Dr. Bhimrao Ambedkar University, Agra

A State University of Uttar Pradesh (Paliwal Park, Agra -282004)

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A Documentary Support

for

Matric No. – 1.1.2

employability/ entrepreneurship/ skill development

under the

Criteria – I

(Curriculum Design and Development)

Key Indicator - 1.1

in

Matric No. – 1.1.2

MASTER OF SCIENCE (BOTANY)

1997

Mapping of course to:

Employability | Entrepreneurship | Skills Development

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Choice based credit system (CBCS)

Department of Botany
School of Life Sciences
Dr. Bhimrao Ambedkar University
Khandari Campus, Agra

Programme: M.Sc. BOTANY

Programme Outcomes (PO's):

Upon completion of the post-graduate program the students will be able to:

PO 1	Develop critical thinking ability and will apply the knowledge to answer scientific queries and expand comprehension potential.
PO 2	Demonstrate graduate attributes like core competency, communication skills, reflective thinking, scientific temper, research skills, digital literacy, moral and ethical awareness.
PO 3	Develop the aptitude for creative thinking, critical analysis and decision making for productive research and development in the area of botanical sciences.
PO 4	Develop effective communication skills through seminar presentations to successfully transfer the scientific knowledge which will facilitate students to look for avenues in higher education.
PO 5	Participate and succeed in various national and international competitive, fellowships and scholarships examinations.

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Programme Specific Outcome (PSO's)

Upon completion of M.Sc., Botany degree programme the students will be able to:

PSO 1	Procure updated and quality knowledge in the specialized areas of Botany.
PSO 2	Acquire practical skills in plant diversity and related topics.
PSO 3	Identify plants applying classical and modern taxonomical skills.
PSO 4	Evolve entrepreneurial skills related to advanced fields of Botany.
PSO 5	Equip with various computational skills applied in the field of Bioinformatics.
PSO 6	Gain knowledge in organization of plants at gene, molecular, cellular and tissue level.
PSO 7	Design and carryout biological experiments, projects and interpret data providing meaningful solutions and recommendations.
PSO 8	Beware of environmental issues and live-in harmony with nature.
PSO 9	Utilize bio resources without profiteering motives.
PSO 10	Become competent enough in various analytical and technical skills related to Plant Science.

Core Course	Course Title: M.Sc. Botany I Semester
BOT-C101	Plant Diversity I

Course Objective: The objective of this paper is to provide the knowledge of different groups of Algae, Bryophytes, Pteridophytes and Gymnosperms and their economic importance.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	2	1	3	-	3	-	3	-	-	-	-	2	3	1
CO 2	3	2	1	3	-	3	-	3	-	-	-	-	2	3	1
CO 3	3	2	1	3	-	3	-	3	-	-	-	-	2	3	1
CO 4	3	2	1	3	-	3	-	3	-	-	-	-	2	3	1

Course Outcomes (COs)

CO 1	Deals with distribution, structure, classification and life history of some groups of algae. Understands with technological application of algae.
CO 2	Classify various Bryophytes and understand their economic uses and deals with distribution, structure, and life history and affinities of bryophytes with other plants.
CO 3	Analyze the morphology, anatomy, reproduction, classification, life, cycle, evolution of stele, heterospory and origin of seed habit of different groups of Pteridophytes and evolution of Pteridophytic orders understand the concept of Fossil Pteridophytes.
CO 4	Understand classification, general characters, distribution and phylogeny, economic importance of Gymnosperms. Critically differentiate the character of four orders of Gymnosperms i.e. Cycadales, Coniferales, Ginkoales and Gnetales.

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M.Sc. Botany I semester

Core Course

BOT-C101 Plant Diversity- I

UNIT I

Phycology: Algae in diversified habitats; thallus-organization; cell ultrastructure; reproduction (vegetative, asexual and sexual); classification of algae; pigments, reserve food, flagella; algal blooms, Economic importance of algae(as fertilizers, food feed and industry).

Classification, salient features of Chlorophyta, Xanthophyta, Bacillariphyta, Phaeophyta and Rhodophyta.

UNIT II

Bryophytes: Morphology, structure, reproduction and life history; distribution; Sporophyte evolution of bryophytes; classification; general account of Marchanitales, Jungermaniales, Anthocerotalcs, Funariales, economic and ecological importance.

UNIT III

Pteridophyta: Morphology, anatomy and reproduction; classification, life cycle, evolution of stele; heterospory and origin of seed habit.

General account of fossil pteridophyte, Brief introduction of Psilopsida, Lycopsida, Sphenopsida and Pteropsida

UNIT IV

GYMNOSPERMS

Classification of Gymnosperms. Comparative study vegetative, anatomical and reproductive structures of Cycadophyta, Coniferophyta and Gnetophyta. Evolutionary trends and phylogenetic relationship among various groups of Gymnosperms. Economic importance of Gymnosperms.

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

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Core Course	Course Title: M.Sc. Botany I Semester
BOT-C102	Plant Diversity II

Course Objective: This paper deals with diversity of microbes; classification, distribution, characters and structure of viruses, bacteria, fungi and phytoplasma and to provide the knowledge of plant pathology and diseases caused by different plant pathogens.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	1	2	3	-	3	-	3	-	-	3	-	3	2	1
CO 2	3	1	2	3	-	3	-	3	-	-	3	-	3	2	1
CO 3	3	1	2	3	-	3	-	3	-	-	3	-	3	2	1
CO 4	3	1	2	3	-	3	-	3	-	-	3	-	3	2	1

Course Outcomes (COs)

CO 1	Understand the general account, Ultrastructure, Nutrition and Reproduction and economic importance of Archaebacteria and Eubacteria and Cyanobacteria
CO 2	Rememberingthe Characteristics, Ultrastructure of Viruses and Virions. Their isolation and purification techniques. Their chemical nature,replication, transmission and Economic importance. General characters of Phytoplasma and their role in causing diseases.
CO 3	Apply the position of Fungi in latest classification system. List the morphological and anatomical characters of groups and examples of groups. Exemplify endosymbiotic and symbiotic associations of lower groups. Implement bioprospecting of Fungi.Remembering the brief information of plant diseases, symptoms and economic importance and deals with causal organism, symptoms and control of some plant diseases along with general principles of plant disease management. Deals with methods of isolation of pathogens and their culture.
CO 4	Understanding the idea of fungal cell structure, nutrition and reproduction. Provides the knowledge of plant parasitic fungi and their economic importance.

M.Sc. Botany I semester

Core Course

BOT-C102 Plant Diversity- II

UNIT I

Archaebacteria and eubacteria: General account; ultrastructure, nutrition and reproduction biology and economic importance: cyanobasseri-salint feature and biological importance.

