.
4. To sustain student's motivation and enthusiasm and to help them not only to appreciate the beauty of different life forms but also to inspire them in the dissemination of the concept of biodiversity conservation.
5. To develop problem solving skills in students and encourage them to carry out innovative research projects thereby enkindling in them the spirit of knowledge creation.
6. To maintain a high level of scientific excellence in botanical research with added emphasis on the role of plants in the structure and functioning of terrestrial and aquatic communities and ecosystem.
7. To equip students to perform functions that demand higher competence in National/International fields.

Approved syllabus for M.Sc. Botany by the members of Board of Studies for the Sessions 2025 - 2026

S. No.	Paper No.	Course Code	Name of Paper	Marks		
				Internal	Semester	Total
SEMESTER I						
1.	I	MBO101	Cell Biology	20	80	100
2.	II	MBO102	Microbiology, Phycology and Mycology	20	80	100
3.	III	MBO103	Biology and Diversity of Bryophyta, Pteridophyta and Gymnosperm	20	80	100
4.	IV	MBO104	Plant Physiology	20	80	100
5.	Lab Course – I		Based on Paper I & III	-	-	
6.	Lab Course – II		Based on Paper II & IV	-	-	
SEMESTER II						
1.	I	MBO201	Genetics	20	80	100
2.	II	MBO202	Taxonomy of Angiosperm	20	80	100
3.	III	MBO203	Molecular Biology	20	80	100
4.	IV	MBO204	Plants Metabolism	20	80	100
5.	Lab Course - I		Based on Paper I & III	-	100	100
6.	Lab Course – II		Based on Paper II & IV	-	100	100
SEMESTER III						
1.	I	MBO301	Plant Development and Plant Resources	20	80	100
2.	II	MBO302	Plant Ecology – 1	20	80	100
3.	III	MBO303	Plant Biotechnology	20	80	100
4.	IV	MBO304	Microbial ecology {Elective Paper– I} Ethnobotany (Elective Paper-I)	20	80	100
5.	Lab Course – I		Based on Paper I & III	-	100	100
6.	Lab Course – II		Based on Paper II & IV	-	100	100
SEMESTER IV						
1.	I	MBO401	Plant Reproduction & Utilization of Resources	20	80	100
2.	II	MBO402	Ecology – II (Pollution & Biodiversity Conservation)	20	80	100
3.	III	MBO403	Genetic Engineering	20	80	100
4.	IV	MBO404	Microbial Ecology {Elective Paper – II} Ethnobotany (Elective Paper-II)	20	80	100
5.	Lab Course - I		Based on Paper I, II, III & IV	-	100	100
6.	Lab Course - II		Project / Dissertation Work	-	100	100

The syllabus for M.Sc. Botany is hereby approved for the sessions 2025-2026

Name and Signatures of Members Board of Studies

S. No.	Category	Name of Nominated Members	Signature
1.	**Chairperson**	**Dr. G. S. Thakur**	
2.	Members	Dr. Vijay Laxmi Naidu	
		Dr. Satish Kumar Sen	
		Dr. Shriram Kunjam	
		Mr. Motiram Sahu	
		Dr. Rajeshwari Prabha Lahare	
3.	Subject specialist	1. Prof. P.C. Panda Retd. Professor Borsi Durg C.G.)	
		2. Dr. N.B. Singh (Govt. N.PG. Science College Raipur C.G.)	
4.	VC Nominated member	Dr. Aruna Shrivastava (Govt. D.B. Girls PG College Raipur C.G.)	
5.	Corporate/ Industrial area Representative	Shri Manish Jain (Apollo College, Durg C.G.)	
6.	Ex Meritorious Student PG	Devika Janghel	
7.	Subject expert from other Department	Dr. Divya Minz (Department of Zoology, Govt. V.Y.T. PG. Autonomous College Durg C.G.)	

Syllabus and Marking Scheme for M.Sc. First Semester

Session 2025-2026

Paper No.	Title of the Paper/Paper Code	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I CC- MBO101	Cell biology	80	16	20	04	05
II CC- MBO102	Microbiology, Phycology and Mycology	80	16	20	04	05
III CC- MBO103	Biology and diversity of Bryophyta, Pteridophyta and Gymnosperm	80	16	20	04	05
IV CC- MBO104	Plant Physiology	80	16	20	04	05
V	Lab Course I - based on paper I and II	100	33			04
VI	Lab Course II - based on paper III and IV	100	33			04
	Total	**520**		**80**		**28**

***CC- Course Code**

04 Theory papers - 320
04 Internal Assessments - 80
02 Practical - 200
Total Marks - 600

Note: 1. 20 marks = 01 credit in Theory Papers and 25 Marks = 01 Credit in Practical/Project work

M.Sc. (BOTANY) SCHEME 2025-2026
SEMESTER –I-LAB COURSE

LAB COURSE-1 (4 Hrs)	100
Part – I Exercise based on Cell biology	20
Part – II Exercise based on Microbiology, Phycology and Mycology	30
Part – III Spotting	15
Part – IV Field Study	15
Part – V Viva- Voce	10
Part – VI Sessional	10

LAB COURSE-2 (4 Hrs)	100
Part – I Exercise based on Biology and diversity of Bryophyta, Pteridophyta and Gymnosperm	25
Part – II Exercise based on Plant Physiology	25
Part – III Spotting	15
Part – IV Field Study	15
Part – V Viva- Voce	10
Part – VI Sessional	10

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GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE, DURG (C.G.)
M.Sc. – BOTANY SEMESTER – I
SESSION– 2025-2026
PAPER – I (Course Code- MBO101)
CELL BIOLOGY

Max. M. 80 **Min. M. 16**

UNIT - I

- The dynamic cells, Structural organization of the plant cell, specialized plant cell type chemical foundation, biochemical energetics.
- **Cell wall**: Structure, functions, biogenesis, growth.
- **Plasma membrane**: structure, models, functions, Ion carriers, channels and pumps, receptors.

UNIT - II

- **Chloroplast**: Structure, functions, genome organization.
- **Mitochondria**: Structure, genome organization, biogenesis.
- **Ribosome**: Structure and functions.
- **Plant Vacuole**: Structure, Functions.

UNIT - III

- **Nucleus**: Structure, nuclear envelope, nuclear pore complex, nucleolus.
- **Cell cycle**: Control mechanisms, role of cyclin and cyclin dependent kinases.
- Retinoblastoma and E2F proteins
- **Apoptosis**: Programmed cell death, Mechanism.

UNIT - IV

- **Cell shape and motility:** The cytoskeleton; organization, role of microtubules, microfilaments; motor protein; implications in cilia, flagella and chromosome movement.
- **Other cellular organelles**: Structure and functions of Lysosome, Peroxysome, Golgi apparatus, Endoplasmic reticulum.
- **Techniques in cell biology:***In Situ*hybridization to locate transcripts in cell types FISH, GISH, Flow cytometry.

Laboratory Exercise

- Smear of root tips showing different stages of mitosis. {Onion,Garlic}
- Smear of anther showing different stages of meiosis. {Onion,Tradescantia}
- To study the effect of colchicines on mitosis cell division. {Onion root tip}
- Study of mitotic index from suitable plant materials.

Recommended Books:-

- Albert Etal 2002 (Fourth Edition). Molecular Biology of the cell, Garland Science (Iaylarand Francis) New York Group (wt)
- Buchanan B.B, Gruissm W. and Jones R.L 2000. Biochemistry and Molecular Biology of Plant. American Society of Plant Physiologist, Maryland, USA.
- Cooper G.M and Hausman R.E 2007 (Fourth Edition). The Cell molecular approach Sinauer associate, Inc, Suderland (USA).
- De Robertis and De Robertis 2005 (Eight edition) (Indian) Cell and Molecular Biology, Lippincott Williams, Philadelphia. [B.I Publications Pvt. Ltd. New Delhi].
- Gerald Karp 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and ScneIne., USA.
- Gupta P.K Cell and Molecular biology Rastogi Publications.
- Krishnamurthy, K.V 2000. Methods in Cell Wall Cytochemistry. CRC Press, Boca Raton, Florida.
- Lewin, B. 2000. Gene VII. Oxford University Press, New York, USA.
- LodishEtal 2004 (Fifth Edition). Molecular Cell Biology, W H Freeman and company, New York.
- Powar C.B 2005 (Third Edition). Cell Biology, Himalaya Publishing, Mumbai.

Outcome:-

- To gain knowledge about "Cell Science.
- To understand the structure, chemistry and functions ofplantcell,cell wall and Plasma membrane.
- To know about the structure, biogenesis and functions of cell organelles.
- To understand genome organization in mitochondria and chloroplast.
- To understand the mechanism of cell cycle, growth and cell divisionin plants.
- To learn about mechanism of programmed cell death in plants.
- To have knowledge of the cell motility organization and functions of cytoskeleton.
- To develop skill in flow cytometry and hybridization techniques.
- Study of structure of plant cell organelles from electron micrographs.
- To study the Squash and Smear techniquesand showing the stages of mitosis (Onion root tips) and showing permanent slides/photographs of mitosis and meiosis.

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2018-19. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :
   - Q.1 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
   - Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Internal Assessment Examination will be as follows:
   i. Internal Test in each paper (20 marks)
   ii. Seminar (Power point presentation) in any one of the paper (20 marks)
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   iv. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE, DURG (C.G.)
M.Sc. – BOTANY SEMESTER – I
SESSION– 2025-2026
PAPER – II (Course Code- MBO102)

MICROBIOLOGY, PHYCOLOGY AND MYCOLOGY

Max. M. 80 **Min. M. 16**

UNIT-I

A. Microbes

- Characteristics, structure and replication of viruses
- Structure, nutrition and genetic recombination of Bacteria
- General account of Mycoplasma.

B. Phycology -I

- General characters of Algae including diversified habitat, range of vegetative structure and reproduction.
- Classification of algae giving emphasis on pigment composition, flagellation, cell wall composition and reserve food material.

UNIT-II

Phycology -II

General account of -

a. Cyanophyceae
b. Chlorophyceae (Pandorina, Cladophora, Drapernaldiopsis)
c. Charophyceae (Chara)
d. Xanthophyceae (Botridium)
e. Bacillariophyceae (Pinnularia)
f. Phaeophyceae (Fucus)
g. Rhodophyceae (Batrachospermum)

- Economic importance with special reference to biofertilizers.

UNIT- III

Mycology - I

- General characteristics of fungi including its morphology, cellular structure and nutrition.
- Reproduction in fungi
- Heterothallism and Parasexuality
- Ainsworth system of fungal classification.
- General symptoms of plant disease.

UNIT - IV

Mycology -II

Brief life cycle of -

a. Myxomycotina (*Dictostelium*) b. Mastigomycotina (*Achlya*)
c. Zygomycotina (*Cunnighamella*) d. Ascomycotina (*Penicillium, Phyllactinia*)
e. Basidiomycotina (Rust- *Uromyces*, Smut - *Ustilago*)
f. Deuteromycotina (*Alternaria, Fusarium*
g. Economic importance, Mushroom cultivation.

Laboratory Exercise

- Bacterial staining and identification.
- Preparation of temporary mount and identification of algal material.
- Symptomlogy of some diseased specimens.
- Preparation of temporary mount and identification of fungal material.

Recommended Books

- A Textbook of Microbiology by S. S. Purohit.
- A Textbook of Microbiology by R. C. Dubey and D. K. Maheshwari.
- Microbiology, Vol. I and II by C. B. Powar and Daginawala.
- Algae by B. R. Vashishta.
- Algae by H. O. Kumar.
- Algae by Chapman.
- Structure and Reproduction of AlgaeVol.I and II by F. E. Fritsch.
- Cryptogamic Botany, Vol I by G. M. Smith.
- Introduction to Mycology by C. J. Alexopoulos.
- Mycology by Malothra and Aneja.
- An Introduction to Fungi by H. C. Dube.

Outcome :-

- Student will able to understand the structure and replication of different microbes and know the disease caused by them, disease symptoms and their control.
- They will know all about algae including their habitat, range of thallus organization, reproduction and classification.
- Student will know all about fungi including morphology,mode of nutrition, reproduction, heterothallism and para sexuality, classification, disease symptoms and their control.
- Student will get knowledge of the life cycle of all groups of algae and fungi and their economic importance.

