GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE

RAJNANDGAON (C.G.)

SYLLABUS & MARKING SCHEME

FOR

M.Sc. BOTANY

Programme Code: MSBOT

YEAR

2025-26

DEPARTMENT OF BOTANY

2025-26

SEMESTER PATTERN

M.Sc. BOTANY

Semester	Course Title	Credit	IA	ESE	Total
I Sem.	Cell biology of plants	4+0+0	20	80	100
	Cytology, genetics, and cytogenetics	4+0+0	20	80	100
	Molecular biology	4+0+0	20	80	100
	Biology and diversity of viruses, bacteria, algae, and fungi	4+0+0	20	80	100
	Lab. Course- I- Cell biology, cytology, genetics, and cytogenetics	0+0+2	-	-	100
	Lab. Course- II- Molecular biology, viruses, bacteria, algae and fungi	0+0+2	-	-	100
II Sem.	Taxonomy & Diversity of Bryophytes, Pteridophytes, and Gymnosperms	4+0+0	20	80	100
	Taxonomy & Diversity of Angiosperms	4+0+0	20	80	100
	Plant growth and development	4+0+0	20	80	100
	Reproduction and embryology of Angiosperms	4+0+0	20	80	100
	Lab. Course – I- Bryophyta, Pteridophyta, and Gymnosperms	0+0+2	-	-	100
	Lab. Course- II- Angiosperms: Taxonomy, growth & development, reproduction, and embryology	0+0+2	-	-	100
III Sem.	Plant ecology	4+0+0	20	80	100
	Plant resource utilization, and conservation	4+0+0	20	80	100
	Plant physiology	4+0+0	20	80	100

	Plant metabolism	4+0+0	20	80	100
	Lab. Course- I- Plant ecology, plant resource utilization, and conservation	0+0+2	-	-	100
	Lab. Course II- Plant physiology and metabolism	0+0+2	-	-	100
IV Sem.	Biotechnology & genetic engineering of plants	4+0+0	20	80	100
	Biotechnology & genetic engineering of microbes	4+0+0	20	80	100
	Molecular plant pathology	4+0+0	20	80	100
	Elective paper- Ethnobotany I	4+0+0	20	80	100
	Plant disease & control mechanism	4+0+0	20	80	100
	Elective paper- Ethnobotany II	4+0+0	20	80	100
	Lab Course- I- Based on Paper I & II (Biotechnology & genetic engineering of plants and microbes)	0+0+2	-	-	100
	Lab Couse – II- Based on Paper III & IV (Molecular plant pathology, Plant disease & control mechanism)	0+0+2	-	-	100
	Lab Course II for Elective Paper- Ethnobotany I and II	0+0+2	-	-	100
IV Sem.	Project (Optional)	6	-	-	600

2025-26

SEMESTER PATTERN

M.Sc. BOTANY

Candidates for the M.Sc. Examination will be requiring passing in written as well as in practical examinations separately. It's compulsory to attend a part of their training at least one Botanical excursion to a Hill station (within or outside C.G.) or Seashore.

M.Sc. Examination is in semester pattern, there are four semester examination within two years. In each semester there are four theory paper and two practical.

Their shall be 16 papers in theory carrying 80 marks and of three hours duration, and 16 internal assessment and 16 assignment each of 10-10 marks and eight practical examination each carrying 100 marks and having 4 Credit in each paper. Each practical examination is carrying 100 marks and is based on two theory papers having 2 Credit in each practical examination.

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2025-26

SEMESTER PATTERN

M.Sc. BOTANY

SEMESTER – I

THEORY		Theory	Internal assessment	Total	Credit
1.	Cell biology of plants	80	20	100	4
2.	Cytology, genetics and cytogenetics	80	20	100	4
3.	Molecular biology	80	20	100	4
4.	Biology and diversity of viruses, bacteria, algae and fungi	80	20	100	4
PRACTICAL					
1.	Practical – I. Cell biology, cytology, genetics, cytogenetics	-	-	100	2
2.	Practical – II. Molecular Biology, viruses, bacteria, algae, fungi	-	-	100	2
TOTAL MARKS				**600**	**20**

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2025-26

M.Sc. BOTANY SEMESTER – I

PAPER I **M.M. - 80**

CELL BIOLOGY OF PLANTS

Credit 4

Course Code: PBOCT101

UNIT- 1

Plant Cell: Cell theory, Structural organization of plant cell, difference between Prokaryotic and Eukaryotic cell.
Cell Wall: Structure, Cytoskeleton and functions, biogenesis, growth.
Plasma Membrane: Structure, models and functions, site for ATPases, ion carriers, channels and pumps, receptors.
Plasmodesmata: Structure, role in movement of molecules and macromolecules.

UNIT- 2

Chloroplast: Ultra-structure, isolation, chemical composition, function, genome organization.
Mitochondria: Ultra-structure, isolation, chemical composition, function, genome organization, biogenesis.
Plant vacuole: Tonoplast membrane, transporters, as storage organelle.

UNIT -3

Nucleus: Ultra-structure, nuclear pores, nuclear envelope, nucleolus.
Ribosome: Ultra–structure, chemical composition, biogenesis and functional significance.
Other cell organelles: Ultra-structure and functions of microtubules, microfilaments, microbodies, Golgi apparatus, lysosomes and endoplasmic reticulum, peroxisomes.

