Department of Botany

Akal College of Basic Sciences

Learning Outcomes
Ph.D. 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	D
I	BOT-601	Research Methodology	3	0	0	0
	BOT-602	Instrumental Methods of Analysis	3	0	0	0
	BOT-691	Seminar	0	1	0	0
	BOT-701	Dissertation	0	0	0	5
		Sub Total	**6**	**1**	**0**	**5**

(Optional Course-I)

Semester	Course code	Course name	L	T	P	D
I	BOT-603	Recent advances in botany	3	0	0	0
	BOT-604	Taxonomy of Angiosperms & Gymnosperms	3	0	0	0
	BOT-605	Phycology	3	0	0	0
	BOT-606	Biochemistry & Molecular Biology of Plants	3	0	0	0
	BOT-607	Bryophytes & Pteridophytes	3	0	0	0
		Sub Total	**3**			

Optional Course-II)

Semester	Course code	Course name	L	T	P	D
I	BOT-608	Plant resources & Utilization	3	0	0	0
	BOT-609	Plant Physiology	3	0	0	0
	BOT-610	Cytogenetics & Plant Breeding	3	0	0	0
	BOT-611	Plant Pathology	3	0	0	0
	BOT-612	Mycology	3	0	0	0
		Sub Total	**3**			

Semester	Course code	Course name	L	T	P	D
II	BOT-692	Synopsis Seminar	0	1	0	0
III	BOT-701	Dissertation	0	0	0	15
IV	BOT-701	Dissertation	0	0	0	15
V	BOT-701	Dissertation	0	0	0	15
VI	BOT-701	Dissertation	0	0	0	15
		Sub Total	**0**	**1**	**0**	**75**

Doctor of Philosophy

PROGRAMME OUTCOMES (POs)

PO1: Qualified doctors in the philosophical background in the biology of plants.

PO2: Qualified professional Botanists: Plant Taxonomists, Phyto-Physiologists, Phyto-Geneticist, Ecologist, and many more in the field of teaching and scientific research.

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: 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs): PhD – 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: Research Methodology **Subject Code: BOT – 601**

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: Instrumental Methods of Analysis **Subject Code: BOT – 602**

CO1. Principle, working and applications of Microscopy and spectroscopy.
CO2. To understand the advancement in Radio-isotopy.
CO3. Elaborate the concept of Chromatography techniques.
CO4. To understand the process and function of different electrophoresis techniques.
CO5. To acquaint with principle, working and applications of dialysis, microfiltration, centrifugation and hydro-dynamic methods.
CO6. To learn methods of DNA and peptide sequences.

Subject: Seminar **Subject Code: BOT – 691**

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: Dissertation **Subject Code: BOT – 701**

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.

Subject: Recent Advances in Botany **Subject Code: BOT – 603**

CO1. To know the diversified habitats of cryptogams,
CO2. To understand the recent advancement in biodiversity assessment and conservation.
CO3. Elaborate the concept of recent advancement in plant physiology.
CO4. To understand the process and function of cellular totipotency, somatic embryogenesis and use of tissue culture in agroforestry.
CO5. To acquaint with recent advancement in cytogenetics, molecular biology, plant breeding and transgenics.
CO6. To learn about the scope and importance of Biotechnology.

Subject: Taxonomy of Angiosperms & Gymnosperms **Subject Code: BOT – 604**

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: Phycology **Subject Code: BOT – 605**

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.

Subject: Biochemistry & Molecular Biology of Plants **Subject Code: BOT–606**

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: Bryophytes & Pteridophytes **Subject Code: BOT – 607**

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.
CO6: Understand the concepts and salient features of different taxonomic categories of Pteridophyta.
CO7: Demonstrate the structure and function of comparative morphology of the sporophyte, stelar system, sporangial characteristics.
CO8: Understand the spore structure, types and patterns of spore germination in ferns.
CO9: Demonstrate the natural and induced apogamy and apospory in pteridophytes.
CO10: Understanding the utility concept of ferns for phytoremediation, ferns as hyper accumulators of arsenic, mechanism of uptake, transfer and tolerance.

Subject: Plant Resource and Utilization **Subject Code: BOT – 608**

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: Plant Physiology **Subject Code: BOT – 609**

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: Cytogenetics & Plant Breeding **Subject Code: BOT – 610**

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: Plant Pathology **Subject Code: BOT – 611**

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: Mycology **Subject Code: BOT – 612**

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 – 692**

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.