Scheme for M.Sc. Botany NEP 2020

For 2 Year PG programme

First Year

Scheme for M.Sc. Botany NEP 2020

For 2 Year PG programme

Scheme sem-1: (For the course of science having major practicum components)

M.Sc. Botany I Semester

S.No	Course Code	Course Name	Total Mark	Credit (s)	End Semester Exam Marks		Internal Marks	
					Max	Min.	Max	Min.
1.	MBS2-511	Biology and diversity of Fungi, Algae and Bryophyta	100	6	60	24	40	16
2.	MBS2-512	Biology and Diversity of Pteridophyta and Gymnosperms	100	6	60	24	40	16
3.	MBS2-513	Practical - I	100	4	60	24	40	16
4.	MBS2-514	Practical – II	100	4	60	24	40	16
5.	MBS2-515	Internship/Seminar/Field Project	100	2	-	-	100	40
		Grand Total	500	22				

BRANCH	Subject	Subject Code
M.Sc. (Botany)	**Biology and diversity of Fungi, Algae and Bryophyta**	MBS2-511

Course learning outcomes (CLO):-

1. The students will be able to identify and classify fungi and algae, Bryophyta
2. They will be acquainted with algal and fungal technology and its application in various industries

Unit-1

Algae and Bryophyta in Indian traditional knowledge. Contributions of Indian scientists MOP Iyenger and TV Desikachari in Algae, K C,Mehata in Fungi, Shiv Ram Kashyap in Bryophyta, Microbes in Indian Gyan parampara, Brief account of Virus and bacteria. Traditional fermented food beverages.

Unit-2

Mycology: General characters, and thallus organization, mode of nutrition (saprophytic, parasitic, symbiotic) and reproduction. Modern Classification of fungi, Economic importance of fungi in Industry. Fungal diseases in plants: Wart disease of Potato, Green ear disease of Bajra. Black rust of Wheat.

Unit-3

Mycology: General account of Mastigomycotina and Zygomycotina. Diagnostic features and general account of Ascomycotima, Basidiomycotina and Deuteromycotina .

Morphology and anatomy of Mycorrhiza, importance of mycorrhizae in agriculture. Parasexual cycle in fungi.

Unit-4

Algae 1: General characters, diversified habitats (terrestrial, freshwater, marine); thallus organization, cell ultra-structure; criteria of classification(pigments, reserve food, flagella); economic importance (as food, feed, industry, algal blooms and bio-fertilizer,bio-fuel).

Unit-5

Algae2: Salient features, classification, reproduction and economic importance of Chlorophyta, Charophyta and Xanthophyta. Salient features, classification, reproduction and economic importance of Bacillariophyta, Phaeophyta and Rhodophyta. Techniques in commercial cultivation of Algae.

Bryophyta: General characters, distribution, classification of bryophytes. Ecological importance of Bryophytes. General account of Marchantiales Jungermanniales, Sphagnales. Funariales and Polytichales

BRANCH	Subject	Subject Code
M.Sc. (Botany)	Biology and Diversity of Pteridophyta and Gymnosperms	MBS2-512

Course learning outcomes (CLO):-

1. The students will be able to identify and classify Bryophyta, Pteridophyta, Gymnosperm
2. Comprehend concepts in the evolution of plants
3. Identify the economic importance of plants

Unit 1

History and evolution of pteridophytes Contribution of Indian scientists DD Pant and Birbal Sahni General introduction of pteridophytes Peculiar features, similarities and dissimilarities with bryophytes and gymnosperms. Origin and evolution of Pteridophytes

Unit 2

Pterodophyta-1: Evolution of stele, Heterospory and origin of seed habit. General account of Psilophytopsida, Psilopsida, Lycopsida

Unit-3

Pterodophyta-2. Morphology, anatomy, reproduction and phylogeny of Lycopsida, Sphenopsida and Pteropsida. Brief study of the following form genera Rhynia, Lepidodendron and calamites. Apospory and Apogamy in pteridophyta

Unit-4

Gymnosperms1: General characters, morphology, anatomy and reproduction of Gymnosplans. Diversity and distribution of Gymnosperm. Classification of gymnosperms (D D Pant, 1957, Sporne, 1965, Stewart, 1983, Christenhusz, 2011), Economic importance of Gymnosperm.

