Department of Botany

Akal College of Basic Sciences

Learning Outcomes
Master of Science in Botany
(M Sc Botany)

ETERNAL UNIVERSITY
Baru-Sahib, Sirmaur (H.P.)

Eternal University, Baru Sahib (HP)
Master of Science (M Sc Botany)

Semester	Course code	Course name	L	T	P	C
I	BOT-511	Bryology	2	0	1	3
	BOT-512	Pteridology	2	0	1	3
	BOT-513	Gymnosperms	2	0	1	3
	BOT-514	Plant Resource Utilization	2	0	1	3
	BOT-515	Angiosperms: Phylogeny & Embryology	2	0	1	3
	BOT-516	Phycology	2	0	1	3
	BT-501	Cell &Molecular Biology	3	0	1	4
		Sub Total	**15**	**0**	**7**	**22**
II	BOT-521	Plant Anatomy	2	0	1	3
	BOT-522	Taxonomy of Angiosperms	2	0	1	3
	BOT-523	Cytogenetics& Plant Breeding	2	0	1	3
	BOT-524	Environmental Botany	2	0	1	3
	BOT-525	Mycology	2	0	1	3
	BOT-591	Synopsis Seminar	1	0	0	1
	BIOCHEM-522	Biochemistry and Molecular Biology of Plants	3	0	1	4
	BT-507	Plant & Animal Biotechnology	3	0	1	4
		Sub Total	**17**	**0**	**7**	**24**
III	BOT-531	Forestry	2	0	1	3
	BOT-532	Comprehensive Test & Field Botany	2	0	1	3
	BOT-533	Plant Pathology	2	0	1	3
	BOT-534	Plant Physiology	2	0	1	3
	BOT-591	Seminar	1	0	0	1
	BOT-599	Research Methodology	3	0	0	3
	BT-505	Computational Biology & Biostatics	3	0	0	3
	BT-513	Genetic Engineering	3	0	0	3
		Sub Total	**18**	**0**	**4**	**22**
IV	BOT-600	Dissertation	0	0	20	20
		Sub Total	**0**	**0**	**18**	**20**
Grand Total of All Semesters (I + II + III + IV)			**50**	**0**	**38**	**88**

Master of Science (Two-year degree programme)

PROGRAMME OUTCOMES (POs)

PO1: Qualified degree holders with broad background in the biology of plants.

PO2: Practically skilled and theoretical sound, educated botanists in the mission of Nation - building process with knowledge of plant molecules to the organism level - by covering a wide range of scientific disciplines concerned with the study of plants.

PO3: Help in meeting the manpower requirements of institutions of lower as well as higher learning and research centres by providing qualified professional plant biologists.

PO4: Influential contributions to scientific discovery and engage in formal and informal teaching and mentoring, and progress to careers in academia, industry, government and non-governmental organizations.

PO5: Qualified professional Botanists: Plant Taxonomists, Phyto-Physiologists, Phyto-Geneticist, Ecologist, and many more in the field of teaching and scientific research.

PROGRAMME SPECIFIC OUTCOMES (PSOs): M Sc – Botany

PSO1: Scientific knowledge and understanding of: Wide range of scientific disciplines concerned with the study of plants, which includes Bryology, Pteridology, Gymnosperms, Plant Resource Utilization, Angiosperms: Phylogeny & Embryology, Phycology, Cell &Molecular Biology, Plant Anatomy, Taxonomy of Angiosperms, Cytogenetics & Plant Breeding, Environmental Botany, Mycology, Biochemistry and Molecular Biology of Plants, Plant & Animal Biotechnology, Forestry, Comprehensive Test & Field Botany, Plant Pathology, Plant Physiology, Research Methodology, Computational Biology & Biostatics, Genetic Engineering.

PSO2: Practical skills: To write and conduct independent research under mentorship; To identify the diverse group of plants and their pathogens from the environment; To perform and present self before the challenging teaching and research problems; To carry out practical work, in the field and in the laboratory, with precaution and minimal risk; To conduct vegetation and biochemical analyses of plants; Knowledge of appropriate statistical methods and computer basics.

PSO3: Intellectual skills: To generate logical thinking to solve the problem in effective and practical manner; To assimilate knowledge and ideas to plan and conduct an independent project; To construct and test the hypothesis to execute the real problems of plant sciences.

PSO4: Use of modern scientific instruments & tools: Understanding of principle, procedure, methodology, application of instrumentation, their precaution and limitations. Use of modern instruments and equipment for Biochemical analysis & estimation, Molecular Biology, Biotechnology, Plant Tissue culture experiments, cellular and physiological activities of plants.