UNIT II

Viruses: Characteristics and ultrastructure of virions; isolation and purification of viruses; chemical nature, replication, transmission viruses; economic importance.

Phytoplasma: General characteristics and role in causing plant diseases.

UNIT III

Mycology and Plant Pathology:

Fungi: General characters of fungi: substrate relationship in fungi; cell ultrastructure, unicellular and multicellular organization;

Plant Pathology: Concept of disease in plants; Definition of plant disease; Historical development of Plant Pathology. Methods of studying plant diseases: Collection, preservation, isolation of pathogens and proving Koch postulates. Symptoms caused by Plant Pathogenic fungi, bacteria and viruses. Brief Classification of Plant diseases.

UNIT IV

General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina; fungi in industry, medicine anc as food; fungal diseases in plant humans; Mycorrhizae, fungi as biocontrol agents.

Cell wall composition; nutrition-saprobic, biotrophic, symbiotic; reproduction-vegetative, asexual and sexual; heterothallism; heterokaryosis; Para sexuality; recent trends in classification, phylogeny of fungi.

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

Core Course	Course Title: M.Sc. Botany I Semester
BOT-C103	Plant Physiology and Metabolism

Course Objective: The main purpose of this paper is to provide the knowledge of different aspects of physiology and metabolism of nitrogen and lipid etc.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	-	-	2	3	3	-	2	-	3
CO 2	3	3	3	3	-	3	-	-	2	3	3	-	2	-	3
CO 3	3	2	3	3	-	3	-	-	2	3	3	-	2	2	3
CO 4	3	1	3	3	-	3	-	-	2	3	3	-	2	2	3

Course Outcomes (COs)

CO 1	Understand the concepts of thermodynamics and photobiology. This unit covers the information of Enzymology, plant water relation and mineral nutrition. Provides the knowledge of Signal Transduction, Phospholipid Signaling and Sucrose sensing mechanism in bacteria and plants.
CO 2	Deals with photosynthesis and respiration steps. This unit applies and analyzes the metabolism of lipid.
CO 3	This unit helps in remembering the metabolism of nitrogen and sulphur.
CO 4	Provides the understanding of growth regulators and sensory photobiology.

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M.Sc. Botany I semester

Core Course

BOT-C103 PANT PHYSIOLOGY AND METABOLISM

UNIT I

Energy flow: Principles of thermodynamics, free energy and chemical potential redox reaction structure and function of ATP.

Fundamentals of enzymology: General account, isozymes, kinetics of enzymatic catalysis, Michel's Menten equation and its significance.

Membrane transport and translocation of water and solutes: Plant water relations, mechanism of water transport through xylem, phloem; passive and active solute transport, membrane transport problems.

Signal transduction: Overview, receptors and G-proteins, phospholipid signaling, role of cyclic nucleotides, calcium-O clamodulin cascade, diversity in protein kinases and phosphatases, specific signaling mechanism, e.g. two component sensor regulating system in bacteria and plants, sucrose sensing mechanism.

UNIT II

Phytochemistry and photosynthesis: Evolution of photosynthetic apparatus, photosynthetic pigment and light harvesting complexes, photooxidation of water, mechanism of electron and proton transport, carbon assimilation-the Calvin cycle, photorespiration, C4 cycle, CAM pathway.

Respiration and Lipid metabolism: Glycolysis, TCA cycle, electron transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidases system structure and function of lipids, fatty acid biosynthesis and their catabolism.

UNIT III

Nitrogen fixation, Nitrogen and Sulphur metabolism: Overview, biological nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and reduction, ammonia assimilation

Sensory photobiology: Phytochromes and their photochemical and biochemical properties, photoperiodism and its significance, vernalization

UNIT IV

Plant growth regulators and elicitors: Physiological effect and mechanism of action of auxin, gibberellins, cytokinin, ethylene, abscisic acid, brassinosteroids and polyamines

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

Core Course	Course Title: M.Sc. Botany I Semester
BOT-C104	Plant Morphology and Anatomy

Course Objective: The chief objective of this paper is to understand about the development of root, shoot and leaf as well as secretary ducts.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	-	2	3	-	3	-	2	3	-	1	-	2	-	3
CO 2	3	-	2	3	-	3	-	2	3	-	1	-	2	-	3
CO 3	3	-	2	3	-	3	-	2	2	-	1	-	2	-	3
CO 4	3	-	2	3	-	3	-	2	2	-	1	-	2	-	3

Course Outcomes (COs)

CO 1	Provides the knowledge of understanding of Unique features of Plant Development.
CO 2	Provides the knowledge of understanding of Seed Germination and Seedling Growth.
CO 3	This unit helps in the remembering of Shoot System in Flowering plants.
CO 4	This unit helps in the remembering of Root System in Flowering plants.

M.Sc. Botany I semester

Core Course

BOT-C104 PLANT MORPHOLOGY AND ANATOMY

UNIT I

Introduction: Unique features of plant development. Differentiates specialization and morphogenesis.

UNIT II

Seed Germination and seedling growth: Metabolism of nucleic acids, proteins and mobilization of food reserves; tropisms hormonal control of seedling growth; gene expression

UNIT III

Shoot development: Organization of the shoot apical meristem (SAM); Cytological and molecular analysis of SAM; control of cell division and cell to cell communication; anomalous secondary growth; tissue differentiation- xylem and phloem; secretary ducts and laticifers; wood development in relation to environmental factors; nodal anatomy.

UNIT IV

Leaf growth and differentiation: Determination; phyllotaxy; control of leaf form; differentiation of epidermis (with special reference to stomata and trichomes and mesophyll.

Root Development: Organization of root apical meristem (RAM); cell fates and lineages; vascular tissue differentiation; lateral roots, root hairs; root-microbe interactions, Rood nodules.

