DDU Gorakhpur University, Gorakhpur

Department of Botany

MSc in BOTANY

(CBCS)NEP

2024

PG PROGRAMME CURRICULUM

DETAIL

M.Sc. Botany CBCS

PROGRAMME SPECIFIC OUTCOME

PSO1. To develop deep understanding of the fundamental axioms in botany and capability of developing ideas based on them.

PSO2. To provide advanced knowledge of the diversity of lower botany diversity their role in environment and endowing the students to proceed with the area at higher level.

PSO3. Students will be able to develop brief knowledge of microbiological diversity and able to conduct independent research and pathological skills

PSO4. To develop understanding microbial diversity including viruses and motivating the students to develop industrial skills.

PSO5. Students will be able to identify the floristic diversity of angiosperm plants in field, well acquainted with herbarium knowledge, able to recognize the medicinal properties of plants, plant resource utilization.

PSO6. Students will be able to learn several plant sciences techniques, develop an understanding of ecology, physiology, genetics, molecular biology, plant breeding, cytology, soil sciences, data analysis, biochemistry and allied fields of plant sciences.

PSO7. To provide students a wide variety of employment options as they can adopt researches a career or take up teaching jobs or can get employment or can go for any other profession.

PSO8. To train thinking and creativity through presentations, assignments and project work.

PSO9. To help students in their preparation for various competitive exams e.g. civil services, ARS-NET, CSIR-NET, GATE, SET, UGC-NET etc.

PSO10. To enable the students being life-long learners who are able to independently expand their expertise over plant sciences when needed.

Curriculum

PG Programme in BOTANY 2024

DDU Gorakhpur University, Gorakhpur

NEP-2020 and CHOICE BASED CREDIT SYSTEM (CBCS)

SEM	Course Code	Core Paper	Type	Credit	Semester Credits
I	**BOT 501N**	Algae and Bryophytes	Core theory	**4+0**	**20**
	BOT 502N	Fungi and Plant Viruses	Core theory	**4+0**	
	BOT 503N	Pteridophyta, Gymnosperms and Paleobotany	Core theory	**4+0**	
	BOT 504N	Microbiology	Core theory	**4+0**	
	BOT 505N	Practical	practical	**0+4**	
II	**BOT 506N**	Angiosperms I: Taxonomy and Biosystematics	Core theory	**4+0**	**24**
	BOT 507N	Angiosperms II: Morphology, Embryology and Anatomy	Core theory	**4+0**	
	BOT 508N	Cytology and Genetics	Core theory	**4+0**	
	BOT 509N	Soil Science and Phytogeography	Core theory	**4+0**	
	BOT 510N	Practical	practical	**0+4**	
		OPEN ELECTIVE (other PG Programme)	Elec theory	**4+0**	
III	**BOT 601N**	Plant Biochemistry	Core theory	**4+0**	**24**
	BOT 602N	Plant Physiology	Core theory	**4+0**	
	BOT 603N	Plant Ecology	Core theory	**4+0**	
	BOT 604N-613N	**Discipline Specific Elective (DSEs)***	Sub Elec th	**4+0**	
	BOT 614N	GENERAL Practical	practical	**0+3**	
	BOT 615N	Practical Based on **DSEs**	Elec practical	**0+1**	
	BOT 616N	Industrial Training/Survey/Research Project	project	**0+4**	
IV	**BOT 617N**	Molecular Biology and Biotechnology	Core theory	**4+0**	**24**
	BOT 618N	Plant Resource Utilization and Conservation	Core theory	**4+0**	
	BOT 619N	Cytogenetics, Plant Breeding	Core theory	**4+0**	
	BOT 620N	Biostatistics and Data Handling	Core theory	**4+0**	
	BOT 621N	GENERAL Practical	practical	**0+4**	
	BOT 622N	**Dissertation and Viva-voce: Based on DSEs**	dissertation	**0+4**	
				Total credits: 92	

Open Elective theory Courses # semester II. (4+0 Credits Each)

Sr. No.	Code/activity	Open electives
1.	**BOT 623N**	Biodiversity and its Conservation
2.	**BOT 624N**	IPR, Bio-safety and Bioethics
3.	**BOT 625N**	Pharmacognosy and Health Care Practices
4.	**BOT 626N**	Greenhouse management
5.	**BOT 627N**	Air pollution and climate change

Discipline Specific Elective Courses (DSEs)