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Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**

Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Internal Assessment Examination will be as follows:
   i. Internal Test in each paper (20 marks)
   ii. Seminar (Power point presentation) in any one of the paper (20 marks)
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   iv. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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		Dr. Satish Kumar Sen	
		Dr. Shriram Kunjam	
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		Dr. Rajeshwari Prabha Lahare	
3.	Subject specialist	1. Prof. P.C. Panda Retd. Professor Borsi Durg C.G.)	
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GOVT. V.Y.T PG. AUTONOMOUS COLLEGE, DURG (C.G)
M.Sc. – BOTANY SEMESTER – 1
Session – 2025-2026
Paper –III (Course Code- MBO103)

BIOLOGY AND DIVERSITY OF BRYOPHYTA, PTERIDOPHYTA AND GYMNOSPERM

M.M – 80 **Min – 16**

Unit – I

- General characters, classification, distribution and, Ecological significance of Bryophytes. Fossil bryophytes.
- General account including morphology, anatomy, reproduction and interrelationship of the following groups.
    - Marchantiales – *Plagiochasma*
    - Jungermanniales –*Porella*
    - Anthocerotales{eg.*Anthoceros}*
    - Sphagnals {eg.*Sphagnum}*
    - Polytricales {eg.*Polytrichum}*

Unit – II

- General characteristics, classification, and distributionofPteridophyta
- Evolution of stele, heterospory and seed habit.
- General account of following fossil Pteridophytes.
    - *Asteroxylon., Lepidodendron, Calamophyton.*
- Morphology, anatomy, and reproduction of the following groups:
    - Psilopsida {living Member} - *Psilotum.*
    - Lycopsida – *Isoetes.*
    - Pteropsida- *Ophioglossum, Osmunda*

Unit- III

- General Characteristics, Diversity, Classification,Evolution& Economic importance of Gymnosperms.
- General account of Cycadeoidales (Cycadeoidea, Williamsonia), Cordiatales (Cordiates).
- Brief account of following –
    - Pteridospermales –Lyginopteridaceae (*Lyginopteris*) .
    - Medullosaceae –*(Medullosa)*.
    - Caytonaceae –*(Caytonia)*.
    - Pentoxylales *(Pentoxylon)*.

Unit-IV

- Structure and Reproduction of the following–
    - *Cycadales (Zamia,).*
    - *Coniferales (Araucaria, Cedrus).*
    - *Ephedrales (Ephedra)*
    - *Welwischiales (Welwischia)*
    - *Gnetales (Gnetum, Ginkgo bioloba).*

Laboratory Exercise

- **Monographic** study of following genera: (Bryophyta)
  Plagiochasma, Fimbrieria, Porella, Fossombronia, Anthoceros, Sphagnum,Funaria, Polytrichum
- **Monographic** study of following genera (Pteridophyta)
  Psilotum, Isoetes,Equisetum, Ophioglossum, Osmunda, Marsilea
- **Monographic** study of the following members of (Gymnosperms)
  - *Cycas, Pinus, Araucaria, Thuja, Ginkgo biloba, Ephedra, Gnetum*
  - Fossil specimen and slides.

Recommended Books:

- Sporne, K.R. An introduction to Gymnosperms
- Coutler and chamberian
- Bhatnagar, S.P. Gymnosperms
- Vashishta, P.C. Gymnosperms
- Stewart, W.N. and Rathwell, G.W.1993, Paleobotany and Evolution on plants . Cambridge university press.
- Cavers, Interrelationship of Bryophyta.
- Udar, R. Bryophyta.
- Prempuri, Bryophyta
- Parihar , N.S An introduction of Embryophyta, Vol.I Bryophyta.
- Parihar , N.S An introduction of Embryophyta, Vol.II Bryophyta.
- Rashid A. An Introduction of pteridophyta.
- Vashishta, P.C. Pteridophyta.
- Smith, G.M. Cryptogamic Botany.
- Eames. J. Morphology of Vascular plants- Lower Groups.

Outcome:-

- Student will able to understand the evolutionary trends of Bryophyta, Pteridophyta and Gymnosperms.
- They will get knowledge about habitats, structure and life cycle of the different members of the plant groups of Bryophyta, Pteridophyta and Gymnosperms.
- They will get knowledge about economic importance of Bryophyta, Pteridophyta and Gymnosperms & also they will know about Azolla as a biofertilizer.
- They will able to understand about geological time scale and fossil plants.

Question Paper Format and Distribution of Marks for PG Semester Examination

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Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
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Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
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4. Internal Assessment Examination will be as follows:
   v. Internal Test in each paper (20 marks)
   vi. Seminar (Power point presentation) in any one of the paper (20 marks)
   vii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   viii. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE, DURG (C.G.)
M.Sc. – BOTANY SEMESTER – I
SESSION - 2025-2026
PAPER – IV (Course Code- MBO104)
PLANT PHYSIOLOGY

M.M. – 80 **Min. - 16**

UNIT - I

Energy flow: Principles and Application of thermodynamics, free energy & chemical potential, Redox reactions, structure & function of ATP,
Hierarchical structure of proteins: folding, degradation, purification, detection and functional characterization; sequence alignments. Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds).

Fundamentals of Enzymology: General aspects, Nature of enzymes, mode of enzyme action, classification, enzyme kinetics, Michaelis Menten Equation & ribozymes, abzymes, artificial enzymes, enzyme technology its Significance, Enzyme inhibition, allosteric mechanism, regulatory & active sites, isozymes, factors affecting enzyme activity.

UNIT – II

Membrane Transport & Translocation of water & solutes:
Plant water relations – properties of water, diffusion, osmosis, permeability, plasmolysis, imbibitions, DPD.
Mechanism of water transport through xylem – absorption of water, ascent of sap, transpiration and mineral nutrition.
Root microbe interaction (mycorrhiza) in facilitating nutrient uptake,
Comparison of Xylem & Phloem transport. Phloem loading & unloading (translocation) - active & passive solute transport.

UNIT – III

Signal Transduction: Overview, second messengers, receptors and G-proteins, phospholipid signaling, role of cyclic nucleotides, calcium-calmodulin cascade, diversity in protein kinases and phosphatases, specific signaling mechanisms and their regulation, e.g. simple and hybrid type of two-component sensor-regulator system in bacteria and plants (examples of chemotaxis, osmosensing, ethylene and cytokinin signaling),quorum sensing.

UNIT – IV

Plant Growth Regulators & Elicitors:
Physiological effects & mechanism of action of auxin, gibberllins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid & salicylic acid, hormone receptors.
Stress Physiology: plant responses to biotic & abiotic stress, mechanism of biotic & abiotic tolerance, HR & SAR, water deficit & drought resistance, salinity stress, metal toxicity, cold & heat stress, oxidative stress.

Laboratory Exercise

- To determine osmotic pressure of cell sap by Plasmolytic method.
- To determine osmotic pressure of cell sap by Weight method.
- To determine the rate of transpiration by Ganong's photometer.
- To find out stomatal index of different mesophytic leaves.
- To determine absorption transpiration ratio.
- Comparison of cuticular and stomatal transpiration by Cobalt chloride method.
- Demonstration of Catalase activity.
- Demonstration of Peroxidase activity.
- Demonstration of Dehydrogenase activity.
- Demonstration of Amylase activity.
- Comparison of cuticular and stomatal transpiration by Blackman's apparatus.

- **Recommended Books:**

- Cell Physiology by Giese.
- Plant Physiology by Bidwell.
- Plant Physiology by Subhash chandra Dutta.
- Plant Physiology by Noggle and Frutz.
- Plant Physiology by Devlin.
- Plant Physiology by Taiz and Zeiger.

Outcome:-

- The basic principles of enzymology, to understand the relationship between proteins and the nucleic acids (DNA and RNA) that provide the blueprint for the assembly of proteins with in the cell.
- Genetic engineering is thus predominantly concerned with modifying the proteins that a cell contains, and genetic defects (in medicine) generally relate to the abnormalities that occur in the proteins within cells. Much of the molecular age of biochemistry is therefore very much focused on the study of the cell, its enzymes and other proteins, and their functions.
- Through this unit students understand Knowledge of plant water relationship. it is important because water is essential for both plants and animals. It serves as a medium for the dissolution of substances. A huge amount of water is taken up daily by plants and a considerable amount is lost in transpiration. The water requirement of different categories of plants is different.
- Students understand the signal transduction unit understand the basic principles of signal transduction mechanisms, in particular the concepts of response specificity, signal amplitude and duration, signal integration and intracellular location.

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2020-21. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :

Q.1 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**

Q.2 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**

Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.

   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Internal Assessment Examination will be as follows:
   - ix. Internal Test in each paper (20 marks)
   - x. Seminar (Power point presentation) in any one of the paper (20 marks)
   - xi. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   - xii. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

Name and Signatures of Members Board of Studies

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1.	**Chairperson**	**Dr. G. S. Thakur**	
2.	Members	Dr. Vijay Laxmi Naidu	
		Dr. Satish Kumar Sen	
		Dr. Shriram Kunjam	
		Mr. Motiram Sahu	
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SYLLABUS AND MARKING SCHEME FOR M.Sc. (BOTANY)

SECOND SEMESTER

Session: 2025-2026

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I **CC- MBO201**	Genetics	80	16	20	04	05
II **CC- MBO202**	Taxonomy of Angiosperm	80	16	20	04	05
III **CC- MBO203**	Molecular Biology	80	16	20	04	05
IV **CC- MBO204**	Plant Metabolism	80	16	20	04	05
V	Lab Course I - based on paper I and II	100	33			04
VI	Lab Course II - based on paper III and IV	100	33			04
	Total	**520**		**80**		**28**

***CC – Course Code**

04 Theory papers - 320

04 Internal Assessments - 80

02 Practical - 200

Total Marks - 600

Note: 1. 20 marks = 01 credit in Theory Papers and 25 Marks = 01 Credit in Practical/Project work

M.Sc. (BOTANY) SCHEME 2025-2026
SEMESTER – II, LAB COURSE

LAB COURSE-1 (4 Hrs)	**100**
Part – I Exercise based on Genetics	20
Part - II Exercise based on Taxonomy of Angiosperm	30
Part – III Spotting	15
Part – IV Field Study	15
Part – V Viva- Voce	10
Part – VI Sessional	10

LAB COURSE-2 (4 Hrs)	100
Part – I Exercise based on Molecular Biology	30
Part – II Exercise based on Plant Metabolism	30
Part – III Spotting/ field study	20
Part – IV Viva- Voce	10
Part – V Sessional	10

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GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG (C.G.)

M.Sc. – BOTANY SEMESTER – II

SESSION - 2025-2026

PAPER – I (Course Code- MBO201)

GENETICS

Max. M. - 80 **Min. M. - 16**

UNIT-I

- **Chromatin Organization:** Chromosome structure and packaging of DNA, molecular organization of centromere and telomere, chromatin and heterochromatin, banding pattern, Karyotype. Ribosomal RNA genes.
- **Special types of chromosomes**: Polytene, lamp brush, B chromosomes and sex chromosomes & Sex determination in plants.
- **Cytoplasmic inheritance:** Mitochondrial DNA & Cytoplasmic male sterility in plants.

UNIT-II

- **Structural alterations in chromosomes**: origin, meiosis and breeding behaviour of duplication, deficiency, inversion and translocation heterozygotes;
- **Numerical alterations in chromosomes**: Aneuploids - monosomic, nullisomic, trisomic and tetrasomic; Euploids - haploids and polyploids; origin & production of autopolyploids, allopolyploids.
- **Genetics of prokaryotes and eukaryotic organelles:** Phage phenotype, genetic recombination in virus & bacteria (transformation, conjugation and transduction in bacteria).

UNIT-III

- **Genetic recombination-** Mechanism of crossing over, molecular mechanism of genetic recombination.
- Role of Rec-A, Rec-B, Rec- C and Rec-D enzymes.
- Homologus & Site specific recombination,
- Linkage - theories, types mechanism & linkage group.

UNIT-IV –

- **Chromosome inheritance**: Chromosome theories, mendelian laws, gene interaction.
- **Transposones:** transposable elements in prokaryotes and eukaryotes.
- **DNA damages & Repair**: mechanisms, inherited human diseases and defects in DNA repair.

Laboratory Exercise

- Problems on genetics: based on inheritance / interaction / crossing over / linkage.
- Karyotype analysis (Slide/ Photograph).
- To study the salivary gland chromosomes from Chironomous larva.