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

Core Course	Course Title: M.Sc. Botany I Semester
BOT-C105	Practicals

Course Objective: Exercises corresponding to the theory courses.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	3	3	1	-	2	1	3	2	3
CO 2	3	3	3	3	-	3	3	3	1	-	2	1	3	2	3
CO 3	3	3	3	3	-	3	3	3	1	3	3	3	3	2	3
CO 4	3	3	3	3	-	3	3	3	1	-	2	3	3	2	3

Course Outcomes (COs)

CO 1	To give the students some detail idea for the evaluation of Cryptogams (Algae, Bryophytes, Pteridophytes and Gymnosperms) classification. Preparation and study of temporary and permanent slides of vegetative and reproductive structures of various genera of Cryptogams (Algae, Bryophytes, Pteridophytes and Gymnosperms). To create the plant specimens under various genera according to the syllabus in the field study (local) by specimen collection, preservation and study in the field of Cryptogams (Algae, Bryophytes, Pteridophytes and Gymnosperms)
CO 2	To give the students some detail idea for the evaluation of fungal and bacterial classification, vegetative and reproductive structures of fungi. Preparation and study of temporary and permanent slides of fungi and bacteria. To create the various plant specimens under various genera according to the syllabus in the field study (local) by specimen collection, preservation and study in the field Pathogens (Viruses, Bacteria and Fungi). Understanding introduction to plant pathology, classification of diseases, process of infection and pathogenesis.
CO 3	Evaluate the basic physiological relationship of Plant, water and soil and translocation of organic solutes Mechanism of stomatal transpiration, Photosynthesis and Respiration. Analyze the basic biochemical and physiological knowledge about the utility and estimation of different plant contents (Chlorophyll content, Proline, Carbohydrates). To get detail practical knowledge about Separation and identification of sugars and amino acids by paper chromatography. To learn how to determine water potential of plant tissue. To learn how to determine Chlorophyll- a, Chlorophyll- b and total Chlorophyll and carotenoid.
CO 4	To give the students some detail idea about Angiosperms (Dicots as well as Monocots). Create the temporary and permanent slides by the section cutting of roots and stems of Angiosperms (Dicots as well as Monocots) with double staining.

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Core Course	Course Title: M.Sc. Botany II Semester
BOT-C201	Angiosperms, Systematic and Economic Botany

Objective: The main objective of this paper is to understand the concept of species, variation, speciation, genus, family and classification of angiospermic plants and their Economic importance.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	2	2	3	-	3	-	2	2	-	1	-	3	3	3
CO 2	3	2	2	3	-	3	-	1	2	-	1	-	3	3	3
CO 3	3	2	3	3	-	3	-	3	3	-	1	-	3	3	3
CO 4	3	2	3	3	-	3	-	3	3	-	1	-	3	3	3

Course Outcomes (COs)

CO 1	Provides the knowledge to understand the Plant Diversity and concept of Species.
CO 2	This unit deals with the applicable knowledge of Taxonomic Tools.
CO 3	This unit helps in remembering of the Classification in Angiosperms.
CO 4	Provides the knowledge to understand the description of the families of Angiosperms (Dicotyledons and Monocotyledons).

M.Sc. Botany II semester

Core Course

BOT-C201 ANGISOPERMS, SYSTEMATICS AND ECONOMIC BOTANY

UNIT I

Origin of in trapopulation variation and the environment: ecades and ecotype: Ex. hotspots plant diversity.

The species concept: Taxonomic hierarchy, species, genus, family and other categories; Modern trends in plant taxonomy: Anatomy in relation to taxonomy, embryology in relation to taxonomy; salient features of the ICBN

UNIT II

Taxonomic tools: Herbarium, numerical taxonomy, cytotaxonomy, chemotaxonomy, serological and molecular taxonomy

UNIT III

Systems of angiospermic classification: Phenetic verses phylogenetic system: Bentham& Hooker, Engler and Prantell& Hutchinson's system; relative merits and demerits of major systems

UNIT IV

Description of the families:

(a) **Dicotyledons:** Ranunculaceae, Rutaceae, Meliaceae, Euphorbiaceae. Malvaceae, Apiaceae, Apocynaceae, Asciemadacoae, Cnvolvuiaceae, Lamiaceae, Solanaceac, Rubiaceae, Cucurbitaceae, Asteraceae, Verbinaceae

(b) **Monocotyledons:** Poaceae, Cyperaceae, Palmae, Zingiberaceae, Orchidaceae

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

Core Course	Course Title: M.Sc. Botany II Semester
BOT-C202	Plant resources utilization and Conservation

Course Objective: This paper deals with plant resources and their utilization as well as conservation.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	3	1	2	3	3	3	3	3	3
CO 2	3	3	3	3	-	3	2	1	3	2	3	3	3	3	3
CO 3	3	3	3	3	-	3	3	1	3	2	3	3	3	3	3
CO 4	3	3	3	3	-	3	3	1	3	3	3	3	3	3	3

Course Outcomes (COs)

CO 1	Deals with understand to different procedures of plant conservation. Provides information of some revolutions occurred for conservation of plants.
CO 2	Provides the information to remember the some domesticated plants used as cereal, fiber and medicine.
CO 3	Provides the information to remember some oil yielding, fire and timber plants.
CO 4	Provides the information of understand the Green Revolution and its consequences. Plants used as avenue trees for shades, pollution control and aesthetics and general account and activities of different governmental institutions which are engaging conservation and research activities (BSI, NBPGR, ICAR, CSIR, DBT).

M.Sc. Botany II semester

Core Course

BOT-C202 PLANT RESOURCES UTILIZATION AND CONSERVATION

UNIT I

Strategies for conservation- *In situ* conservation: International efforts and Indian initiatives; protected areas in India-Sanctuaries, National Parks, biosphere reserves, wetlands, mangroves and coral reefs for conservation of wild biodiversity.

Strategies for conservation: ex situ conservation: Principles and practices: botanical gardens, field gene banks, *in vitro* repositories, cryobanks.

UNIT II

Origin, evolution, botany, cultivation and uses of food, forage and fodder, fiber, medicinal and aromatic plants, and vegetable oil yielding crops.

UNIT III

Important fire wood and timber yielding plants and non-wood forest products (NWFPs) such as bamboos, rattans, raw materials for paper making, tannins, dyes, resins and fruits.

UNIT IV

Green revolution: Benefits and adverse consequences.

Innovations for meeting world food demand.

Plants used as avenue trees for shade, pollution control and aesthetics.

Principles of conservation; extinction's environmental status of plant based on International union for conservation of Nature.

General account of the activities of Botanical Survey of India (BSI); National Bureau of Plant Genetic Resources (NBPGR), Indian Council of Agricultural Research (ICAR), Council of Scientific & Industrial Research (CSIR), and the Department of Biotechnology (DBT) for conservation, non-formal conservation efforts.

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

Core Course	Course Title: M.Sc. Botany II Semester
BOT-C203	Fundamentals of Ecology

Course Objective: The main objective of this syllabus is to provide the knowledge of ecosystem, biodiversity and ecological management.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	2	3	3	-	3	2	3	2	1	1	3	3	3	3
CO 2	3	2	3	3	-	3	2	3	2	1	1	3	3	3	3
CO 3	3	2	3	3	-	3	2	3	2	1	1	3	3	3	3
CO 4	3	2	3	3	-	3	2	3	2	3	-	3	3	3	3

Course Outcomes (COs)

CO 1	Provides the knowledge to evaluate the Climate, soil and vegetation patterns of Life zones and Vegetation Organization.
CO 2	Apply the knowledge to understand the Vegetation patterns.
CO 3	Analyze the knowledge of Ecosystem and its Organization.
CO 4	Evaluate the Air, Water and Soil Pollution. Provides the knowledge of Climate change.