Sr.No.	Code/activity	DSE
1.	BOT 604N	Advance PlantPathology
2.	BOT 605N	Advance PlantTaxonomy
3.	BOT 606N	Advance PlantPhysiology
4.	BOT 607N	Plant Mutation Breeding
5.	BOT 608N	Nutraceutical Biomolecules
6.	BOT 609N	Water Resource Management
7.	BOT 610N	Applied Phycology
8.	BOT 611N	Forest Ecology
9.	BOT 612N	Advance MolecularGenetics
10.	BOT 613N	Environment Managementand Technology

Every course is of 100 marks, distributed into 75 external and 25 internal assessment marks.

BOTANY SEMESTER-I

Paper-I

(Code: BOT-501N)

ALGAE AND BRYOPHYTES

Unit 1

General characteristics, life cycle and classification (by Fritsch, Smith, Lee), modern trends for algal classifications, Study of division Cyanophyta, Chlorophyta and Xanthophyta with reference to the following:

General features, Range of structure and organization of thallus, Reproductive diversity,pigments and reserve food products, Classification up to the level of order.

Unit 2

Study of division Phaeophyta and Rhodophyta with reference to the following:

General features, Range of structure and organization of thallus, Reproductive diversity and life cycle patterns, Classification up to the level of order. General characteristics of the divisions Prochlorophyta, Charophyta, Euglenophyta, Pyrrophyta, Bacillariophyta and Cryptophyta.

Unit 3

Criteria and recent trends in the classification of Bryophytes; Origin and evolution of bryophytes; Ecological -significance and economic importance of Bryophytes.

Diversity in Bryophytes: Habit and Habitat; Developmental morphology and- organization of gametophyte and sporophyte bodies.

Unit 4

Comparative study of morphology, anatomy, life history, classification and phylogeny of the following groups (with special-reference to Indian forms): Takakiales, Calobryales, Monocleales, Sphaerocarpales, Marchantiales, Jungermanniales, Anthocerotales, Sphagnales, Andreaeales and Bryales.

Course Outcomes-

CO1. The study will provide the basic concepts of developmental details of Algae. It will utilize for increasing yield in agriculture.

CO2. It can be utilized for development of bio-fertilizers.

CO3.Studentswillbeabletounderstandtheoriginandevolutionaryaspectsof bryophytes and know the ecological-significance and economic importance ofBryophytes.

BOTANY SEMESTER-I

Paper- 2

(Code: BOT 502N)

FUNGI AND PLANT VIRUSES **Total** **Credits: 04**

Unit 1

The status of fungi. Principles of important systems of classification up to the rank of classes. A study of the Myxomycetes,Plasmodiophorornycetes, Chytridiomycetes, Omycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes with reference to: Classification upto the rank of orders; Range of structure and organization of vegetative and reproductive bodies; Ultrastructure; Method of reproduction; Variation in life-cycle; Economic importance;Nutritional and physical requirement for growth and reproduction in fungi.

Unit 2

Heterokaryosis, Parasexuality, Heterothallism, Hormonal control of sexual reproduction.General account of lichens with special reference to: Habitat, Structure and organization of lichens, Method of reproduction. Physiological relationship of mycobiont and phycobiont, Economic importance of lichens;
Mycorrhizae: Types and significance.

Unit 3

Brief history of plant viruses and their origin; Nomenclature and classification of plant virus and their strains, mode of transmission; Variation in morphology and ultrastructure of plant viruses.Mode of infection and replication of plant viruses; Translocation of viruses in the host; Basic control measures and production of virus-free plants

Unit 4

Modern concept of oncogenic viruses, viroids, virusoids, satellite viruses and Prions. Techniques of virus diagnostics.

Course Outcomes-

CO.1 Students will be able to develop mycological knowledge and skill to conduct independent research.

CO.2 Pathological identification and work in different mycological industries for economic purposes.

CO.3 Students will be able to learn the nomenclature, classification, identification of various strains of viruses and will be able to apply different control measures for production of virus-free plants.

CO.4 Management of different diseases caused by viruses in plants.

BOTANY SEMESTER-I

Paper – 3

(Code: BOT-503N)

PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY
Total Credits: 04

Unit 1

Classification and origin of Pteridophytes; The vegetative sporophyte; Microphylls and megaphylls; Stelar theory; Telometheory; The fertile sporophyte: sporangia; position, ontogeny. Types, structure. Heterospory: Occurrence, causes and significance. The gametophytes: Germination of fern spores, development of fern prothallus; Comparative study of Psilopsida, Lycopsida, Sphenopsida andPteropsida.