UNIT- 4

Cell Division: Mitosis, Meiosis.
Cell cycle and apoptosis: Control mechanisms, cytokinesis and cell plate formation, Apoptosis, mechanism of programmed cell death.

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M.Sc. BOTANY SEMESTER – I

PAPER II **M.M. - 80**

CYTOLOGY, GENETICS AND CYTOGENETICS

Credit 4

Course Code: PBOCT102

UNIT- 1

Chromatin organization: Chromosome structure and packing of DNA, molecular organization of centromere and telomere, euchromatin and heterochromatin.

Specialized type of chromosomes, polytene lampbrush, B- chromosomes and sex chromosomes.

Chromosomal aberration : Structural and Numerical chromosomal aberrations.

UNIT- 2

Genetics of prokaryotic and eukaryotic cell: Mapping the Bacteriophage genome, genetic recombination in phage, genetic transformation, conjugation and transduction in bacteria.

Gene structure and expression: fine structure of gene, regulation of gene expression in prokaryotes and eukaryotes.

Mutations: Spontaneous and induced mutations, physical and chemical mutagenes, molecular basis of gene mutations, transposable elements in prokaryotes and eukaryotes, mutations induced by transposon.

UNIT- 3

Cytoplasmic inheritance, Robertsonian translocation, B-A translocation.

Genetic recombination and Genetic mapping: mechanism of crossing over, molecular mechanism of recombination, role of Rec A and Rec B C D enzymes, site specific recombination, linkage, linkage groups and gene mapping, genetic markers.

UNIT- 4

Molecular Cytogenetics: Nuclear DNA content, C-value paradox, cot curve and its significance, restriction mapping- concept and techniques, *in situ* hybridization- concept and techniques, inherited human diseases, initiation of cancer at cellular level, proto-oncogenes.

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2025-26
M.Sc. BOTANY SEMESTER – I
PAPER III M.M. - 80
MOLECULAR BIOLOGY OF PLANTS
Credit 4
Course Code: PBOCT103

UNIT- 1

DNA: Ultra- structure, Types of DNA: A, B, D and Z Forms, Chemical composition.

DNA Replication: Types of DNA Replication: Dispersive, Conservative, Semi conservative. Enzymes required for DNA replication, DNA damage and repair mechanism.

RNA: Types of RNA: m-RNA, r-RNA, t-RNA, structure, and functions. Biosynthesis of m-RNA.

UNIT- 2

Protein Synthesis I: Transcription, transcription factors, promoters, introns and their significance, RNA Splicing, RNA editing, m- RNA transport.

UNIT- 3

Protein Synthesis II: Mechanism of translation, gene expression in chloroplast, nucleochloroplastic interactions.

Signal transduction.

UNIT- 4

Protein Sorting: Targeting of proteins to organelles.

Techniques: Immunotechniques, *in situ* Hybridization Techniques to locate transcripts in cell types, FISH, GISH, confocal microscopy, Flow cytometry.

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2025-26
M.Sc. BOTANY SEMESTER – I
PAPER IV M.M. - 80
BIOLOGY AND DIVERSITY OF VIRUSES, BACTERIA, ALGAE AND FUNGI
4 Credit
Course Code: PBOCT104

UNIT- 1
Viruses: Characteristics and ultra structure of virions, isolation and purification of viruses, chemical nature, replication, transmission and economic importance of viruses.
Archaebacteria and Eubacteria: General account, Ultra structure, nutrition and reproduction, biology and economic importance.
Cyanobacteria: Salient features and biological importance.
Phytoplasma: General characteristics and role in causing plant diseases.

UNIT- 2
Phycology: Algae in Diversified habitats (terrestrial, fresh water, marine), thallus organization, cell ultra structure, reproduction (vegetative, asexual and sexual), criteria for classification of **Protochlorophyta:** *Nostoc, Anabaena, Oscillatoria*, **Chlorophyta**: *Volvox, Pandorina, Chlorella, Ulva,Frietschella, Coleochaete, Zygnema, Acetabularia.* **Charophyta**: *Chara, Nitella* **Xanthophyta:** General Account **Bacillariophyta:** General Account **Phaeophyta**: *Ectocarpus, Dictiyota, Fucus,lamineria* **Rhodophyta**: *Porphyra, Batrachospermum, Gracillaria, Polysiphonia.* Economic importance of Algae.

UNIT- 3
Mycology: General characteristics of fungi, substrate relationship in fungi, cell ultra structure, unicellular and multicellular organization, cell wall composition, nutrition (saprophytic, biotrophic, symbiotic), reproduction (vegetative, asexual and sexual), heterothallism, heterokaryosis, parasexuality, and recent trends in classification. General account of Lichens.

UNIT- 4
Phylogeny and general account of: *Allomyces, Synchitrium, Saprolegnia, Mucor, Perenospora, Albugo, Chaetomium, Protomyces, Erysiphae, Penicillium, Neurospora, Claviceps, Phyllactinia, Xylaria, Morchella, Puccinia, Ustilago, Uromyces, Lycoperdon,, Alternaria, Cercospora, Coletotrichium,, Helminthosporium, Fusarium.*and Mycorrhizal fungi as biocontrol agent.