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M.Sc. Botany II semester

Core Course

BOT-C203 FUNDAMENTALS OF ECOLOGY

UNIT I

Climate, soil and vegetation patterns of Life zones: major biomer and major vegetation, Soil types, pedogenesis; physical and chemical characters.

Vegetation Organization: Concepts of community and continuum; analysis of communities (analytical and synthetic characters); inter-and intra-specific associations; concept of ecological niche.

UNIT II

Vegetation development: Temporal changes (Cyclic and non-cyclic); mechanism of ecological succession; Ecological life-cycle of plants; autoecology, genecology- gene study in India, synecology.

UNIT III

Ecosystem Organization: Structure and functions; primary production (methods of measurement), energy dynamics (trophic organization, energy flow pathways, ecological efficiencies; global biogeochemical cycles of C, N, P and S.

Biological Diversity: Concepts of levels; role of diversity in ecosystem functions and stability; speciation and extinction; IUCN categories of threat; distribution and global warming, sea level rise, UV radiation.

UNIT IV

Air, water and soil pollution: Kinds; source; quality parameters; effects on plants and ecosystems.

Climate change: Greenhouse gases (CO_2, CH_4, N_2O, CFCs: source, trends and role); ozone layer and ozone hole; consequences of climate change (CO_2 fertilization, global warming, sea level rise, UV radiation).

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

Core Course	Course Title: M.Sc. Botany II Semester
BOT-C204	Plant Cell, Tissue and Organ Culture

Course Objective: The main objective of this paper is to understand the tissue culture and genetic engineering techniques.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	3	2	3	1	3	3	3	3	3
CO 2	3	3	3	3	-	3	3	2	3	1	3	3	3	3	3
CO 3	3	3	3	3	-	3	3	2	3	1	3	3	3	3	3
CO 4	3	3	3	3	-	3	3	2	3	3	3	3	3	3	3

Course Outcomes (COs)

CO 1	Understand the different tissue culturing procedures for culturing different parts of plant.
CO 2	Provides the information to understand the Meristem and Embryo Culture.
CO 3	Remember the different tools and procedures of tissue culture. Knowledge of protoplast isolation and somatic hybridization.
CO 4	Remember the methods of preservation and storage of germplasm.

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M.Sc. Botany II semester

Core Course

BOT-C204 PLANT CELL, TISSUE AND ORGAN CULTURE

UNIT I

General introduction, history scope, concept of cellular differentiation and totipotency; Tissue culture media; preparation and sterilization procedures; Anther culture production of androgenic hapoids, bullbosum method.

UNIT II

Meristem culture and production of disease-free plants; Cell culture and production of secondary metabolites / natural products; Embryo culture.

UNIT III

Callus culture, somatic embryogenesis and production of synthetic seeds; Endosperm culture; Somatic hybridization: Protoplast isolation fusion and culture, hybrid selection and regeneration possibilities.

UNIT IV

Somaclonal and gametoclonal variation; Clonal propagation; Cryopreservation, germplasm storage and gene banks. Germplasm conservation and synthetic seed technology, Industrial application. Suspension culture, hairy root culture and bioreactors

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

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Core Course	Course Title: M.Sc. Botany II Semester
BOT-C205	Practicals

Course Objective: Exercises corresponding to the theory courses.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	3	3	3	1	3	3	3	3	3
CO 2	3	3	3	3	-	3	3	3	3	2	3	3	3	3	3
CO 3	3	3	3	3	-	3	3	3	3	2	3	3	3	3	3
CO 4	3	3	3	3	-	3	3	3	3	3	3	3	3	3	3

Course Outcomes (COs)

CO 1	To give the students some detail idea to understand the Description of the families of Angiosperms and How to prepare Herbarium.
CO 2	To give students practical understandings of various plant resources and its utilization.
CO 3	To give the students some detail idea to understand the soil profile and soil properties. To give students practical understandings of species abundance, density and frequency.
CO 4	To give students practical understandings of different types of tissue culture medias and micropropagation of various explants.

Core Course	Course Title: M.Sc. Botany III Semester
BOT-C301	Biology of Plant Reproduction

Course Objective: The main of objective of this paper is to understand the embryology of monocots and dicots.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	2	2	3	-	3	2	1	-	-	1	-	2	1	3
CO 2	3	3	2	3	-	3	2	1	-	-	2	-	2	1	3
CO 3	3	2	2	3	-	3	2	1	-	-	1	-	1	1	3
CO 4	3	3	2	3	-	3	2	1	-	-	2	-	2	2	3

Course Outcomes (COs)

CO 1	Provides the knowledge for remembering the Methods of reproduction in flowering plants and Pollination.
CO 2	Provides the knowledge to analyze Pollen-Pistil interaction and Pollen Physiology.
CO 3	Provides the knowledge for remembering of Morphology of Carpels.
CO 4	Evaluate the development of Seed biology.

M.Sc. Botany III semester

Core Course

BOT-C301 BIOLOGY OF PLANT REPORDUCTION

UNIT I

Methods of reproduction in flowering plants: Vegetative, asexual, sexual and parasexual mode reproduction. Sexual system in flowering plants. Structure and development of male gametophyte and female gametophyte.

Pollination: Self and cross pollination, flower structure in relationship to the mono of pollination, contrivances promoting cross pollination, methods of cross pollination, insect pollination, the pollinators and causal factors, attractants and reward of pollination.

UNIT II

Pollen-Pistil interaction: Significance of pollen pistil interaction, structure of stigma and style, post- pollination events, fertilization.

Pollen Physiology: Viability, FCR, Alexander's stain, TLC

UNIT III

Carpel Morphology: Form of carpel, closure of carpel, complex carpel, solid carpel, placentation.

UNIT IV

Seed Biology: Seed and fruit physiology of growth and development, interaction of seed and Twit, involvement of extraovarian parts in fruit development. Physiology of seed germination, seed dormancy and seedling establishment. **Morphological sterility:** Mechanical and physiological factors. **Incompatibility:** Sexual incompatibility, general concepts, mechanism of intraspecific incompatibility Methods employed for overcoming incompatibility.