Unit 5

Gymnosperm2: Geological time scale, Types of fossil and fossilization process. Fossil gymnosperms

General account of order Pteridospermales, Cordaitales and Cycadeoidales

Gymnosperm 3: General account of Cycadales, Ginkgoales and Coniferales.

Morphology, anatomy, reproduction and inter relationship of, Ephedrales, Welwitschiales and Gnetales 15. Evolution of Gymnosperms

BRANCH	Subject	Subject Code
M.Sc. (Botany)	**Practical – I (Biology and diversity of Fungi, Algae and Bryophyta).**	MBS2-513

Course learning outcomes (CLO):-

1. The students will be able to identify and classify fungi and algae, bryophyta.
2. By engaging in these practical exercises students can gain a deeper understanding of unique characteristics, life cycle, and ecological roles and economic importance of algae, bryophyta and fungi.

List of practical

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

BRANCH	Subject	Subject Code
M.Sc. (Botany)	**Practical – II (Biology and the diversity of Ptreodophyta and Gymnosperms)**	MBS2-514

Course learning outcomes (CLO):-

On successful completion of course, students will be able to:

1. The students will be able to identify and classify Bryophyta, Pteridophyta, Gymnosperm
2. By engaging in these practical exercises students can gain a deeper understanding of unique characteristics, life cycle, and ecological roles and economic importance of Ptreodophyta and Gymnosperms.

List of Practical

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

BRANCH	Subject	Subject Code
M.Sc. (Botany)	**Internship/Seminar/Field Project**	MBS2-515

Project /Dissertation work (Six weeks) in the form of small thesis based upon the topic related to the M.Sc. Botany syllabus . The topics of the dissertation with synopsis will be decided by the

Departmental Research Advisory Committee (DRAC).

M.Sc. Botany II Semester

S.No	Course Code	Course Name	Total Mark	Credit (s)	End Semester Exam Marks		Internal Marks	
					Max	Min.	Max	Min.
1.	MBS2-521	Taxonomy of Angiosperms	100	6	60	24	40	16
2.	MBS2-522	Morphology, anatomy and embryology of angiosperms	100	6	60	24	40	16
3.	MBS2-523	Practical - I	100	4	60	24	40	16
4.	MBS2-524	Practical – II	100	4	60	24	40	16
5.	MBS2-525	Value-added course (VAC) from /MOOCS, SWAYAM, NPTEL	100	2	-	-	100	40
		Grand Total	500	22				

BRANCH	Subject	Subject Code
M.Sc. (Botany)	**Taxonomy of Angiosperms**	**MBS2-521**

Course learning outcomes (CLO):-

On successful completion of this course, the students will be able to:

1. After completion of the course on Taxonomy of Angiosperms, students would be able to identify, classify, and describe angiosperms;
2. Understand the principles of taxonomy and classification systems; and understand the origin, evolution, and phylogeny of angiosperms.
3. They should also be able to apply taxonomic tools and techniques, including herbarium preparation and plant identification.

Unit-1

History and Principles of plant taxonomy: Ancient Indian system classifying and naming plants(Rigveda, Manusmriti, Charak samhita, Samhita, Susruta samhita, Parasaras Vrikshayurveda). Herbs and plants in Vedic literature. History, Aims and principles of taxonomy Relationships of various disciplines with taxonomy. Taxonomic hierarchy, species, genus, family and other categories, Species concept.

Unit 2

Plant nomenclature: Binomial nomenclature. Principles and rules of 15 ICN(International Code of Nomenclature for algae, fungi, and plants). Author citation. Rules of priority, Effective and valid publication, Nomenclatural type. Taxonomic tools: Herbaria, Botanical garden, Taxonomic literature, Monographs and revisions., Image comparison, Expert determination, Preparation and uses of keys

Unit-3

Taxonomic evidences and Phylogeny, Morphology, Plant anatomy, Palynology, Embryology, Cytology, Phytochemistry in relation to taxonomy. Plant molecular systematics and its importance. Origin and evolution of angiosperms.

Unit-4

Plant classification and identification:

Bentham and Hooker's system of classification, Hutchinson and Cronquist's system of classification APG-IV system of classification. Cladistic analysis

Unit-5

Diversity of angiosperm 1: Study of plants with respect to systematic position, general characters, morphological variations economic importance and affinities of families Magnoliaceae, Ranunculaceae, Meliaceae, Rosaceae, Myrtaceae, Apiaceae, Cucur bitceae, Cactaceae.

