Ordinance No. :- V-141-B-7

(Approved in Academic Council meeting held on 11.03.2026
Proposed to be ratified in forthcoming executive council)

Evaluation Scheme and Syllabus

of

M.Sc. Botany

TWO – YEAR POST GRADUATE

PROGRAM

(AS PER NEP-2020)

Keral Verma Subharti College of Science

Swami Vivekanand

SUBHARTI UNIVERSITY

Meerut

(Effective from session 2025-26)

K. V. Subharti College of Science
S. V. Subharti University
NH-58 Bypass Road, Meerut

PROGRAMME OBJECTIVES

- To provide advanced knowledge of plant sciences, including systematics, physiology, ecology, molecular biology, and biotechnology.
- To develop an in-depth understanding of cellular and molecular processes, enabling scientific analysis of plant structure and function.
- To cultivate expertise in modern analytical, biochemical, and molecular techniques used in advanced botanical research.
- To enhance the ability to identify research problems, design experiments, apply appropriate methodologies, and interpret scientific data.
- To strengthen competency in plant diversity assessment, taxonomy, herbarium techniques, and field-based botanical studies.
- To train students in the application of ecological principles, conservation biology, and sustainable use of plant resources.
- To build proficiency in bioinformatics tools, data analysis, genomics, proteomics, and computational approaches in plant sciences.
- To develop critical thinking, scientific reasoning, and problem-solving abilities necessary for addressing real-world biological challenges.
- To prepare students for the use of plant biotechnology, genetic engineering, and tissue culture techniques for research and industrial applications.
- To improve communication skills for effective scientific writing, presentation, literature review, and dissemination of research findings.
- To develop ethical understanding, scientific integrity, and professional values required in academic and research environments.
- To prepare learners for careers in research, teaching, agriculture, biotechnology, environmental management, and for pursuing doctoral studies.

PROGRAMME OUTCOMES

PO1. Advanced Knowledge of Plant SciencesDemonstrate comprehensive understanding of plant morphology, anatomy, physiology, taxonomy, ecology, genetics, and biotechnology at an advanced level.

PO2. Research CompetenceDevelop the ability to identify research problems, formulate hypotheses, design experiments, and conduct independent scientific investigations.

PO3. Expertise in Laboratory and Analytical TechniquesAcquire hands-on skills in modern laboratory methods, instrumentation, molecular techniques, microscopy, biochemical assays, and data interpretation.

PO4. Application of Molecular and Cellular BiologyUnderstand advanced concepts in molecular genetics, genomics, proteomics, and use of molecular tools in plant science research.

PO5. Critical Thinking and Problem-Solving Skillsnalyze scientific data, evaluate evidence, and apply critical reasoning to solve botanical, ecological, and biotechnological problems.

PO6. Ecological and Environmental UnderstandingDemonstrate knowledge of ecosystem functioning, biodiversity assessment, environmental issues, and sustainable resource management.

PO7. Field Investigation SkillsConduct field studies, vegetation analysis, biodiversity documentation, herbarium preparation, and ecological surveys using modern tools and techniques.

PO8. Knowledge of Applied Botany and BiotechnologyApply concepts of plant breeding, plant tissue culture, bioprospecting, and genetic engineering in agriculture, industry, and conservation.

PO9. Proficiency in Bioinformatics and Data AnalysisUse bioinformatics databases, computational tools, statistical methods, and software relevant to molecular and ecological research.

PO10. Scientific Communication SkillsPrepare scientific reports, research papers, project proposals, and deliver effective oral and poster presentations.

PO11. Ethical and Professional ResponsibilityDemonstrate scientific ethics, academic integrity, environmental responsibility, and professional behavior in research and workplace settings.

PO12. Employability and Higher Education PreparednessDevelop competencies for careers in research institutions, universities, biotechnology industries, environmental agencies, agriculture sectors, and pursue Ph.D. programmes.

CREDIT DISTRIBUTION TABLE

SWAMI VIVEKANAD SUBHARTI UNIVERSITY MEERUT							
KERAL VERMA SUBHARTI COLLEGE OF SCIENCE							
Department of Life Science							
M.Sc. Botany (Session 2025-26 onwards)							
		I	**II**	**Internship after II Sem**	**III**	**IV**	**Total**
1	Core Course	16	16	**4**	8	4	44
2	Elective (DEC)	-	-		8	8	16
3	PC/Dissertation/Project Work	8	8		8	12	36
4	Seminar/VAC/OEC/EEC/CHM	2 (Seminar)	2 (CHM)		2 (OEC)	2 (EEC)	8
	Total	26	26		26	26	108

K. V. Subharti College of Science
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I YEAR

SWAMI VIVEKANAD SUBHARTI UNIVERSITY MEERUT														
KERAL VERMA SUBHARTI COLLEGE OF SCIENCE														
Department of Life Science														
Course Name - M.Sc Botany														
SEM:I														
Batch:2025-26							SEM:I							
S. No.	Course Type	Course Code	Course Name	Teaching Load			Credits		Internal Assessment		External Assessment	Total	Remark	
				L	T	P								
THEORY and PRACTICAL SUBJECTS								Attendance (5)	quiz/ PPT/ Assignment (10)	Mid Sem Test (15)	End Sem Exam (70)			
1	Core Course 1	MSBY -101	Plant diversity (Algae, Fungi, Lichens, and Bryophytes)	4		0	4	5	10	15	70	100		
2	Core Course 2	MSBY -102	Cell and Molecular Biology	4		0	4	5	10	15	70	100		
3	Core Course 3	MSBY -103	Biochemistry and Plant anatomy	4		0	4	5	10	15	70	100		
4	Core Course 4	MSBY -104	Developmental Biology	4		0	4	5	10	15	70	100		
5	Practical I (Based on CC 1 & 3)	MSBY -105P	Plant diversity and cell biology Lab	0		4	4	5	10	15	70	100		
6	Practical II (Based on CC 2& 4)	MSBY -106P	Biochemistry and developmental biologyLab	0		4	4	5	10	15	70	100		
7	Seminar I	MSBY -107S	Seminar	0		2	2	5	10	0	35	50		
TOTAL CREDITS / ASSESSMENT							26	35	70	90	455	650		

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NH-58 Bypass Road, Meerut

SEM:II													
Batch:2025-26								**SEM:II**					
S. No.	**Course Type**	**Course Code**	**Course Name**	**Teaching Load**			**Credits**		**Internal Assessment**		**External Assessment**	**Total**	**Remark**
				L	**T**	**P**							
THEORY and PRACTICAL SUBJECTS								**Attendance (5)**	**quiz/PPT/Assignment (10)**	**Mid Sem Test (15)**	**End Sem Exam (70)**		
1	Core Course 5	MSBY-201	Plant Diversity 2 (Pteridophytes, Gymnosperms, and Paleobotany)	4		0	4	5	10	15	70	100	
2	Core Course 6	MSBY-202	Plant-nanotechnology	4		0	4	5	10	15	70	100	
3	Core Course 7	MSBY-203	Genetics and Cytogenetics	4		0	4	5	10	15	70	100	
4	Core Course 8	MSBY-204	Reproductive Biology and Angiosperm	4		0	4	5	10	15	70	100	
5	Practical III (Based on CC 5 & 6)	MSBY-205P	Plant diversity and Nanobiotechnology Lab	0		4	4	5	10	15	70	100	
6	Practical IV (Based on CC 7 & 8)	MSBY-206P	Genetics and cytogentics lab	0		4	4	5	10	15	70	100	
7	CHM 1	MSBY-207S	Seminar	2		0	2	5	10	0	35	50	
TOTAL CREDITS / ASSESSMENT							**26**	**35**	**70**	**90**	**455**	**650**	

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S. V. Subharti University
NH-58 Bypass Road, Meerut

SYLLABUS: M.SC. (BOTANY)
I YEAR; I SEMESTER

Paper: 1. Plant diversity (Algae, Fungi, Lichens, and Bryophytes)
Paper code: MSBY-101
Course Outcomes
CO1. Explain the diversity, structure, reproduction, and life cycles of major groups of lower plants Algae, Fungi, Lichens, and Bryophytes.
CO2. Understand the systematic position, classification, and evolutionary relationships among the lower plant groups based on morphological, cytological, and molecular evidence.
CO3. Describe the **ecological and economic significance** of algae, fungi, lichens, and bryophytes in ecosystems and human welfare.
CO4. Analyze the life cycle patterns and alternation of generations in representative genera from each group.
CO5. Identify and differentiate important genera of algae, fungi, lichens, and bryophytes through morphological and anatomical observations.

Unit – I **12h**

Algae: Salient features (pigments, food reserves, flagellation, thallus organization, reproduction and life cycle) and classification of different class. A knowledge of algal life cycles; alternation of generation in algae; nitrogen fixation; parasiticalgae.Economic importance of algae.

Fungi: History of Mycology; India andabroad. General characters of Fungi, Cell ultra structure; Thallus organization, classification on the basis of mode of nutrition; reproduction (vegetative, asexual, sexual); Economic Importance; Recent trends in theclassification.

Unit – II **12h**

Phylogeny of Fungi; General account and life cycle of *Pythium*, *Albugo*, *Aspergillus*, *Penicillium*, *Cercospora*, *Puccinia*, *Rhizopus*, *Mucor*, *Saprolignia*. Fungi in industry, medicine and as food.Mycorrhizae; Fungi asbiocontrolagents.

Unit – III **12h**

Bryophytes: General characters, Classifications, Thallus organization, reproduction and lifehistory. Knowledge of the distribution of bryophytes in the India and Himalaya.Structure and Reproduction of Hepaticopsida - (Marchantiales, Jungermanniales) Anthoceroptopsida (Anthocerotales) Bryopsida (Funariales and Polytrichales), Economic importance of Bryophytes, Evolution of Sporophytes, Fossil Bryophytes.

Unit – IV **12h**

Classification and Phylogeny of variousgroups.Ecology of bryophytes, their association with otherorganisms.Generalaccount of fossil bryophytes. Economic importance of Bryophytes

Unit – V **12h**

General account of Marchantiales, Jungermanniales, Calobryales, Sphaerocarpales, and Anthocerotales.Sphagnales, Andrealesand Polytrichales.