Unit 2

Classification of gynmospermsupto the rank of orders. General account of the following groups with special reference to the genera indicated in brackets: Pteridospermales (*Calymmatotheca,Hoeninghausi*), Glossopteridales, Caytoniales (*Caytonia*), Cycadales, Bennettitales (*Williamsonia* sp.), Pentoxylales, Corditales (*Cordaites* sp.)

Unit 3

General account of the following groups with special reference to the genera indicated in brackets: Ginkgoales (*Ginkgo biloba*), Coniferales: general anatomy, cone organization, life history and distribution), Ephedrales (*Ephedra* sp.) Gnetales (*Gnetum* sp.) and Welwitschiales (*Welwitschia* sp.)

Unit 4

Fossil history of Bryophytes, Pteridophytes and Gymnosperms: Principles of Palaeobotany and geological time scale; Process of fossilization and types of fossils; Methods of study of fossils and carbon dating technique.

Course Outcome-

CO1. To study first vascular land plants, naked seed plants and palaeological evidences.

CO2. Students will be able to learn the diversity and adaptation of pteridophytes and gymnosperms during the long geological time periods.

CO3. The study will provide an insight to evolution and palaeological knowledge. CO4. Students will learn the economic importance of pteridophytes and gymnosperms as this group includes highly medicinal plants.

BOTANY SEMESTER-I

Paper - 4

(Code: BOT –504N)

MICROBIOLOGY Total Credits: 04

Unit 1

Microbial taxonomy: Basis of bacterial classification: analysis of phenetic, genetic and phylogenetic characteristics; polyphasic approaches to bacterial taxonomy. Salient features of major bacterial groups according to Bergey's Manual of Systematic Bacteriology. Types of culture media, isolation of pure cultures, enrichment culture techniques, maintenance and preservation of bacterial cultures.

Unit 2

Photosynthesis and fermentative metabolism: Bacterial photosynthesis (anoxygenic and oxygenic): antennae complex and reaction centre, chemosynthesis. Bacterial fermentative pathways: lactic acid, propionic acid, mixed and butanol fermentation.

Unit 3

Genetic analysis of bacteria: Conjugation: molecular mechanism of gene transfer and regulation. Conjugation mapping, Plasmids: types, function and application. Transformation: molecular mechanism of transformation. Transduction: Generalized and specialized transduction-T4, T7 and lambda phages. Lysogenic phages: genome organization and its regulation. Types of bacterial transposons.

Unit 4

Nitrogen metabolism: ammonification, nitrification, denitrification and nitrogen fixation. *Nif* genes: functions and regulation. Antibiotics and their mode of action. Basic principles of immunology, vaccines and antibodies.

Practical: Based on the above 4 papers.

Course outcomes:

CO1. Students will be introduced with the basic principles of classifying prokaryotes, which will enhances the knowledge of classical to modern molecular approach of classification of bacteria commonly used nowadays.

CO2. To understand the nitrogen metabolism and also to effect yield of nitrogen content in legumes

CO3. Commercial production of different acids in Industry with the help of microbes eg. Lactic acid, Ethanol, Propionic acid etc.

Practical : Code: BOT –505N

BOTANY SEMESTER-II
Paper-I
(Paper Code: BOT-506N)

ANGIOSPERMS-I (Taxonomy & Biosystematics) Total Credits: 04

UNIT-1

Angiosperms: Evolutionary trends in characters; Contribution of Ancient India in taxonomy and classification of Plants.

Brief comparative study of the following System of Classifications:

a) Engler and Prantle
b) Hutchinson
c) Takhtajan
d) Bentham and Hooker

UNIT-2

Basic concepts of Molecular Systematics: Angiosperm phylogeny groups (APG); Homology assessment, Apomorphic characters; Rooted and unrooted trees;Phenetic and Cladistics methods. Botanical nomenclature: International code of nomenclature (ICN); Principles: rules and recommendations; typification,priority,rules of effective and valid publications; Synonyms, Basionym, conservation of names.

UNIT-3

Recent trends in taxonomy; Plant identification: Taxonomic keys

Field and Herbarium techniques: Plant Collection and Documentation: Methods of collecting plants; Herbarium Specimens'preparations; Role of Botanic Gardens in conservation of biodiversity.