Diversity of angiosperm 2: Study of plants with respect to systematic position, general characters, morphological variations, economic importance and affinities of familiesRubiaceae, Asteraceae, Solanceae, Santalaceae, Orchidaceae, Zingiberaaceae and Alismataceae, Poaceae.

BRANCH	Subject	Subject Code
M.Sc. (Botany)	**Morphology, anatomy and embryology of angiosperms**	**MBS2-522**

Course learning outcomes (CLO):-

1. On completion of the course, students would be able to identify and describe different plant parts, understand the functional roles of various tissues, and comprehend the mechanisms of secondary growth and reproduction in angiosperms.

2. They will able to understand the structure and internal organization of flowering plants. Students will be able to connect plant morphology and anatomy to various industries, such as agriculture (crop development), medicine (pharmaceutical plants), and forestry (timber production).

Unit - I

Floral morphology: Morphology, anatomy and classification of plants in veda Morphological nature of different plant parts; Morphology of stipule and their types; Morphology of stamen and carpel and their evolution; Types, origin and evolution of Inflorescence; Flower:is a modified shoot; A,B,C models of floral development, Inferior Ovary; Fruit types and its evolution.

Unit – II

Shoot Apical Meristem: Apical, lateral and intercalary meristems their ultra structure and histochemistry Shoot development. Organization of shoot apical meristem (SAM), secretory ducts and laticifers, Nodal Anatomy and its evolution. Root Apical Meristem: Organization of root apical meristem (RAM), cell fate and lineages, lateral roots, root hairs, secondary growth and root stem transition. Root-microbe interactions

Unit – III

Leaf histogenesis, leaf meristem, differentiation of epidermis (with special reference to types of stomata and trichomes), mesophylls and vascular system of dicot and monocot leaves. Secondary growth and anomalies: Secondary Secondary growth and anomalies: Secondary growth of stem and activity of the cambium. Anomalous secondary growth: Nyctanthes, Boerhaavia, Bignonia, Leptadenia, Salvadora, Tinospora and Draceana stems. Wood properties, wood identification. Wood development in relation to environmental factors. Dendrochronology and its application.

Unit – IV

Microsporogenesis and development of male female gametophyte, Placentation and its types,

Pollination and sexual Incompatibility Self-pollination: Contrvances for self-pollination, merit and demerit. Pollen tube greet and guidance. Cross pollination: Types of cross pollination, Contrivances for cross pollination, merit and demerit. Agents of pollination: Abiotic pollinators and biotic pollinators. Floral adaptation of pollinations. Pollen stigma interactions. Self-Incompatibility: Sporophyte self-incompatibility(ssi) and gametophyte self-incompatibility(gsi) Genetic basis of self- incompatibility. Physiological and biochemical basis of incompatibility.

Unit – V

Fertilization and seed development: Process, mechanism and significance of double fertilization Endosperm development and its morphological nature. Storage proteins of endosperm and embryo, Development of dicot and monocot embryo. Formation of seed and its: Endosperm development and its morphological nature. Storage proteins of endosperm and embryo, Development of dicot and monocot embryo. Formation of seed and its structure.

Experimental Embryology: Polyembryony, Parthenocarpy, Apomixis, pollen allergy, pollen storage. In vitro fertilization, Invitro pollination and its application, application of pollens in forensic science

BRANCH	Subject	Subject Code
M.Sc. (Botany)	**Practical – I (Taxonomy of Angiosperms)**	MBS2-523

Course learning outcomes (CLO):-

1. On completion of this course students will typically develop the ability to identify, classify, and understand the diversity of flowering plants.
2. This includes learning about plant morphology, anatomy, and reproductive structures, as well as the principles of plant nomenclature and classification systems.
3. Students also gain experience with taxonomic tools like herbaria and botanical gardens and learn about the economic importance of various plant families.

List of Practicals

1. Exercise based on description and identification of plants up to species level
2. Description of various species of a genus: location of key characters and preparation of keys at generic level
3. Exercise based on nomenclatural notes.
4. Exercise on similarity and dissimilarities of plant species
5. Comparison of different species of a genus or different genera of a family to calculate similarity coefficients ar preparation of dendrograms.
6. Description of a species based on various specimens to study interspecific variation a collective exercise.
7. Field trips compilation of field notes and preparation of herbarium sheets
8. Training in using floras and herbaria for identification of specimens described in the class.