Lichens: Salient features, Ecology and Distribution, Structure, Classification, Economic and Applied Importance, reproduction and Economic Importance.

SUGGESTED READINGS:

1. Cavers, F. 1979. The Interrelationships of the Bryophytes Reprint. Bishen Singh Mahendrapal Singh, Dehradun.
2. Fritsch, F.E. 1979. The Structure and Reproduction of Algae. Reprint. Bishen Singh

Mahendrapal Singh,Dehradun.
3. Kumar, H.D. 1988. Introductory Phycology. Affiliated East-West Press Ltd., NewDelhl.
4. Parihar, N.S.1991. Bryophyta. Central Book Depot,Allahabad.
5. Presscott, G.W. Algae: A Review. Bishen Singh MahendrapalSingh.
6. Puri, P. 1980. Bryophytes. Atma Ram & Sons,Delhi.
7. Mehrotra, R.S. and Aneja, R.S. 1998. An Introduction to Mycology. New Age Intermediate Press.
8. Webster, J. 1985. Introduction to Fungi. Cambridge UniversityPress.
9. Doelle, H.W. and C.G, Heden 1986. Applied Microbiology, Kluwer Academic Press,London.
10. Pelczar, M.J., Chan, ECS and Kreig, N.R. 1993. Microbiology, Concept and Applications. McGraw Hill, NewYork.

SYLLABUS: M.SC. (BOTANY)
I YEAR; I SEMESTER

Paper: 2. Cell and Molecular Biology
Paper code: MSBY-102

Course Outcomes:

CO1. Explain the **structure and function of prokaryotic and eukaryotic cells**, including cellular organelles and their roles in maintaining cell physiology.
CO2. Understand the **organization and dynamics of biological membranes**, mechanisms of transport, and cellular communication.
CO3. Describe the **molecular composition and structure of nucleic acids and proteins**, and their role in cellular processes.
CO4. Explain the **molecular mechanisms of DNA replication, transcription, and translation**, including regulation of gene expression in prokaryotes and eukaryotes.
CO5. Analyze the **cell cycle, its regulation, and the molecular basis of cell division (mitosis and meiosis)**.

Credits= L+T+P = 04 (4+0+0)	**TOTAL HOURS = 60**

Unit	**Topic**	**No.of Lectures(60hrs)**
I	**Geneticmaterial** MieschertoWatsonandCrick-historicperspective,Griffith'sandAvery'stransformation experiments,Hershey-Chase,bacteriophageexperiment,DNAstructure,typesofDNA, typesofgeneticmaterial.DNAreplication(Prokaryotesandeukaryotes):semi–conservative. DNA replication (Prokaryotes and eukaryotes): bidirectional replication, semi– conservative, semi discontinuous RNA priming, Ǿ (theta) mode of replication, replication of linear, dsDNA,replicatingthe5 ´endof linear chromosomeincludingreplicationenzymes.	**12h**

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II	**Transcription&Regulationofgeneexpression** Types of structures of RNA (mRNA, tRNA, rRNA), RNA polymerase-various types; Translation, (Prokaryotes and eukaryotes), genetic code. Regulation of gene expression in Prokaryotes: LacoperonandTryptophanoperon;andinEukaryotes	**12h**
III	**Principles&Techniquesofgeneticengineering** Blottingtechniques:Northern,SouthernandWesternBlotting,DNAFingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCRand Reverse Transcriptase-PCR. Hybridoma and monoclonal antibodies, ELISA and Immunodetection.AntibodyEngineering.	**12h**
IV	**ApplicationsofGeneticengineering** Pest resistant (Bt-cotton); herbicide resistant plants (RoundUp Ready soybean); Transgenic crops with improved quality traits (FlavrSavr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug); Industrial enzymes (Aspergillase, Protease, Lipase); Genetically Engineered Products, Biosafety concerns..	**12h**
V	**Bioinformatics&itsapplications** Computerfundamentals- programminglanguagesinbioinformatics,roleof supercomputers in biology. Historical background. Scope of bioinformatics-Genomics, Transcriptomics, Proteomics, Metabolomics, Molecular Phylogeny, computeraidedDrugDesign (structure basedandligandbasedapproaches),SystemsBiology andFunctional Biology.Applications andLimitationsofbioinformatics.	**12h**

SUGGESTED READINGS:

1. Ross, F.C. 1983. Introductory Microbiology. Charles E. Merril. Publ. Co. Columbus,Ohio.
2. Alexander, M. 1991. Microbial Ecology. John Wiley and Sons. NewYork.
3. APHA. 1971. Standard Methods for the Examination of water and Waste Water. Washington DC
4. Atlas. R. M. Principle ofMicrobiology.
5. Board, R.G. and D.W., Lovelock 1975. Some Method for Microbiological Assay. Acadmic Press. New York

SYLLABUS: M.SC. (BOTANY)

I YEAR; I SEMESTER

Paper: 3. Biochemistry and Plant anatomy

Paper code: MSBY-103

Course outcomes:

C01: Differentiate the biomolecules of living organisms, their interactions for perpetuation of life

CO2: Analyze structure-function relationships of nucleic acids and protein
CO3: Distinguish between replication, transcription and translation in prokaryotes and eukaryotes
CO4: Interpret the gene expression mechanisms
CO5: Recognize anatomical parts of plant and different embryological stages of plant

Unit	Topic	No.of Lectures(60hrs)
I	Types and significance of chemical bonds; Structure and properties of water; pH and buffers. Carbohydrates: Nomenclature and classification; Monosaccharides; Disaccharides; Oligosaccharides and polysaccharides.	**12h**
II	**Molecules of life:** Nucleic Acids – structure of nucleosides and nucleotides ; oligo- and poly nucleotides , B & Z form of DNA, RNA- different forms; nucleotide derivatives (ATP, NADP); Proteins – structure and classification of amino acids; primary, secondary, tertiary and quaternary structure of proteins; Carbohydrates - structure of mono-, di- and polysaccharide; stereoisomers, enantiomers and epimers; Lipids - structure of simple lipid and compound lipid (phospholipids and glycolipids), fatty acids-saturated and unsaturated.	**12h**
III	**Energy flow and enzymology:** Bioenergetics-Thermodynamic principles; free energy; energy rich bonds-phosphoryl group transfer and ATP; redox potentials and Biological redox reactions, Enzymes – classification and nomenclature (IUBMB); Co-factors and co-enzymes; isozymes, Mechanism of enzyme action; enzyme inhibition; Enzyme kinetics (Michaelis- Menten equation) and simple problems.	**12h**
IV	Simple and complex tissues, Root and shoot apical meristems, Root development: organization of root apical meristem (RAM), initiation of lateral roots, Shoot development: organization of shoot apical meristem (SAM), Structure of dicot and monocot root, stem and leaf. Mechanism of vascular tissue differentiation, secondary growth, wood development in relation to environmental factors; Leaf growth and determination of phyllotaxy, differentiation of stomata &trichomes.	**12h**
V	Adaptive and Protective Systems Epidermis, cuticle, lenticels, hydathodes; General account of adaptations in xerophytes and hydrophytes. Structural organization of flower, Structure of anther and pollen; Structure and types of ovules; Pollination: Different methods of Pollination and adaptations in plants for pollination: Seed-structure appendages and dispersal mechanisms.	**12h**

Suggested readings:

1. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology.John Wiley & Sons,

U.S.A. 4th Edition.
2. Buchanon, Gruissen and Jones. Plant Physiology & Biochemistry: Biochemistry and Molecular Biology of plants, 2000, I.K. International.
3. Chaudhuri, D., Kar, D.K., and Halder, S.A. Handbook of Plant Biosynthetic Pathways, 2008, New Central Book Agencies.
4. Conn, E.E. and Stumpf, R.R. Outlines of Bio-Chemistry, Latest Ed., Wiley Eastern.
5. Davies P.J. (ed.) Plant Physiology: Physiology, Bio-Chemistry & Molecular Biology, Academic Press.
6. Hall. D.O. &Rao, K.K. photosynthesis (5th ed.), 1995, Cambridge University Press.
7. Hames, B.D. Bio-Chemistry (2nd ed.) Viva Books.
8. Jain, V.K. Fundamental of Plant Physiology (7th ed.) 2004. S. Chand and Company.
9. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
10. Beck, C. B. (2010), An Introduction to Plant Structure and Development – Plant Anatomy for the Twenty – First Century, 2nd edition, Cambridge University Press.

SYLLABUS: M.SC. (BOTANY)
I YEAR; I SEMESTER

Paper: 4. Developmental Biology

Paper code: MSBY-104

Course outcomes:

On completion of this course, the students will develop the following skills:

CO1: Observation of variations that exist in internal structure of various parts of a plant

C02:Among different plant groups in support of the evolutionary concept.

CO3: Skill development for the proper description of internal structure using botanical terms, their identification and further classification.

C04: Induction of the enthusiasm on internal structure of locally available plants.

C05: Understanding various levels of organization in a plant body with an outlook in the relationship between the structure and function through comparative studies.