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship

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Core Course	Course Title: M.Sc. Botany III Semester
BOT-C302	Mycology and Plant Pathology

Course Objective: The objective of this paper is to provide the knowledge of different types of pathogens and biochemical effects on them.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	1	3	-	3	3	2	1	1	1	-	3	3	3
CO 2	3	3	3	3	-	3	2	3	1	2	2	-	3	3	3
CO 3	3	3	1	3	-	3	2	2	1	1	1	-	3	3	3
CO 4	3	3	2	3	-	3	3	2	1	1	1	-	3	3	3

Course Outcomes (COs)

CO 1	Deals with understands to introduction, general characteristics, ecology and distribution of different orders of Fungi.
CO 2	Provides the knowledge of Applied Mycology and Role of fungi in Biotechnology.
CO 3	This unit helps in remembering the introduction of the Plant Pathology.
CO 4	Provides the knowledge to evaluate the Geographical distribution of Diseases.

M.Sc. Botany III semester

Core Course

BOT-C302 MYCOLOGY AND PLANT PATHOLOGY

Unit I

Introduction. General characteristics; Ecology and Distribution; Thallus organization; EM of haustorium and septum: Wall composition: Nutrition; Growth; Reproduction and spore); Heterokaryosis and Para sexuality; Sexual compatibility: Life cycle patterns of Myxomycota. Oomycota, Zygomycota, Ascomycota, Basidiomycota, Deuteromycota.

Unit II

Applied Mycology Role of fungi in biotechnology Application of fungi in food industry of flavour& texture. Fermentation. Baking, Organic acids, Enzymes, Mycoproteins); Secondary metabolites Pharmaceutical preparations); Agriculture (Biofertilizers): Mycotoxins; Biological Control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Medical mycology.

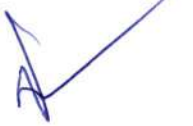
Unit III

Plant Pathology Introduction: Definition: Importance; Terms and Concepts, Classification; Causes, Symptoms Host Pathogen relationships

Unit IV

Geographical distribution of diseases; etiology, symptomology, disease cycle and environmental relation; prevention and control of plant diseases, and role of quarantine

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.



Core Course	Course Title: M.Sc. Botany III Semester
BOT-C303	Molecular Biology and Genetic Engineering

Course Objective: The main objective of this paper is to understand about the cell organelles and techniques used in cell biology and to provide the knowledge of DNA, genes and chromosomes as well as their different functions and activities.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	-	1	3	3	3	3	3	3	3
CO 2	3	3	3	3	-	3	-	1	3	3	3	3	3	3	3
CO 3	3	3	3	3	-	3	-	1	3	3	3	3	3	3	3
CO 4	3	3	3	3	-	3	-	1	3	3	3	3	3	3	3

Course Outcomes (COs)

CO 1	Apply the Basic concepts, principles and scope of Molecular Biology and Genetic Engineering.
CO 2	Provide the Knowledge to understand the Genetic Engineering of Plants.
CO 3	Analyze the Microbial manipulations.
CO 4	Provides the knowledge to understand the Genomics and Proteomics.

M.Sc. Botany III semester

Core Course

BOT-C303 MOLECULAR BIOLOGY AND GENETIC ENGINEERING

UNIT I

Basic concepts, principle and scope of molecular biology and genetic engineering.

Recombinant DNA technology: Gene cloning principles and techniques, construction of genomic/c DNA libraries, choice of vectors, DNA synthesis and sequencing, polymerase chain rejection, DNA fingerprinting.

UNIT II

Genetic Engineering of plants: Aims, strategies for development of transgenics (with suitable examples), Agrobacterium- the natural genetic engineer, T-DNA and transposon mediated gene tagging, chloroplast transformation and its utility, intellectual property rights.

UNIT III

Microbial Genetic Manipulation: Bacterial transformation, selection of recombinants and transformants, genetic improvement of industrial microbes and nitrogen fixers, fermentation technology.

UNIT IV

Genomics and Proteomics: Genetic and physical mapping of genes, molecular markers for introgression of useful traits, artificial chromosome, high throughout sequencing, genome projects, bioinformatics, microarrays.

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

Core Course	Course Title: M.Sc. Botany III Semester
BOT-E304	Cytogenetics

Course Objective: The main objective of this paper is to provide the knowledge of DNA, genes and chromosomes as well as their different functions and activities.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	2	1	3	3	3	2	3	3	3
CO 2	3	3	3	3	-	3	2	1	3	3	3	2	3	3	3
CO 3	3	3	3	3	-	3	3	1	3	3	3	2	3	3	3
CO 4	3	3	3	3	-	3	2	1	3	3	3	2	3	3	3

Course Outcomes (COs)

CO 1	Analyze the Organization of Chromatin.
CO 2	Provides the knowledge to understand theStructural and Numerical alterations in Chromosomes.
CO 3	Deals with the study to remember the Genetics of Prokaryotes and Eukaryotic Organelles.
CO 4	Provides the knowledge to analyze the different types of Mutations.

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M.Sc. Botany III semester

Elective

BOT-E304 CYTOGENETICS

UNIT I

Chromatin Organization: Chromosome structure and packaging of DNA, molecular organization of centromere and telomere; nucleolus and ribosomal RNA genes; euchromatin and heterochromatin; chromosomes-polythene, Lampbrush, B-chromosome and sex chromosome, molecular basis of chromosome pairing.

UNIT II

Structural and numerical alterations in chromosomes: Origin, meiosis and breeding behavior of duplication, deficiency, inversion and translocation heterozygotes; origin, occurrence, production and meiosis of haploids, aneuploids and euploids; origin and production of autopolyploid; chromosomes and chromatid segregation; allopolyploids, types, genome constitution and analysis; evolution of wheat and paddy crop induction and characterization of trisomics and monosomic.

UNIT III

Genetics of Prokaryotes and eukaryotic organelles: Mapping the bacteriophage genome; phage phenotypes; genetics recombination phage; genetics transformation, conjugation and transduction in bacteria; cytoplasmic male sterility.

Gene Structure and Expression: Genetics fine structure; cis-trans test; fine structure analysis of eukaryotes; introns and their significance; regulation of gene expression in prokaryotes and eukaryotes.

UNIT IV

Mutations: Spontaneous induced mutations; physical and chemical mutagens; molecular basis of gene mutations; transposable elements in prokaryotes and eukaryotes; mutations induced by transposons; site- directed mutagenesis; DNA damage and repair mechanisms.