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2025-26

M.Sc. BOTANY SEMESTER – I
PRACTICAL-I
(CELL BIOLOGY, CYTOLOGY, GENETICS, CYTOGENETICS)
2 Credit
Course Code: PBOCL105

(i)	Microtomy	15
(ii)	Study of mitosis/meiosis (Smear method)	20
(iii)	Plant breeding/hybridization/isolation of cell organelle	20
(iv)	Spotting	15
(v)	Viva	10
(vi)	Sessional	20

Total – 100 marks

M.Sc. BOTANY SEMESTER – I
PRACTICAL-II
(MOLECULAR BIOLOGY, VIRUSES, BACTERIA, ALGAE, FUNGI)
2 Credit
Course Code: PBOCL106

(i)	Study of bacterial/fungal culture	10
(ii)	Mycology	15
(iii)	Identification of at least 02 algae from given mixture	10
(iv)	Techniques	20
(v)	Spotting	15
(vi)	Viva	10
(vii)	Sessional	20

Total – 100 marks

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2025-26
M.Sc. BOTANY
SEMESTER – II

THEORY		Theory	Internal assessment	Total	Credit
1.	Taxonomy & diversity of Bryophytes, Pteridophytes and Gymnosperms	80	20	100	4
2.	Taxonomy & diversity of Angiosperms	80	20	100	4
3.	Plant growth and development	80	20	100	4
4.	Reproduction and embryology of Angiosperms	80	20	100	4
PRACTICAL					
1.	Practical – I. Bryophyta, Pteridophyta & Gymnosperm	-	-	100	2
2.	Practical – II. Angiosperm: - taxonomy, growth & development, reproduction and embryology	-	-	100	2
TOTAL MARKS				**600**	**20**

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2025-26
M.Sc. BOTANY SEMESTER – II
PAPER I
M.M. - 80
TAXONOMY AND DIVERSITY OF BRYOPHYTA, PTERIDOPHYTA AND GYMNOSPERMS
Credit 4
Course Code: PBOCT201

UNIT- 1
Bryophyta: Morphology, structure, reproduction and life history, distribution, and classification.
General account: Marchantiales- *Riccia, Ricciocarpus, Cyathodium, Dumortiera* . **Jungermaniales-** *Riccordia, Porella* **Anthocerotales-** *Anthoceros, Notothylas*, **Sphagnales-** *Sphagnum*, **Funariales** - *Funaria* and **Polytrichales** -*Pogonatum.*
Economic and ecological importance of Bryophyta.

UNIT- 2
Pteridophyta: Morphology, anatomy, reproduction and classification of Pteridophyta, evolution of stele and heterospory, origin of seed habit.
General account of fossil Pteridophyta with special reference to Rhynia.
Introduction to: Psilopsida- *Psilotum, Tmesipteris,* **Lycopsida-** *Lycopodium, Phylloglossum, Lepidodendron, Isoetes,* **Sphenopsida-** *Calamophyton, Calamites, Sphenophyllum, Equisetum,* and **Pteriopsida-** *Bryopteris, Ophioglossum, Osmunda, Cyathea, Salvinia, Azolla.*

UNIT- 3
Gymnosperms: General characters mentioning diversity, origin and evolution of gymnosperm stele, resemblances and differences among Pteridophyta, Gymnosperms and Angiosperms.
Origin of Paleozoic ovules.
Classification and distribution of Gymnosperms in India, Gymnosperm biotechnology.
General account: Pteridospermales, Glossoptridales and Caytoniales.

UNIT- 4
General account: Cycadeiodales- *Cycadeiodia*, **Pentoxylales**, General account **Cycadales-** *Cycas* **Ginkgoales-** *Ginkgo*, **Coniferales-** *Pinus & Taxus*, **Ephedrales-** *Ephedra*, **Gnetales-** *Gnetum* and **Welwitschiales-** *Welwitschia.*

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2025-26
M.Sc. BOTANY SEMESTER – II
PAPER II M.M. - 80
TAXONOMY AND DIVERSITY OF ANGIOSPERMS
Credit 4
Course Code: PBOCT202

UNIT- 1
Pre - Darwinian Classification: based on form relationship (Bentham and Hooker).
Post – Darwinian Classification: Engler and Prantle's, Hutchinson's, Cronquist's.
Recent Modification: Dahlgreen's system.
Fossil Angiosperms.

UNIT- 2
Taxonomic Hierarchy: Major categories, minor categories, and species concept.
Plant Nomenclature: Binomial nomenclature, international code of botanical nomenclature.
Plant Identification: Herbaria, Botanical Gardens, Taxonomic literature, Taxonomic keys.

UNIT- 3
Study of Following Families with particular reference to systematic position, phylogeny, evolutionary trends and economic importance:
Dicotyledonous families: Ranunculaceae, Magnoliaceae, Nymphaeceae Capparidaceae, Meliaceae, Fabaceae, Cucurbitaceae, Apiaceae, Asteraceae, Sapotaceae, Bignoniaceae, Verbenaceae, Lamiaceae, Euphorbiaceae, Moraceae.