Unit	Topic	No.of Lectures (60 hrs)
I	**Tissue and tissue systems** - Definitions, structure and functions of Meristematic tissues and permanent tissues (Simple and Complex). A brief account of plant secretary tissues/cells. Concept of tissue systems - Ground tissues, Dermal tissues and Vascular tissues.	**12h**
II	Initiation of leaf primordia and development of leaves and Phyllotaxis, Diversity in size, shape and arrangement of leaves.	**12h**
III	Root Apical Meristem: development – Establishment of primary root meristem, Lateral root development, Root cap, quiescent centre. Shoot Apical meristem (SAM): Origin, structure and function, Cytohistological zonation and Ultrastructure of meristems.	**12h**

IV	**Differentiation and Morphogenesis in Plants** Introduction to the concepts of differentiation and morphogenesis (definitions and significance in plant growth and development process). **Concept of totipotency and de-differentiation**. Differentiation and cell polarity in acellular (Dictyostelium), Unicellular (Acetabularia) and multicellular plant system (Arabidiopsis).	**12h**
V	**Organogenesis:** Differentiation of root, stem, leaf and axillary buds; bud dormancy Leaf development. **Flower development:** Overview of flower initiation and development, Genetic control of flower development - ABC model of flower development. Senescence in plants – a general account.	**12h**

Suggested readings:

1. Lincoln Taiz, Eduardo Zeiger, Ian M. Møller, and Angus Murphy. Plant Physiology and Development (6th ed.), Sinauer Associates.
2. Mehta, S.L., Lodha, M.L. & Bane, P.V. Recent Advances in Plant Biochemistry, 1989.I.C.A.R.
3. Mukherjee, S. &Ghosh, A. Plant Physiology (2nd ed.), 2005, New Central Book Agency.
4. Panday, S.N. &Sinha, B.K. Plant Physiology (4th ed.), 2006, Vikas Publishing House Pvt. Ltd.
5. Pua, E. C. and Davey, M. R. Plant Developmental Biology – Biotechnological Perspective (Vol-I), 2010, Springer.
6. Pua, E. C. and Davey, M. R. Plant Developmental Biology – Biotechnological Perspective (Vol-II), 2010, Springer.
7. Raman, H. Transport Phenomenon in Plants, 1997. Narosa Publishing House. 16. Sackheim, G. Chemistry for Biology Students (5th ed.) 1996, Benjamin/Cummings
8. Salisbury, F.B. & Ross, C.W. Plant Physiology (4th ed.), 19992, Wadsoworth Publishing Company.
9. Singhal, G.S. Concepts of Photobiology: Photosynthesis &Photomorphogenesis, 1999, Narosa

SYLLABUS: M.SC. (BOTANY)
I YEAR; I SEMESTER

Paper:Practical I
Paper code: MSBY-105P

1. Study of algal thallus forms (unicellular, colonial, and filamentous).
2. Identification of important algal groups using permanent slides.
3. Observation of pigments in algae using microscopic examination.
4. Study of fungal culture techniques (Aseptic transfer on PDA).
5. Microscopic study of fungal hyphae and reproductive structures
6. 4 Demonstration of mycorrhizaein root samples.
7. Fungi as biocontrol agents observation of Trichoderma culture.
8. Study of general characters and thallus organization in bryophytes.
9. Microscopic observation of Marchantiales Marchantia: thallus, gemma cup, capsule).
10. Study of Jungermanniales (leafy liverworts).
11. Study of Anthocerotopsida Anthoceros sporophyte).
12. Study of Bryopsida Funaria and Polytrichum gametophyte & sporophyte).

13. Observation of DNA structure through models/animation; identification of A-, B-, Z-DNA.
14. Extraction of DNA from onion/banana (demonstration).
15. Estimation of DNA by diphenylamine method (demo).
16. Study of DNA replication models semi-conservative, bidirectional, theta mode.
17. Identification of replication enzymes using charts (DNA pol, ligase, helicase, primase).

SYLLABUS: M.SC. (BOTANY)
I YEAR; I SEMESTER

Paper:Practical 2
Paper code: MSBY-106P

1. Biomolecules & Biochemical Principles
2. Demonstration of types of chemical bonds using molecular models (ionic, covalent, H-bond).
3. Study of nucleosides & nucleotides through structural models.
4. Model study of DNA forms (A-, B-, Z-DNA).
5. Demonstration of ATP as an energy molecule through charts/reactions.
6. Study of redox reactions using simple oxidation-reduction experiments.
7. Study of simple and complex tissues (epidermis, collenchyma, sclerenchyma, xylem, phloem).
8. Study of flower structure (calyx, corolla, androecium, gynoecium).
9. Study of dermal, ground & vascular tissue systems in plant sections.
10. Observation of secretory tissues laticifers, glandular hairs (slides/charts).
11. Study of leaf primordia and phyllotaxy (spiral, opposite, whorled).

SYLLABUS: M.SC. (BOTANY)
I YEAR; II SEMESTER

Paper: 1. Plant Diversity 2 (Pteridophytes, Gymnosperms, and Palaeobotany)
Paper code: MSBY-201
Course outcomes:

CO1: On completion of this course, the students will develop the following skills:
CO2: Knowledge about plants and botanical skills needed for teaching and research, and an understanding of environmental issues needed to become naturalists or conservationists.
CO3: Critical and reflective thinking to enable them to make an honest assessment of their strengths and weakness, so that they put in the necessary efforts to carve a better future for themselves.
CO4: Communication skills through effective presentations and interactive sessions in the class.
CO5: Problem-solving skills to help generate confidence for a more substantive life.

Unit	Topic	No. of Lectures (60 hrs)

I	Pteridophytes: General features, classification, stelar system and its evolution. Heterospory andseed habit. Comparative study of morphology, anatomy, development, vegetative and reproductive systems of following: Lycopsida - Lycopodium, Selaginella;Psilopsida- Rhynia General characteristics of Pteridophytes Criteria and comparative systems of classification of Pteridophytes Origin and evolution of Pteridophytes-Algal and Bryophytic origin Different types of fossils. Comparative study of the followingRhyniopsida:RhyniaPsilopsida: Psilotum, TmesipterisLycopsida:	**12h**
II	General and comparative account of gametophytic and sporophytic system only inFilicopsida -Pteridium, Nephrolepis. Marsilea. Evolution of stelar system in Pteridophytes Evolution of Telome theory in Pteridophytes Comparative account of apogamy and apospory Economic importance of Pteridophytes Comparative study of morphology of sporophytes, soral arrangement, sporangial characters and development of gametophytes in different major groups of Ferns: Eusporangiatae: Ophioglossales- Ophioglossum; Marattiales	**12h**
III	Gymnosperms: General characters, classification. Comparative study of morphology, anatomy, development of vegetative and reproductive parts in: Cycadales: Cycas Classification, Distribution, Evolutionary tendencies and Economic importance of Gymnosperms Pteridospermales: A general account of the order with reference to families- (i) Lyginopteridaceae (ii) Medullosaceae (iii) Glossopteridaceae (iv) Corystospermaceae (v) Peltaspermaceae (vi) CaytoniaceaeCycadales: A general account Nilssoniales: A general account. Bennettitales (Cycadeoideales): A general account, affinities and inter-relationships among the families (i) Williamsoniaceae (ii) Wielandiellaceae (iii) CycadeoideaceaePentoxylales: A general account and evolutionary tendencies	**12h**
IV	Study of morphology, anatomy, development and reproductive parts in: Coniferales – Pinus ; Gnetales - Ephedra Affinities and relationship of Gymnosperms, evolutionary significance. Elementary Palaeobotany: general account, types of fossils, methods of fossilization and geological time scale. Cordaitales: A general account of the order with reference to families- (i) Eristophytaceae (ii) CordaitaceaeGinkgoales: A general account with special reference to Ginkgo Coniferales: Evolution of megastrobilus and seed-scale complex in various families.	**12h**
V	Gnetales - A general comparative account with reference to Ephedra, Gnetum and Welwitschia (Affinities and inter-relationships, morphology, anatomy and reproductive biology) Study of fossils: Methods of preservation, investigation and importance in stratigraphy. Continental drift and geological time scale.	**12h**

Suggested readings:

1. Agashe, S. N. (1995). Paleobotany, Oxford and IBH Publ. Co. Pvt. Ltd, New Delhi.
2. Arnold, A. C. (2005). An Introduction to Paleobotany, Agrobios (India), Jodhpur.
3. Bhatnagar S. P. and Moitra A. (1996). Gymnosperms. New Age International, New Delhi.
4. Biswas C. and Johri B. M. (1997). Gymnosperms.2 Narosa Publishers, NewDelhi.
5. Cavers, F. (1976). The inter relationships of the bryophyte. S.R. Technic, Ashok Rajpath, Patna.
6. Chapman V.J. and Chapman D.J. (1975). The algae, 2nd Edition, Mac.Millan Publ. Inc. New York.
7. Parihar, N.S. (1976). Biology and morphology of the Pteidophytes.Central Book Depot.
8. Rashid, A. (1999). An Introduction to Pteridophyta, Vikas Publishing House Pvt. Ltd., New Delhi.
9. Ramanujan, C.K.G. (1970). Indian Gymnosperms in time and space. Today &Tomorrow's Printers & Publishers.
10. Singh, V. P. (2006). Gymnosperms (Naked seed plants): Structure and Development, Sarup and Sons, New Delhi.
11. Sporne, K.R. (1965), Morphology of Gymnosperms Hutchinson University Library.
12. Sporne, K.R. (1986). The morphology of Pteridophytes. Hutchinson University Press, London, 3
13. Surange, K.R. (1966). Indian fossil Pteridophytes Council of Scientific and Industrial research. New Delhi.
14. SundaraRajan, S. (1999). Introduction to Pteridophyta.New Age International Publishers, New Delhi.

I YEAR; II SEMESTER

Paper: 2. Plant-nanotechnology

Paper code: MSBY-202

Course outcomes:

CO1. Explain the **basic principles of nanoscience and nanotechnology**, including the unique physical, chemical, and biological properties of nanomaterials.

CO2. Describe various **types of nanomaterials** (nanoparticles, nanotubes, nanocomposites, quantum dots, etc.) and their **methods of synthesis**, with emphasis on **green synthesis using plant systems**.

CO3. Understand the **interaction of nanomaterials with plant cells and tissues**, including uptake, translocation, and accumulation mechanisms.

CO4. Analyze the **applications of nanotechnology in agriculture and plant sciences**, such as in crop improvement, nutrient delivery, pest management, and stress tolerance.