Recommended Books:-

- Ahluwalia K.B 2005 (First Edition). Genetics. New Age International Private Ltd. Publishers, New Delhi.
- Gardner and Simmons Snustad 2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons, Singapore.
- Gupta P.K Genetics , Rastogi Publications.
- Karp, G. 1999. Cell and Molecular Biology : Concept and Experiments. John Wiley and Sons, Inc., USA.
- Lewin, B. 2000. Gene VII. Oxford University Press, New York, USA.
- Lewis, R. 1997. Human Genetics: Concepts and Application (Second Edition). WCB McGraw Hill, USA.
- Pawar C.B 2003 (First Edition). Genetics Vol. I and II. Himalaya Publishing House, Mumbai.
- Russel, P.J. 1998. Genetics (Fifth Edition). The Benjamin/Cummings Publishing Company IND., USA.
- Sariu C 2004 (Sixth Edition) Genetics. TATA McGraw-Hill Publishing Company Ltd., New Delhi.
- Snustad, D.P and Simmons, M.J 2000. Principles of Genetics (Second Edition). John Wiley and Sons Inc., USA.
- Strickberger 2005. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
- Verma and Agarwal, Genetics, S. Chand Co, New Delhi.. 20. Singh B.D 2004. Genetics. Kalyani Publication, Ludhiana.

Outcome:-

- Analyzing the structure of chromosomes and how the packaging of DNA occurs. Students can differentiate Euchromatin and Heterochromatin region of chromosome on the basis of staining properties.
- Students can draw a good karyotype and Idiograms of Karyotype, and also how the evolution of Karyotype takes place.
- Evaluating the different structural and numerical changes why? And how? It occurs in the chromosome students, can able to use the trisomic and monosomic for the chromosomes mapping.
- Categorizing the role and process of mutation and different mutagenic agent which brings about mutation in the organism.
- Students will also understand the role of mutation in crops improvement and permutation.
- Understanding of the history of gene from 'something', 'factor'; and gene and one gene one enzyme one character hypothesis.
- Students will also know the interaction of gene, genetic recombination producing the characters differently.

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2018-19. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :
   - Q.1 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
   - Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Internal Assessment Examination will be as follows:
   i. Internal Test in each paper (20 marks)
   ii. Seminar (Power point presentation) in any one of the paper (20 marks)
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar.(20 marks)
   iv. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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M.Sc. – BOTANY SEMESTER – II

SESSION - 2025-2026

PAPER – II (Course Code- MBO202)

TAXONOMY OF ANGIOSPERMS

M.M. - 80 **Min. - 16**

UNIT– I

- **Taxonomy Tools**- Herbarium, Floras.
- **The species Concepts**- Taxonomic, hierarchy, species, Genus, family and other categories. Principles used in assessing relationship.
- Delimitation of taxa and attribution of rank. Salient features of international code of Botanical nomenclature.

UNIT– II

- **System of Angiosperm classification**: - Phenetic versus Phylogenetic Systems, cladistics in Taxonomy.
- Salient Features of the systems Proposed by Bantham and Hooker, Hutchinson, Takhtajan and Cronquist.
- **Taxonomic evidence** - Morphology, Anatomy, Palynology, Embryology-Cytology and Phytochemistry.

UNIT – III

- **Diversity of flowering plants**: General account of following families -
  - Dicotyledons – Polypetalae.
    - Ranales – Ranunculaceae, Magnoliaceae, Annonaceae, Nymphaeaceae.
    - Geraniales – Rutaceae, Meliaceae.
    - Myrtales – Myrtaceae, Lythraceae.

UNIT – IV

- **Diversity of flowering plants**: General account of following families -
  - Dicotyledons – Gamopetalae –
    - Asterales – Compositae,
    - Lamiales –Lamiaceae, Verbenaceae.
  - Monochlamydeae – Polygonaceae, Euphorbiaceae.
  - Monocotyledons – Musaceae, Liliaceae, Palmaceae, Cyperaceae.

Laboratory Exercise

❖ Description and classification of the following plants.

Dicot:

1. Polypetalae –

a. Delphinium

b. Annona sp.

c. Polyalthia longifolia

d. Nymphaea sp.

e. Azadirachta indica

f. Melia azadirach

g. Callistemon sp.

h. Lagerstromia sp.

2. Gamopetalae –

a. Members of Astereceae

b. Oscimum sp.

c. Hyptis

d. Lippianodiflora

e. Vitex negundo

f. Duranta sp.

3. Monochlamydae –

a. Polygonum sp.

b. Antigonanleptopus

c. Croton sp.

4. Monocot:

a. Musaceae – Musa sp.

b. Liliaceae – Allium cepa

c. Cyperaceae – Cyperus rotandus

Recommended Books

- Mathur, R.C., Systematic Botany of Angiosperms.
- Rajkumar, Systematic Botany.
- Tyagi, Y.D. and Kchhetrapal, An Introduction to the Taxonomy of Angiosperms.
- Sumbhamusthi,v.S.S., Taxonomy of Angiosperms.
- Singh and Pandey, Jain, A Text book of Botany- Angiosperms.
- Chopra, G.L., Angiosperms.

Outcome :-

1. Student will able to get knowledge about taxonomic tools, species concept, ICBN, systems of classification and taxonomic evidences.

2. They will understand the diversity of flowering plants including dicots and monocots, their economic importance.

3. Student willable to identify scientifically the plants up to species level around their locality.

Question Paper Format and Distribution of Marks for PG Semester Examination

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1. The question paper will be of **80 marks** (as before).
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows

Q.1 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**

Q.2 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**

Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
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   i. Internal Test in each paper (20 marks)
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GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG (C.G.)

M.Sc. – BOTANY SEMESTER – II

SESSION - 2025-2026

PAPER – III (Course Code- MBO203)

MOLECULAR BIOLOGY

Max. M. 80 **Min. M. 16**

UNIT – I

- **DNA**: structure - A, B and Z forms, replication, RNA editing, RNA Splicing
- **tRNA**: Structure and function.
- **Protein Synthesis:** mechanism of protein synthesis, transcription in prokaryotes & eukaryotes, translation.

UNIT – II

- **Proteins sorting**: targeting of proteins to organelles.
- **Mutations**:
  - spontaneous and induced mutations, physical and chemical mutagens,
  - Molecular basis of gene mutations.
- Site directed mutagenesis.
- Robertsonian translocation, B-A translocation.

UNIT – III

- **Gene structure and expression**: fine structure of gene, Cis-trans test, fine structure analysis of eukaryotes, introns and their significance.
- Regulation of gene expression in prokaryotes (operon circuit) and eukaryotes (Britten-Davidson model).
- **Molecular Genetic mapping**: Genetic markers: RFLP, RAPD, AFLP, VNTRs.

UNIT – IV

- **Molecular Cytogenetics**:
  - Nuclear DNA content;
  - C - value paradox, cot curve and its significations,
  - Restrictions mapping, concept and techniques
- **Alien genes transfer through chromosomes manipulations**: transfer of whole genomes from Wheat, Brassica, Arachis; transfer of individual chromosomes and chromosomes segments; Inbreeding and heterosis.

Laboratory Exercise:

- Separation of proteins by SDS PAGE.
- Separation of plant DNA by Agarose Gel Electrophoresis.
- Isolation of DNA by CTAB Method.
- Isolation of plant DNA and quantification by UV spectrophoretic method.

- Restriction digestion of plant DNA, its separation by Agarose Gel Electrophoresis and visualization by ethidium bromide staining.
- Isolation of plant DNA from Onion (house hold method)

Recommended Books:-

- Albert Etal 2002 (Fourth Edition). Molecular Biology of the cell, Garland Science (Iaylar and Francis) New York Group (wt)
- Buchanan B.B, Gruissm W. and Jones R.L 2000. Biochemistry and Molecular Biology of Plant. American Society of Plant Physiologist, Maryland, USA.
- Cooper G.M and Hausman R.E 2007 (Fourth Edition). The Cell molecular approach Sinauer associate, Inc, Suderland (USA).
- De Robertis and De Robertis 2005 (Eight edition) (Indian) Cell and Molecular Biology, Lippincott Williams, Philadelphia. [B.I Publications Pvt. Ltd. New Delhi].
- Gerald Karp 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and ScneIne., USA.
- Gupta P.K Cell and Molecular biology Rastogi Publications.
- Gupta P.K, Cytogenetics Rastogi Publications.
- Krishnamurthy, K.V 2000. Methods in Cell Wall Cytochemistry. CRC Press, Boca Raton, Florida.
- Lewin, B. 2000. Gene VII. Oxford University Press, New York, USA.
- LodishEtal 2004 (Fifth Edition). Molecular Cell Biology, W H Freeman and company, New York.
- Powar C.B 2005 (Third Edition). Cell Biology, Himalaya Publishing, Mumbai.

Outcome:-

- To learn the biochemical nature and types of nucleic acids, their functions in living systems.
- To understand the process of proteins synthesis in prokaryotes and eukaryotes.
- To know the protein targeting to organelles.
- To obtain knowledge about mutation
- To know gene regulation in prokaryotes and eukaryotes.
- To construct the molecular map of genome (RFLP, RAPD, AFLP, VNTRs).
- To construct restriction mapping of DNA and measure DNA content of a cell.
- To study of chromosomal manipulation for obtaining a desire characters and improve quality in crops.

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   vi. Seminar (Power point presentation) in any one of the paper (20 marks)
   vii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   viii. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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M.Sc. – BOTANY SEMESTER – II

SESSION - 2025-2026

PAPER – IV (Course Code- MBO204)

PLANT METABOLISM

M.M. – 80 **Min. - 16**

UNIT - I

- **Photochemistry & photosynthesis:**
  - General concepts & historical background.
  - Evolution of photosynthetic apparatus, photosynthetic pigments & light harvesting complexes.
  - Photooxidation of water, mechanism of electron & proton transport (Hill reaction).
  - Carbon assimilation- the Calvin cycle, C4 cycle, CAM pathway.
  - Photorespiration & its significance.
  - Biosynthesis of Starch & Sucrose.

UNIT – II

- **Respiration & Lipid Metabolism:**
  - Overview of Plant respiration, Glycolysis, TCA cycle, electron transport & ATP synthesis, Pentose Phosphate pathway,
  - Glyoxalate pathway,
  - Alternative Oxidase system,
  - Structure & function of lipids fatty acid biosynthesis, synthesis of membrane lipids, structure lipids & storage lipids & their catabolism.

UNIT– III

- **Nitrogen & Sulphur Metabolisms:-**
  - Biological Nitrogen fixation. Nodule formation & Nod factors.
  - Mechanism of Nitrate uptake & reduction, ammonium assimilation. Nitrate and ammonium assimilation; amino acid biosynthesis. Sulphur uptake, transport & assimilation.
  - Secondary metabolites - Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.

UNIT – IV

- **Sensory Photo-Biology :-**
  - Sensory photobiology - Structure, function and mechanisms of action of Phytochromes, Cryptochromes and Phototropins. Photophysiology of light induced responses.
  - The flowering process: Photoperiodism & its significance, vernalization - floral induction & development genetic & molecular analysis. Flowering as a multi-organ function, floral induction, evocation and development. Regulation of flowering by light and temperature.

Role of circadian rhythm. Involvement of hormones. Genetic, molecular and biotechnological aspects, manipulation of flowering and floriculture.

- Endogenous clock & its regulation.

Laboratory Exercise

- Extraction and separation of chloroplast pigments by chemical method by separating funnels.
- Separation of chloroplast pigments by Paper chromatography.
- Separation of plant pigments by Column chromatography.
- To demonstrate Hill's reaction.
- Separation of amino acids by Paper chromatography.
- To determine the rate of photosynthesis under different concentration of CO2 / different light intensity / different colors of light.
- Demonstration of fermentation by Kuhne's vessel.
- To determine RQ by Ganong'srespiroscope/ Hare's respiroscope.
- Protein test by Xanthoproteic reactions / Million's reaction.
- Demonstration of Catalase activity / Peroxidase activity / Dehydrogenase activity / Amylase activity.

Recommended Books

- Cell Physiology by Giese.
- Plant Physiology by Bidwell.
- Plant Physiology by Subhash Chandra Dutta.
- Plant Physiology by Noggle and Frutz.
- Plant Physiology by Devlin.
- Plant Physiology by Taiz and Zeiger.
- Photosynthesis by Robinowitch and Govindjee.