UNIT-4

Taxonomic features, systematic phylogeny and economic importance of families**:**

Dicotyledons: Nymphyaceae, Annonaceae, Flacourtiaceae, Tilicaceae, Magnoliaceae,Capparidaceae, Caryophyllaceae, Sterculiaceae, Rosaceae, Anacardiaceae, Combretaceae, Oleaceae, Asclepiadaceae, Boraginaceae, Scrophulariceae, Bignoniaceae, Pedaliaceae, Acanthaceae, Verbaenaceae, Polygonaceae, Piparaceae, Moraceae, Sapotaceae.

Monocotyledons: Amaryllidaceae, Araceae and Arecaceae, Zingiberaceae, Cyperaceae, Poaceae

Course Outcome-

CO1.Students will be able to understand the basics of plant collections, identification and nomenclature.

CO2. Conservation of plants. They will be acquainted with herbarium concepts and able to utilize plant diversity for their basic needs such as foods, fruits and medicine.

CO3. They will be able to know the evolutionary history of plants by molecular systematic concepts.

CO4. To make herbaria of local plants.

BOTANY SEMESTER-II
Paper-II
(Paper Code: BOT-507N)

ANGIOSPERMS-II (Morphology, Embryology &Anatomy) Total Credits: 04

Unit 1
Phylogeny of Angiosperms; Morphology of flower; Morphology of carpel and ontogeny of inferior Ovary.

Unit 2
Fertilization: double fertilization, self-incompatibility mechanisms; Development of endosperm, embryo and its culture, polarity during embryogenesis; somatic embryogenesis; apomixis, polyembryony and its induction, Induced Parthenocarpy; in vitro pollen germination.

Unit 3

Primary meristem organization of shoot and root apices; Differentiation of cells: stomata, trichomes, tracheary elements etc.; Development of organs: organ identity, key regulatory mechanisms in development of size and shape of specific organs such as leaf, stem, shoot etc.

Unit 4
Cambium and its derivative tissues, differentiation of secondary xylem and secondary phloem; Structure of wood in relation to its weight, strength and durability; Cork cambium and its derivatives, function of cork and abscission layers, Anatomy of floral organs.

Course outcome-

CO1. This course provides an opportunity to grasp the knowledge of cell development, regulation and *in vitro* fertilization for the improvement of crop varieties.

CO2. Students will be able to learn interaction of growth regulators in developmental processes.

CO3. To understand the concept of polyembryony and produce seedless fruits and can perform control of fertilization and different experiments of embryology in field.

BOTANY SEMESTER-II

Paper-III
(Paper Code: BOT-508N)

CYTOLOGY AND GENETICS Total Credits: 04

Unit-1

Plant cell wall: structure and function. Cell membrane: structure and function. Solute transport across the membrane: passive transport, primary active and secondary active transport. Membrane transport systems: ion channels and its types, aquaporins, P-type, V-type, F-type ATPases, ABC transporters, endomembrane system.Vesicular trafficking.Plasmodesmata.Nucleus and nuclear pore complex (NPC).

Unit 2

Cytoskeleton: microtubules, microfilaments, and intermediate filaments. Cell organelles: structure and functions. Cell signaling: cell surface receptors, G-protein, GPCRs, second messengers, membrane derived messengers, serine/threonine kinases and receptor tyrosine kinases (RTKs), Ca^{+}-calmodulin-dependent protein kinases (CaM kinases), MAPK cascade. Cell division: cell cycle. Control of cell division: cyclins, Cdks, cell cycle check points, spindle organization and chromosomal movement, uncontrolled cell division, apoptosis and programmed cell death in plants.

Unit 3

Concept of gene, allele, multiple allele, pseudoallele, complementation test, extensions of Mendelian principles: gene interaction, genomic imprinting,

Unit 4

Quantitative inheritance, QTL mapping, population genetics, factors responsible for changes in allele frequency, Hardly-Weinberg equilibrium (HWE), genetic drift, speciation, and adaptive radiation.

Course Outcome-

CO1. Students will be able to learn the techniques related to cytological analysis.

CO2. The knowledge of cell and its organelles will provide an insight into drug development processes.

CO3. To understand the concept of tumor formation and its control.