CO5. Evaluate the **role of nanotechnology in plant disease diagnosis, genetic engineering, and controlled release of agrochemicals.**

Unit	Topic	No.of Lectures (60 hrs)
I	**Introduction to nanotechnology and nanobiotechnology** Fundamental concepts: The basic principles of nanotechnology, including the unique physical, chemical, and biological properties of materials at the nanoscale.Nanomaterials: An overview of different types of nanomaterials, including nanoparticles, nanotubes, nanocomposites, and quantum dots.Green synthesis: Environmentally friendly methods for synthesizing nanomaterials using plant extracts, microorganisms, and other biological	**12h**

	entities.	
II	**Nanomaterials in plant systems** Uptake and transport: The mechanisms by which plants absorb, translocate, and accumulate nanoparticles. This includes studying the pathways and factors influencing their movement within the plant body.Nanomaterial-plant interactions: Investigating how nanomaterials affect plant growth, development, and physiology, including root development, photosynthesis, and nutrient assimilation.Impact on soil and ecosystem: Assessing the effects of nanomaterials on soil microbes, nutrient cycles, and the broader agro-ecosystem.	**12h**
III	**Nanotechnology applications in agriculture** Nano-fertilizers: Using nanomaterials to create more efficient fertilizers that increase nutrient use efficiency and reduce environmental pollution.Nano-pesticides and herbicides: Developing targeted and controlled-release delivery systems for pesticides and herbicides to minimize chemical runoff and improve crop protection.Genetic engineering: Using nanomaterials as tools for targeted gene delivery into plant cells to enhance genetic modification processes.	**12h**
IV	**Nanotechnology for plant protection and stress management** Disease management: Employing nanomaterials with antimicrobial properties to combat plant diseases caused by bacteria, fungi, and viruses.	**12h**
V	**Abiotic stress mitigation:** Using nanomaterials to help plants tolerate stresses such as drought, salinity, and heavy metal contamination. **Controlled-release systems:** Designing nano-encapsulation techniques to deliver beneficial compounds, like plant growth regulators, at a sustained and controlled rate.	**12h**

References

1. Rai, M., et al. (2015). *Nanotechnology in Agriculture and Food Industry*. Springer.
2. Prasad, R., Kumar, V., & Prasad, K.S. (2014). *Nanotechnology in sustainable agriculture: Present concerns and future aspects*. *African Journal of Biotechnology*, 13(6), 705–713.
3. Singh, R.P., &Nalwa, H.S. (2011). *Nanotechnology and health safety—Toxicity and risk assessments of nanostructured materials on human health*. *Journal of Nanoscience and Nanotechnology*, 11(8), 6671–6678.

4. Tripathi, D.K., et al. (2017). *An overview on manufactured nanoparticles in plants: Uptake, translocation, accumulation and phytotoxicity*. *Plant Physiology and Biochemistry*, 110, 2–12.
5. Paramo, L.A., et al. (2020). *Green synthesis of nanoparticles: Current trends and future challenges*. *Materials*, 13(10), 2199.
6. Chen, J., et al. (2022). *Nanotechnology for sustainable agriculture: Challenges and opportunities*. *Journal of Agricultural and Food Chemistry*, 70(12), 3552–3564.
7. Wang, P., Lombi, E., Zhao, F.J., &Kopittke, P.M. (2016). *Nanotechnology: A new opportunity in plant sciences*. *Trends in Plant Science*, 21(8), 699–712.
8. Mishra, S., & Singh, H.B. (2020). *Nanoparticles in sustainable agriculture: Recent developments, challenges, and perspectives*. *Frontiers in Plant Science*, 11, 590.

I YEAR; II SEMESTER

Paper:3. GENETICS AND CYTOGENETICS **Paper code: MSBY-203**

Course outcomes:

CO1. Explain the **basic principles of heredity and variation**, including Mendelian and non-Mendelian inheritance patterns.

CO2. Describe the **structure, organization, and function of chromosomes** and other components of the genetic material.

CO3. Understand the **molecular basis of gene expression, mutation, and genetic recombination** in prokaryotes and eukaryotes.

CO4. Analyze the **chromosomal aberrations** (structural and numerical) and their **cytological and genetic consequences**.

CO5. Examine the **mechanisms of linkage, crossing over, and genetic mapping** to understand gene interactions and chromosomal behavior.

Unit	Topic	No.of Lectures (60 hrs)
I	Microbial Genetics: Viral and bacterial genomes and derived vectors; Recombination in viruses and bacteria (transformation, conjugation and transduction); Fine structure of gene; Prokaryotic gene regulation; Fungal genetics – mating types and genetic exchange, heterokaryosis, parasexual cycle.	**12h**
II	Mendelian and Non-Mendelian Inheritance: Meiosis; Chromosome theory of inheritance; Mendelian laws; Gene interactions; Organelle inheritance. Eukaryotic Genome: Evolution, structure and organization; Gene regulation.	**12h**
III	Mutation: Basic concept, spontaneous and induced mutations, allele theory, physical and chemical mutagens; Molecular basis of mutations; Transposons and their use in mutagenesis and gene tagging in plant systems; Oncogenes and cancer.	**12h**

IV	Concepts in: Developmental genetics; Behavioral genetics; Population genetics and Quantitative genetics. Cytogenetics: Chromosome: Structure and nomenclature, centromere and telomere; Sex determination: mechanisms, sex chromosomes;	**12h**
V	Chromosomal aberrations: Duplications, deficiencies/deletions, inversions, interchanges/translocations; Role of chromosomal aberrations in crop evolution; Ploidy changes: Haploids, polyploids and aneuploids; Genome analysis in crop plants; Molecular Cytogenetics: FISH, GISH, FIBER-FISH, Flow Cytogenetics, Flow karyotyping, Applications of molecular cytogenetics	**12h**

References

1. Brock, T.D., Madigan, M.T., Martinko, J.M., & Parker, J. (2015). *Brock Biology of Microorganisms*. Pearson Education.
2. Snyder, L., &Champness, W. (2007). *Molecular Genetics of Bacteria*. ASM Press.
3. Maloy, S.R., Cronan, J.E., &Freifelder, D. (2004). *Microbial Genetics*. Jones & Bartlett Publishers.
4. Willey, J.M., Sherwood, L.M., &Woolverton, C.J. (2017). *Prescott's Microbiology*. McGraw-Hill.
5. Fincham, J.R.S., Day, P.R., & Radford, A. (1979). *Fungal Genetics*. Blackwell Scientific Publications.
6. Davis, R.W., Botstein, D., & Roth, J.R. (1980). *Advanced Bacterial Genetics*. Cold Spring Harbor Laboratory Press.
7. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., &Doebley, J. (2015). *Introduction to Genetic Analysis* (11th Ed.). W.H. Freeman.
8. Klug, W.S., Cummings, M.R., Spencer, C.A., Palladino, M.A., & Killian, D.J. (2019). *Concepts of Genetics* (12th Ed.). Pearson.
9. Snustad, D.P., & Simmons, M.J. (2015). *Principles of Genetics* (7th Ed.). Wiley.
10. Russell, P.J. (2016). *iGenetics: A Molecular Approach* (3rd Ed.). Pearson.
11. Reece, J.B., et al. (2020). *Campbell Biology* (12th Ed.). Pearson Education

I YEAR; II SEMESTER

Paper: 4. Reproductive Biology of Angiosperms **Paper code: MSBY-204**

Course outcomes:

CO1. Explain the **structure, organization, and development of reproductive organs** in angiosperms.

CO2. Describe the **processes of microsporogenesis and megasporogenesis**, and the development of male and female gametophytes.

CO3. Understand the **mechanisms of pollination, pollen-pistil interaction, fertilization, and double fertilization** in flowering plants.

CO4. Analyze the **developmental stages of embryo, endosperm, and seed formation**, and their physiological significance.

CO5. Evaluate the **mechanisms of apomixis, polyembryony, and self-incompatibility** and their importance in plant reproduction and breeding.

Unit	Topic	No.of Lectures (60 hrs)
I	Introduction and scope of Reproductive Biology. General - Need for reproductive system as experimental material, Interdisciplinary approaches: genetic and molecular perspective. Contributions of G.B. Amici, W. Hofmeister, E. Strasburger, S.G. Nawaschin, P. Maheshwari, B.M. Johri, W.A. Jensen, J. Heslop-Harrison, H.Y. Mohan Ram. Embryological Features of Taxonomic Importance, Role of embryology in taxaonomy. Reproduction in angiosperms: Types of reproduction, Vegetative reproduction (natural and artificial) and sexual reproduction, The Life cycle of an Angiosperm.	**12h**
II	Flower Development: Rise of Flowering plants, Evolution of Flower, Development of Flower in Angiosperms, Basic structure of Flower, floral organ differentiation. The flower: A modified shoot, parts of flower (types and modification in Bracts, Calyx. Corolla, Androecium, Cohesion of stamens, Adhesion of stamens, Gynoecium, Placentation) Types of Flowers (On the basis of sex organs present, symmetry, Position of floral leaves and presence of Accessory whorls). Floral formula and floral diagram.	**12h**
III	Sex determination in flowering plants: bisexual and unisexual flowers, regulation of unisexuality, genetic regulation of monoecy, genetics of sexuality in dioecious plants (1. Active-y system of sex determination and 2. X-to- autosome balance system of sex determination) hormonal regulation of sexuality, evolution of sexual dimorphisms in plants. Inflorescence: Types of inflorescence, Special types and its significance.	**12h**
IV	Anther: Development of anther (microsporangium), Structure, anther wall, endothecium, middle layer, tapetum-Structure, types-structure function relationship, role of tapetum.	**12h**
V	Microsporogenesis: Sporogenous cells cytoplasmic reorganization during sporogenesis (Ultrastructural changes), molecular biology of meiosis, DNA and RNA synthesis, Protein synthesis, meiosis specific genes. Pollen tetrad development.Unique features: Pseudomonads, polyads, massulae, pollinia, pollen embryo sacs.	**12h**

References

1. **Maheshwari, P. (1950).***An Introduction to the Embryology of Angiosperms.* McGraw-Hill Book Company, New York.
2. **Johri, B. M. (Ed.). (1984).***Embryology of Angiosperms.* Springer-Verlag, Berlin.
3. **Bhojwani, S. S., &Bhatnagar, S. P. (1999).***The Embryology of Angiosperms* (4th ed.). Vikas Publishing House, New Delhi.
4. **Raghavan, V. (1997).***Molecular Embryology of Flowering Plants.* Cambridge University Press, Cambridge.