Outcome:-

- Students understand the the rate of photosynthesis influence the productivity of agricultural crops. It ensures that all living species have access to oxygen in the atmosphere and their effects in global concerns.
- Through this units Nitrogen and Sulfur are essential nutrients for plants, and their metabolism is crucial for various physiological processes and overall plant growth and development.
- Students understand the phytochrome system to sense the change of season. Photoperiodism is a biological response to the timing and duration of day and night. It controls flowering, setting of winter buds, and vegetative growth. Detection of seasonal

changes is crucial to plant survival.

- With the help of plant respiration units' students understand, the metabolism in plants of organic molecules using enzymes to generate usable energy in the form of adenosine triphosphate (ATP). Through these units students understand importance of respiration in plants is crucial for their survival, growth, and overall metabolism. Respiration in plants refers to the process by which cells break down organic molecules (such as sugars) to release energy in the form of ATP (adenosine triphosphate).
- Outcome of the flowering process in plants is the production of flowers, which are the reproductive structures of angiosperms (flowering plants). Flowering plants undergo a series of developmental stages to produce flowers, which are crucial for sexual reproduction. Students understand this chapter flowering process is fundamental to the reproductive success and survival of flowering plants, contributing to biodiversity and ecosystem stability.
- Plants require an endogenous regulatory network and mechanism to cope with diurnal environmental changes and compensate for their sessile nature. Plants use the circadian clock to anticipate diurnal changes.

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2018-19. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :

Q.1 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**

Q.2 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**

Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Internal Assessment Examination will be as follows:
   i. Internal Test in each paper (20 marks)
   ii. Seminar (Power point presentation) in any one of the paper (20 marks)
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7.	Subject expert from other Department	Dr. Divya Minz (Department of Zoology, Govt. V.Y.T. PG. Autonomous College Durg C.G.)	

SYLLABUS AND MARKING SCHEME FOR M.Sc. (BOTANY)

THIRD SEMESTER

Session: 2025 -2026

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I CC- MBO301	Plant Development and Plant Resources	80	16	20	04	05
II CC- MBO302	Plant Ecology	80	16	20	04	05
III CC- MBO303	Plant Biotechnology	80	16	20	04	05
IV CC- MBO304	Elective – I &II 1. Microbial Ecology 2. Ethnobotany	80	16	20	04	05
V	Lab Course I - based on paper I and II	100	33			04
VI	Lab Course II - based on paper III and IV	100	33			04
	Total	520		80		28

CC – Course Code

04 Theory papers	-	320
04 Internal Assessments	-	80
02 Practical	-	200
Total Marks	-	600

Note: 1. 20 marks = 01 credit in Theory Papers and 25 Marks = 01 Credit in Practical/Project work

M.Sc. (BOTANY) SCHEME 2025-2026 SEMESTER –III, LAB COURSE

LAB COURSE-1 (4 Hrs)	**100**
Part – I Practical based on Plant Development And Plant Resources	20
Part – II Exercise based on Plant Ecology	30
Part – III Spotting	15
Part – IV Field Study	15
Part – V Viva- Voce	10
Part – VI Sessional	10

LAB COURSE-2 (4 Hrs)	100
Part – I Exercise based on Plant Biotechnology	30
Part – II Exercise based on Microbial ecology/Ethnobotany {Elective – I}	30
Part – III Spotting/ field study	20
Part – IV Viva- Voce	10
Part – V Sessional	10

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M.Sc. – BOTANY SEMESTER – III

SESSION – 2025-2026

PAPER – I (Course Code- MBO301)

PLANT DEVELOPMENT AND PLANT RESOURCES

Max. M. - 80 **Min. M. - 16**

UNIT-I

- **Introduction**: Unique features of plant development.
- **Seed germination and Seedling growth**, metabolism of nucleic acids, proteins and mobilization of food reserves hormonal control of seedling growth.
- **Seed dormancy**, overcoming of seed dormancy, Bud dormancy.
- **Root development**: Organization of root apical meristem (RAM), Vascular tissue differentiation of root, lateral roots, Root hairs, Root microbe interaction.

UNIT-II

- **Shoot Development**: Organization of shoot apical meristem (SAM). Control of tissue differentiation; especially Xylem and Phloem.
- **Secretory ducts and laticifers**,
- **Wood development** – Formation of annual ring, heart wood and sap wood, porous and non porous, autumn & spring wood, periderm, lenticels, tylosis.

UNIT-III

- **Leaf growth and differentiation**: Development; phyllotaxy; differentiation of epidermis (with special reference to stomata and trichome) and Mesophyll.
- **Senescence**, influences of hormones and environmental factors on sensescence.
- **Flower development**: Genetics of Floral organ differentiation: Homeotic mutant in *Arabidopsis* and *Antirrhinum.*

UNIT-IV

- **Plant resources**: Introduction, cultivation and uses of

    - **Food / Fodder crops**: Wheat, Rice, Sugarcane, Berseem, Black gram & Bengal gram.
    - **Vegetable Oil Yielding Crops**: Groundnut and Soyabean.
    - **Fiber Crops:** Cotton and Jute.
    - **Timber And Fire Wood Plants**:
    - Sal, Teak, Shisham, Deodar, Pines,
    - Babul, Amaltas, Emli, Bija, Jamun.
    - **Non Wood Forest Products (NWDPS):** Bamboos, Gums & Dyes (Sindoori, Heena).

Laboratory Exercise

- Study of alternate, opposite, opposite and superposed, opposite and decussate, spiral leaf arrangement.
- Microscopic examination of V.S. of leaves (such as Nerium, Maize, Grass) to understand the internal structure of the leaf tissues, trichome and glands etc.
- Study of epidermal peels of leaves of different plants; to study the structure of stomata and stomatal index.
- Microscopic examination of root (monocot, dicot, aerial root {Banyan}, hygroscopic {Vanda root}, assimilatary root {Tinospora}).
- Anatomy of stem (monocot and dicot). Study of stem modification.

{Field Survey}

- Listing of firewood and timber yielding trees of local origin. {Local name, Scientific name, Family, Properties}.
- Study of live or herbarium specimens or other visual materials to become familiar with these resources.
- Micro chemical tests for stored food material.

Recommended Books

- Fahn, A.1982, Plant Anatomy. (3rd Edi.). Pergamon Press, Oxford.
- Tayal, M.S. Plant Anatomy, Rastogi Pub.
- Vashista, P.C. Plant Anatomy, S. Chand.
- Pandey, B.P., Plant Anatomy.
- Chandurkar, Plant Anatomy.
- Emes, J. Plant Anatomy.
- Bendre, A. and Kumar, 2004 A. Rastogi pub. Meerut, India.
- Santra, S.C., Chattergee, T.P. and Das. 2005 A.P. College Botany Practical Vol. II New central pub. India.
- Botany of field crops, J.S. Nanda, P. K. Agarwal.
- Economic Botany in the tropics S. L. Kochhar.
- Hill's economic botany Dr. O.P, Sharma.

Outcome:-

- To understand about life cycle of major group of plants viz. Angiosperms.
- Learn Seed germination,root microbe interaction shoot development.
- Analyse types and development of Wood.
- To know about leaf,stomata and genetics of flower development.
- Learn and analyse useful products of plants and about non wood forest To Products like Bamboo, Gum, and Dyes.

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   - Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
   - Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
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M.Sc. – BOTANY SEMESTER – III

SESSION – 2025-2026

PAPER – II (Course Code- MBO302)

PLANT ECOLOGY I

Max. M. 80 **Min. M. 16**

UNIT-I

- **Ecosystem Organization**:
  - Law of Ecology, Structure – Structure of ecosystem (Abiotic, biotic components & ecological pyramids), Function of ecosystem (Productivity, food chain, food web, Nutrient cycles & Energy flow).
  - Primary production (Methods of measurement, global pattern, controlling factors), Energy dynamics (tropic organization, energy flow pathways, ecological efficiencies).Litter fall and decomposition (mechanism, substrate quality and climatic factors).
  - Global biogeochemical cycles of C, N, P and S mineral cycles (pathways and processes) in terrestrial and aquatic systems.

UNIT-II

- **Ecosystem Management**:
  - Concept (resistance and resilience), Ecological perturbations – Natural (flood, drought, fire, Volcano, landslide, earthquake, & cyclone) and anthropogenic (deforestation, desertification, usage of pesticide, insecticide, chemical fertilizers and plastics, water, air, soil, noise & nuclear pollutions and their impact on plants and ecosystems.
  - Ecology of plant invasion, Environment impact assessment (EIA), Ecosystem restorations.
- **Sustainable development:** Concept, Strategies, Principle and threats of Sustainable development, Causes of unsustainability, Sustainable development-international & national efforts, and Sustainability indicators.

UNIT-III

- **Vegetation development** :
  Concepts of community and continuum, analysis of communities (analytical – Quantitative (frequency, density, abundance, cover and basal area), Qualitative (physiognomy, phenology, stratification, abundance, sociability, vitality & life forms), Synthetic characters (presence & constantance, fiedality, dominance, interspecific associations, index of similarity, species diversity, diversity index).
  Community coefficients, inter specific associations (Positive interaction & Negative interaction), ordination.

- **Statistical Methods**: Measures of central tendency and dispersal; probability distributions (Binomial, Poisson and normal); Sampling distribution; Difference between parametric and non-parametric statistics; Confidence Interval; Errors; Levels of significance; Regression and Correlation; t-test; Analysis of variance; X2 test;; Basic introduction to Muetrovariate statistics, etc

UNIT-IV

- **Vegetation development and Organization:**
  - Temporal changes (cyclic and non cyclic). Types of ecological succession – hydrosere and xerosere, mechanism of ecological succession (relay floristic and initial floristic composition, facilitation and tolerance), change in ecosystem properties during succession. Climax concept in succession – Monoclimax and Polyclimax theory.
  - **Habitat and Niche**: Concept of habitat and niche; niche width and overlap, fundamental and realized niche, resource partitioning, character displacement.
  - **Population Ecology**: Characteristics of a population, Population growth curves, Population regulation, Life history strategies (r and K selection), Concept of metapopulation – Demes and Dispersal, interdemic extinctions, age structured populations.

Laboratory Exercise:

- To determine minimum size and number of quadrat required for reliable estimate of biomass in grassland.
- To compare protected and unprotected grassland using community coefficients (similarity indices).
- To determine relative density of the species in a woodland using point centred quarter method.
- To determine relative frequency of the species in a woodland using point cantered quarter method.
- To estimate IVI of the species in a woodland using point cantered quarter method.
- To calculate mean, variance, standard deviation, standard error, coefficient of variations and to use t test for comparing two means related to ecological data.
- To find out the relationship between two ecological variables using correlation and regression analysis.
- To find out important grassland species using chi square test.

Recommended Books

- Shukla, R.S. and Chandel P.S. A text book of Plant Ecology including Ethno Botany and Soil Science. S. Chand and Company LTD.
- Dash, M.C., Fundamentals of Ecology, Tata McGraw Hill Company LTD.
- Sharma, P.D., Ecology and Environment, Rastogi Pub.
- Sharma, P.D., Environmental Biology, Rastogi Pub.
- Ambasht, R.S., A text book of Plat Ecology, Dev Jyoti Press, Varanasi.
- Arora, M. P., Ecology, Himalaya Pub. House.
- Tansley, A.G., An introduction to Plant Ecology, Discovery pub. House.

- Kochhar P.L. Plant Ecology, Genetics and Evolution, Jalandher.
- Arora Mohan p., Ecology, Himalaya Pub. House.
- Weaver John E., Clements, E., Plant Ecology, Tata McGreaw Hill Company LTD.
- Odum Eugene, P. Fundamentals of Ecology, W.B. Sauneds Company.
- Kumar, H. S. General Ecology, Vikas Pub. House.
- Mishra, K.C. Manual of Plant Ecology, 3rd Ed. Oxford Pub. Company.
- Rana, S.V.S., Environmental Studies, Rastogi Pub.
- Benjamin cummings, Publication Company, California.
- Chapman, J.L. and Reiss, M.J. 1988. Ecology principles and applications, Cambridge University press, Cambridge, U.K.