UNIT- 4
Study of Following Families with particular reference to systematic position, phylogeny, evolutionary trends and economic importance:
Monocotyledonous Families: Liliaceae, Orchidaceae, Zingiberaceae, Cyperaceae, Poaceae, Musaceae.
Taxonomic Evidences: Morphology, anatomy, palynology, embryology, cytology, phytochemistry, Geological Information System.

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M.Sc. BOTANY SEMESTER – II
PAPER III M.M. - 80
PLANT GROWTH AND DEVELOPMENT
Credit 4
Course Code: PBOCT203

UNIT- 1
Seed Germination and Seedling Growth: Seed germination, Types of seed germination, Process of seed germination, metabolism of nucleic acid, protein and food reserves, tropism, hormonal control of seedling growth.

UNIT- 2
Leaf Growth and Differentiation: Development, phyllotaxy, control of leaf form, differentiation of epidermis (with special reference to stomata and trichome) and mesophyll. Difference between Monocot & Dicot leaf, Modification of Leaf

UNIT -3
Unique features of plant development: differences between animal and plant development.
Root Development: Root Modification, Organization of root apical meristem (RAM), cell fates and lineage, Vascular tissue differentiation, lateral roots, root hair, root microbe interactions.

UNIT- 4
Shoot Development: Shoot modifications, Organization of shoot apical meristem (SAM), cytological and molecular analysis of SAM, control of tissue differentiation, secondary growth especially xylem and phloem, secretory ducts and laticifers, wood development in relation to environmental factors.

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2025-26
M.Sc. BOTANY SEMESTER – II
Paper – IV M.M. - 80
REPRODUCTION AND EMBRYOLOGY OF ANGIOSPERM
Credit 4
Course Code: PBOCT204

Unit–1
Reproduction: Vegetative options and asexual reproduction, Flower development, Homeotic mutant in *Arabidopsis* and *Antirrhinum*, Sex determination, Pollination. Pollen-pistil interaction, Floral characteristics, Pollination mechanism and vector, Structure of the pistil, Pollen-stigma interactions, Sporophytic and gametophytic self-incompatibility (cytological, biochemical and molecular aspects).

Unit–2
Male gametophyte: - Structure of anthers, Microporogenesis, Role of tapetum, Pollen development, Male sterility, Sperm dimorphism and hybrid seed production. Pollen germination, Pollen tube growth and guidance, Pollen storage, Pollen allergy. Pollen embryo.
Female gametophyte: - Ovule development, Megasporogenesis, Organisation of embryo sac, Structure of embryo sac cells, Fertilization, Double fertilization, *Invitro* fertilization.

Unit–3
Seed development and fruit growth: - Endosperm development during early maturation desiccation stage, Storage protein of endosperm and embryo, Polyembryony, Apomixis, Embryo culture, Dynamic of fruit growth, Biochemistry and molecular biology of fruit maturation.

Unit–4
Latent life dormancy: - Importance and types of dormancy, Seed dormancy, Overcoming seed dormancy, Bud dormancy.
Senescence and programmed cell death (P.C.D.)- Basic concepts, Types of cell death, P.C.D. in the life cycle of plants, Metabolic changes associated with senescence and its regulation, Influence of hormones and environmental factors on senescence.

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2025-26
M.Sc. BOTANY SEMESTER – II
PRACTICAL-I
(BRYOPHYTA, PTERIDOPHYTA, GYMNOSPERM)
Credit 2
Course Code: PBOCL205

(i)	Monographic study of given Bryophytic material	15
(ii)	Monographic study of given Pteridophytic material	15
(iii)	Monographic study of given Gymnospermic material	15
(iv)	Preparation of permanent slide from Pteridophytic/ Gymnospermic material	10
(v)	Spotting	15
(vi)	Viva	10
(vii)	Sessional	20

Total – 100 marks

M.Sc. BOTANY SEMESTER – II
PRACTICAL-II
(ANGIOSPERM- TAXONOMY, GROWTH, DEVELOPMENT, REPRODUCTION AND EMBRYOLOGY)
Credit 2
Course Code: PBOCL206

(i)	Taxonomic description of given plants: -	
	(a) Major	20
	(b) Minor	10
(ii)	Development and reproduction	15
(iii)	Embryology	10
(iv)	Spotting	15
(v)	Viva	10
(vi)	Sessional	20

Total – 100 marks

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2025-26
M.Sc. BOTANY
SEMESTER – III

THEORY		Theory	Internal assessment	Total	Credit
1.	Plant Ecology	80	20	100	4
2.	Plant resource utilization and conservation	80	20	100	4
3.	Plant Physiology	80	20	100	4
4.	Plant metabolism	80	20	100	4
PRACTICAL					
1.	Practical – I. Plant ecology, plant resources utilization and Conservation			100	2
2.	Practical – II. Plant physiology and metabolism			100	2
TOTAL MARKS				**600**	**20**

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2025-26
M.Sc. BOTANY SEMESTER – III
Paper I
PLANT ECOLOGY
Credit 4
Course Code: PBOCT301

M.M. - 80

Unit–1
Ecosystem organization: - Structure and function, Primary production (methods of measurement, global pattern, controlling factors), Energy dynamics (trophic 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.