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

Core Course	Course Title: M.Sc. Botany III Semester
BOT-E305	Plant Breeding

Course Objective: The objective of this paper is to impart the basic knowledge of Cytogenetics and plant breeding in detail.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	2	3	3	1	3	2	3	3	3
CO 2	3	3	3	3	-	3	2	3	3	3	3	2	3	3	3
CO 3	3	3	3	3	-	3	2	3	3	2	3	2	3	3	3
CO 4	3	3	3	3	-	3	2	3	3	3	3	2	3	3	3

Course Outcomes (COs)

CO 1	Deals with the study to understand the Cytogenetics of Anuploids and Structure of Heterozygotes.
CO 2	Provides the knowledge to analyze theAllien gene transfer and Chromosome manipulation.
CO 3	Applying of Perspectives of Plant Breeding, Methods of Reproduction in Crop Plants and Breeding methods in Crops.
CO 4	Apply the knowledge of Polyploidy, Mutation and Biotechnology in Crop improvement and Seed production practices.

M.Sc. Botany III semester

Elective

BOT-E305 Plant Breeding

UNIT I

Cytogenetics of anuploids and structure heterozygote: Effect of an on phen.... transmission of monosomics and trisomics; breeding behavior and genetics of structure heterozygotes; translocation tester sets; Robertsonian translocation; B-B translocation.

UNIT II

Alien gene transfer, chromosome manipulation: transfer of whole genome, example from wheat, Arachis and Brassica; transfer of individual chromosomes and chromosome segments; method of detecting alien chromatin; production characterization and utility of alien addition and substitution lines; genetic basis of inbreeding and heterosis; exploitation of hybrid vigor.

UNIT III

Perspectives of plant breeding, methods of reproduction in crop plants and breeding methods in crops:

a. Aims and achievements of plant breeding

b. Breeding methods for self-pollinated crops, pure line breeding and mass selection, pedigree method

c. Selection in cross pollinated crops, Recurrent selection, Clonal selection

d. Hybrid and synthetic varieties

e. Heterosis and in breeding depression

UNIT IV

Polyploidy mutation and biotechnology in crop improvement, seed production practices:

a. Autoploidy, Allopolyploidy and aneuploidy, seed production practices

b. Mutation breeding: procedure, achievements and pitfalls of mutation breeding

c. Haploid production Embryo culture, somatic cell hybridization, genetic engineering

d. Seed production practices: Improved varieties, role of seed certification, National seed corporation, seed labeling and seed testing

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

Core Course	Course Title: M.Sc. Botany III Semester
BOT-C306	Practicals

Course Objective: Exercises corresponding to the theory courses.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	-	-	3	3	3	3	1	2	3	3	3	3
CO 2	3	3	3	-	-	3	3	3	3	1	2	3	3	3	3
CO 3	3	3	3	-	-	3	3	3	3	3	3	3	3	3	3
CO 4	3	3	3	-	-	3	3	3	3	1	2	3	3	3	3
CO 5	3	3	3	-	-	3	3	3	3	2	2	3	3	3	3

Course Outcomes (COs)

CO 1	To give the students some detail practical idea to create morphology of Flowers belonging to different families of Angiosperms. To give students practical understandings of seed viability and pollen-pistil interactions.
CO 2	To give students practical understandings of Plant diseases caused by Bacteria, Fungi and Viruses.
CO 3	To give the students some detail practical idea for the evaluation ofapplications of Genetic Engineering in the development of plants.
CO 4	To give the students some detail practical idea to apply the knowledge in cell organelles, types of cell division and mutations.
CO 5	To give the students some detail practical idea to remember the breeding methods in Crop plants.

Core Course	Course Title: M.Sc. Botany IV Semester
BOT-C401	Biostatistics and Computer Applications

Course Objective: The main objective of this paper is to understand in brief about biostatistics and Computer Applications.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	-	-	3	3	-	3	-	3	3
CO 2	3	3	3	3	-	3	-	-	3	3	-	3	-	3	3
CO 3	3	3	3	3	-	3	-	-	3	3	-	3	-	3	3
CO 4	3	3	3	3	-	3	-	-	3	3	-	3	-	3	3

Course Outcomes (COs)

CO 1	Apply the knowledge of concepts of Biostatistics and Biometry.
CO 2	Evaluate the study of Deviations, Variances and Elementary Probability.
CO 3	Apply the knowledge of Simple linear regression and correlation.
CO 4	Evaluation of Computer organization, Programming Techniques, Software's and its applications.

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M.Sc. Botany IV semester

Core Course

BOT-C401 Biostatistics and Computer Application

UNIT I

1. Concepts of statistics and biometry
2. Continuous and discontinuous variables
3. Brief description and tabulation of data in its graphical representation.

UNIT II

1. Measures of central tendency and dispersion, mean, median mode, range, standard deviation, variance
2. Elementary probability: addition and multiplication laws.

UNIT III

1. Simple linear regression and correlation
2. Idea of two types of errors and level of significances, test of significance (F & t test); chi-square tests.

UNIT IV

1. Introduction of digital computers: organization; low level and high level language; binary number system.
2. Flow charts and programming techniques.
3. Introduction to programming techniques.
4. Introduction to programming techniques.
5. Introduction to data structure and database concepts, introduction to internet and its application.
6. Introduction to MS-Office software, covering Word Processing, Spreadsheets and Presentation software- introduction to Corel Draw.

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

Core Course	Course Title: M.Sc. Botany IV Semester
BOT-C402	Cell Biology and Plant Biochemistry

Course Objective: The main objective of this paper is to understand about the cell organelles and techniques used in cell biology and plantbiochemistry.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	-	2	3	2	3	3	3	3	3
CO 2	3	3	3	3	-	3	-	2	3	3	3	3	3	3	3
CO 3	3	3	3	3	-	3	-	2	3	3	3	3	3	3	3
CO 4	3	3	3	3	-	3	-	2	3	3	3	3	3	3	3

Course Outcomes (COs)

CO 1	Apply the knowledge of Cell components in detail.
CO 2	Analyze the knowledge of Classification, Structure, Function and Metabolism of Carbohydrates, Proteins and Lipids.
CO 3	Apply the detail Knowledge of Plant Growth Hormones.
CO 4	Apply the General aspects, Characteristics and Classification of Enzymes.

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M.Sc. Botany IV semester

Core Course

BOT-C402 CELL BIOLOGY AND PLANT BIOCHEMISTRY

Unit-I

Cell components:

Structural and functional aspects of cytoskeleton system, role in cell organization and movement, organization of microtubules, microfilaments and plasmodesmata. Ultrastucture and function of microbodies, Golgi apparatus, lysosomes, peroxisomes, endoplasmic reticulum, vacuole, ribosomes, nucleus and nucleolus. Structural organization and functions of: Cell wall and Plasma membrane. Membrane transport: Structure and functions of ion carriers, channel proteins.