Course Outcomes:-

- Through these units students understand ecosystem organization is the establishment of balanced, functional ecosystems that support diverse life forms and provide critical services to both the environment and human populations.
- Describe examples of the ways in which ecology requires the integration of different scientific disciplines.
- Distinguish between abiotic and biotic components of the environment.
- Recognize the relationship between abiotic and biotic components of the environment.
- Through the ecosystem management understand the highlight the holistic and integrated approach of ecosystem management, which considers ecological, social, and economic factors to promote the health and well-being of both natural systems and human communities.
- Students clearly understand between population & community ecology & their significant role in society.
- Through the Ecological succession" students observed process of change in the species structure of an ecological community over time. Within any community some species may become less abundant over some time interval, or they may even vanish from the ecosystem altogether.

Question Paper Format and Distribution of Marks for PG Semester Examination

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Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
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M.Sc. – BOTANY SEMESTER – III

SESSION – 2025-2026

PAPER – III (Course Code- MBO303)

PLANT BIOTECHNOLOGY

Max. M. - 80 **Min. M. - 16**

Unit I

- **Plant cell and Tissue Culture**: General introduction, history, scope, concept of cellular differentiation, cellular totipotency, Organogenesis.
- **Plant Tissue Culture Media:** Types, constituents, Selection of media and media preparation.
- **Callus & Suspension Cultures:** Initiation and Maintenance of callus, Isolation and cloning of single cell, Single cell culture, suspension culture, cell viability test and application.
- **Clonal Propagation:** (Micropropagation) – Shoot tip culture, Apical meristem culture, production of virus free plant, somaclonal variations.

Unit II

- **Embryogenesis in Plant Tissue Culture:** Somatic embryogenesis, Embryo culture & embryo rescue, Artificial seed production.
- **Haploid Plant Generation:** Androgenesis, Anther and Pollen culture, ovary culture
- **Somatic Hybridization:** Methods of Protoplast isolation, and fusion, production of hybrid and cybrid plants, identification and selection of hybrid cell, regeneration of hybrid plants; possibilities, limitations and application.
- **Plant secondary metabolites Production**: secondary metabolites, Pathway and mechanisms, media composition, factors consideration for Production of secondary metabolites/natural products:

Unit III

- **Plant transformation technology**: Basis of tumor formation, Hairy root, Agrobacterium, Features of Ti & Ri plasmids, Use of Ti & Ri plasmids as vectors, Mechanism of DNA transfer.
- **Chloroplast transformation:** vectors for chloroplast transformation, chloroplast transformation method, advantages, limitation of chloroplast transformation.
- **Transgenic Plant Production:** Herbicide resistance. Insect resistence, Virus resistance: Disease resistance, Transgenic plants as bioreactors, biodegradeable plastic, production of edible vaccine, therapeutic proteins. Transgenic plants for quality: Improved storage, longer life, male sterility.
- **Cryopreservation and germplasm storage**: Introduction, Principles of Cryopreservation, Cryopreservation Techniques, Germplasm Collection and Preparation, Cryopreservation Protocols, Quality Control and Monitoring, Applications of Cryopreservation

Unit – IV

- **Drug discovery and Designing:** Introduction, Historical Perspective, Drug Targets and Pharmacological Relevance, Drug Discovery Process, Drug Designing Approaches, Technologies and Tools in Drug Discovery, Challenges and Opportunities, Emerging Trends, Ethical and Regulatory Considerations in Drug Development.
- **Pharmacology:** Introduction, Importance and applications, Pharmacokinetics, Pharmacodynamics, Drug Classes and Classification, Drug Development and Approval Process, Drug Safety and Adverse Effects, Pharmacotherapy, Pharmacogenomics, Drug Abuse and Addiction, Emerging Trends in Pharmacology, Ethical and Legal Issues in Pharmacology.
- **Intellectual Property Rights:** Introduction to IPR, Types of IPR; Patents, Trademarks, Copyrights, Trade Secrets, Industrial Designs, Geographical Indications, International IPR Treaties, IPR in Biotechnology, Economic Impact of IPR, Challenges and Future Trends.

Laboratory Exercise

- Sterilization of glassware, media, instruments, and Surface sterilization of plant material
- Preparation of Murashige and Skoog (MS) medium and various plant tissue culture media
- Induction of callus from various explants (e.g., leaf, stem, root)
- Clonal propagation through axillary bud proliferation and Induction and selection of somaclonal variants
- Isolation and Culture of protoplasts and regeneration of plants
- Induction of haploid plants through anther culture
- Techniques for cryopreservation of plant tissues
- Induction of secondary metabolite production in cultured cells
- Regeneration of complete plants from various explants and Hardening and acclimatization of regenerated plants
- Encapsulation of somatic embryos or shoot tips and Germination of synthetic seeds
- Meristem culture for virus-free plant production

Recommended Books

- Bhojwani, S. S., & Razdan, M. K. (1996). Plant tissue culture: Theory and practice (Revised ed.). Elsevier Science Publishers.
- Bhojwani, S. S. (1990). Plant tissue culture: Applications and limitations. Elsevier Science Publishers.
- Kumar, U. (2002). Methods in plant tissue culture (2nd ed.). Agrobios India.
- Prakash, M., & Arora, C. K. (2003). Cell and tissue culture. Anmol Publications.
- Jogdand, S. N. (n.d.). Industrial biotechnology. Himalaya Publishing House.
- Gupta, P. K. (2003). Elements of biotechnology. Rastogi Publications.
- Singh, B. D. (2005). Biotechnology. Kalyani Publications.
- Dubey, R. C. (n.d.). A textbook of biotechnology. S. Chand Publications.

- Jha, T., & Ghosh, B. (2006). Plant tissue culture: Basic and applied.
- Keshavachandra, R., & Peter, K. V. (2006). Plant biotechnology: Methods in tissue culture and gene transfer.
- Gamborg, O. L., & Phillips, G. C. (2005). Plant, cell, tissue and organ culture.
- Vasil, I. K., & Thorpe, T. A. (2005). Plant cell and tissue culture.
- Clark, A. J. (2013). Principles of Drug Design. Cambridge University Press.
- Choudhary, M. M. I., & Kumar, A. (2019). Drug Design: Principles and Applications. CRC Press.
- Charman, W. N., & Eckhardt, A. (2012). Introduction to Drug Discovery. CRC Press.
- Ahmed, M. (2015). Drug Discovery and Development. John Wiley & Sons.
- Nag, A. (2017). Computer-Aided Drug Design and Delivery Systems. CRC Press.
- Rang, H. P., Dale, M. M., Ritter, J. M., & Flower, R. J. (2021). Rang & Dale's Pharmacology. Elsevier.
- Katzung, B. G., Trevor, A. J., & Kruidering-Hall, M. (2018). Basic & Clinical Pharmacology. McGraw-Hill Education.
- Hitner, H., & Nagle, B. T. (2019). Pharmacology: An Introduction. McGraw-Hill Education.

Course Objectives

This course aims to provide a comprehensive understanding of plant biotechnology, covering topics such as plant cell and tissue culture, media preparation, callus and suspension cultures, clonal propagation, embryogenesis, somatic hybridization, secondary metabolite production, plant transformation technology, cryopreservation, germplasm storage, drug discovery, pharmacology, and intellectual property rights, equipping students with essential knowledge and skills in these areas.

Course Outcomes

By the end of this course, students will be able to:

- Explain the Fundamentals of Plant Tissue Culture: Describe the history, scope, and principles of plant cell and tissue culture, including cellular differentiation and totipotency.
- Prepare and Select Appropriate Media: Identify and prepare different types of plant tissue culture media, understanding their constituents and selection criteria.
- Develop Callus and Suspension Cultures: Initiate and maintain callus cultures, isolate and clone single cells, perform cell viability tests, and apply suspension culture techniques.
- Perform Clonal Propagation: Conduct micropropagation techniques such as shoot tip and apical meristem culture, produce virus-free plants, and recognize somaclonal variations.
- Apply Embryogenesis and Hybridization Techniques: Perform somatic embryogenesis, embryo culture, artificial seed production, protoplast isolation and fusion, and regenerate hybrid plants.
- Produce Plant Secondary Metabolites: Understand the pathways and factors influencing the production of plant secondary metabolites and natural products.

- Utilize Plant Transformation Technologies: Explain the basis of tumor formation, Agrobacterium-mediated transformation, and produce transgenic plants with traits like herbicide and disease resistance.
- Implement Cryopreservation Techniques: Understand and apply the principles and techniques of cryopreservation for germplasm storage, ensuring quality control and monitoring.
- Engage in Drug Discovery and Designing: Explain the drug discovery process, identify drug targets, and utilize various technologies and tools in drug designing.
- Understand Pharmacology Concepts: Describe the importance and applications of pharmacology, including pharmacokinetics, pharmacodynamics, and the drug development process.
- Apply Knowledge of Intellectual Property Rights: Understand different types of IPR, their relevance in biotechnology, and their economic and legal implications.

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2018-19. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
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3. From each Unit, the questions will be asked as follows:

Q.1 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**

Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**

Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.

3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.

Thus, there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.

4. Internal Assessment Examination will be as follows:
   - ix. Internal Test in each paper (20 marks)
   - x. Seminar (Power point presentation) in any one of the papers (20 marks)
   - xi. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   - xii. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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		Dr. Satish Kumar Sen	
		Dr. Shriram Kunjam	
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M.Sc. – BOTANY SEMESTER – III

SESSION – 2025-2026

PAPER-IV {Elective-I} (Course Code- MBO304)

MICROBIAL ECOLOGY

M.M. - 80 **Min. - 16**

UNIT - I

- **Methods in Microbial Ecology:**
  - Methods of cleaning, sterilization (Disinfection, incineration, physical method and chemical method), media preparation (Liquid and solid).
  - Enrichment and isolation methods, pure culture techniques (Pour plate, Streak plate, serial dilution). Identification and quantification (Micrometry).
- **Instrumentation (Principle, Structure and Functions):**
  - Autoclave, Colony counter, Hot air oven, Incubator, Laminar air flow,
  - Microscopy {Light microscope, Bright field microscope, Dark-field microscope, Phase-Contrast microscope, Fluorescent microscope, Electron microscope (Transmission and Scanning), Spectrophotometry.

UNIT - II

Microbial Interaction

- **Clay-Humus-Microbe Interaction.**
- **Plant-Microbe Interaction**:
  - Interaction of above ground part - Destructive associations (diseases) - and beneficial association (symbiosis)
  - Interaction on below ground parts Destructive associations (diseases)
  - Beneficial association {Cyanobacterial (Cyanobacteria with Azolla and cycas)
  - Bacterial- associative symbiont, PGPR, Rhizobium, Actinomycetes, and
  - Fungal symbiosis - Mycorrhiza and their types).
- **Animal-Microbe Interaction**:
  - Destructive association; Neutralism (normal microbiota of human body),
  - Symbiotic association (ectosymbiosis of protozoa, bacteria and fungi with insects and birds, endosymbiosis of bacteria and fungi with birds and insects, ruminant symbiosis).
- **Microbe-Microbe interaction:** Symbiosis, Antagonism, Ammensalism, Competition, Parasitism and Predation.

UNIT – III

Extremophiles – Definition, Introduction, Application and Importance.

- (Acidophiles, Alkalophiles, Halophiles, Psychrophiles, Barophiles, Thermophiles and Hyperthermophiles),

- **Microbes in Human Welfare -**
- **Microorganisms in human nutrition**
- **Biofertilizers** : types, Significance and advantages – Nitrogen fixing, Phospahte biofertilizer, Rhizobium, Azospirillum, Azotobactor, Cyanobacteria, Azolla, and Mycorrhiza
- **Organic Fertilizer** : Type, Advantages and Significance
- **Microbes in industries** : Production of ethanol, Acetone, Citric Acid, Antibiotics, Microbial Enzyme (Amylase, Protease, Lipase)
- **Microorganisms in agriculture** : **Bacteria** :- Arthrobacter, Clostridium
- **Actinomycetes** : Streptomycis,
- **Fungi** : Aspergillus, Mucor, AMF and PGPR
- **Protozoa** : Flagellates, Cilliates, and Amoebae, Nematodes

UNIT – IV

[Soil Microbiology]

- **Soil as a habitat for microorganisms:** Soil quality, Physico-chemical properties of soil (Organic matter; Soil, water &air; Soil microbes: algae, bacteria, actinomycetes, bacteriophages, protozoa, nematode and fungi).
- **Rhizosphere and rhizoplane microorganisms**,
- **Organic matter decomposition:**
  - Composition of litter (cellulose, hemi cellulose, lignin, water soluble components, ether and alcohol, soluble components and proteins)
  - Microorganisms associated with organic matter decomposition (cellulose decomposers, hemicellulose decomposers, lignin decomposers);
  - Factors affecting organic matter decomposition (litter quality, temperature, aeration, soil pH, inorganic chemicals, moisture);
- **Biogeochemical cycling:** Carbon cycle, Nitrogen cycle (nitrogen fixation, ammonification, nitrification, denitrification); Phosphorous cycle, Sulphur cycle.