5. **Raghavan, V. (2000).***Developmental Biology of Flowering Plants.* Springer, New York.
6. **Shivanna, K. R., &Johri, B. M. (1985).***The Angiosperm Pollen: Structure and Function.* Wiley Eastern Ltd., New Delhi.

SYLLABUS: M.SC. (BOTANY)
I YEAR; II SEMESTER

Paper:Practical III
Paper code: MSBY-205P

1. Study of general features and classification of Pteridophytes using charts.
2. Study of general characters and classification via charts.
3. Study of Pinus (Coniferales)
4. Fossil GymnospermsLyginopteridaceae, Glossopteridaceae, Medullosaceae (charts).
5. Study of types of fossils impression, compression, petrifaction, casts.
6. Introduction to nanomaterials observation of nanoparticles, nanotubes, nanocomposites

SYLLABUS: M.SC. (BOTANY)
I YEAR; II SEMESTER

Paper:Practical IV
Paper code: MSBY-206P

1. Demonstration of green synthesis of silver nanoparticles using plant extract (colour change
2. Demonstration of nanoparticle uptake via root vs. foliar pathways (using coloured nanoparticles).
3. Study of nano-fertilizers types & release system (charts/models).
4. Antimicrobial activity of nanoparticles (agar well diffusion – silver NP).
5. Stress mitigation experiment– salt/drought stress with/without nanoparticles.
6. Nano-encapsulation demonstration using alginate beads for controlled release.
7. Isolation of bacterial genomic DNA
8. Bacteriophage infection experiment plaque observation.
9. Study of heterokaryosis & parasexual cycle in fungi (slides/charts).
10. Study of meiosis using onion flower bud squash.
11. Induced mutation experiment using EMS/UV on seeds (demo only).
12. Eukaryotic Genome & Regulation
13. Structure of chromosomes observation of karyotype slides.
14. Study of gene regulation lac operon & trp operon models. Preparation of root tip squash for mitosis

II YEAR

SEM:III														
Batch:2025-26							SEM:III							
S. No.	Course Type	Course Code	Course Name	Teaching Load			Credits		Internal Assessment		External Assessment	Total	Remark
				L	T	P							
THEORY and PRACTICAL SUBJECTS								Attendance (5)	quiz/PPT/Assignment (10)	Mid Sem Test (15)	End Sem Exam (70)		
1	Core Course 9	MSBY-301	Plant PHYSIOLOGY AND BIOCHEMISTRY	4	1	0	4	5	10	15	70	100	
2	Core Course 10	MSBY-302	Plant Biotechnology and tissue culture	4	1	0	4	5	10	15	70	100	
3	DEC 1	MSBY-303A	Microbiology, Immunology, and Plant Pathology										
		MSBY-303B	PLANT ECOLOGY AND PHYTOGEOGRAPHY	4	1	0	4	5	10	15	70	100	
4	DEC 2	MSBY-304A	ADVANCES IN ARCHEGONIATAE										
		MSBY-304B	Diversity and Cultivation of Mushrooms	4	1	0	4	5	10	15	70	100	
5	Practical V (Based on CC 9 & 10)	MSBY-305P	Plant physiology and Biotechnology Lab	0	0	4	4	5	10	15	70	100	
6	Practical VI (Based on DEC 1	MSBY-306P	Microbiology, Immunology, and Plant	0	0	4	4	5	10	15	70	100	

	& 2)		Pathology Lab										
7	OEC 1	MSBY -307S	Seminar	2	0	0	2	5	10	0	35	50	
TOTAL CREDITS / ASSESSMENT							**26**	**35**	**70**	**90**	**455**	**650**	

SEM:IV (With Project Work)													
Batch:2025-26							**SEM:IV (Without Project Work)**						
S.No.	**Course Type**	**Course Code**	**Course Name**	**Teaching Load**			**Credits**		**Internal Assessment**		**External Assessment**	**Total**	**Remark**
				L	**T**	**P**							
THEORY and PRACTICAL SUBJECTS								**Attendance (5)**	**quiz/PPT/Assignment (10)**	**Mid Sem Test (15)**	**End Sem Exam (70)**		
1	Core Course 11	MSBY-401	SYSTEMATICS, EVOLUTION AND ENVIRONMENTAL SCIENCE	4	1	0	4	5	10	15	70	100	
		MSBY-402A	Conservation of Natural Resources and Policies										
2	DEC 5	MSBY-402B	MEDICINAL PLANTS	4	1	0	4	5	10	15	70	100	
		MSBY-403A	Ethno Botany, Naturopathy, and traditional Health care										
3	DEC 6	MSBY-403B	CONSERVATION BIOLOGY	4	1	0	4	5	10	15	70	100	
5	EEC 1	MSBY-405	EEC	4	1	0	2	5	10	15	70	100	
6	Project Work	MSBY-404R	Project	0	0	4	12	0	0	0	250	250	

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TOTAL CREDITS / ASSESSMENT	**26**	**20**	**40**	**60**	**530**	**650**	

SYLLABUS: M.SC. (BOTANY)
II YEAR; III SEMESTER

Paper: 1. Plant Physiology and Biochemistry
Paper code: MSBY-301

Course outcomes:

C01: This course aims to cultivate an in-depth understanding of the physiological and biochemical mechanisms that govern plant growth, development, and metabolism.

CO2: It emphasizes how plants perceive, integrate, and respond to internal and external environmental cues through intricate molecular and biochemical networks.

CO3: Students will explore the structure, function, and dynamics of cellular biomolecules such as carbohydrates, lipids, proteins, and nucleic acids, along with their metabolic interconnections in energy generation and biosynthesis.

CO4: The course provides a detailed study of enzymology, photosynthesis, respiration, and nitrogen metabolism, highlighting regulatory mechanisms and their role in plant productivity.

CO5: It also examines plant–water relations, membrane transport processes, and nutrient uptake systems essential for physiological homeostasis.

Unit	Topic	No.of Lectures (60 hrs)
I	**Plant–Water Relations and Mineral Nutrition** Explores water potential, osmotic adjustment, absorption, and transport through xylem. Mechanisms of transpiration, stomatal regulation, and mineral uptake (macro and micronutrients) are studied. Physiological disorders due to nutrient deficiency and their management are discussed in detail.	**12h**
II	**Photosynthesis and Carbon Assimilation** Examines light and dark reactions, chloroplast structure, C_3, C_4, and CAM pathways, photorespiration, and carbon fixation. Regulation of photosynthetic efficiency and photoinhibition mechanisms are explored with emphasis on improving productivity.	**12h**
III	**Respiration and Nitrogen Metabolism** Details glycolysis, TCA cycle, oxidative phosphorylation, pentose phosphate pathway, and alternative respiratory mechanisms. Nitrogen fixation, nitrate reduction, and ammonia assimilation pathways are discussed in biochemical depth.	**12h**

IV	**Plant Growth Regulators and Signal Transduction** Covers auxins, cytokinins, gibberellins, ethylene, and abscisic acid. Mechanisms of hormone signaling, cross-talk among phytohormones, photoreceptors, and stress signaling pathways are analyzed.	**12h**
V	**Enzymes, Secondary Metabolites, and Stress Physiology** Describes enzyme kinetics, regulation, and coenzymes. Discusses the biosynthesis of alkaloids, flavonoids, phenolics, and terpenoids. Mechanisms of plant stress tolerance—abiotic (drought, salinity, temperature) and biotic (pathogen, herbivore)—are explained with molecular perspectives.	**12h**

Suggested readings:

1. Taiz&Zeiger (2015), Buchanan et al. (2015), Salisbury & Ross (1992), Hopkins (2009).
2. **Raghavan, V. (2000).***Developmental Biology of Flowering Plants.* Springer, New
3. York. **Shivanna, K. R., &Johri, B. M. (1985).***The Angiosperm Pollen: Structure and Function.* Wiley Eastern Ltd., New Delhi

SYLLABUS: M.SC. (BOTANY)

II YEAR; III SEMESTER

Paper: 2. PLANT BIOTECHNOLOGY AND TISSUE CULTURE

Paper code: MSBY-302

Course outcomes:

CO1: This course equips students with comprehensive theoretical and practical knowledge of modern plant biotechnology, genetic engineering, and tissue culture techniques.

CO2: It emphasizes the principle of cellular totipotency, providing insights into somatic hybridization, micropropagation, somatic embryogenesis, and synthetic seed production as key tools for plant regeneration and improvement.

CO3: Students will learn the design and optimization of plant tissue culture media, aseptic handling of explants, and large-scale propagation methods.

C04:The course further explores molecular techniques such as Agrobacterium-mediated and biolistic gene transfer, transformation strategies.

CO5: Use of molecular markers for genetic analysis and crop enhancement. conservation of endangered plant species.

Unit	Topic	No.of Lectures (60 hrs)
I	Basic concepts of Biotechnology. Overview of Plant Biotechnology. Plant tissue culture laboratory, culture media and culture techniques	**12h**
II	Totipotency and cyto-differentiation. Cell suspension and callus cultures.Morphogenesis: Caulogenesis and rhizogenesis through	**12h**

III	Callus. Rooting & establishment of regenerated shoots.Somaclonal variation. Embryogenesis: Embryogenic callus, somatic embryos and plant regeneration. Importance of synthetic seeds.	**12h**
IV	Meristem culture, multiple shoot production and micropropagation. Anther & pollen culture. Significance of haploidy. Isolation, culture & fusion of protoplasts	**12h**
V	Cryopreservation and germplasm storage. . Application of micropropagation in horticulture and forestry. In vitro production of secondary metabolites from medicinal and aromatic plants and industrial applications. Hairy root cultures.	**12h**

Suggested readings:

1. Chawla, H.S. (2009). *Introduction to Plant Biotechnology (3rd Edition).* Science Publishers, CRC Press.
2. Slater, A., Scott, N.W., & Fowler, M.R. (2008). *Plant Biotechnology: The Genetic Manipulation of Plants.* Oxford University Press.
3. Gamborg, O.L. & Phillips, G.C. (1995). *Plant Cell, Tissue and Organ Culture: Fundamental Methods.* Springer.
4. Vasil, I.K. & Thorpe, T.A. (1994). *Plant Cell and Tissue Culture.* Springer.
5. Singh, B.D. (2018). *Biotechnology: Expanding Horizons.*Kalyani Publishers.
6. Purohit, S.S. (2012). *Biotechnology: Fundamentals and Applications.*Agrobios.