Unit-II

Classification, structure and functions of: Carbohydrates- Monosaccharides, oligosaccharides, polysaccharides (storage and structural) Amino acids- protein, non- protein, essential and non-essential. Proteins- simple and conjugated Lipids- Fatty acids, simple and compound lipids. Nitrogen and sulfur metabolism: Biological nitrogen fixation, nitrogenase enzyme complex, nodule formation and nod factors. Mechanism of nitrate reduction-nitrate and nitrite reductase. Ammonia assimilation. Assimilation of sulfur.

Unit-III

Plant growth hormones:

Biosynthesis, function and mechanisms of action of Auxins. Gibberellins. Cytokinins. Abscisic acid, Ethylene. Brasssinosteroids, Polyamines, Jasmonic acid and Salicyclic acid.

Unit-IV

Enzymes:

General aspects, characteristics and classification. Factors affecting enzyme activity Active sites and mode of action. Regulation of enzyme activity and allosteric mechanism Enzyme inhibition - reversible and irreversible, competitive and non-competitive. Enzyme kinetics and Michaelis-Menton equation.

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

Core Course	Course Title: M.Sc. Botany IV Semester
BOT-E403	In Vitro Plant Propagation

Course Objective: The main objective of this paper is to impart the basic knowledge of tissue culture, germplasm storage, growth regulators and mutagenesis.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	2	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	-	3	2	3	3	3	3	3	3	3	3
CO 3	3	3	3	3	-	3	2	3	3	3	3	3	3	3	3
CO 4	3	3	3	3	-	3	2	3	3	3	3	3	3	3	3

Course Outcomes (COs)

CO 1	Analyze the basic concepts, Principles and Scope of Plant Cell and tissue culture.
CO 2	Provides the knowledge to understand the Organogenesis and Embryogenesis.
CO 3	Deals with the detail knowledge to apply Micropropagation.
CO 4	Deals with the knowledge of Applications of Plant Tissue culture.

M.Sc. Botany IV semester

Elective

BOT-E403 In Vitro Plant Propagation

Unit I

Basic concepts, principles and scope of Plant cell and tissue culture: General introduction, history, concept of cellular differentiation, totipotency.

Unit II

Organogenesis and adventives embryogenesis: Fundamental aspects of morphogenesis somatic embryogenesis and androgenesis. Mechanism techniques and utility. Somatic hybridization: Protoplast isolation, fusion and culture, hybrid selection and regeneration. Possibilities, achievements and limitation of protoplast research.

Unit III

Micropropagation- Factors affecting morphogenesis and proliferation rate; technical problems in micropropagation. Organogenesis- formation of shoots and roots, production of virus free plants by meristem and shoot-tip culture

Unit-IV

Application of plant tissue culture: Clonal propagation, artificial seed, production of hybrids and somaclones. Production of secondary metabolites/ natural products. Cryopreservation and germplasm storage.

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

Core Course	Course Title: M.Sc. Botany IV Semester
BOT-E404	Stress Physiology of Plants

Course Objective: The main objective of this paper is to impart the knowledge of secondary metabolites, regulatory metabolism and physiological stresses on plants.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	-	1	3	-	3	3	3	3	3
CO 2	3	3	3	3	-	3	-	1	3	-	3	3	3	3	3
CO 3	3	3	3	3	-	3	-	1	3	-	3	3	3	3	3
CO 4	3	3	3	3	-	3	-	1	3	-	3	3	3	3	3

Course Outcomes (COs)

CO 1	Apply the knowledge of Biological Stress and Physical stress.
CO 2	Analyze with the knowledge of Low Temperature Stress.
CO 3	Evaluate the knowledge of Nutrient Deficiency Stress.
CO 4	Apply the knowledge of Water deficit.

M.Sc. Botany IV semester

Elective

BOT-E404 Stress Physiology of Plants

Unit-I

Biological stress vs. Physical Stress, Types of stresses and general methods of measurement of stress response (Strain), Stress physiology in crop improvement, Response to UV stress: Injury and resistance mechanism

Unit- II

Response to low temperature stress: Chilling, freezing, frost injury and mechanism of resistance, Adaptations, Response to high temperature stress: Injury and mechanism of resistance, Heat shock proteins, Adaptations

Unit –III

Response to nutrient deficiency stress, Heavy metal stress, injury and mechanism of resistance, adaptations, Salinity stress, Ionic and salt stress injury, mechanism of resistance

Unit-IV

Response to water deficit: Desiccation, Dehydration injury; Mechanism of resistance, Adaptations, Response to water excess: Flooding, hypoxia, Mechanism of resistance, Adaptations, Causative agents for Biotic Stresses, Mechanism of Resistance against Fungal, Bacterial and viral pathogens

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

Core Course	Course Title: M.Sc. Botany IV Semester
BOT-E405	Environmental Biotechnology

Course Objective: The chief objective of this syllabus is to impart the knowledge of different types of pollution and their sources and effects on plants and the environmental effects on plants and pathogens as well as their control.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	1	-	3	1	1	3	3	3	3
CO 2	3	3	3	3	-	3	1	-	3	3	1	3	3	3	3
CO 3	3	3	3	3	-	3	3	-	3	1	2	3	3	3	3
CO 4	3	3	3	3	-	3	1	-	3	1	2	3	3	3	3

Course Outcomes (COs)

CO 1	Apply the knowledge of Pollution and Pollutants.
CO 2	Analyze the knowledge of Climate Change.
CO 3	Deals with the knowledge to understand the Ecosystems Stability.
CO 4	Evaluate the Ecological Management and Phytoremediation.

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M.Sc. Botany IV semester

Elective

BOT- E405 ENVIRONMENTAL BIOTECHNOLOGY

Unit – I

1. Pollution and Pollutants: Cost of pollution, Kinds of Pollution and Pollutants- Air, Water, and Soil Pollution, Their effects on Plants and Ecosystems;
2. Role of Plants in Pollution Management.

Unit – II

3.Climate Change: Greenhouse Gases (CO_2, CH_4, N_2O, CFCs: sources and roles), Ozone layer and Ozone hole, Consequences of Climate change (acid rain, global warming, sea level rise, UV radiation).

Unit – III

Ecosystem Stability: Concept (resistance and resilience), Ecological Perturbations (natural and anthropogenic) and Their Impacts on Plants and Ecosystems, Ecology of Plant Invasion, Environmental Impact Assessment (EIA), Ecosystem Restoration.

Environment and energy, Energy resources – Renewable and Non-renewable. Natural resources, Loss of Diversity, causes and consequences, Environmental Auditing, Conservation of Biodiversity.

Unit – IV

Ecological Management: Concepts, Sustainable Development, Remote sensing and GIS as Tools for Resources Management.

Phytoremediation: Prevention and Control, Methods of reducing Environmental impacts of Chemicals, Weedicides, Pesticides and Fertilizers. Biotechnological advances in pollution control through GEMs.