Laboratory Exercise

- Methods in Microbial Ecology.
- Calibration of microscope: determination of dimensions of microorganisms (micrometery)
- Cultivation media for autotrophic and heterotrophic microorganisms (cleaning of glasswares, mineral media, complex media, solid media, sterilization).

- Isolation of microorganisms: spread plate/pour plate method/streaking on agar plates&preservation.
- Microscopic observation of root colonization by VAM fungi.
- Isolation of *Rhizobium* from soil/root nodules.
- Isolation and enumeration of rhizospheric microorganisms. Estimation of R:S ratio and assessment of Rhizospheric effect.
- Demonstration of bacterial antagonism.
- Isolation and enumeration of fungi from soil.
- Isolation of bacteria from soil.
- Demonstration/Isolation and identification of Cyanobacteria from soil.
- Soil Test.

Recommended Books

- A text book of Microbiology, R.C. Dubey and D.K. Maheshwari.
- Microbiology and Plant Pathology, P. D. Sharma.
- Microbiology. M. Pelczar, Chan and Krieg.
- A text book of Microbiology. R.M. Johri, Snehlata.
- Experiments in Microbiology, Plant Pathology and Biotechnology.

Outcome:-

- Know about genetic microbial technique for isolation of pure culture techniques.
- Master aseptic techniques and be able to perform routine culture effectively.
- Know various culture media and their applications and also understand means of sterilizations.
- Comprehend various methods for identification of unknown microorganisms. Demonstrate theory & practical skill of various instruments and microscopy.
- Understand the various microbial interaction specially mycorrhiza, root nodules. Conceptual basis for understanding the human body's normal micro flora.
- Understand various biogeochemical cycles. Students will be able to demonstrate concept of Bio-fertilizer, Bio-pesticides and their applications.

Question Paper Format and Distribution of Marks for PG Semester Examination

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III & IV. The following are the main points of the new format:

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Q.1 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**

Q.2 Very short answer type question
(Answer in one or two sentences) **(02 Marks)**

Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**
Short (1 Question) 200-250 words	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**
Long answer (1 Question) 400-450 words	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**

Note:

1. Question no. 1 and Question 2 will be compulsory.
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GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE, DURG (C.G.)

M.Sc. – BOTANY SEMESTER – III

SESSION – 2025-2026

PAPER-IV {Elective-II} (Course Code- MBO304)

ETHNOBOTANY

M.M. – 80 **Min. - 16**

Unit I

Ethnobotany: Introduction, concept, scope and objectives.Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context. Major and minor ethnic groups or tribals of Chhattisgarh and their life styles. (Gond and Baiga)

Unit II

Role of ethnobotany in primary health care Programmes

Ethno botany in India retrospect's & prospects in India -

Plants used by the tribals-

(a) Food plants

(b) Intoxicants and beverages

(c) Resins, oils and miscellaneous uses

(d) Sacred plants

Unit III

Indigenous System of medicines in india.

Ethnobotany on Development and Conservation on bio resources.

Methodology of ethnobotanical studies:

(a) Field work

(b) Herbarium

(c) Ancient Literature

(d) Archaeological findings

(e) Temples and sacred places

Unit IV

Ethnobotanical study of following plants with special reference to their medicinal importance

(a) *Azadirachta indica* (Neem)

(b) *Emblica officinalis* (Amla)

(c) *Ricinus communis* (Andi)

(d) *Madhuca indica* (Mahua)

(e) *Cassia fistula* (Amaltash)

(f) *Ficus religiosa* (pipal)

(g) *Oscimum sanctum* (Tulsi)

(h) *Asparagus recemosus* (Satavar)

(i) *Aloe vera* (Ghritkumari)

(j) *Andrographis paniculata* (Bhuineem)

Laboratory Exercises-

- Description and identification of medicinal plants and its medicinal properties
- Preparation of medicinal plants herbarium and photograph
- Herbal preparation –
  a. Extract of Tulsi leaves.
  b. Ointment from Neem leaves
  c. Ayurvedic Tooth powder
  d. Amla Churna
  e. Face pack preparation from various herbs
- To cultivate at least 2 medicinal plants in earthen pots.

Suggested Readings:

- Baker H. G. 1978.Plants and civilization (3rd Edition) C. A. Wadsworth, Belmont.
- Chandel, K. P. S.,Shukla , G. & Sharma, N. 1996. Biodivrsity in medicinal and Aromatic plants in india. Conservation & Utilization. National Bureau of Plant Genetic Resources, New Delhi.
- Ambasta S. P. (ed) (1986). The useful plants of india. Publication & information Directorate, CSIR, New Delhi. India.
- Anon, (1978). The tribes of Madhya Pradesh, Dept. of tribal Welfare, Govt. of M. P.
- Cotton, C.M., (1996). Ethnobotany, Principals and Applications, John Willey & Sons,Chichester, New York.

Outcome:

The study of ethno medicine is concerned with the study of the traditional medical system from the indigenous point of view. The ethno medical approach proves particularly useful for the study of indigenous therapeutic agents that enables to understand the healing practices according to indigenous explanatory models and its correlation to the modern medicine or allopathy. Ethno medicine will strengthen our understanding of the issues relating to tribal problems and development.

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   - vi. Seminar (Power point presentation) in any one of the paper (20 marks)
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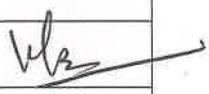
		2. Dr. N.B. Singh (Govt. N.PG. Science College Raipur C.G.)	
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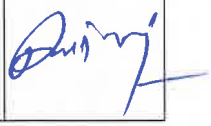
7.	Subject expert from other Department	Dr. Divya Minz (Department of Zoology, Govt. V.Y.T. PG. Autonomous College Durg C.G.)	

SYLLABUS AND MARKING SCHEME FOR M.Sc. (BOTANY)

FOURTH SEMESTER

Session: 2025-2026

Paper No.	Title of the Paper	Marks Allotted in Theory		Marks Allotted in Internal Assessment		Credits
		Max	Min	Max.	Min.	
I CC- MBO401	Plant Reproduction & Utilization of Resources	80	16	20	04	05
II CC- MBO402	Plant Ecology – II (Pollution & Biodiversity Conservation)	80	16	20	04	05
III CC- MBO403	Genetic Engineering	80	16	20	04	05
IV CC- MBO404	Elective – I &II 1. Microbial Ecology 2. Ethnobotany	80	16	20	04	05
V	Lab Course I	100	33			04
VI	Lab Course II/Project work	100	33			04
	Total	520		80		28

CC- Course Code

04 Theory papers	-	320
04 Internal Assessments	-	80
02 Practical	-	200
Total Marks	-	600

Note: 1. 20 marks = 01 credit in Theory Papers and 25 Marks = 01 Credit in practical/Project work

GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE, DURG (C.G.)
M.Sc. (BOTANY), SESSION - 2025-2026
PRACTICAL SCHEME, SEMESTER – IV LAB COURSE

LAB COURSE - 1(6 Hrs)	**Max. M. 100**
Part – I Plant Reproduction	**15**
Part – II Plant Resource Utilization and Conservation	**15**
Part – III Exercise based on Genetic Engineering	**15**
Part – IV Exercise based on Microbial Ecology	**15**
Part – V Spotting/	**10**
Part – VI Field study	**10**
Part – VII Viva- Voce	**10**
Part – VIII Sessional	**10**
LAB COURSE - 2 Project (to be evaluated by external examiner)	**100**

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M.Sc. – BOTANY SEMESTER – IV

SESSION - 2025-2026

PAPER – I (Course Code- MBO401)

PLANT REPRODUCTION AND UTILIZATION OF RESOURCES

Max. M. - 80 **Min. M. - 16**

UNIT-I

- **Reproduction**: Methods of Vegetative propagation.
- **Pollination** – pollination – Mechanism and vector
- **Pollen - pistil interaction and Self-incompatibility**.
- Structure of pistil, Pollen stigma interaction, Saprophytic and Gametophytic self incompatibility
- **Fertilization**: Double fertilization, *in-vitro fertilization.*

UNIT-II

- **Male gametophyte**: Structure of anther & development of microsporangium and microsporogenesis, Role of tapetum. Pollen germination, Development of male gametophyte. Pollen storage, Pollen allergy.
- **Female gametophyte**: Structure of Ovule & development of megasporangium, megasporogenesis, Organization of embryo sac and Structure of mature embryo sac cells.

UNIT-III

- **Seed and Fruit development**:
  - **Endosperm** – development and types of endosperm, Xenia and Metaxenia, Mosaic and ruminate endosperm, function and morphological nature of endosperm.
  - **Embryogenesis** – development of dicot and monocot embryo, nutrition of embryo.
  - **Polyembryony**–types and significance of polyembryony.
  - **Apomixes** – types and significance of apomixes.
  - Endospermic &non-endospermic seeds, Dynamics of fruit growth and fruit maturation.

UNIT-IV

- **Utilization of resources**:
  - Plants Used As Avenue Trees**:** For Shade, Pollution control and aesthetics. {Banyan Tree, Neem, Karanj, Peepal, Siris, Saptparni, Amaltas, Gulmohar, Kadam, *Kachanar.*
  - General information about ethanobotanically important plants of Chhattisgarh.
  - Medicinally and aromatic important plants of Chhattisgarh
    - Aloe, Giloey, Gurmar, Satawari, Kirayat.
    - Tulsi, Dauna, Lemon grass, Mint, Sewanti.

Laboratory Exercise

- Study the structure of pollen grain {eg.*Brasica, Hibiscus, Datura, Tridex, Thevesia, Ipomea, Solanum xanthocarpum*}.
- Study the different types of placentation (Axile, Basal, Marginal Pariental, Free central) {eg. Pea, Hibiscus, Brasica, Sunflower, Dianthus}.
- Isolation of mature embryo from Dicot and Monocot seed {Maize and Gram}.
- Study the types of pollination in saliva and Vallisneria, Calotropis.
- Study of Endospermic and nonendospermic seeds.
- Study of live or herbarium specimens or other visual materials to become familiar with these resources.
- Botanical characters and their chief constituent of medicinal and aromatic plants.
- Survey of avenue trees (Local) {Identification, Size, Canopy shape, Status and their other uses}.

Recommended Books

- Bhojwani, S.S. and Bhatnagar, S.P. 2000.The Embryology of Angiosperm. 4th Ed.vikas Pub. House. N. Delhi.
- Shivanna, K.R. and Johri, B.M. 1985.The Angiosperm Pollen: Structure and Function. Wieley Eastern Ltd. New York.
- Maheshwari P.An introduction to the Embryology of Angiosperm.Tata Mc. Graw Hill Pub. Company LTD. New Delhi.
- Dawara, G.P. and Sharma S.K., Introductory Embryology, Jaiprakash nath and Company, Meerut.
- Singh, Pandey and Jain, Structure and Development of Angiosperm, Rastogi Pub
- Proctor. And Yeo, P. 1973. The Pollination of Flowers, William Collins, London.
- Raghavan V. 1997. Molecular Embryology of Flowering Plants. Cambridge University, Press, Cambridge.
- Medicinal Plants S. C. Joshi.
- The spirit of beautiful trees Raju.

Outcome:-

- To understand various methods of vegetative reproduction such Air Layering, Budding, Grafting.
- Significance of double fertilization in Angiosperms.
- They know about allergies from pollen grains and pollen storage.
- Learn about endosperm, embryo, Polyembryony and seedless fruits.
- Analyze importance of Avenue trees and uses of medicinal plants.
- Learn about Biodiversity of Ethnobotanical Plants of Chhattisgarh.