PSO5: Moral principles & ethics: To be morally responsible and ethical-conduct towards sustainability of biodiversity, environment and conservation.

COURSE OUTCOMES (COs)

Subject: Bryology **Subject Code: BOT – 511**

CO1: Understand the concepts and salient features of different taxonomic categories of bryophyta.
CO2: Demonstrate the structure and function of Antheridia and Archegonia in major taxonomic groups of bryophytes.
CO3: Understand the concepts related to evolution of sporophyte in bryophytes, conduction and water relations.
CO4: Demonstrate the epiphytes, epiphylls; epiliths litter species fire mosses, coprophilous species, calcicoles and calcifuges, halophytes, epizoic bryophytes.
CO5: Understanding the concept of dispersal of bryophyte diaspores, major patterns of bryophyte distribution.

Subject: Pteridology **Subject Code: BOT – 512**

CO1: Understand the concepts and salient features of different taxonomic categories of Pteridophyta.
CO2: Demonstrate the structure and function of comparative morphology of the sporophyte, stelar system, sporangial characteristics.
CO3: Understand the spore structure, types and patterns of spore germination in ferns.
CO4: Demonstrate the natural and induced apogamy and apospory in pteridophytes.
CO5: Understanding the utility concept of ferns for phytoremediation, ferns as hyper accumulators of arsenic, mechanism of uptake, transfer and tolerance.

Subject: Gymnosperms **Subject Code: BOT – 513**

CO1: Understand the concepts and salient features of different taxonomic categories of gymnosperms.
CO2: Demonstrate the distribution of gymnosperms with special reference to Indian members.
CO3: Understand the concepts of gymnosperms characteristics and their affinities with pteridophytes and angiosperms.
CO4: Demonstrate the vegetative morphology and reproductive organs of gymnosperms of Indian representatives.
CO5: Understanding the concept of comparative of analysis of various gymnosperm taxa on the basis of their distribution, morphology and reproductive structures.

Subject: Plant Resource and Utilization **Subject Code: BOT – 514**

CO1: Demonstrate the center of origin and uses of minor cereals, oil crops and legumes.
CO2: Understand the concepts related to psychoactive drugs and narcotics: source, botany, active principle and commercial significance.

CO3: Demonstrate the concepts related to medicinal plants and their classification with reference to obtained drugs.
CO4: Demonstrate the concepts related to aromatic plants and their classification with reference to obtained drugs.
CO5: Understanding the concept of uses of plant-based insecticides.

Subject: Angiosperms: Phylogeny & Embryology Subject Code: BOT – 515

CO1: Understand the concepts related to evolution and origin of Angiosperms.
CO2: Demonstrate the origin of monocot and dicots with reference to their relationships in evolutionary trends.
CO3: Understand the concepts related to development of male and female gametophytes.
CO4: Demonstrate the polyembryony.
CO5: Understanding the concept related to the development of embryo and their regulation of gene activity during embryogenesis.
CO6: Understanding the concept of the applied embryogenesis in vitro, embryo rescue in inviable crosses; Clonal multiplication, preservation of germplasm.

Subject: Phycology Subject Code: BOT – 516

CO1: Understand the concepts and salient features of different taxonomic categories of algae.
CO2: Demonstrate the structure and function of thallus organization in algae.
CO3: Understand the current concepts and relationships of prochlorophycean algae.
CO4: Demonstrate the rhythms and bioluminescence in dinoflagellates.
CO5: Understanding the economic importance of algae.

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Subject: Cell & Molecular Biology Subject Code: BT – 501

CO1: Understand the concepts related to evolution of cell and biological macromolecules.
CO2: Demonstrate the structure and function of plasma membrane, molecular organization of cytoskeleton.
CO3: Understand the concepts related to chromosome organization, chromatin structure, complexity of eukaryotic chromosome.
CO4: Demonstrate the DNA replication in prokaryote and eukaryotes.
CO5: Understanding the concept transcription process in prokaryote and eukaryotes.
CO6: Understanding the concept of Cell division and cell cycle, cell-cell interaction, cell differentiation.
CO7: Evaluate concept of translation process, genetic code, and apoptosis.

Subject: Plant Anatomy Subject Code: BOT – 521

CO1: To acquaint the students with Structure and activity of vascular and cork cambia.
CO2: Demonstrate the xylem: constituents, differentiation of treachery elements.
CO3: Understand the concepts of phloem: constituents, differentiation of sieve elements and companion cells.
CO4: Understanding the concept related leaf and its variation in structure,and Kranz anatomy.