Unit–2
Vegetation organization: - Concept of community and continuum, Community coefficients, Interspecific associations, Concept of ecological niche.
Vegetation development: - Temporal changes (cyclic and non cyclic), Mechanism of ecological succession (relay floristic and initial floristic composition, changes in ecosystem properties during succession).

Unit–3
Climate, soil and vegetation patterns of the world: - Life zones, Major biomes, major vegetation and soil types of the world.
Biological diversity: - Concept and levels, Role of biodiversity in ecosystem function and stability, Speciation and extinction, IUCN categories of threat, Terrestrial biodiversity hot spots.
Air, water and soil pollution: - Kinds, Sources, Quality parameters, effect on plants and ecosystems.

Unit–4
Climatic changes: - Green house gases (CO_2, CH_4, N_2O, CFCS, sources, trends and role). Ozone layer and ozone hole, Consequences of climatic change (global warming, sea level rise,Acid rain).
Ecosystem stability: - Concepts (resistance and resilence), Ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems, Ecology of plant invasion, Environmental impact assessment.

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2025-26
M.Sc. BOTANY SEMESTER – III
Paper II M.M. - 80
PLANT RESOURCE UTILIZATION AND CONSERVATION
Credit 4
Course Code: PBOCT302

Unit–1
Plant diversity: - Concepts, Status in India, Utilization and concerns.
Sustainable development: - Basic concepts, Sustainable development and Sustainability indicators.
World centers of primary diversity of domesticated plants: - The Indo-Burmese center, Plants introduction and secondary centers.

Unit–2
Origin, evolution, botany, cultivation and uses: - (i) Food storage and fodder crops (ii) Fibre crops (iii) Medicinal and aromatic plants and (iv) Vegetable oil yielding crops.
Important fire-wood and timber-yielding plants and non wood forest products (NWFPs): - such as bamboos, raw material for paper-making, gums, tannins dyes, resins and fruits. Ethnobotanically important plant of Chhattisgarh and its conservation

Unit–3
Green revolution: - Benefits and adverse consequences.
Innovations for meeting world food demands.
Plants used as avenue trees: - For shade, pollution control and aesthetics. Principles of conservation, Extinctions, Environmental status of plants based on international union for conservation of nature.
Endangered species: - Concept and conservation

Unit–4
Strategies for *in-situ* conservation: - International efforts and initiatives, Protected areas in India – sanctuaries, national parks, biosphere reserves, wetlands, mangroves and coral reefs for conservation of wild biodiversity.
Strategies for *ex-situ* conservation: - Principles and practices, botanical gardens, gene banks, seed banks, cryobanks. General account of the activities of Botanical survey of India (BSI), National bureau of plant genetic resources (NBPGR), Indian council of agricultural research (ICAR), Council of scientific & industrial research (CSIR) and Department of biotechnology (DBT) .

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2025-26
M.Sc. BOTANY SEMESTER – III
Paper III
M.M. - 80
PLANT PHYSIOLOGY
Credit 4
Course Code: PBOCT303

Unit–1
Translocation of water and solutes and membrane transport: - Plant water relations, Mechanism of water transport through xylem, Root-microbe interactions in facilitating nutrient uptake, Comparison of xylem and phloem transport, Phloem loading and unloading, Passive and active solute transport, Membrane transport system.

Unit–2
Photochemistry and photosynthesis: - General concept and historical background, Evolution of photosynthetic apparatus, Photosynthetic pigments and light harvesting complexes, Photo-oxidation of water, Mechanism of electron and proton transport.
Carbon assimilation: - The Calvin cycle, Photorespiration and its significance, C_4 cycle, the CAM pathway, Physiological and ecological consideration.

Unit–3
Sensory photobiology: - History of discovery of phytochromes, cryptochromes and their photochemical and biochemical properties, Photo-physiology of light induced responses, Cellular localization, Molecular mechanism of action of photomorphogenetic receptors.

Unit–4
Respiration: - Overview of plant respiration, Glycolysis, TCA cycle, Electron transport and ATP synthesis, Pentose phosphate pathway, Glyoxylate cycle.
Stress physiology: - Plant responses to biotic and abiotic stress, Mechanism of biotic and abiotic stress tolerance, HR and SAR, Water deficit and drought resistance, Salinity stress, Metal toxicity, Freezing and Heat stress, Oxidative stress. High temp. stress, low temp. stress

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2025-26
M.Sc. BOTANY SEMESTER – III
Paper – IV
M.M. - 80
PLANT METABOLISM
Credit 4
Course Code: PBOCT304

Unit–1
Energy flow: - Principles of thermodynamics, Free energy and redox reactions, Structure and function of ATP.
Signal transduction: - Overview, receptors and G-protein, Phospholipid signaling, Role of cyclic nucleotides, Calcium-Calmodulin cascade, Diversity in protein kinases and phosphatases, Specific signaling mechanisms e.g. Two component sensor-regulator system in bacteria.