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

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Core Course	Course Title: M.Sc. Botany IV Semester
BOT-E406	Ethnobiology and Ethnopharmacology

Course Objective: The chief objective of this paper is to impart the knowledge of Ethnobiology and Ethnopharmacology.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	3	2	2	-	1	3	3	3	3
CO 2	3	3	3	3	-	3	3	2	2	-	1	3	3	3	3
CO 3	3	3	3	3	-	3	3	2	3	-	1	3	3	3	3
CO 4	3	3	3	3	-	3	3	2	2	-	2	3	3	3	3

Course Outcomes (COs)

CO 1	Apply the brief knowledge of Ethnobotany.
CO 2	Evaluate the brief knowledge of Ethnobiology.
CO 3	Understand the brief knowledge of Ethnopharmacology.
CO 4	Analyze the brief knowledge of Natural products from Plants.

M.Sc. Botany IV semester

Elective

BOT- E406 ETHNOBIOLOGY AND ETHNOPHARMACOLOGY

UNIT- I ETHNOBOTANY

Ethnobotany: concept, history, evolution and scope; Indigenous knowledge and traditional practices of some Himalayan communities; Taxonomic epidermal characters and pharmacognostical studies to check adulteration. Problems and prospects of value addition applicable to plant resources. Scope for development of plant resources.

UNIT II: ETHNOBIOLOGY

Major ethnic group in North East India, their social institutions, livelihood, cultural and religious practices Shamanism and other belief systems, sacred groove and methods of biological resource conservation. Current status of Ethnobiology; Ethnobiology, biodiversity and traditional knowledge;

UNIT- III ETHNOPHARMACOLOGY

Role of Ethnobotany in drug discovery. Ayurvedic drug preparation and drug adulteration. Chemical composition of few medicinal and aromatic plants, extraction and uses pertaining to typical Indian formulation of drugs. Ethnopharmacological validation of traditional medicine; approaches to drug discovery from ethnobotanical leads.

UNIT- IV NATURAL PRODUCTS FROM PLANTS

Definition, importance and systematics and characterization of Natural products. Phenolic acids, alkaloids, glycosides, terpenoids, flavonoids, steroids, tannins in plants kingdom. Function of secondary metabolite for plant defense and protection.

Syllabus covers Value addition, Employability, Skill development and Entrepreneurship.

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Core Course	Course Title: M.Sc. Botany IV Semester
BOT-C407	Practicals

Course Objectives: Exercises corresponding to the theory courses.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	-	3	1	1	3	3	-	3	3	3	3
CO 2	3	3	3	3	-	3	1	2	3	3	2	3	3	3	3
CO 3	3	3	3	3	-	3	2	3	3	3	3	3	3	3	3
CO 4	3	3	3	3	-	3	1	3	3	3	2	3	3	3	3
CO 5	3	3	3	3	-	3	2	3	3	3	1	3	3	3	3
CO 6	3	3	3	3	-	3	2	3	3	3	2	3	3	3	3

Course Outcomes (COs)

CO 1	To give students practical understandings to create Computer and its Software's and Biostatistical analysis of Data.
CO 2	To give students practical understandings evaluate the Cell organelles and Role of Plant Growth regulators (Auxin, Cytokinin, Gibberellin, Ethylene, Abscisic Acid), and Enzymes and Metabolism of Carbohydrates, Proteins and Lipids.
CO 3	To give the students some detail practical idea to understand the Micropropagation.
CO 4	To give the students some detail practical idea to remember Biotic and Abiotic Stresses.
CO 5	To give the students some detail practical idea to analyze Pollutants and Components of Ecosystem and Bioremediation.
CO 6	To give students practical understandings of Uses of Medicinal Plants.

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Core Course	Course Title: M.Sc. Botany IV Semester
BOT-C408	Industrial Training/Survey/Research Project

Course Objective: To develop the research temperament in this field.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	PSO 9	PSO10
CO 1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO 4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Course Outcomes (COs)

CO 1	Projects for students in 5 identifies fields Plant Genetics, Plant Physiology, Angiosperm Taxonomy, Plant ecology and Plant Biotechnology are carried on under the supervision of subject expert in different identified fields.
CO 2	Project work deals with literature review, understanding local issues and challenges and generating solution for the same.
CO 3	Students capacity as a researcher and preparing them for further research work is being supervised identifying his or her own area of interest.
CO 4	This also helps the students to explore a subject in depth, manage a research project and define a suitable question and to use the appropriate research tools. Seminars, study tours, collection of specimens, cultivating crops (on specialized area) regular filed visit, data collection, survey, laboratory analysis, data interpretation, learning research methodology, joining in workshops, presenting papers in seminars, application of Biostatistics and bioinformatics on their data, writing skills, visiting advance laboratories and industries etc are some of the tools applicable while doing the projects.

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List of students undertaken for field and research project in the academic year 2021-22.

S.NO.	NAME	TITLE
1.	Bharti Baghel	Effect of lead (Pb) induced change on some biochemical parameters on *Vigna radiate* L. (Mung)
2.	Chanchal Sharma	Effect of chromium (Cr) a heavy metal and some growth parameters of *Vigna radiate* L. (Mung bean)
3.	Gireesh Chand	Qualitative screening of some secondary phytochemicals in *Cuscuta reflexa* Roxb.
4.	Neha Aziz	Quantification of primary phytochemicals *Cuscuta reflexa* Roxb. as parasite on *Ziziphus mauritiana* as host
5.	Pragyanjali	Estimation of some primary phytochemicals of *Cuscuta reflexa* Roxb. on the host *Ricinus communis* L.
6.	Priya Verma	Assesment of Arsenic as heavy metal on the biochemical parameters of Mungo L.
7.	Pretty Sharma	Qualitative analysis of phytochemicals present in the leaves of *Aloe vera* L.
8.	Prahalad Yadav	A review on therapeutic potential of *Prosopis cineraria*
9.	Sangeeta Yadav	Anti-diabetic activity of flavonoid and phenolic compound in the leaves of *Hibiscus rosa-sinensis* L.
10.	Sanjay Yadav	Effect of various concentration GA_3 on germination and seed vigour of different varieties of Sorghum (*Sorghum bicolor*)
11.	Satakshi Upadhyay	Screening of some secondary metabolites in *Ricinus communis* and *Cuscuta reflexa*
12.	Surabhi Singh	Qualitative screening of some secondary phytochemicals in *Ziziphus mauritiana* and *Cuscuta reflexa*
13.	Varshita Baghel	Screening of some secondary phytochemicals in the leaves of *Syzygium cumuni* L.

Emplyability Entrepreneurship Skill Development

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