SYLLABUS: M.SC. (BOTANY)
II YEAR; III SEMESTER

Paper:3 MICROBIOLOGY, IMMUNOLOGY, AND PLANT PATHOLOGY

Paper code: MSBY-303A

Course outcomes:

CO1. Explain the basic structure, classification, growth, and metabolic activities of microorganisms, including their beneficial and harmful roles.

CO2. Perform fundamental microbiological techniques (media preparation, sterilization, inoculation, staining, and isolation of pure cultures) following aseptic and safety guidelines.

CO3. Describe the components and functions of the immune system and interpret basic antigen–antibody reactions used in immunological tests.

CO4. Identify major plant pathogens (fungal, bacterial, viral, etc.), describe their life cycles and mechanisms of infection, and relate them to characteristic disease symptoms.

CO5. Apply the principles of disease diagnosis and integrated disease management to suggest suitable control measures for important plant diseases of agricultural importance.

Unit	Topic	No.of Lectures (60 hrs)
I	Introduction History of Microbiology Concepts of Microbiology General Microbiology Classification Ultra Stricture of Cell Wall Bacterial Staining , Bacterial Reproduction	**12h**

II	Spoilage of Food Fermented Products Microbes in sewage treatment Role of Microbes in Agriculture Mycotoxins Industrial Applications	**12h**
III	History of Viruses Classification of Virus Structure of Viruses Transmission of Virus Isolation of Virus Life cycle of Virus Medicinal Importance of Virus Special Study	**12h**
IV	Introduction Immunity Immune System The Immune Response Immunoglobulins Block IV: Immunology Antigen –Antibody Reaction	**12h**
V	History, scope and significance of Plant Pathology – Host – parasite interactions Block V: Plant Pathology Principles of plant infection – inoculum potential – infection and dissemination of pathogens. Causal agents of plant diseases - biotic Koch's postulates - Symptoms of plant diseases. Defense mechanisms: Host defense (Structural and Biochemical defenses). Disease resistance – Genetics of virulence and resistance, Gene-for-gene concept, Methods for incorporation of resistant genes	**12h**

Suggested readings:

1.Agrios, G.N. (2005). *Plant Pathology (5th Edition).* Academic Press, Elsevier.

2.Tortora, G.J., Funke, B.R., & Case, C.L. (2016). *Microbiology: An Introduction (12th Edition).* Pearson Education.

3.Prescott, L.M., Harley, J.P., & Klein, D.A. (2008). *Microbiology (7th Edition).* McGraw-Hill Education.

4.Mehrotra, R.S. &Aggarwal, A. (2017). *Plant Pathology (2nd Edition).* Tata McGraw-Hill Publishing Company, New Delhi.

5.Sharma, P.D. (2011). *Microbiology and Plant Pathology.*Rastogi Publications, Meerut.

6.Willey, J.M., Sherwood, L.M., &Woolverton, C.J. (2019). *Prescott's Microbiology (11th Edition).* McGraw-Hill Education.

7.Staskawicz, B., Collmer, A., &Dangl, J.L. (2015). *Molecular Plant Pathology: Principles and Practice.* Springer.

Paper 4: PLANT ECOLOGY AND PHYTOGEOGRAPHY
Paper code: MSBY-303B
Course Outcomes

CO1: Explain fundamental ecological concepts **including ecosystem structure, function, energy flow, nutrient cycling, population and community dynamics.**
CO2: Analyze ecological relationships using quantitative field methods such as quadrat sampling, frequency, density, abundance, dominance, and diversity indices.
CO3: Evaluate environmental factors (soil, climate, biotic interactions) and their influence on plant distribution, adaptation, and community structure.
CO4: Interpret phytogeographical patterns and classify major vegetation types at regional, national, and global levels, understanding floristic zones and plant endemism.
CO5: Apply ecological and phytogeographical knowledge to real-world issues such as biodiversity conservation, habitat management, climate change impact assessment, and sustainable ecosystem restoration.

Unit – I **12h**

Ecological factors (light, air, water, topographic, edaphic, biotic), Genecology and Ecological niche. Population Ecology, Community Ecology.

Unit II **12h**

Ecological succession: Process concept and trends, Ecosystem. Pollution: Kinds of pollution (Air, Water, Soil and Noise) and green house gases, Ozone hole, and global warming. Biogeochemical cycles (C, N, P, S and Hydrological cycle).

Unit – III **12h**

Biodiversity: types and its Conservation i. e. *In situ* and *Ex-situ* conservation,endangered species.Soil erosion and conservation, rainwater harvesting, chipko movement, van mahotsava, Afforestation and reforestation.

Unit – IV **12h**

Phytogeography: Principles, vegetation and regions of India. Remote sensing: Concepts, principles, processes, tools, techniques in acquisition of R.S. data. Ecosystem Stability: Concept (resistance and resilience), Ecological Perturbations, Plant Invasion.

Unit V **12h**

International Biological Programme (IBP), Man and Biosphere Programme(MAB). Environmental Impact Assessment (EIA), Ecosystem Restoration.Energy resources– Renewable and Non-renewable.Environmental Auditing. Ecological Management: Concepts, Sustainable Development, Remote sensing and GIS as Tools for Resources Management. Phytoremediation: Prevention and Control, Methods of reducing Environmental impacts.

Suggested reading:

1. Odum, E. P. and Barret G.W. 2005. Fundamentals of Ecology. Cengagepublication
2. Odum, E.P., 1983. Basic Ecology., Saunders CollegePublishing
3. Singh, J.S., Singh S.P. and Gupta S.R. 2006. Ecology Environment and Resource

II YEAR; III SEMESTER

Paper 5: ADVANCES IN ARCHEGONIATAE

Paper code: MSBY-304A

Course outcomes:

CO1: Understand the evolutionary trends, morphology, and reproduction in Bryophytes, Pteridophytes, and Gymnosperms, and explain their phylogenetic significance.

CO2: Analyze the structural and functional adaptations of Archegoniates in relation to habitat, life cycle patterns, and alternation of generations.

CO3: Explain fossil evidence and evolutionary relationships among early land plants, with emphasis on the origin of vascular tissues and seeds.

CO4: Identify and classify major groups of Archegoniatae using distinguishing features, anatomical characters, and reproductive structures.

CO5: Apply knowledge of Archegoniatae in ecological and economic contexts, including their role in ecosystem processes, bioindicators, and commercial importance.

Unit	Topic	No.of Lectures (60 hrs)
I	**Introduction and General Features of Archegoniatae** Introduction students to the group *Archegoniatae*, comprising Bryophytes, Pteridophytes, and Gymnosperms, the early land plants that exhibit a distinct alternation of generations with a multicellular gametophyte and sporophyte. Diagnostic characteristics, structural organization, and adaptive features that distinguish these groups from Thallophytes and Angiosperms. Emphasis is placed on the evolutionary transition from aquatic to terrestrial life, highlighting adaptations for land colonization such as cuticle formation, stomata, and vascular tissues. life cycle patterns, including homospory and heterospory, the concept of alternation of generations, and its evolutionary implications in plant evolution. Reproductive organs (antheridia and archegonia), their origin, development, and evolutionary modifications across the Archegoniatae lineages are also discussed.	**12h**
II	**Bryophytes: Morphology, Reproduction, and Evolution** Structure, classification, and life history of Bryophytes — the first land plants exhibiting alternation of generations. It covers the three major groups: Hepaticopsida (liverworts), Anthocerotopsida (hornworts), and Bryopsida (mosses), with emphasis on their gametophytic dominance and dependent sporophyte. External and internal morphology of representative genera such as *Riccia, Marchantia, Pellia, Anthoceros,* and *Funaria*. Detailed discussions include anatomical structures, sexual and asexual reproduction, sporogenesis, and spore dispersal mechanisms.	**12h**
III	**Pteridophytes: Structure, Life Cycle, and Phylogeny** Morphology, anatomy, reproduction, and life cycles of Pteridophytes, the first vascular cryptogams. It covers Psilopsida, Lycopsida, Sphenopsida, and Pteropsida, explaining their evolutionary trends from simple to complex vascular systems.	**12h**

	Students will examine vascularization and stele evolution (protostele, siphonostele, dictyostele), development of leaves (microphylls vs. megaphylls), and root systems. The gametophyte–sporophyte relationship, reproductive biology, and life cycle studies of *Selaginella*, *Lycopodium*, *Equisetum*, and *Pteris* are discussed. heterospory and the origin of the seed habit, a crucial evolutionary transition toward seed-bearing plants. spore development, prothallus formation, and alternation of generations, along with the fossil record of early vascular plants (Rhyniophytes, Zosterophylls, Trimerophytes).	
IV	**Gymnosperms: Anatomy, Reproduction, and Evolutionary Trends** Structural, reproductive, and developmental biology of Gymnosperms — the seed-producing vascular plants that bridge the gap between Pteridophytes and Angiosperms. It includes a comparative study of Cycadales, Coniferales, Ginkgoales, and Gnetales. Students will explore anatomical adaptations such as secondary growth, tracheid differentiation, resin canals, and xerophytic leaf structures. Detailed accounts of reproductive organs, pollination, fertilization, and embryogeny are provided for genera like *Cycas*, *Pinus*, *Ginkgo*, and *Ephedra*. Seed evolution, double fertilization-like phenomena, and affinities between Gnetales and Angiosperms. Phylogenetic relationships among major gymnosperm lineages are analyzed using both morphological and molecular markers.	**12h**
V	**Recent Advances and Molecular Phylogeny** Developments in the understanding of Archegoniate evolution through molecular, genomic, and paleobotanical evidence. Students will be introduced to the use of molecular markers (rbcL, matK, ITS, and chloroplast genomes) and DNA barcoding in plant systematics. The application of cladistics, comparative genomics, and transcriptomics in reconstructing the phylogenetic relationships of Bryophytes, Pteridophytes, and Gymnosperms,	**12h**

Suggested Readings:

1. Rashid, A. (1998). *An Introduction to Bryophyta.*Vikas Publishing House, New Delhi.
2. Parihar, N. S. (1977). *An Introduction to Embryophyta: Vol. I & II.* Central Book Depot, Allahabad.
3. Sporne, K. R. (1991). *The Morphology of Pteridophytes.* Hutchinson University Library.
4. Stewart, W. N., &Rothwell, G. W. (1993). *Paleobotany and the Evolution of Plants.* Cambridge University Press.
5. Gifford, E. M., & Foster, A. S. (1989). *Morphology and Evolution of Vascular Plants.* W. H. Freeman and Company.
6. Beck, C. B. (2010). *An Introduction to Plant Structure and Development: Plant Anatomy for the Twenty-First Century.* Cambridge University Press.
7. Judd, W. S. et al. (2016). *Plant Systematics: A Phylogenetic Approach.*Sinauer Associates.