BRANCH	Subject	Subject Code
M.Sc. (Botany)	**Practical – II (Morphology, anatomy and embryology of angiosperms)**	MBS2-524

Course learning outcomes (CLO):-

1. On completion of this course students will be able identify and understand the various plant parts (roots, stems, leaves), their internal structures (tissues, cells), and reproductive processes (from gametophyte development to seed formation).

2. Students will able to Understand the organization of vascular bundles and other specialized structures the development of the embryo and endosperm and the processes of microsporogenesis and megasporogenesis.

List of Practical

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

M.Sc. Botany III Semester

S.No	Course Code	Course Name	Total Mark	Credit (s)	End Semester Exam Marks		Internal Marks	
					Max	Min.	Max	Min.
1.	MBS2-531	Plant Physiology and Biochemistry	100	6	60	24	40	16
2.	MBS2-532	Material Science	100	6	60	24	40	16
3.	MBS2-533	Practical - I	100	4	60	24	40	16
4.	MBS2-534	Practical – II	100	4	60	24	40	16
5.	MBS2-535	Internship/Seminar/Field Project	100	2	-	-	100	40
		Grand Total	500	22				

BRANCH	Subject	Subject Code

M.Sc. (Botany)	Plant Physiology and Biochemistry	MBS2-531

Course learning outcomes (CLO):-

1. After completion of course students will gain a comprehensive understanding of plant systems at the molecular level, including their responses to environmental cues and developmental processes.
2. Students will have knowledge on nuclear organization, DNA structure, replication and repair.

Unit - I

Introduction and Plant Water relation: History and contribution of Rishi Parashar and Indian Scientist in the field of Plant Physiology and Biochemistry. Contribution of J.C. Bose, P. Maheshwari, Govindjee, S.M. Sircar, Shri Ranjan in plant physiology. Water Potential and its Components; Intercellular Water and solute (ions, Nutrient and macromolecules) transport and membrane transport system; Water and solute absorption by Roots from soil; Water and solute transport through xylem; Mechanism of Transport across xylem; Transpiration, mechanism and regulation of stomatal opening and its closing Guttation. Photo assimilates: translocation and mechanisms of its loading and unloading.

Unit - II

Photosynthesis: General concept, evolution of photosynthetic apparatus; Photosynthetic pigments and photo-system; Photo-oxidation of water, mechanism of electron and proton transport. Carbon assimilation: Calvin Cycle and its regulation, Photorespiration and its significance, C4 Cycle and its evolutionary significance and CO, fixation in Dark (CAM Pathways); Factors affecting Photosynthesis; Concept of Artificial Photosynthesis.

Unit – III

Respiration and Lipid metabolism: Glycolysis; Oxidative Pentose Phosphate Pathway (PPP) and importance; TCA Cycle; Mitochondrial electron transport and ATP synthesis; Significance of ATP, FADH, NADH,; Glyoxylate Cycle and its significance. Structure and function of lipids; synthesis of membrane lipid; structural and storage lipid; Fatty acid biosynthesis and oxidation.

Unit – IV

Nitrogen Metabolism and secondary metabolites: Nitrogen uptake and Nitrogen metabolism over view; Nitrogen fixation mechanism, Nodule formation; Ammonium assimilation; amino acid biosynthesis. Introduction, synthesis and role of plant secondary metabolites: terpenes, phenols and nitrogenous compounds.

Unit – V

Plant Hormone Sensory Photobiology: Biosynthesis, storage, breakdown, transport, physiological effects and mechanism of action of auxins. gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, Jasmonic acid and salicyclic acid. Structure, Function and Mechanisms of action of Phytochromes, Cryptochromes and Phototropins; Photoperiodism and Biological clocks.

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

M.Sc. (Botany)	Cytology, Genetics and Biostatistics	MBS2-532

Course learning outcomes (CLO):-

1. Student will enable to gain knowledge on various components of nuclear and organellar genome, with special reference to their regulatory role.
2. They can understand the principal mechanisms of genome replication, maintenance, function and regulation of expression.
3. Students can be able to apply statistical methods to biological data, understand the principles of experimental design, and interpret statistical results in the context of plant biology research.

