SHRI LAL BAHADUR SHASTRI DEGREE COLLEGE, GONDA

श्री लाल बहादुर शास्त्री डिग्री कॉलेज, गोंडा

Department of Botany

Course outcome

Of

M.Sc. Botany

SHRI LAL BAHADUR SHASTRI DEGREE COLLEGE, GONDA

Course outcome of M.Sc. Botany

M.Sc. I Year (Semester-I) Paper -1	
Course Title:	**Advance Microbiology**

Course outcomes:

CO1: Indian traditional knowledge integrates ancient medicine, sacred plant references, tribal plant use, and ethnobotanical significance in Indian systems of medicine.

CO2: The students will gain a comprehensive understanding of microbiology, including its history, scope, evolution, and practical applications.

CO3: The students will learn techniques for enriching and isolating pure cultures, media preparation, sterilization, inoculation methods, growth measurement, and culture maintenance.

CO4: The students will explore microbiology's role in food preservation, fermentation processes, and microbial production of various compounds.

CO5: The students will delve into the microbiology of waterborne pathogens, wastewater treatment, fermenter design, biosensors, and bioremediation techniques.

M.Sc. I Year (Semester-I) Paper -2	
Course Title:	**Fungi and Plant Pathology**

Course outcomes:

CO1: The students will learn about the general characteristics, cellular structure, nutritional types, reproductive strategies, and systematics of fungi.

CO2: The students will systematically study the structure, reproduction, life cycle, and phylogeny of diverse fungi groups including Myxomycetes, Plasmodiophoromycetes, Oomycetes, Chytridiomycetes, Zygomycetes, Ascomycetes, Basidiomycetes, and Deuteromycetes.

CO3: The students will gain an overview of plant pathology, including its history, classification of diseases, diagnosis methods, pathogen mechanisms, disease development, environmental influences, epidemiology, and disease control strategies.

CO4: The students will study the specific diseases affecting principal crops in Uttar Pradesh, including rust, smut, bunt, blight, wilt, leaf spot, mildews, cankers, viral diseases, and diseases caused by mycoplasma.

CO5: The students will learn about rapid diagnostic methods for plant diseases caused by viruses, bacteria, and fungi, focusing on techniques like ELISA (Enzyme-Linked Immunosorbent Assay) and PCR (Polymerase Chain Reaction).

M.Sc. I Year (Semester-I) Paper -3

Course Title:	Algae and Bryophytes

Course outcomes:

CO1: The students will be introduced to Phycology, covering principles and systems of algae classification, along with comparisons of algal pigments, food reserves, cell wall composition, flagellation, chloroplasts, and eye-spots, highlighting their phylogenetic and taxonomic significance.

CO2: The students will gain a comprehensive understanding of the structure, reproduction, and taxonomic features of Cyanophyceae, Chlorophyta, Phaeophyta, and Rhodophyta algae.

CO3: The students will gain insight into the taxonomy, economic significance, and various uses of diverse algal groups.

CO4: The students will explore the classification of Bryophytes, including a comparative analysis of gametophyte and sporophyte structures.

CO5: The students will study the morphology, structure, reproduction, life history, distribution, and phylogeny of bryophytes.

M.Sc. I Year (Semester-I) Paper -4

Course Title:	Bacteria, Virus and Lichen

Course outcomes:

CO1: The students will explore bacterial identification, classification, and genetics, including new methods like ribotyping and genetic recombination mechanisms.

CO2: The students will study diverse bacterial nutritional modes, including sulfur and nitrogen metabolism, nitrogen fixation, biofertilizers, rhizobium-legume symbiosis, and mycorrhizal associations.

CO3: The students will learn about the biotechnological potentials of Archaea, including extremophilic microbes, as well as anoxygenic photosynthesis and methanogenesis.

CO4: The students will explore the nomenclature, classification, detection, purification, and molecular aspects of plant viruses, viroids, bacteriophages, and prions, including host-virus interactions and quantification techniques.

CO5: The students will gain a comprehensive understanding of lichens, including their symbiotic nature, taxonomy, morphology, reproduction, ecological roles, chemistry, conservation, and economic importance.

M.Sc. I Year (Semester-I) Paper -5	
Course Title:	**Environment and Plant Response**

Course outcomes:

CO1: Students will explore the soil environment, covering soil composition, organic matter decomposition, nutrient storage in plants, and the impact of agrochemical residues on soil pollution.