CO5: Understanding the concept of seed coat anatomy with reference to legumes and cereals.
CO6: Understanding the concept related anatomy in relation to taxonomy, phylogeny and ecology

Subject: Taxonomy of Angiosperms **Subject Code: BOT – 522**

CO1: To acquaint the students with significance, aims and procedures of plant taxonomy; Alpha- and Omega- taxonomy; Biosystematics.
CO2: Demonstrate the herbaria practices, and Botanical gardens.
CO3: Understand the concepts of diagnostic keys, ranks of taxa and nomenclature of taxa according to their ranks.
CO4: Understanding the plant nomenclature and the International Code of Botanical Nomenclature (ICBN).
CO5: Understanding the concept of numerical taxonomy.
CO6: Understanding the Botanical Survey of India, its organization and role.

Subject: Cytogenetics & Plant Breeding **Subject Code: BOT – 523**

CO1: To acquaint the students with genomes organization in prokaryotes and eukaryotes.
CO2: Demonstrate the organization of plastid and mitochondrial genomes.
CO3: Understand the concepts of chromosome structure and DNA packaging, euchromatin and heterochromatin, karyotype analysis and banding patterns.
CO4: Understanding the enzymes involved in replication, polymerase, topoisomerase, methylase, nucleases and restriction endonucleases.
CO5: Understanding the concept of genetic recombination, and sex determination.
CO6: Understanding the concept of principles of plant breeding.

Subject: Environmental Botany **Subject Code: BOT – 524**

CO1: To acquaint the students to components and problems of environment, status of environment, its impact especially on plants.
CO2: Demonstrate the management and conservation of natural resources.
CO3: Understand the concept, level, measuring of biodiversity, significance in terms of economic, spiritual, scientific, educational, ecological and genetic values, the reasons for depletion, magnitude, distribution and conservation strategies.
CO4: Understanding the concept of ozone depletion.
CO5: Understanding the concept of weed ecology & management.
CO6: Understanding the concept related to allelopathy, and allelochemics.

Subject: Mycology **Subject Code: BOT – 525**

CO1: To acquaint the students with introduction to fungi and their significance to humans.
CO2: Demonstrate the characteristics of fungi and fungal systematic.
CO3: Understand the general account, structure and reproduction of Chytridiomycota, Myxomycota, Oomycota, Zygomycota, Ascomycota, Basidiomycota and mitotic fungi.
CO4: Understanding the concept related to rust and smut fungi.

CO5: Understanding the detailed account of the different orders with specific reference to *Saprolegnia, Achlya, Legninidium, Pythium, Phytophthora* and *Albugo*.

Subject: Synopsis Seminar **Subject Code: BOT – 591**

CO1: To acquaint the students with natural flora and fauna in various regions through field trips.
CO2: To organizing botanical excursions and visits to various herbaria and botanical gardens of the country.
CO3: Analyze effective application of management principles to diagnose and solve organizational problems and develop optimal managerial decisions.
CO4: Demonstrate the applicability of field report on the basis of their excursion tours.
CO5: Understanding the concept of field botany and their application in comprehensive test based on it.

Subject: Biochemistry & Molecular Biology of Plants **Subject Code: BIOCHEM–522**

CO1: To acquaint the students with structure and function of cell organelle.
CO2: Demonstrate the synthesis and transport of sucrose.
CO3: Understand the concepts of biochemistry of seed germination and development, biochemistry of fruit ripening, phytohormons and their mode of action, signal transduction.
CO4: Understanding the concept of nitrogen fixation and nitrate assimilation, sulphate reduction and incorporation of sulphur into amino acids.
CO5: Understanding the concept of biochemistry and significance of secondary metabolites.
CO6: Understanding the concept of molecular biology of various stresses.

Subject: Plant & Animal Biotechnology **Subject Code: BT – 507**

CO1: To acquaint the students with laboratory organization and tissue culture.
CO2: Demonstrate the protoplast isolation, culture and applications.
CO3: Understand the somaclonal variation, production of haploid plants, embryo rescue and wide hybridization, cell suspension culture, production of secondary metabolites, biotransformation, and cryopreservation.
CO4: Understanding the concept of vectorless and vector mediated transformation.
CO5: Understanding the concept of different types of culture media and cell cultures.
CO6: Understanding the concept related to In vitro fertilization, embryo transfer technology and animal cloning.

Subject: Forestry **Subject Code: BOT – 531**

CO1: To acquaint the students with silviculture.
CO2: Demonstrate the protection, causes and control of forest fires; Major diseases of forest plants.
CO3: Understand the concepts of forests types, climate of India, different climatic regions of India and central characters and distribution of the different forest types of India.

CO4: Understanding the concept of forest effects and economic value.
CO5: Understanding the concept of social and urban forestry.
CO6: Understanding the concept related to agroforestry.