Paper: 6. DIVERSITY AND CULTIVATION OF MUSHROOMS (Elective Paper)
Paper code: MSBY-304B

Course Outcomes:

CO1: Understand mushroom diversity and taxonomy
CO2: Identify edible, medicinal, and poisonous mushrooms
CO3: Demonstrate skills in substrate preparation and mushroom cultivation techniques
CO4: Apply disease and pest management practices in mushroom farms
CO5: Evaluate economic and entrepreneurial opportunities in mushroom production

UNIT I

General characteristics and life history: Reproduction,spore print, dissemination, growth size, colour and surface textures, odour, taste, Exudation and fairy rings; Bioluminescence and economicimportance. Biodiversity ofMushrooms.Status of Mushroom research inIndia.

UNIT II

Ethnomycological approach of mushrooms, Edible and poisonous mushrooms. Mushroom recipes, mushroom toxins, disease and pests of mushrooms. Introduction to mushroomgroups.

UNIT III

Systematics of light spored families. Agaricaceae, Amanitaceae, Hygrophoraceae, Pluteaceae,Tricholomataceae.

UNIT IV

Computer application in Mushroom Science, Formation of clade, dendrograms and sequence alignment;Knowledgetosubmitmushroomsequencedataonline,NCBI,MEGA4andMuttalig n. Ecology of mushrooms.Role of mushrooms in forestecosystem.

UNIT V

Tissue culture in wildmushrooms. Preparation of compost- paddy straw, saw dust. Cultivation of edible and medicinal mushrooms: *Agaricus, Calocybe, Flammulina, Ganoderma, Hericium, Lentinus, Pleurotus*.

SUGGESTED READINGS:

1. Allen, M.F. 1991. The Ecology of Mycorrhiza. Cambridge Univ. Press,Cambridge.
2. Bakshi, B.K. 1974. Mycorrhiza and its role in forestry, FRI,Dehradun.
3. Chang, S.T. and W.A. Hayes. 1978. The Biology and Cultivation of Edible Mushrooms. AcademicPress.
4. Hacskaylo, E. 1971. Mycorrhizae, USDA Forest Service Publ. No. 1189. US Govt. Printing Office, Washington,DC.
5. Hawksworth,DL; Sutton, B.C. and Ainsworth G.C. 1983. Dictionary of the Fungi. Kew, Surrey,England.
6. Krieger, LCC. 1967. The Mushroom Handbook. Dover Publications. INC NewYork.
7. Largent, D.L. 1977. How to identify Mushrooms to genus? I Macroscopic features. Mad River Press. Inc.Eureka.
8. Miller, O.K. Jr. 1981. Mushrooms of North America. EP Dutton, NewYork.
9. Singer, R. 1986. The Agaricales in Modern Taxonomy. BSMPS,Dehradun.
10. Stamets, P. and J.S. Chitton 1983. The Mushroom Cultivator, Agarikon Press, Olympia, Washington.

Paper:Practical V
Paper code: MSBY-305P

1. Measurement of Transpiration Rate (Potometer / Weighing method)
2. Stomatal Density and Stomatal Index (Epidermal peel / Impression)
3. Determination of Relative Water Content (RWC)
4. Photosynthetic Pigment Estimation (Chlorophyll a, b, carotenoids)
5. Determination of Respiratory Rate (CO_2 evolution or O_2 uptake)
6. Seed Germination Tests and Effects of Abiotic Factors (salt/osmotic stress)
7. Auxin/Cytokinin Effect on Adventitious Root/Shoot Formation (Cutting experiment)
8. Callus Induction from Explants (Plant Tissue Culture — Basic)
9. Shoot Regeneration / Micropropagation (From Callus or Nodal Explants)
10. In vitro Rooting and Hardening (Acclimatization)
11. Anther Culture for Haploid Production (Outline practical)
12. Protoplast Isolation and Plating (Demonstration / Outline)
13. Simple DNA Extraction from Plant Tissue (CTAB / Quick Prep)
14. Agrobacterium-mediated Leaf Disc Transformation (Demonstration/outline)
15. Enzyme Assay: Catalase Activity (Simple spectrophotometric/titrimetric)

Paper:Practical VI
Paper code: MSBY-306P
1. **Preparation and Sterilization of Culture Media (Nutrient Agar)**
2. Aseptic Transfer and Streak Plate Method
3. Gram Staining
4. Determination of Blood Group (ABO System)
5. Ouchterlony Double Diffusion (Antigen–Antibody Reaction)
6. Identification of Plant Pathogens (Microscopic Observation)
7. Koch's Postulates Demonstration
8. Quadrat Study for Frequency, Density, and Abundance
9. Soil Analysis – pH and Moisture Content
10. Mapping Plant Distribution Using Local Flora

II YEAR; IV SEMESTER

Paper: 1. SYSTEMATICS, EVOLUTION AND ENVIRONMENTAL SCIENCE

Paper code: MSBY-401

Course outcomes:

CO1. Explain the **principles, concepts, and history of systematics**, including classical and modern approaches to classification and taxonomy.

CO2. Describe the **methods of species identification, nomenclature, and phylogenetic systematics**, following the rules of botanical nomenclature.

CO3. Understand the **concepts and mechanisms of evolution**, including variation, natural selection, adaptation, and speciation.

CO4. Analyze the **patterns of microevolution and macroevolution**, and interpret **phylogenetic relationships** among major groups of organisms.

CO5. Evaluate the **role of molecular systematics and bioinformatics tools** in studying evolutionary relationships and biodiversity.

Unit	Topic	No.of Lectures (60 hrs)
I	Systematics and Evolutionary Biology: History of developments in taxonomy: Linnaean to post-Linnaean era; Systematics - concepts and components;	**12h**
II	Botanical Nomenclature; Evolutionary ecology-concepts and principles; Microevolution - theory and concepts; Species and speciation; Phylogenetic systematics; Macroevolution - inferring phylogenies;	**12h**
III	Diversity and classification of flowering plants; Taxonomic evidence - structural and biochemical; Molecular systematics; Diversity and classification of flowering plants; Biological diversity-concepts and applications; Diversity- patterns, indices and applications.	**12h**
IV	Environmental Science: Introduction to Environmental Science and Sustainability, Environmental laws, Ecosystems and living organisms, Major ecosystems of the world and India.	**12h**
V	Human health and environmental change, Population issues, the search for fuels, natural resources and their management, applications of GIS and RS technology in environmental studies, the future of planet earth.	**12h**

References

1. **Davis, P. H. & Heywood, V. H. (1963).***Principles of Angiosperm Taxonomy.* Oliver and Boyd, Edinburgh.

2. **Heywood, V. H., & Moore, D. M. (Eds.) (1984).***Current Concepts in Plant Taxonomy.* Academic Press, London.
3. **Stuessy, T. F. (2009).***Plant Taxonomy: The Systematic Evaluation of Comparative Data* (2nd ed.). Columbia University Press, New York.
4. **Judd, W. S., Campbell, C. S., Kellogg, E. A., Stevens, P. F., & Donoghue, M. J. (2016).***Plant Systematics: A Phylogenetic Approach* (4th ed.). Sinauer Associates, Sunderland,
5. **Futuyma, D. J. (2013).***Evolution* (3rd ed.). Sinauer Associates, Sunderland, MA.
6. **Ridley, M. (2004).***Evolution* (3rd ed.). Blackwell Science, Oxford.
7. **Mayr, E. (1963).***Animal Species and Evolution.* Harvard University Press, Cambridge.
8. **Odum, E. P., & Barrett, G. W. (2005).***Fundamentals of Ecology* (5th ed.). Thomson Brooks/Cole, California.

II YEAR; IV SEMESTER

Paper: 2. Conservation of Natural Resources and Policies

Paper code: MSBY-402A

Course outcomes:

CO1.Discuss the basic concepts of global frame work, acts and policies in natural resource management.

CO2. Familiar with major activities of different committees

CO3Biodiversity Board / BMC, NGO's with special reference to Biodiversity conservation in Kerala state.

CO4.Acquainted with National and International organizations and NGOS with special reference to UN

CO5.Specialized agencies, institutional regulatory bodies and authorities.