Unit – I

Discovery of cell and cell theory The Vedic period and the early texts (Gotra and Pravaras) on genetics. Prokaryotic vs Eukaryotic cells Structural organization and function of intracellular organelles

Unit – II

Chromosomes and cell cycle: Characteristics of chromosomes in different plant groups. Chromosome structures and components Specialized chromosomes, Numerical and structural changes in Chromosome. Cell division and cell cycle, Cycline, Cycline-dependent kinases(Cdks), Anaphase Promoting Complex(APC/C), Apoptosis

Unit – III

Mendelian Inheritance: Monohybrid cross and Law of segregation, dihybrid crosses and Law of independent assortment, Gene interaction, co- dominance and lethal allele; extra nuclear inheritance, chloroplast DNA and mitochondrial DNA. Crossing over, mechanism of genetic recombination. Molecular basis of mutation

Unit – IV

Genome organisation

Genome organization, Nuclear DNA content, C-value paradox, Cot curve and its Significance DNA packaging, unique and repetitive DNA, Satellite DNA, in situ hybridization of satellite DNA Introns and their significance.

Gene structure and expression Gene structure and expression: Fine structure of gene, Cis-trans

test, RNA splicing, regulation of gene expression in prokaryotes and eukaryotes.

Unit – V

Biostatistics: Graphical representation of data Measurement of central tendencies, Standard deviation, standard error, Probability rules, Chi-square test, correlation, regression analysis, Analysis of variance.

BRANCH	Subject	Subject Code
M.Sc. (Botany)	**Practical – I (Plant Physiology and Biochemistry)**	MBS2-533

Course learning outcomes (CLO):-

1. On completion of this course students will able to explain and apply knowledge of plant processes like photosynthesis, respiration, and mineral nutrition.
2. Students should also be able to understand water and solute transport, and how plants respond to environmental stresses.
3. Practical skills in conducting experiments, analyzing data, and interpreting results related to plant physiologyand biochemistry.

List of Practicals

1) Effect of time and enzyme concentration on the rate of reaction of enzyme Cc.g. acid phosphate, nitrate reductase.

2) Effect of substrate concentration on activity of any enzyme C (Catalase, amaylase).

3) Demonstration of the substrate inducibility of the enzyme nitrate reductase.

4) Determination of succinate dehydrogenase activity, its kinetics and sensitivity to inhibitors.

5) Separation of isoenzyme of esterase, peroxidase by native polyacrylamide gel electrophoresis.

6) To demonstrate photophosphorylation in intact chloroplast, resolve the photoproteins by SDS-PAGE and perform autoradiography desalting of proteins by gel filtration chromatography embaying Sephadex G-25.

7) Extraction of seed proteins depending upon the solubility.

8) Desalting of proteins by gel filtration chromatography employing Sephadex G-25.

9) Preparation of standard curve of protein and estimation of protein contents in extracts of plant material by Lowry's Bradford's method.

10) Fraction of proteins using gel filtration chromatography by Sephadex G-100 or Sephadex G-200.

11) Radioisotope methodology, autoradiography, instrumentation (GM counter and scintillation counter) and principles involved.

12) Principles of colorimetry, spectrophotometry, and florimetery /calorimetery.

13) Determine rate of transpiration by Ganong's photometer.

14) Determine rate of respiration in germination/young buds by Gannong's raspirometer.

15) Determination of Osmotic Potential by incipient plasmolysis.

16) Determination of DPD by Schardakov's method.

17) Effect of light intensity on the rate of Photosynthesis.

18) Separation of chlorophyll pigment by paper chromatography

BRANCH	Subject	Subject Code
M.Sc. (Botany)	**Practical – II** (Cytology, Genetics and Biostatistics)	MBS2-534

List of Practical

1. Collection and growth of plant materials for study of Mitosis/Meiosis.
2. To study different stages of Mitosis.
3. To determine the mitotic index of given plant material.
4. Study of Meiosis in given plant material.
5. Effect of Mutation on germination of seed eg. Trigonella.
6. To prove Mendel's law of Segregation.
7. To prove Mendelian Monohybrid ratio.
8. Numerical exercise on Mendel's dihybrid crosses, gene interaction and genetical mapping.
9. To calculate the value of X^2 to test the goodness fit of experimental results.
10. Exercise on Laws of probability (single coin toss and double coin toss)
11. Numerical problem on mean mode and medium
12. To determine the standard deviation and standard error

BRANCH	Subject	Subject Code
M.Sc. (Botany)	**Internship/Seminar/Field Project**	MBS2-535

Project /Dissertation work (Six weeks) in the form of small thesis based upon the topic related to the M.Sc. Botany syllabus . The topics of the dissertation with synopsis will be decided by the

Departmental Research Advisory Committee (DRAC).