Unit–2
Biosynthesis of starch and sucrose.
Lipid metabolism: - Structure and function of lipids, Fatty acid biosynthesis, Synthesis of membrane lipids, Structural lipids, storage lipids and their catabolism.

Unit–3
Nitrogen fixation, nitrogen and sulphur metabolism: - Overview, Biological nitrogen fixation, Nodule formation and nod factors, Mechanism of nitrate uptake and reduction, Ammonium assimilation, Sulfate uptake, transport and assimilation.

Unit–4
The flowering process: - Photoperiodism and its significance, Endogenous clock and its regulation, floral induction and development, Genetic and molecular analysis, Role of vernalization.
Plant growth regulators and elicitors: - Physiological effect and mechanism of action of Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic acid, Brassinosteroids, Jasmonic acid and Salicylic acid. Hormone receptors.

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M.Sc. BOTANY SEMESTER – III

PRACTICAL-I

(PLANT ECOLOGY, PLANT RESOURCE UTILIZATION AND CONSERVATION)

Credit 2

Course Code: PBOCL305

(i)	Ecological study	10
(ii)	Ecological adaptation	05
(iii)	Soil/Air/Water Analysis	10
(iv)	Study of Pond/Grassland/ Forest/Marine Ecosystem	10
(v)	Medicinal/Aromatic plants	10
(vi)	Conservation of plants	15
(vii)	Spotting	10
(viii)	Viva	20
(ix)	Sessional	

Total – 100 marks

M.Sc. BOTANY SEMESTER – III

PRACTICAL-II

(PLANT PHYSIOLOGY AND METABOLISM)

Credit 2

Course Code: PBOCL306

(i)	Physiology experiment (major)	25
(ii)	Physiology experiment (minor)	10
(iii)	Extraction and estimation of protein	20
(iv)	Techniques: - Electrophoresis/Chromatography/ Colorimetry/Spectrophotometry	15
(v)	Viva	10
(vi)	Sessional	20

Total – 100 marks

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M.Sc. BOTANY
SEMESTER – IV

THEORY		Theory	Internal assessment	Total	Credit
1.	Biotechnology & genetic engineering of plants	80	20	100	4
2.	Biotechnology & genetic engineering of microbes	80	20	100	4
3.	Molecular plant pathology	80	20	100	4
	Elective paper- Ethnobotany I				
4.	Plant disease & control mechanism	80	20	100	4
	Elective paper- Ethnobotany II				
PRACTICAL					
1.	Lab course based on Paper I and Paper II (Biotechnology & genetic engineering of plants and microbes)			100	2
2.	Lab course based on Paper III and Paper IV (Molecular plant pathology, Plant disease & control mechanism or Ethnobotany I and II)			100	2
TOTAL MARKS				**600**	**20**

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2025-26
M.Sc. BOTANY SEMESTER – IV
Paper – I
M.M. - 80
BIOTECHNOLOGY AND GENETIC ENGINEERING OF PLANTS
Credit 4
Course Code: PBOCT401

Unit–1
Biotechnology: - Basic concepts, principles and scope.
PLANT CELL AND TISSUE CULTURE :- General introduction, History, scope, concept of cellular differentiation, totipotency, culture media and their constituents.

Unit–2
Applications of plant tissue culture: - Clonal propagation, artificial seed production of hybrids and somaclones, Production of secondary metabolites/natural products, Cryopreservation and germplasm storage.
Strategies for Plant Conservation :- Ex-situ and in-situ conservation.

Unit–3
Organogenesis and adventives embryogenesis: - Fundamental aspects of morphogenesis, Somatic embryogenesis and androgenesis. Mechanism, techniques and utility.
Somatic hybridization: - Protoplast isolation, fusion and culture, Hybrid selection and regeneration possibilities, Achievements and limitations of protoplast research.

Unit–4
Genetic engineering of plants: - Aims, Strategies for development of transgenic (with suitable examples), *Agrobacterium* - the natural genetic engineer. T – DNA and transposon mediated gene tagging, Intellectual property rights, Possible ecological risks and ethical concerns.

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M.Sc. BOTANY SEMESTER – IV

Paper II **M.M. - 80**

BIOTECHNOLOGY & GENETIC ENGINEERING OF MICROBES

Credit 4

Course Code: PBOCT402

Unit–1

Recombinant DNA technology: - Gene cloning principles and techniques, cloning and expression vectors, chimeric DNA, molecular probe, Applications, Construction of genomic/cDNA libraries, Choice of vectors, DNA synthesis and sequencing, Polymerase chain reaction. DNA fingerprinting.

Unit–2

Genomics and proteomics: - Genetic and physical mapping of genes, Molecular markers, Artificial chromosomes, Genome projects, Bioinformatics, Functional genomics, Microarrays, Protein profiling and its significance.

Unit–3

Microbial genetic manipulation: - Bacterial transformation, Introduction of the recombinant DNA into a suitable host, Selection of recombinants and transformants, Multiplication Expression and Integration of the DNA insert in host genome.

Unit–4

Genetic Improvement of Industrial Microbes and nitrogen Fixers, Enzyme Technology: - Use of microbes in industry and agriculture, Intellectual Property right, Possible ecological risk and ethical concerns, Cryopreservation and germplasm storage.