CO2: Students will explore the hydrological cycle, aquatic weed productivity, freshwater and wetland plant dynamics, and pollution sources in water environments.

CO3: Students will study the ecological impact of air pollution from various sources such as SO2, fluoride, photochemicals, and particulates on local vegetation.

CO4: Students will learn about indexing plant sensitivity and resistance to pollutants, as well as the environmental effects of nuclear power energy.

CO5: Students will study environmental planning, standards, monitoring, and pollution control methods, including plant and microbial solutions for air pollution and measures to prevent water pollution.

M.Sc. I Year (Semester-II) Paper -1	
Course Title:	**Research Methodology and IPR**

Course outcomes:

CO1 Students will understand the meaning, objectives, and principles of legal research in India, including evaluation, development, and associated challenges.

CO2 Students will acquire skills in legal research tools, empirical methods, interviewing, scaling techniques, research design, sampling, data analysis, and fostering creativity for societal application.

CO3 Students will develop proficiency in report and research paper writing, including layout, chapter organization, citation methods, and communication skills for presentations and seminars.

CO4 Students will utilize computer applications for research, including word processing, data analysis, graphics, web-2 tools, multimedia, and ethical considerations.

CO5: Students will understand bioethics, IP rights, including WIPO, patents, copyright, trademarks, and India's patent office organization.

M.Sc. I Year (Semester-II) Paper -2	
Course Title:	**Angiosperms: Taxonomy**

Course outcomes:

CO1: Students will explore plant taxonomy, including historical developments, classification aims, system types, and modern approaches such as APG and order characteristics.

CO2: Students will examine the need and aims of nomenclature, International Rules of Botanical Nomenclature, and concepts of species, genus, and family, with a focus on the type concept.

CO3: Plant taxonomy integrates morphology, anatomy, genetics, molecular biology, and other disciplines to classify and understand plant diversity.

CO4: Students will gain an overview of herbaria, botanical gardens worldwide and in India, botanical survey initiatives, and the use of identification keys in plant taxonomy.

CO5: Students will learn to distinguish important families of dicotyledons and monocotyledons, including their distinguishing features, within the local flora.

M.Sc. I Year (Semester-II) Paper -3	
Course Title:	**Angiosperm: Plant Development and Reproduction**

Course outcomes:

CO1: Students will learn the morphology and anatomy of higher plants, including root and stem structure, meristem organization, xylem and phloem development, leaf anatomy, and the significance of trichomes and stomata.

CO2: Students will explore vascular cambium and its derivatives, stem anomalies, floral anatomy, fruits, seeds, periderm, wood structure, and growth rings.

CO3: Students will study experimental embryology, focusing on morphogenetic phenomena and factors affecting them, including genetic, physical, and chemical influences.

CO4: Students will learn about the life history of angiosperms, including plant embryology, anther development, microsporogenesis, pollen morphogenesis, germination, and male gametophyte development.

CO5: Students will study pollen-pistil interaction, including the role of proteins, fertilization, apomixis, endosperm and embryo types, and their relationship to taxonomy.

M.Sc. I Year (Semester-II) Paper -4	
Course Title:	**Floriculture and Nursery**

Course outcomes:

CO1: Students explore commercial floriculture's significance in India, techniques for cultivating ornamental plants, orchards' importance, and horticultural crops' nutritive value.

CO2: Students explore vermicomposting, green manuring, biofertilizers, biocontrol agents, biopesticides, pheromones, and organic food's health benefits.

CO3: Students study vegetative propagation methods like cuttings, layering, grafting, micropropagation's industrial application, seed propagation limitations, and plant quarantine practices.

CO4: Students learn about gardening's scope, objectives, styles (formal, informal), and types (English, Mughal, Japanese), along with planning considerations for different outdoor and indoor settings.

CO5: Students will learn principles, elements, planning, and computer applications for landscape design in various settings.

M.Sc. I Year (Semester-II) Paper -5	
Course Title:	**Plant Resource Utilization and applied Botany**

Course outcomes:

CO1: Students will gain insights into India's plant diversity and sustainable development principles and practices.

CO2: Students will learn about economically important plants, food crops, and fiber-yielding crops, including their cultivation and uses.

CO3: Students will study the Green Revolution's benefits, challenges, and innovations to meet global food demands.