M.Sc. Botany IV Semester

S.No	Course Code	Course Name	Total Mark	Credit (s)	End Semester Exam Marks		Internal Marks	
					Max	Min.	Max	Min.
1.	MBS2-541	Molecular structure and replication of DNA	100	6	60	24	40	16
2.	MBS2-542	Plant ecology and environment	100	6	60	24	40	16
3.	MBS2-543	Practical - I	100	4	60	24	40	16
4.	MBS2-544	Practical – II	100	4	60	24	40	16
5.	MBS2-545	Value-added course (VAC) from /MOOCS, SWAYAM	100	2	-	-	100	40
		Grand Total	500	22				

BRANCH	Subject	Subject Code
M.Sc. (Botany)	**Molecular structure and replication of DNA**	MBS2-541

Course learning outcomes (CLO):-

1. Molecular Biology, Biotechnology, and Genetic Engineering courses aim to equip students with the foundational knowledge and hands-on skills to understand and manipulate biological systems at the molecular level.

2. Key learning outcomes include mastering techniques like DNA/RNA isolation, PCR, gel electrophoresis, and transformation, as well as understanding gene expression, cloning, and genetic engineering principles

Unit – I

DNA structure, chemical nature of DNA, Molecular structure of DNA and RNA, B-DNA and Z-DNA. Identification of genetic materials.

Replication of DNA, Mechanism of DNA replication in Prokaryotes and Eukaryotes. Replication errors and their repairs. DNA damage and repair. Transposable genetic elements.

Unit – II

Expression of Genome and Gene regulation: Fine structure of Gene, Split gene, overlapping gene, Mechanism of transcription in Prokaryotes and Eukaryotes. The denetic code. Regulation of transcription, Processing of mRNA. Translation in prokaryotes and Eukaryotes.

Unit – III

Protein targeting and sorting: Physical, chemical properties of genome, types and strategies for genome analysis. Gene mapping Protein profiling. Targeting of proteins to organelles, mechanism of sorting and regulation of target transport.

Unit – IV

Plant Tissue Culture: General introduction, History and scope and basic 15 concepts, laboratory organization; media preparation and sterilization techniques Nutrition of plant tissue Growth limiting factors, Concept of cellular differentiation and totipotency, Types of culture, Embryo and endosperm culture, Induction and maintenance of callus and suspension culture. Somatic embryogenesis.

Protoplast and somatic hybridization Isolation, fusion, culture, hybrid selection and regeneration of Protoplast and possibilities with special reference to crop plants, Limitation of protoplast research, Somatic hybridization and selection mechanism for hybrids and cybrids, cell line selection through callus/suspension culture for the production of stress resistant plants, their application in crop

Improvement

Unit – V

Genetic engineering: Recombinant DNA technology and its Tools Restriction enzymes and others- Types and applications Transgenic plants Agrobacterium mediated gene transfer Molecular techniques Basic concept, principles, technique and application. Gel electrophoresis. In artu hybridization, Southern blotting technique, Northern bloting technique, Western blotning technique and Dot blots technique. Imunlogical techniques: Enzyme Linked Immunsorbent Assay(ELISA).

M.Sc. (Botany)	Plant ecology and environment	MBS2-542

Course learning outcomes (CLO):-

1. Students will gain a comprehensive understanding of plant interactions with their environment, including biotic and abiotic factors, and their role in ecosystems.

2. They will also learn about plant distribution, diversity, conservation, and adaptation to changing conditions, including climate change: Additionally, students will develop skills in ecological research, data analysis, and critical thinking

Unit – I

Ecology and Brosystem: Types of forest described by Rishi parasar. Contribution of Indian Scientists in the field of Ecology and Environment (Prof. Ramdeo Mishra). Environment and Ecology: Climate and Topographic Beton Elaphie Factoes: Bisse Factors: Concept of Freshwater Ecology Marine Ecology, Estuarine Ecology, Terrestrial Ecology, Desert Ecology,

Unit – II

Plants-Environment relations: Adaptions and evolutions in response to abiotic factors (light, Teopershire, Watty, minerals) and biotic the (herbivory, moerspecies, competition.