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2025-26
M.Sc. BOTANY SEMESTER – IV
Paper – III
M.M. - 80
MOLECULAR PLANT PATHOLOGY
Credit 4
Course Code: PBOET403

Unit–1
Introduction: - History of plant pathology, general principles of plant pathology and classification of plant diseases.

Disease inciting organisms: - Animate pathogen, Fungi, Bacteria, Mycoplasma, Viruses, Nematodes and their general characteristics, heterotrophic behaviour with emphasis on parasitism ability and virulence.

Unit–2
General symptoms of plant diseases: - Pathogenic and non-pathogenic symptoms caused by fungi, bacteria, viruses, Mycoplasma and nematodes.

Unit–3
Pathogenesis: - Dissemination of plant pathogens, Mode of infection, Inoculums-potential, Koch's postulates.

Host-parasite relationship: - Mechanism and physiology of infection, Path of infection, Role of enzymes, Growth regulators and toxins in pathogenesis.

Effect of Infection on the physiology of the host

Enzymes and toxins in plant disease

Defence mechanism: - Defence of host against pathogen, Resistance and susceptibility, Hyper-sensitive reaction (HR), Phytoalexins. Disease syndrome, Physiological specialization with special reference to smuts and rusts.

Unit–4
Effect of environment on disease development: - Predisposing factors, Survival of fungi, Germination of spores, Disease initiation and epidemics.

Epidemiology and disease forecasting: - Form of epidemics, Factors responsible for the establishment of an epidemic, Disease forecasting.

Source of infection: - Seed, soil, water and air born diseases of plants, Significations of phyllosphere and rhizosphere studies.

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M.Sc. BOTANY SEMESTER – IV

Paper – IV **M.M. - 80**

PLANT DISEASE & CONTROL MECHANISM

Credit 4

Course Code: PBOET405

Unit–1

Diseases due to fungi: - Rusts, Smuts, Downy mildews, Powdery mildews, Wilts, Leaf blight, Ergots, Tikka, Necrosis, Red Rots, Damping off, Warts, stem gall

Unit–2

Diseases due to bacteria: - Blight of rice, Tundu disease, Citrus canker, Crown gall of stone fruits, Angular leaf spots.

Diseases due to viruses: - Mosaic of tobacco, potato, tomato and banana; Leaf curl of tomato and papaya; Yellow vein mosaic of bhindi, Bunchy top of banana.

Unit–3

Diseases due to mycoplasma: - Sandal spike, Little leaf of brinjal, Grassy shoot disease, Sesamum, phyllody, Citrus greening.

Diseases due to nematodes: - General characters of plant nematodes, Root knot, Malaya disease of barley, wheat, Citrus nematodes, Ear cockles of wheat.

Non Parasitic Disease and angiospermic parasite

Unit–4

Principles of plant disease control: - Regulatory, chemical and biological control, breeding with resistant varieties of host plants, Plant quarantine, Recurrence of disease with special reference to rust disease in India.

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2025-26
M.Sc. BOTANY SEMESTER IV
Elective Paper
PAPER –III
M.M. - 80
ETHNOBOTANY- I
Credit 4
Course Code: PBOET404

UNIT I

- Ethnobotany: History, general account and its sub disciplines.
- Interdisciplinary approaches & aim of ethno botany.
- Ethnobotany with special reference to Chhattisgarh.
- Ethnobotanical Research done in India:
- Ethnobotany in relation to national priorities and health care programme.
- Practical application of ethnobotany for tribal development programme.

UNIT II

- Methods and techniques in ethnobotany.
- General account of major and minor tribes of Chhattisgarh with special reference to Gond, Kamar, Baiga, Abujhmaria.
- Ethnobotanical aspect of art and literature.
- Ethnobotany with special reference to folklore.

UNIT –III

- Ethnobotanical importance of Bacteria, Algae, Fungi, Bryophyta, Pteridophyta and Gymnosperm.
- Ethnovaterinary medicines from plants.
- Major & Minor Forest Products (NWFPs) of Chhattisgarh.
- Ethnobotany in relation to livelihood security reference to tribes.

UNIT - IV

- Ethnobotanical study of following plants with special reference to their medicinal importance 1. *Azadirachta indica* (Neem) 2. *Emblica officinalis* (Amla) 3. *Ricinus conmunis* (Andi) 4. *Madhuca indica* (Mahuaa) 5. *Cassia fistula* (Amaltash) 6. *Ficus religiosa* (Pipal) 7. *Oscimum sanctum* (Tulsi) 8. *Asparagus racemosus* (Satavar) 9. *Aloe vera* (Ghrit kumari) 10. *Andographis paniculata* (Bhui neem).

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- Martin, G.J. (1995). Ethnobotany. Chapman and Hall, London. Suggested Laboratory

Exercises:-

1. Description and identification of medicinal plants and its medical properties.
2. Preparation of medicinal plants herbarium and photographs.
3. Herbal preparation:- a. Extract of Tulsi leaves. b. Ointment from Neem Leaves. c. Ayurvedic tooth powder. d. Face pack preparation from various herbs. e. Preparation of Triphla. f. Kwath of Triphla. g. Preparation of diabeties controlled powder. h. Preparation of herbal shampoo.
4. To cultivate at least two medicinal plant in earthen pot.
5. Field Study of Forest area or Tribal area.
6. Documentation technique of Ethnobotanical knowledge.
7. To separate active principles from the extract of Medicinal plant.