Unit	Topic	No.of Lectures (60 hrs)
I	Introduction: Legal and political environments in resource management. Global and localgovernance, challenges of good governance. Ostrom design principles and basic frameworks,organizational structure and stakeholders in NRM and livelihood. Natural Resource Governance in rapidly changing world. Local utilization and institutions: Joint Forest Management Committees (JFMCs), watershed committees, irrigation committees, Forest Rights Act (FR	**12h**
II	Overview of legal policy instruments in Natural Resource Management: National Forest Policy of 1988, National Environment Policy of 2004, National Conservation Policy, National Action Plan on Climate Change of 2008, and Coastal Protection Act. Wildlife Protection Act of1972, Forest Protection Act of 1980, Environment Protection Act of 1986, ICZM-Indian Coastal zone management, Water Act, 1981. Gadgil report and KasturiRangan Report.	**12h**
III	Biological Diversity Act of 2002 and Rule 2004, Forest Rights Act of 2006. Green Tribunal Act, 2009. The precautionary principle and common responsibilities. On-Timber Forest Products (NTFP) related policies and other acts: (PESA 1996, FRA2006), sustainable harvesting rules of MP, Nistar Rights in MP and Chhattisgarh, product specific policies, taxation,	**12h**

	Institutional/Organizational Arrangements.	
IV	NTFP Deregulation, Policy of Odisha. Conflicts in resource management: Resource management planning, protecting traditional knowledge, Significance of PBR, customary laws and practice related to traditional knowledge, implications for access benefit sharing.	**12h**
V	International and National efforts by Non-Governmental organizations on resource management: CITES and other international treaties and conventions, roles of international organizations and NGOS with special reference to UN and specialized agencies, institutional regulatory bodies and authorities: direct intervention by the state, green business and green ethics, stakeholder analysis.	**12h**

References

1. Bhattacharya P., Kandya A.K. and Krishna Kumar (2008). Joint Forest Management in India,
2. Aavishkar Publisher, Jaipur. • Cleaver, F. (2017). Development through bricolage: rethinking institutions for natural resource management. Routledge. • Daily, Gretchen, editor, et al. (1997).
3. Nature‟s Services: Societal Dependence on Natural Ecosystems. Island Press. •
4. Kareiva, Peter, and Michelle Marview. (2010). Conservation Science: Balancing the Needsof People and Nature. Roberts and Company. •Kareiva, Peter, et al. (2011).
5. Natural Capital: Theory and Practice of Mapping Ecosystem Services. Oxford. • Khan, I. A. (2019).
6. Forest Governance and Sustainable Resource Management. SAGE Publishing India. •
7. Knight, Richard L., editor, et al. (1995). A New Century for Natural Resources Management. Island Press. • Krishnamurthy, K. V. (2018). Advanced Textbook On Biodiversity: Principles and Practice. CBS Publ&DistPvt Limited I

Paper 3. MEDICINAL PLANTS

Paper code: MSBY-402B

Course Outcomes:

CO1: Understand the classification, characteristics, and ethnobotanical significance of medicinal plants **and explain their role in traditional healing systems.**

CO2: Identify important medicinal plants and their diagnostic morphological and anatomical features **for accurate authentication and quality control.**

CO3: Explain the phytochemical constituents (alkaloids, glycosides, tannins, terpenoids, etc.) **and their therapeutic properties, extraction methods, and applications.**

CO4: Evaluate cultivation, propagation, and conservation techniques **for medicinal and aromatic plants with emphasis on sustainable utilization and biodiversity protection.**

CO5: Assess the pharmacological activities, formulation development, and safety standards **of herbal drugs, including WHO guidelines and quality assurance practices.**

Unit I:(12 Hrs)

History, Scope and Importance of Medicinal Plants: Indigenous Medicinal Sciences; Definition and Scope-Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments,

Unit II: (12 Hrs)

Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e- tabiya, tumors treatments/ therapy, polyherbal formulations.

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Unit III: (12 Hrs)

Conservation of endangered and endemic medicinal plants: Definition- endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens

Unit IV: (12 Hrs)

Propagation of Medicinal Plants: Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.

Unit V: (12 Hrs)

Application of natural products to certain diseases: Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases.

References

1. Nature‟s Services: Societal Dependence on Natural Ecosystems. Island Press. •
2. Kareiva, Peter, and Michelle Marview. (2010). Conservation Science: Balancing the Needsof People and Nature. Roberts and Company. •Kareiva, Peter, et al. (2011).
3. Natural Capital: Theory and Practice of Mapping Ecosystem Services. Oxford. • Khan, I. A. (2019).
4. Forest Governance and Sustainable Resource Management. SAGE Publishing India. •
5. Knight, Richard L., editor, et al. (1995). A New Century for Natural Resources Management. Island Press. • Krishnamurthy, K. V. (2018). Advanced Textbook On Biodiversity: Principles and Practice. CBS Publ&DistPvt Limited I

II YEAR; IV SEMESTER

Paper: 4. Conservation of Natural Resources and Policies

Paper code: MSBY-403A

Course outcomes:

Co1: Understand the concept of ethnobotany and the life style and traditional practices of plants by Indian tribals.

Co2: Emphasize the importance of non-timber forest products for Indian tribal people livelihoods.

Co3: Evaluate the various research techniques to gather tribal knowledge of ethnobotany.

Co4: Use strategies to turn ethno botanical knowledge into goods with value additions.

Co5: To save and document ethno botanicals in order to use plant resources sustainably.

Unit	Topic	No.of Lectures (60 hrs)

I	Concept, important landmarks in the development, scope, sub disciplines of ethno botany. Interdisciplinary approaches. Knowledge of following sociological and anthropological terms: culture, values and norms, institutions, culture diffusion and ethnocentrism. History of ethnobotany: A brief history of ethno botanical studies in the world and in India.	**12h**
II	PLANTS USED BY TRIBALS OF INDIA: Distribution of tribes in India. Basic knowledge of following tribes of Tamil Nadu: Irulas, Kanis, PaliyarsBadagas, Kurumbres, Thodas and Malayalis. Plants used by tribals of Tamil Nadu.	**12h**
III	SOURCES OF ETHNOBOTANICAL DATA: Primary - archeological sources and inventories, Secondary - travelogues, folklore and literary sources, herbaria, medicinal texts and official records. Methods in ethnobotanical research. Prior Informed Consent, PRA techniques, interviews and questionnaire methods, choice of resource persons. Folk taxonomy – plants associated with culture and socio- religious activities. Non – timber forest products (NTFP) and livelihood – Sustainable harvest and value addition.	**12h**
IV	NATUROPATHIC MEDICINE: Role of plants in naturopathy-Importance and relevance of medicinal drugs in India. Indian Systems of Medicine (Ayurveda, Siddha, Allopathy, Homeopathy, Unani, Tibetan, Yoga and Naturopathy). Disease diagnosis, treatment, and cure using natural therapies including dietetics, botanical medicine, homeopathy, fasting, exercise, lifestyle counseling, detoxification, and chelation, clinical nutrition, hydrotherapy, naturopathic manipulation, spiritual healing, environmental assessment,	**12h**
V	TRADITIONAL HEALTH CARE: Health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain well-being.	**12h**

References

1. Subramaniam, S.V and V.R. Madhavan (Eds,). 1983. Heritage of the Tamil Siddha Medicine. International Institute of Tamil Studies. Madras.
2. Jain, A. and Jain, S.K. 2016. Indian Ethno botany - Bibliography of 21st Century Scientific Publishers (India).
3. Gokhale, S.B., Kokate, C.K and Gokhale, A. 2016. Pharmacognosy of Traditional Drugs. 1st ed. NiraliPrakashan, Pune.
4. Gringauz. 2012. Introduction to Medicinal Chemistry: How Drugs Act & Why? Wiley India Pvt Ltd. Noida. Joshi, S.G. 2018. Medicinal Plants. Oxford & IBH Publishing C., Pvt., Ltd., New Delhi.

Paper 5. CONSERVATIONAL BIOLOGY
Paper code: MSBY-403B

Course Outcomes:

CO1: Explain the concepts, principles, and importance of conservation biology**, including levels of biodiversity and major threats to global and regional biodiversity.**
CO2: Analyze population and community dynamics **to understand species decline, extinction risks, and the ecological processes essential for conservation planning.**
CO3: Evaluate biodiversity conservation strategies**, including in-situ and ex-situ methods, protected area management, and restoration ecology.**
CO4: Apply ecological and genetic tools **(GIS, population genetics, ecological indicators, Red List criteria) for assessing conservation status and designing management plans.**
CO5: Develop sustainable conservation approaches **that integrate ecological, socio-economic, and policy perspectives for long-term biodiversity protection.**

Unit I **12h**

Conservation: The basic concept, History of conservationbiology.The origin and evolution of organism; genetic plasticity a factor in evolution; the invasion of unoccupied ecological niches.

Unit II **12h**

Conservation of Biological diversity: Genetic principles in conservation, biodiversity assessment and inventory. Survey and monitoring of biological resources: sampling population for biological conservation; Collection and analysis of inventory data, criteria on choice of species for conservation. People participation, biodiversity registers and theirmaintenance.

UNIT III **12h**

Conservation of energy resources; conservation and maintenance of non renewable fossil fuel resources; Conservation of biodiversity based renewable energyresources. Conservation of biological resources: In situ and Ex Situ Conservation Strategies, Designing Networks of Protected Areas; Restoration of endangered species, Problems of Small Populations, Establishing New Populations; Sustainable use and public participation, Guidelines for Successful Monitoring, politics and economics in the decision-making process, Challenges for thefuture.

UNIT IV **12h**

Indian biodiversity and its conservation: International efforts for conserving biodiversity viz., CITES, CBD, IUCN, MAB, UNEP, UPOV (Union for the Protection of New Plant Varieties), WTO etc.). International treaty on Plant Genetic Resources, International Agreement for conserving marine biodiversity, Wetland conservation, Rangelandmanagement.

Unit V **12h**

Ecosystem restoration, Strategies and plans for restoration, Passive restoration (natural recovery) and activerestoration.National Forest Policy 1929, Wildlife (Protection) act 1975, Forest (Conservation) Act 1980, Environment (Protection) Act 1986, Fisheries Act 1987, Wildlife (Protection) Amendment Act 1991, Biodiversity Act 2003,etc.

SUGGESTED READINGS

1. Cain, M.L., Bowman, W.D. & Hacker, S.D. 2008. Ecology. Sinauer Associates,Inc.

2. Dhar, U. 1993 (Ed.). Himalayan Biodiversity: Conservation Straegies, GyanodayaPrakashan, Nainital