CO4: Students will learn about conservation biology principles, in situ and ex situ conservation strategies, and key conservation organizations and initiatives in India.

CO5: Students will explore rare and endangered species and innovative conservation techniques like bioremediation and phytoremediation.

M.Sc. I Year (Semester-III) Paper -1	
Course Title:	**Plant Physiology and Biochemistry**

Course outcomes:

CO1: Students will grasp photosynthesis, respiration, nitrogen metabolism, and the metabolism of lipids, amino acids, and nucleotides.

CO2: Students will comprehend plant hormones' synthesis, storage, transport, physiological effects, phytochromes, cryptochromes, phototropins, stomatal movement, photoperiodism, biological clocks, seed germination, dormancy, flowering, leaf abscission, and senescence.

CO3: Students will understand solute transport, photoassimilate translocation, stress physiology, and sensory photobiology in plants.

CO4: Students will learn bioenergetics, thermodynamics, water biochemistry, amino acids, proteins, and enzyme properties and functions.

CO5: Students will explore carbohydrates' structure, properties, biological significance, lipids classification, structure, glycolipids, fatty acid metabolism, vitamins, and coenzymes.

M.Sc. I Year (Semester-III) Paper -2	
Course Title:	**Cytogenetics and Biostatistics**

Course outcomes:

CO1: Students will grasp chromosome structure, special types (polytene, lampbrush, B), gene and allele concepts, and cell division.

CO2: Students will learn Mendelian principles, extensions like codominance, incomplete dominance, gene interactions, gene mapping, and extra chromosomal inheritance.

CO3: Students will explore polygenic inheritance, heritability, QTL mapping, population genetics including gene frequency, Hardy-Weinberg Law, and evolutionary mechanisms.

CO4: Students will study mutation types, causes, detection, chromosomal alterations, DNA repair, mutagens, and genetic implications.

CO5: Students will learn statistics basics, measures of central tendency and deviation, significance tests, correlation, diagrammatic representation, and statistical software.

M.Sc. I Year (Semester-III) Paper -3	
Course Title:	**Ecology, Soil Science and Phytogeography**

Course outcomes:

CO1: Students will grasp ecology basics, population dynamics, vegetation organization, community concepts, succession, and wildlife conservation aspects.

CO2: Students will understand ecosystem organization, primary production measurement, energy dynamics, trophic organization, biogeochemical cycles, and ecological efficiencies.

CO3: Students will explore pollution types, sources, effects, heavy metals, greenhouse gases, global warming, ozone depletion, and acid rain.

CO4: Students will study soil types, profile, formation processes, texture, soil moisture, erosion, and conservation methods.

CO5: Students will explore phytogeography, environmental impact assessment, endangered plant species, ecosystem diversity, remote sensing, sustainable development, terrestrial biomes, Indian biogeography, and major vegetation types.

M.Sc. I Year (Semester-III) Paper -4	
Course Title:	**Plant Breeding and Crop Improvement**

Course outcomes:

CO1: Students will learn about the importance, scope, and achievements of plant breeding, germplasm types and conservation, reproductive modes, incompatibility mechanisms, and male sterility applications.

CO2: Students will understand plant introduction types, procedures, uses, associated organizations, pure line, mass, progeny selection methods, and pedigree and recurrent selection applications.

CO3: Students will explore the role of mutation in plant breeding, isolation of useful mutants, major achievements, and the role of polyploidy in crop improvement.

CO4: Students will delve into hybridization types, procedures, utility, hybrid breeding in self- and cross-pollinated crops, types of hybrids (single, three-way, double cross, synthetic, composite), and heterosis theories and inbreeding depression.

CO5: Students will explore protoplast fusion, somatic hybrids, gene transfer methods, transgenics, marker-assisted selection, breeding for disease resistance, salinity tolerance, and quality traits.

M.Sc. I Year (Semester-III) Paper -5	
Course Title:	**Instrumentation and Analytical Technique**

Course outcomes:

CO1: Students will learn techniques for specimen collection, fixation, embedding, dehydration, and staining in laboratory settings.

CO2: Students will study various microscopy techniques including simple, compound, phase-contrast, fluorescence, electron (SEM and TEM), as well as micrometry and camera lucida methods.

CO3: Students will study centrifugation techniques and electrophoresis methods, along with various spectroscopy techniques for analysis.