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2025-26
M.Sc. BOTANY SEMESTER IV
ELECTIVE PAPER
PAPER –IV M.M. 80
ETHNOBOTANY – II
Credit 4
Course Code: PBOET406

UNIT - I

• Plant Conservation by Tribes and role of Joint Forest Management Programme in Plant Conservation specially People's Protected Area

• Ethnobotany and its role in domestication and conservation of native plant and genetic resources.

• The protection of plant varieties.

• General account of conservation of medicinal plants.

• General role of Aromatic plants.

UNIT -II

• General ideas of various system of medicine using plants.

• Basic knowledge of Ayurvedic, Homeopathic, Allopathic system of medicine.

• General idea of active principles of Plants.

• Herbal Cosmetics.

• General account of toxic plants and Harmful effect of plants on human society with special reference to allergic plants of Chhattisgarh.

UNIT –III

• Endemic plants of Chhattisgarh.

• Endangered plants of Chhattisgarh.

•Techniques of cultivation and marketing of Aromatic plants –Podina, Lemon grass.

• Techniques of cultivation, marketing and importance of mushroom

• Techniques of cultivation, extraction of juice and importance of wheat grass.

UNIT -IV

• Ethnobotanical study of the following plants with special reference to their medicinal importance1. *Allium sativum* (Lahsun) 2. *Aegle marmelos* (Bel) 3. *Terminallia arjuna* (Arjun) 4 *T. bellerica* (Bahera) 5. *T. chebula* (Harra) 6. *Chlorophytum borivianum* (Safed Musli) 7. *Thuja occidentalis* (Vidhya) 8 *Dhatura alba* (Dhatura) 9. *Argemone maxicana* (Pili kateli) 10. *Moringa oleifera* (Munga).

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Exercises:-

1. Description and identification of medicinal plants and its medical properties.
2. Extraction of phytochemicals from various medicinal plants.
3. Preparation medicinal plants herbarium and photographs.
4. Herbal preparation – a. Preparation of digestive powder. b. Mouth freshener of Ajwain. c. Beverage of Tulsi, Bel, Tikhur, Mango. d. Ayurvedic tea preparation. e. Tablet of amla vati. f. Murabba of Awla/Bel. g. Herbal dye h. Shitopladi powder.
5. Identification and study of Ethnobotanical importance of some plants of Rajnandgaon.
6. To cultivate at least two medicinal plant in earthen pot.

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2025-26
M.Sc. BOTANY SEMESTER IV
PRACTICAL- I
(BIOTECHNOLOGY AND GENETIC-ENGINEERING OF PLANTS AND MICROBES)
Credit 2
Course Code: PBOCL407

(i)	Cell/tissue/anther culture.....	15
(ii)	Bacterial growth, fungal growth/fermentation/ Quantitative estimation of nucleic acid.....	20
(iii)	Principles and techniques: - Artificial seed, production of hybrids & Somaclones/Gene cloning/ PCR/Turbidimetry/Spectrophotometry.....	20
(iv)	Spotting	15
(v)	Viva.....	10
(vi)	Sessional.....	20

Total – 100 marks

M.Sc. BOTANY SEMESTER IV
PRACTICAL- II
(MOLECULAR PLANT PATHOLOGY AND DISEASE CONTROL)
Credit 2
Course Code: PBOEL408

(i)	Host parasite relationship.....	20
(ii)	Symptomatological study (except fungi).....	10
(iii)	Fungal culture study.....	15
(iv)	Techniques.....	10
(v)	Spotting.....	15
(vi)	Viva.....	10
(vii)	Sessional.....	20

Total – 100 marks

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M.Sc. BOTANY SEMESTER IV

PRACTICAL II (FOR ELECTIVE PAPER)
(ETHNOBOTANY I AND ETHANOBOTANY II)
Credit 2
Course Code: PBOEL409

(i)	Major Practical	20
(ii)	Minor Practical	10
(iii)	Field report	10
(iv)	Techniques	15
(v)	Spotting	15
(vi)	Viva	10
(vii)	Sessional	20

Total – 100 marks

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2025-26
Project (Optional)
Credit 6

Project Work	External	Internal	Total
Dissertation	240	60	300
Seminar based on project	160	40	200
Viva-voce	80	20	100
Total			**600**

1. A Student of IV Semester will have the option to opt for project work in lieu of four theory papers and two lab courses provided.
2. He/she secures at-least 65% or more marks in aggregate in semester I and II Semester.
3. The project has to be carried out in recognized national laboratories or UGC recognized universities or any other reputed organization of public and private concern.
4. The valuation of all the projects will be carried out by the external examiner.

The project work should be related to the field of Botany. The project report should include declaration by the candidate, certificate by the supervisor, acknowledgement, title and introduction along with the following points.

1. Introduction.
2. Review of Literature.
3. Materials and Methods.
4. Results and Discussion.
5. Summary.
6. Bibliography.

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