BOTANY SEMESTER-II

Paper-IV
(Paper Code: BOT-509N)

SOIL SCIENCE& PHYTOGEOGRAPHY Total Credits: 04

Unit 1
The nature of parent material and development of soil; Major processer of soil formation: Calcification, Podzolization and Laterization; Physical properties:
Particle system, structure of soil; soil moisture constants, soil aeration, pF scale;

Unit 2
Chemical properties: Soil solution and nutrients, soil pH, Cation exchange phenomenon, redox potential, acidity, alkalinity, and salinity of soils; Soil organisms; organic matter, over view of decomposition, Process of humification and mineralization, recycle index, decomposition and release of nutrients.

Unit 3
Phytogeography: Biogeographic divisions; major terrestrial biomes, Vegetation types and Phytogeographical regions of India; theory of island biogeography.

Unit 4
Endemism, Indian endemic flora; Exotics and Alien flora. Hotspots and hottest hotspots of biodiversity; Distribution of plant species, Dispersal and routes of dispersal.

Course outcomes:

CO1. Students will learn the different physical and chemical properties of Soil.

CO2. Learn how to increase soil fertility and overview of decomposition and release of nutrients.

CO3. To test soil pH and help in agricultural crops.

Code: BOT –510 practical;

BOTANY SEMESTER-III
Paper-I
(Paper Code: BOT-601N)

PLANT BIOCHEMISTRY Total Credits: 04

Unit 1

Composition, Structure and functions of carbohydrates, lipids and proteins. Stabilizing interactions (vander Waals, electrostatic, hydrogen bonding and hydrophobic interactions etc.) Conformation of proteins, Secondary structure, domains and motif. Peptide bond, Ramchandran Plot.

Unit 2

Enzymes: regulatory and active sites, activation energy, isozymes, Principles of catalysis, kinetics of enzymatic catalysis, Michaelis-Menten equation, its derivation and significance.

Coenzymes: Structure and classification of coenzymes, Prosthetic group and cofactors; role of vitaminsas coenzymes. Allosteric enzymes, Ribozymes, abzymes, andEnzyme regulation.

Unit 3

Bioenergetics: Laws of thermodynamics and its application in biological systems, concept of entropy and enthalpy, concept of free energy, energy rich bonds and high energy compounds, energetic coupling. Substrate level phosphorylation.

Unit 4

Biochemical techniques: Different types of chromatographic techniques, based on ion exchange and affinity, electrophoresis and electrofocussing, centrifugation:ultracentrifugation and density gradient centrifugation, Spectrophotometry.

Course Outcomes-

CO1. The paper will provide an opportunity to develop an understanding of biomolecules, types, interactions and mechanism of biological catalysts.

CO2. The understanding of biochemical techniques will prepare students to isolate potential biomolecules.

CO3. To understand the role of vitamins and its role in metabolism in plants.

BOTANY SEMESTER-III
Paper-II
(Paper Code: BOT-602N)

PLANT PHYSIOLOGY Total Credits: 04

Unit 1

Photochemistry and Photosynthesis: Photosynthetic pigments and light harvesting complexes, photo-oxidation of water, Q-cycle: mechanism of electron and proton transport.Carbon assimilation: regulation of Calvin cycle; photorespiration and its significance, the C_3, $C_4$and CAM pathways.

Soil and plant water relationship: structure and properties of water, water transport processes. Water balance of plants: water transport through the xylem, water movement from the leaf to the atmosphere. Stomatal physiology.

Unit 2

Translocation in the phloem: pathways of translocation, the pressure-flow model for phloem transport. Mechanism of phloem loading and unloading

Respiration: Glycolysis, TCA cycle, electron transport in plant mitochondria and ATP synthesis, pentose phosphate pathway.

Secondary metabolites: structure, and biosynthesis of terpenes, alkaloids, and phenolic compounds, their role in plant defense and industrial uses.

Unit 3

Plant Growth Regulators: structure, biosynthesis, and storage, break down and transport. Physiological effects and molecular mechanism of action of auxins, gibberellins, cytokinins, ethylene,abscissic acid, brassinosteroids, jasmonates, salicylic acid and strigolactones.

Unit4

Physiology of floral induction:photoperiodism, genome reprogramming during flowering. Molecular mechanism of flowering in long day plant (*Arabidopsis thaliana*) and short day plant (rice: *Oryza sativa*). Vernalization: epigenetic modification during vernalization. Homeotic genes, quartet (ABCE) model of flowering.