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2018-19. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows :
   - Q.1 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
   - Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
   - Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
4. Internal Assessment Examination will be as follows:
   i. Internal Test in each paper (20 marks)
   ii. Seminar (Power point presentation) in any one of the paper (20 marks)
   iii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   iv. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

Name and Signatures of Members Board of Studies

S. No.	Category	Name of Nominated Members	Signature
1.	**Chairperson**	**Dr. G. S. Thakur**	
2.	Members	Dr. Vijay Laxmi Naidu	
		Dr. Satish Kumar Sen	
		Dr. Shriram Kunjam	
		Mr. Motiram Sahu	
		Dr. Rajeshwari Prabha Lahare	
3.	Subject specialist	1. Prof. P.C. Panda Retd. Professor Borsi Durg C.G.)	
		2. Dr. N.B. Singh (Govt. N.PG. Science College Raipur C.G.)	
4.	VC Nominated member	Dr. Aruna Shrivastava (Govt. D.B. Girls PG College Raipur C.G.)	
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6.	Ex Meritorious Student PG	Devika Janghel	
7.	Subject expert from other Department	Dr. Divya Minz (Department of Zoology, Govt. V.Y.T. PG. Autonomous College Durg C.G.)	

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M.Sc. – BOTANY SEMESTER – IV

SESSION - 2025-2026

PAPER – II (Course Code- MBO402)

PLANT ECOLOGY – II (POLLUTION & BIODIVERSITY CONSERVATION)

Max. M. – 80 **Min. M. - 16**

UNIT-I

- **Climate, Soil and Vegetation Patterns of the India:**
  - Climate of India. Life zones (Fresh & marine water),
  - World Major Biomes – Terrestrial and Aquatic biomes (Fresh & Marine water).
  - World Major Vegetation types – forest and grassland vegetation.
  - Soil, Soil genesis, Classification, Texture, Structure, Profiles and types of the India.
  - Biogeography: - Theory of island biogeography, Biogeographical zones of India.

UNIT-II

- **Pollution, climate change and ecosystems:**
  - Air, water and soil Pollution: - kinds, sources, Air quality parameters – C, S, Nitrogen compounds, Acid rain, Ozone, Fluorides, Hydrocarbons, Metals, Particulate Matter (PM), Aerosols & Toxicants. Water quality parameters – DO, BOD, COD, Turbidity, Nitrate, Chlorides & Phosphates, effects on plants & ecosystem.
  - Green house gases (Carbon dioxide, methane, nitrous oxide, Chloro-fluorocarbons: sources, trends and role).
  - Ozone layer, ozone hole, consequences of climate change, (global warming, sea level, UV radiation).

UNIT-III

- **Biological diversity:**
  - Concepts and levels, status, monitoring and documentation in India, Utilization and concerns, major drivers of biodiversity change, biodiversity management approaches. Role of biodiversity in ecosystem functions & stability. Diversity index (Shannon Weavers, Margalf, & Pilou's Methods).
  - IUCN categories of threat, distribution and global patterns, Hot Spots in India and world.
  - World centers of primary diversity of domesticated plants: The Indo Burmese center, plant introductions and secondary centers,
  - Bio-Diversity index (Shannon Weavers, Margalf, & Pilou's Methods)

UNIT-IV

- **Conservation strategies:-**
  - **Conservation Biology:** Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).
  - In situ conservation, International efforts and Indian initiatives, protected areas in India - sanctuaries national parks, biosphere reserves, Wetlands, Mangroves and coral reefs for conservation of wild biodiversity.
  - Ex situ conservation: Principles and practices, botanical gardens, field, general account of the activities of Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources (NBPGR), Indian Council of Agriculture Research (ICAR), Council of Scientific and Industrial Research (CSIR) for conservation and non-formal conservation efforts.

Laboratory Exercise

- Visit NBPGR, BSI, CSIR & ICAR, Recognized Botanical Gardens and Museum.
- To determine soil moisture content, porosity and bulk density of soil collected from varying depths at different locations.
- To determine the water holding capacity of soils collected from different locations.
- To determine percent organic carbon and organic matter in the soils of cropland, grassland and forest.
- To estimate rate of carbon dioxide evolution from different soils using soda lime or alkali absorption method.
- To estimate the dissolved oxygen content in eutrophic and oligotraphic water samples by azide modification method.
- To estimate chlorophyll content in sulphur dioxide fumigated and unfumigated plant leaves.
- Field survey of a part of town or city to make the students aware of the diversity of plants in urban ecosystems.
- Scientific Visit
- A protected area, A wetland, A Mangrove.

Recommended books:

- Magurran, A.E. 1988. Ecological diversity and its measurement, Chapman and Hall. London.
- APHA-AWWA-WPCF Standard methods for the examination of water and waste water, American public health association, Washington, D.C.
- Moore, P.W. and Chapman, S.B. 1986. Methods in plant Ecology, Blackwell scientific publications.

- Treshow, M. 1985. Air pollution and plant life, Wiley interscience.
- Mason C.F. 1991. Biology of fresh water pollution, Longman.
- Hill, M.K. 1997. Understanding Environmental pollution, Cambridge university press.
- Kothari, A. 1997. Understanding Biodiversity: Life sustainability and Equity, Orient Longman.
- Paroda, R.S. and Arora R.K. 1991. Plant resources conservation and management, IPGRIP USA Campus, New Delhi.
- Heywood, V.H. and Watson, R:T. 1995. Global biodiversity assessment, Cambridge University press, Cambridge, U.K.

Outcome:-

With the Study the pollution & pollution control students understand two specific concepts served as the basis for the control approach:-

- The assimilative capacity concept, which asserts the existence of a specified level of emissions into the environment which does not lead to unacceptable environmental or human health effects.
- Principle of control concept, which assumes that environmental damage can be avoided by controlling the manner, time and rate at which pollutants enter the environment.
- Application of appropriate technologies is based on a systematic analysis of the source and nature of the emission or discharge in question, of its interaction with the ecosystem and the ambient pollution problem to be addressed, and the development of appropriate technologies to mitigate and monitor pollution impacts.
- Students will help understand the conservation of plant biodiversity. It is important issue concerning the human population worldwide. The anthropogenic pressure, the introduction of alien species, as well as domesticated species and chronic weed infestation have dramatic effects on plant diversity, which is reflected in an increase in the number of threatened species.
- Students understand Plant biodiversity is a natural source of products to the medical and food industries & their significant value for breeding programs and for developing more productive crops and more resistant plants to biological and environmental stresses

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Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**

Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**

Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**	**2 x 2 = 4 Marks**
Short (1 Question) 200-250 words	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**	**1 x 4 = 4 Marks**
Long answer (1 Question) 400-450 words	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**	**1 x 12 = 12 Marks**

Note:

1. Question no. 1 and Question 2 will be compulsory.
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3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.
   Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.
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   v. Internal Test in each paper (20 marks)
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   vii. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)
   viii. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

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M.Sc. – BOTANY SEMESTER – IV

SESSION - 2025-2026

PAPER – III (Course Code- MBO403)

GENETIC ENGINEERING

Max. M. - 80 **Min. M. - 16**

UNIT I

- **Nucleic Acid Purification:** Technique applied for isolation of Total Bacterial cell DNA, Plasmid DNA, Bacteriophage DNA, and Plants Genomic DNA. Electrophoresis for Analysis of bands.
- **Molecular Tools:** Template dependent DNA polymerase, Nucleases, Restriction Endonuclease (Nomenclature, Types, Mechanism of action with examples), End modification enzymes, DNA ligases. Primers, linkers and adaptors, Chemical synthesis of Gene, their importance in genetic engineering.
- **Vectors:** Properties, Types (Plasmid, Cosmid, Phagemid, M13 vector, Shuttle vector, YAC, BAC, Bacteriophage vector), Cloning vs Expression vectors, Methods for development of competent host for vectors.
- **Transformation Techniques:** General consideration for DNA Transformation, Introduction of DNA into host cells (in Plant and Bacterial cell), Natural gene Transfer method, Vector Mediated Method, Vectorless method Chemical and physical method.

UNIT II

- **Screening and Selection of Recombinant Clone:** Selectable and screenable marker. Selection of transformed bacterial cells, beta galactosidase gene complementation, Blue-white screening, Recombinant screening; Insertional inactivation, Red-white selection.
- **cDNA Library and Genomic Library:** General concept and components, construction and screening of libraries; colony and plaque hybridization, Application.
- **Polymerase Chain Reaction:** Requirements, General process, Types and applications.
- **DNA Sequencing**: Chain termination method, Automated sequencing, Sequencing enzyme, Chemical degradation method, Pyrosequencing method. Next generation sequencing technology.

UNIT III

- **Site Directed Mutagenesis:** Non-PCR based; Cassette mutagenesis, Primer extension mutagenesis, PCR Based; Overlap extension method, Megaprimer PCR, Inverse PCR, Application.
- **Genome Mapping & DNA Profilling:** Genetic marker, Types of DNA Marker; RFLP, RAPD, AFLP, SSLP, SNPs, Physical mapping; Restriction mapping, STS mapping. DNA

fingerprinting.

- **Gene Silencing:** Mechanisms of Gene Silencing, Transcriptional Gene Silencing (TGS), Post-Transcriptional Gene Silencing (PTGS), RNA Interference (RNAi), siRNA and miRNA, Gene Silencing in Plants, Gene Silencing Technologies, Applications of Gene Silencing.
- **DNA Microarray:** Types of DNA Microarrays, Mechanisms and Applications of DNA Microarrays.

UNIT IV

- **Assays:** Electrophoretic mobility Shift Assay, Footprinting assay, Phage Display, Yeast two-hybrid assay, Transcript analysis and their applications.
- **CRISPR/Cas System:** General Mechanism. Types of CRISPR/Cas9 System, CRSIPR/Cas9 and targeted genome editing, Regulation for CRISPR/cas-9 technology, Applications of CRISPR/Cas System.
- **Bioinformatics:** NCBI Data Model, Biological Database, Information retrieval from biological database, Submitting DNA sequence to the database, Sequence alignment, Genebank.

Recommended Books

- Old, R. N., & Primrose, S. B. (1994). Principles of gene manipulation.
- Winnaeker, E. L. (1987). From genes to clones.
- Watson, J. D., Witreowski, J., Gilman, M., & Zoller, M. (1992). Recombinant DNA.
- Nicholl, D. S. T. (n.d.). An introduction to genetic engineering.
- Pasternak, J. J. (1996). Molecular biotechnology.
- Adams, R. L. P., Knowler, J. T., & Leader, D. P. (1996). The biochemistry of nucleic acids.
- Janke, K. S. (1998). Genetic engineering.
- Baxevanis, A. D., & Ouellette, B. F. F. (Eds.). (n.d.). Informatics: A practical guide to the analysis of genes and proteins (2nd ed.).
- Lesk, A. M. (n.d.). Introduction to bioinformatics. University of Cambridge.Bioinformatics and Drug Discovery; Richard S. Larson.

Laboratory Exercise

- Isolation of plasmid DNA.
- Restriction map of plasmid DNA.
- Restriction mapping of Bacterial genomic DNA
- DNA finger printing.
- PCR based experiment. (AFLP. RAPD)
- Ligation of DNA.

- Gene expression in *E. coil* and analysis of gene product.
- DNA end labeling
- Random primer labeling
- Gene amplification and Cloning of amplified product
- Literature mining using pubmed central
- Literature mining using Medline
- Retrieving Protein and DNA Sequences using Entrez at NCBI
- Retrieving Protein and DNA Sequences using SRS at EBI
- Nucleotide BLAST – Search nucleotide database using nucleotide query
- Protein BLAST – Search Protein database using protein query
- Multiple Sequence Alignment – CLUSTALW.

Course Objectives:

This course equips students with essential skills in nucleic acid purification, molecular tools, and genetic engineering. It covers DNA/RNA isolation, vector properties, transformation methods, recombinant clone screening, cDNA/genomic library construction, PCR, DNA sequencing, gene silencing, mutagenesis, genome mapping, DNA profiling, and DNA microarrays. Advanced topics like CRISPR/Cas genome editing and bioinformatics are included, preparing students for practical applications in molecular biology research.