Subject: Comprehensive Test & Field Botany **Subject Code: BOT – 532**

CO1: To acquaint the students with natural flora and fauna in various regions through field trips.
CO2: To organizing botanical excursions and visits to various herbaria and botanical gardens of the country.
CO3: Analyze effective application of management principles to diagnose and solve organizational problems and develop optimal managerial decisions.
CO4: Demonstrate the applicability of field report on the basis of their excursion tours.
CO5: Understanding the concept of field botany and their application in comprehensive test based on it.

Subject: Plant Pathology **Subject Code: BOT – 533**

CO1: To acquaint the students with history of plant pathology and pathogenesis.
CO2: Demonstrate the enzymes and toxins in plant diseases.
CO3: Understand the concepts of host parasite interaction, alteration in plant physiological functions and defense mechanisms in plants.
CO4: Understanding the concept of resistance and susceptibility, vertical and horizontal resistance, mutation, heterokaryosis, transformation, transduction and physiological specialization.
CO5: Understanding the concept of plant pathogens dispersal and diseases forecasting.
CO6: Understanding the concept related to cultural and chemical control, breeding for disease resistance.

Subject: Plant Physiology **Subject Code: BOT – 534**

CO1: To acquaint the students with recent concepts of structure and composition of membrane with various classes of pumps and their significance.
CO2: Demonstrate the plant respiration.
CO3: Understand the concepts of photosynthesis.
CO4: Understanding the concept related to nitrogen fixation by free and symbiotic organisms.
CO5: Understanding the concept of plant hormones.
CO6: Understanding the concept related to reproductive physiology, phytochrome/hormones in reproduction, stress physiology, secondary metabolites.

Subject: Seminar **Subject Code: BOT – 591**

CO1: To acquaint the students with natural flora and fauna in various regions through field trips.
CO2: To organizing botanical excursions and visits to various herbaria and botanical gardens of the country.

CO3: Analyze effective application of management principles to diagnose and solve organizational problems and develop optimal managerial decisions.
CO4: Demonstrate the applicability of field report on the basis of their excursion tours.
CO5: Understanding the concept of field botany and their application in comprehensive test based on it.

Subject: Research Methodology **Subject Code: BOT – 599**

CO1: Understanding the concept of research, research applications in functional areas of business and emerging trends in Botany research.
CO2: Elaborate the scientific method of research, formulation of research projects, steps in research process and preparation of synopsis.
CO3: Understanding the qualities of a good hypothesis and concept of hypothesis testing and test of significance.
CO4: Understanding MS word, MS excel, and MS PowerPoint, graph and figure plotting.
CO5: Elaborate the concept & need of sampling and types of sampling.
CO6: Understating scaling techniques and types of data.
CO7: Understanding the data analysis, graphical representation of data and writing of manuscripts.

Subject: Computational Biology & Biostatics **Subject Code: BT – 505**

CO1: To acquaint the students with definition of biostatistics, concept of variables in biological systems, collection, classification, tabulation, graphical and diagrammatic representation of numerical data, measure of central tendency, measure of dispersion, correlation and regression, linear and quadratic regressions, concept of standard errors.
CO2: Demonstrate the Test of significance based on Z, $\chi 2$, t and F statistics, correlation and regression, curve fitting by least squares methods.
CO3: Understand the concepts of protein and gene information resources.
CO4: Understanding the concept of global and multiple sequence alignment, multiple sequence alignment using FASTA, Sequence alignment using CLUSTAL W, BLAST and PSI BLAST.
CO5: Understanding the concept of gene finding algorithms and software's.
CO6: Understanding the concept related to protein-Protein interactions, proteomics, protein microarrays chips and data analysis.

Subject: Genetic Engineering **Subject Code: BT – 513**

CO1: To acquaint the students with scope and milestones in genetic engineering and different Cloning vectors.
CO2: Demonstrate the extraction, purification and analysis of mRNA from eukaryotic cells.
CO3: Understand the concepts of Construction and screening of genomics and cDNA libraries.
CO4: Understanding the concept related to polymerase chain reaction and its variants.
CO5: Understanding the concept of expression in heterologous systems, vector engineering and codon optimization, expression of cloned genes in *E. coli*, yeast, insect, plants and mammalian cells.
CO6: Understanding the concept related to Genetic manipulation of higher animals and plants.

Subject: Dissertation **Subject Code: BOT – 600**

CO1: To acquaint the students with dissertation work.
CO2: Demonstrate the research topic assigned.
CO3: Understand the concepts of given research topic and analyze and solve the problem.
CO4: To submit thesis for evaluation of students and they required to collect, analyze the data and submit their dissertation.