CO4: Students will explore ESR radioactivity methods (GM counting, scintillation counting, autoradiography) and chromatography techniques (paper, TLC, column, gel filtration, ion exchange, HPLC, GC).

CO5: Students will learn microtomy techniques and advanced technologies like DNA chip technology, microarrays, and mass spectrometry for genome and proteome analysis.

M.Sc. I Year (Semester-IV) Paper -1	
Course Title:	**Plant Molecular Biology and Molecular Techniques**

Course Outcomes:

CO1: Students will explore nucleic acid structure, DNA replication, damage/repair, gene structure, transcription, RNA processing, regulation, and transport.

CO2: Students will delve into protein synthesis covering genetic code, translation mechanisms, post-translational modification, sorting, and synthesis regulation.

CO3: Students will study signal transduction mechanisms including receptor-G protein interactions, cyclic nucleotides, calcium cascades, secondary messengers, gene silencing, and epigenetics.

CO4: Students will master nucleic acid isolation, electrophoresis, sequencing methods, blotting, DNA synthesis, and chromatin remodeling techniques.

CO5: Students will learn protein isolation, electrophoresis, quantification, Western blotting, interaction analysis, sequencing, labeling, and mass spectrometry techniques.

M.Sc. I Year (Semester-IV) Paper -2	
Course Title:	**Plant Biotechnology and Bioinformatics**

Course outcomes:

CO1: Students will learn about biotechnology, recombinant DNA technology, and PCR principles, methods, and applications.

CO2: Students will explore gene cloning, hybridization techniques, molecular markers, functional genomics, protein production, and metagenomics in biotechnology.

CO3: Students will explore gene transfer methods, Agrobacterium-mediated transformation, regeneration techniques, genetic engineering applications in agriculture, chloroplast genome transformation, and biosafety concerns in plant biotechnology.

CO4: Students will engage with bioinformatics tools including genomic and protein databases, BLAST, FASTA, ExPASy-PROSITE, sequence retrieval, primer designing, gene prediction, and restriction analysis.

CO5: Students will explore biofertilizers, organic farming, biotechnology in pollution control and phytoremediation, and ethical considerations in biotechnological research.

M.Sc. I Year (Semester-IV) Paper -3	
Course Title:	**Pteridophyta, Gymnosperms and Palaeobotany**

Course outcomes:

CO1: Students will undertake a detailed study of morphology, anatomy, reproduction, and phylogenetic relationships of various plant taxa, including Psilopsida, Lycopsida, Sphenopsida, Pteropsida, Filicinae, Eusporangiate ferns, and Leptosporangiate ferns.

CO2: Students will explore the telome concept, apogamy, apospory, sex organs, embryogeny, ecology, economic importance, cytogenetics, heterospory, seed habit evolution, stele evolution, and classification of pteridophytes.

CO3: Students will delve into gymnosperms' distinct features, classifications, and evolutionary origins, including Progymnosperms and Devonian pre-ovules.

CO4: Students will explore the diversity, distribution, conservation, cytogenetics, economic importance, and biotechnology of gymnosperms, including Indian species and endangered taxa.

CO5: Students will study fossil preservation methods, investigation techniques, and their significance in stratigraphy, alongside continental drift and geological time scale analysis.

M.Sc. I Year (Semester-IV) Paper -4	
Course Title:	**Biodiversity, Remote Sensing and Environment Management**

Course outcomes:

CO1: The students will be able to understand the need for machine learning for various problem solving.

CO2: The students will be able to understand a wide variety of learning algorithms and know how to evaluatemodels generated from data.

CO3: The students will be able to understand the latest trends in machine learning.

CO4: The students will be able to identify appropriate machine learning algorithms for general real-worldproblems and apply these algorithms to solve these problems.

CO5: Students will study remote sensing, environmental management, and forecasting techniques for sustainable environmental practices.

M.Sc. I Year (Semester-IV) Paper -5	
Course Title:	**Major Research Project/ Dissertation**

The topic would be decided by the candidate in consultation with the respective supervisor.

Major Research Project/ Dissertation will be based on existing branches of botany and the title will be decided keeping the view on the modern aspect in the related discipline. It will be the part of semester IV; however, the title of Major Research Project/Dissertation will be assigned by concerned faculty member/board in the beginning of semester Ill to provide sufficient time to complete Major Research Project /Dissertation.