Course Outcomes:

- Proficiency in Nucleic Acid Purification: Students will be able to perform DNA and RNA isolation techniques and analyze electrophoresis results.
- Application of Molecular Tools: Students will demonstrate the use of molecular tools in genetic engineering, understanding their mechanisms and applications.
- Vector Utilization and Transformation Techniques: Students will understand the properties and types of vectors and apply various transformation techniques in genetic engineering.
- Competency in Screening and Selection: Students will be proficient in screening and selecting recombinant clones using various markers and screening methods.
- Library Construction and Application: Students will be capable of constructing and screening cDNA and genomic libraries and applying these techniques in molecular biology research.
- PCR and Sequencing Techniques: Students will have a thorough understanding of PCR processes and DNA sequencing methods, including their applications in research and diagnostics.
- Gene Silencing and Mutagenesis Applications: Students will comprehend the mechanisms of gene silencing and apply site-directed mutagenesis techniques in

genetic studies.

- Genome Mapping and DNA Profiling Skills: Students will be able to perform genome mapping and DNA profiling, understanding their significance in genetic research.
- Utilization of DNA Microarrays: Students will be skilled in using DNA microarrays for various applications, including gene expression analysis.
- Advanced Assays and CRISPR Technology: Students will be familiar with advanced assays and the CRISPR/Cas system, applying these techniques in genome editing and bioinformatics analysis.
- Students will be proficient in utilizing bioinformatics tools, including understanding the NCBI data model, navigating biological databases, retrieving information, submitting DNA sequences, performing sequence alignment, and effectively using GenBank for genetic research and data analysis.

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Note:

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	Student PG		
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M.Sc. – BOTANY SEMESTER – IV

SESSION - 2025-2026

PAPER-IV {Elective - I} (Course Code- MBO404)

MICROBIAL ECOLOGY

M. M. - 80 **Min. M. - 16**

UNIT - I

[Water Microbiology]

- **Types of water**: Atmospheric water, Surface water; Stored water (sedimentation, interaction of other microbes, light rays, temperature, food supply), Ground Water.
- **Water microorganisms**, Marine microbiology (estuaries, mangroves, deep sea, hydrothermal vent, saltpans, coral reefs), Fresh water microbiology (ponds, lakes, streams).
- **Microbial analysis of water**: Sanitary test for coliforms. Purification of water: Sedimentation, Filtration, Disinfection.

UNIT – II

[Air Microbiology]

- General introduction to air microflora, droplet nuclei, bioaerosol,
- **Indoor and outdoor aeromicrobiology**: aeromicroflora of pharmacy, aeromicroflora of hospitals and other houses, aeromicroflora of storage materials (library, wall paintings);
- **Aeroallergens and aero allergy**; House dust allergens; Pollen grains; Cosmetics;
- **Assessment of air quality** – Air sampling devices and equipments (impaction, liquid impingement, filtration, electrostatic precipitation and gravity sampling).
- **Phylloplanemicroflora**, Phylloplane pathogens (morphological characters, physiological characters; nutrition. Radiation. pH, temprature), microbial interaction on leaf surfaces.

UNIT – III

[Environmental Microbiology]

- **Waste as a resource:** Organic compost (definition, process of composting, factors affecting composting, microorganisms, soil and organic matter, role of compost).
- **Biogas production**: solubilization, acetogenesis and methanogenesis, mechanism of methane formation.
- **Sewage (wastewater) treatment**: Sewage microorganisms, BOD and COD, Small-scale sewage treatment (Cesspools, septic tanks), large-scale sewage treatment (primary, secondary).
- **Biodegradation**: microbial degradation of petroleum & xenobiotics, common process of insecticidal metabolism (hydrolytic process, reductive and oxidation).

- **Biodeterioration** of materials (cellulose, food stuffs, paints, rubbers, plastics, fuels, lubricants, metals, stone, cosmetics, toiletries structures). Microbial plastics.

UNIT - IV

- **[Plant Diseases -** Pathogen and symptoms]
  - **Bacterial disease** {Citrus canker, Bacterial blight of rice,Scab of potato, Angular leaf spot of cotton, Leaf spot of mango}
  - **Viral diseases** {Leaf curl of papaya, Mosaic of bhindi, Mosiac of Tobacco, Bunchy top of banana}
  - **Fungal diseases** (Downy mildew of peas and Crucifers, Powdery mildews of Sisam, rusts diseases of Wheat and Gram, smuts diseases of Wheat and Barly, wilt diseases of Arhar}.
- **Medical Microbiology-** Pathogen and symptoms**:**
  - **Bacterial disease**: {Diphtheria, Pertussis, Tuberculosis, Pneumonia,Meningitis}
  - **Viral disease**: {Small pox, Chicken pox, Measles, Mumps, Influenza};
  - **Fungal disease**: {Aspergillosis, Blastomycosis, Candidiasis, Cryptococcosis, Histoplasmosis}.

Laboratory Exercise

- Water analysis by SPC method.
- Coliform test for water quality.
- Isolation of aquatic fungi by baiting technique.
- Isolation of aeromicroflora by slide exposure method.
- Isolation of aeromicroflora by petriplate exposure method.
- Isolation of Phylloplanemicrofloraby serial dilution method or Impression method.
- Physical analysis of sewage/industrial effluent by measuring Total Solids, Total DissolvedSolids and Total Suspended Solids.
- Determination of indices of pollution by measuring BOD/COD of different effluents.
- Identify and comments upon the plant diseases as per prescribed syllabus {Bacterial/Viral/Fungal}.

Recommended Books

- Dubey, R.C. and D.K., Maheshwari, A Text Bookof Microbiology.
- Sharma, P.D., Microbiology and Plant Pathology.
- Pelczar M. and Chan, Microbiology.
- Johri, R.M. and Snehlata, AText Book of Microbiology.
- Aneja, K.R., Experiments in Microbiology, Plant pathology and Biotechnology.
- Atlas, Microbial Ecology.

Outcome:-

- Appreciate the diversity of microbes and microbial communities.
- Comprehend the various methods to determine the quality of water.
- Understand the methods employed in waste water treatment.
- Learn the basic principles of infectious disease in plant and human.
- Students will acquire a thorough knowledge about the disease caused by bacteria, virus and fungi.
- Students will be able to know about water portability microbial, bioremediation, waste management, biogeochemical cycling.

Question Paper Format and Distribution of Marks for PG Semester Examination

Question paper format for the Post-Graduate Examination has been revised from the Session 2018-19. The revised format will be applicable for all the question papers of Semester I, II, III & IV. The following are the main points of the new format:

1. The question paper will be of **80 marks** (as before)
2. Questions will be asked Unit-wise in each question paper.
3. From each Unit, the questions will be asked as follows:

Q.1 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
Q.2 Very short answer type question **(Answer in one or two sentences)** **(02 Marks)**
Q.3 Short answer type question **(Answer in 200-250 words)** **(04 Marks)**
Q.4 Long answer type questions **(Answer in 400-450 words)** **(12 Marks)**

Type of Question	Unit-I	Unit-II	Unit-III	Unit-IV
Very Short (2 Questions) (Maximum two sentences)	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks	2 x 2 = 4 Marks
Short (1 Question) 200-250 words	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks	1 x 4 = 4 Marks
Long answer (1 Question) 400-450 words	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks	1 x 12 = 12 Marks

Note:

1. Question no. 1 and Question 2 will be compulsory.
2. Question no. 3 and 4 will consist of 2 optional questions of which one has to be attempted.
3. As mentioned above, two compulsory very short answer type questions (2+2 marks), one short answer type question with internal choice (4 marks) and one long answer type question with internal choice (12 marks) will be asked from each unit.

Thus there will be questions of 20 marks from each unit and of total 80 marks from all the four units of the syllabus/syllabi.

4. Internal Assessment Examination will be as follows:

xiii. Internal Test in each paper (20 marks)
xiv. Seminar (Power point presentation) in any one of the paper (20 marks)
xv. Assignment in each of the remaining papers (excluding the paper of Seminar. (20 marks)

xvi. Average of marks obtained in internal test + seminar in any one paper and marks obtained in internal test + assignment in rest of the papers will be calculated and taken into consideration.

Name and Signatures of Members Board of Studies

S. No.	Category	Name of Nominated Members	Signature
1.	**Chairperson**	**Dr. G. S. Thakur**	
2.	Members	Dr. Vijay Laxmi Naidu	
		Dr. Satish Kumar Sen	
		Dr. Shriram Kunjam	
		Mr. Motiram Sahu	
		Dr. Rajeshwari Prabha Lahare	
3.	Subject specialist	1. Prof. P.C. Panda Retd. Professor Borsi Durg C.G.)	
		2. Dr. N.B. Singh (Govt. N.PG. Science College Raipur C.G.)	
4.	VC Nominated member	Dr. Aruna Shrivastava (Govt. D.B. Girls PG College Raipur C.G.)	
5.	Corporate/ Industrial area Representative	Shri Manish Jain (Apollo College, Durg C.G.)	
6.	Ex Meritorious Student PG	Devika Janghel	
7.	Subject expert from other Department	Dr. Divya Minz (Department of Zoology, Govt. V.Y.T. PG. Autonomous College Durg C.G.)	

GOVT. V.Y.T. PG. AUTONOMOUS COLLEGE, DURG (C.G.)

M.Sc. – BOTANY SEMESTER – IV

SESSION - 2025-2026

PAPER-IV {Elective -II} (Course Code- MBO404)

ETHNOBOTANY

M. M. - 80 **Min. M. - 16**

UNITI

Traditional system of medicine – Brief history of use of medicinal herbs, introduction to indigenous systems of medicine Ayurveda, Unani and Siddha system of medicine. Ethnobotany in relation to national priorities and health care programmes.

UNIT II

Ethnobotanical importance of Bacteria and Fungi, Ethnovaterinary medicines from plants. Major and minor forest products of Chhattisgarh and WFP non-wood forest products, Role of ethnobotany in sustainable development. Ethnobotanical research method - qualitative and quantitative research method.

UNIT III

Ethnobotany in relation to livelihood security, Reference to tribes. Ethnobotanical research done in India. Intellectual Property Rights with particular reference to Traditional knowledge and bio wealth.

UNIT IV

Role of ethnobotany in modern medicine, medico ethnobotanical sources in India – Significance of the following plants in ethnobotanical practices (along with their habitat and morphology), a. *Terminalia arjuna,* b. *Vitex negundo,* c. *Pongamia pinnata* d. *Cassia auriculata,* e. *Indigo pheratinctoria.* Role of ethnobotany in modern medicine with special example of *Rauvolfia serpentina, Withania somnifera, Tinospora cordifolia,Vinca rosea, Moringa oleifera.*

Laboratory Exercises –

- Documentation techniques of Ethnobotanical knowledge
- Field study of forest area or Tribal area.
- Herbal Preparation –

a. Preparation of Triphala.

b. Kwath of Triphala
c. Preparation of diabetes controlled powder
d. Preparation of herbal shampoo
e. Giloy Churn
- To separate active principals from the extract of medicinal plants

Suggested readings:-

- Jain S.K. and Rao R.R. (1971) A handbook of field and herbarium methods. New Delhi, Today and Tomorrow's Printers and publishers.
- Jain S.K. (1989) Methods and approaches in Ethnobotany. Society of Ethnobotanist, Lucknow.
- Vaishnaw T.K. (2004) Chhattisgarh kiAnusuchitJanjatiyan ,Adim Jati Anushandhan Avam PrashikshanSansthan Raipur Prakashankramank 2 pp.1-120.
- Joshi S.G.(2000) Medicinal plants, Oxford & IBH Publishing Co. Pvt.Ltd., New Delhi ,India.
- Kirtikar, K.R.& BasuB.D. (1933-1935),IndianMedicinal plants ,Vol.I to VIII (4 Vols text & 4 Vols. Plates) Reprint 1994, Dehradun U.P.
- Maheshwari, J.K.Ed. (2000) Ethnobotany and Medicinal Plants of Indian Subcontinent Scientific Publishers, Jodhpur.
- MartinG.J. (1995) Ethnobotany Chapman and Hall. London.

Outcome:-

- Ethnobotanical research can provide a wealth of information regarding both past and present relationships between plants and the traditional societies.
- Ethnobotany may also prove an important tool in the search of new pharmaceuticals. In addition to its traditional roles in economic botany and exploration of human cognition, ethnobotanical research may be applied to current areas of study such as biodiversity prospecting and vegetation management.
- It is hoped that, in the future, ethnobotany may play an increasingly important role in sustainable development and biodiversity conservation.

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