Population Ecology: Characteristics of a population (Size, Density, 15 Natality, Mortality, Abundance, Dispersion patterns, Age structure etc.); Factors affecting population growth (density-dependent factors and Density-independent factors) and population growth curves, population regulation; life history strategies (r and K selection); Concept of metapopulation demes and dispersal, interdemic extinctions

Unit – III

Species interactions and Community Ecology: Influence of vegetation 15 on climatic condition, weathering and jopography, soil; Interaction among plants, Interaction between plant and animal (Herbivory, Carnivory, Pollination, Seed dispersal by animals, mycorrhizal symbiosis). Nature of communities, community structure (in space biodiversity, and in time-Succession) and attributes: levels of species diversity and its measurements; community dynamics and factors affecting it; concept of Ecads, Ecotypes, Ecological niche, edges and ecotones

Unit – IV

Ecosystem Ecology: Ecosystem structure, ecosystem function, energy flow and mineral cycling (CN.P), Primary Production and decomposition; Structure and function of some Indian ecosystem terrestrial (Forest grassland) and aquatic (fresh water, marine, estuarine).

Unit – V

Pollution Ecology and Conservation: Types, causes and effects of pollution; Greenhouse effect; major effects of Climate change. Utilization of Resources from forest, grassland and aquatic habitat; World centers of primary diversity of domesticated plants, Secondary Centers of origin. Principles of Conservation; In-situ conservation: Sanctuaries, National parks, Habitat conservation practices, conservation for forests, range, soil and water, Ex-sini conservation-Botanical gardens, gene bank and cryo-banks D

M.Sc. (Botany)	**Practical-I** (Molecular Biology, Biotechnology and genetic engineering)	MBS2-543

Course learning outcomes (CLO):-

1. Practical Molecular Biology, Biotechnology, and Genetic Engineering courses aim to equip students with the foundational knowledge and hands-on skills to understand and manipulate biological systems at the molecular level.

2. Key learning outcomes include mastering techniques like DNA/RNA isolation, PCR, gel electrophoresis, and transformation, as well as understanding gene expression, cloning, and genetic engineering principles

List of Practicals

1. To visit Biotechnology Lab.

2. Principle working & uses of instruments. Laminar air flow, Autoclave, Incubator, Hot air oven, Gel Electrophoresis.

3. Preparation of culture media, Nutrient Agar, Nutrient Broth, Eosin Methylen Blue Agar, MacConkey Agar media.

4. Isolation of bacteria by streak plate method.

5. Isolation of bacteria by pour plate method.

6. To determine the growth characteristics of E. coli using plating technique.

7. To determine the growth characteristics of E. coli using turbidimetric method

8. Demonstration of gel for electrophoresis.

9. Isolation of Rhizobium from root nodules

10. To study the effect of antibiotic on growth of micro organism.

11. To demonstrate fermentation technique.

12. To demonstrate fermentation technique.

13. Preparation of Plant Tissue Culture Media.

14. Sterilization techniques Sterilization of glassware, tissue culture, media and explant.

15. Demonstration of callus culture Technique.

16. Demonstration of Androgenesis in Datura.

17. Demonstration of Organogenesis

18. Demonstration of Somatic embryogenesis

M.Sc. (Botany)	**Practical-II** (Plant ecology and environment)	MBS2-544

Course learning outcomes (CLO):-

1. On completion of this course students will understand of plant-environment interactions, ecological principles, and practical skills related to plant identification, data collection, and environmental analysis.

2. Students will learn to analyze plant distributions, assess ecosystem health, and understand the impact of environmental factors on plant life

List of Practical

1) Determination of density of different plant species by Quadrate method.

2) Determination of abundance of different plant species by Quadrate method.

3) Determination of % frequency of different plant species.

4) Determination of minimum size of quadrate.

5) Determination of LAI of a few dicot and monocot species

6) Determination of IV1 of 5 plant species.

7) Determination of soil water holding capacity of soil samples

provided. 8)Determination of dissolved oxygen (D.O.).

9) Determination of pH of polluted water

10) Determination of L/B ratio and leaf injury index

11) Determination of Chloride content in water