Sensory Photobiology: history, discovery, photochemical properties and photophysiology of light induced responses by the photoreceptors: phytochromes,cryptochromes, phototropins, UVR-8and zeitlupe (ZTL).

Course Outcome-

CO1. The students will be able to learn role of growth regulators in plant development.

CO2. Carbon assimilation is a process related to biomass accumulation. Students will learn the factors related to carbon assimilation and processes that regulate it.

CO3. To understand the concept of flowering and understand role of hormones.

BOTANY SEMESTER-III
Paper-III
(Paper Code: BOT-603N)

PLANT ECOLOGY Total Credits: 04

Unit 1

Concept and Scope of Ecology: Collective, and Emergent properties, Habitat and niche: multidimensional niche, fundamental and realized niche, resource partitioning, character displacement.

Unit 2

Population Ecology: Natality, mortality, survivorship growth rates of population, growth curve; biotic potential, carrying capacity and environmental resistance; population interactions, competition- coexistence models, concept of meta-population, life history strategies (r and K selection).

Unit 3

Community Ecology: Bioenergetics of Ecological succession, type of succession Climax theories; Analytical and Synthetic characters of community, biodiversity status, major drivers of biodiversity change, levels of species diversity and measurement, indices of diversity; diversity and stability of ecosystem, edges and ecotones. Species interactions and coevolution.

Unit 4

Ecosystem Ecology: Concept of ecosystem, its structure and function, trophic structure, food chain energy flow, overview of production and decomposition, Sulphur and phosphorous biogechemical cycles, Ecosystem services, restoration ecology, components of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (freshwater, marine and estuarine).

Course outcome:

CO1. Students will learn about different ecosystems, plant communities and other important aspects related to biodiversity.

CO2. Conservation of our forests

CO3. To understand the concept of energy flow in different ecosystems.

BOTANY SEMESTER-III

PAPER IV
Discipline Specific Elective Courses (DSEs) *4 credit each

BOT-604N
ADVANCE PLANT PATHOLOGY

UNIT 1

Study of role of modern molecular technological tools in Plant Pathology- Basic concepts and principles of host pathogen relationship. Basis concept of pathogenesis.Effect of environment on development of infectious disease of plants: Epidemiology. Plant disease forecasting,Transmission and symptoms of plant diseases in general . Major plant pathology centres/institutes

Unit 2

Methods of study of infectious diseases of plants: isolation of pathogens and tests of pathogenicity. Principles and methods of plant disease control.

Control through regulatory methods: Plant quarantine. Cultural and biological methods of control. Control through physical means. Chemical method for plant disease control: Fungicides, chemotherapy. Use of resistant varieties.

Unit 3

Molecular basis of host-pathogen interaction- fungi, bacteria viruses and phytoplasma; recognition system, signal transduction. Biotechnology and disease management; development of disease resistance plants using genetic engineering approaches, gene-for-gene hypothesis; R-gene expression and transcription profiling, mapping and cloning of resistance genes and marker-

aided selection.

Unit 4

Study of importance, symptoms, causal organism, disease cycle and control of following diseases of crop plants in Uttar Pradesh:

Damping off of seedlings of crop plants. Downy mildews of cucurbits. Rust of Barley.

Powdery mildew of pea. Smuts and Bunts: Covered smut of Barley; loose smut of wheat and Bunt of rice. Wilt of sugarcane. leaf spots: leaf spot of turmeric; Leaf blight of wheat. Blast disease of rice. Galls and other abnormalities: stem gall of coriander, leaf curl of Peach

Bacterial diseases: Citrus canker and Tundu disease of wheat. Viral diseases: Mosaics of tobacco, papaya, potato and tungro of rice. Phytoplasmal diseases: Grassy shoot of sugarcane. Nematode diseases: Ear cockle ofwheat

Course Outcome-

CO1. Students will get an idea about major plant diseases of cash crops in India.

CO2. The course discusses major aspects of pathogens, epidemic, disease forecasting, and quarantine rules.

CO3. Students will learn details of various aspects of plant disease control and management.

BOT-605N
ADVANCE PLANT TAXONOMY

Unit 1

Plant Systematics: Taxonomic History and outline of various system of classification; Concept of Taxa; Botanical Nomenclature and type concepts; Citation of authors; Priority of Publication; retention and choice of names; naming a new species; Name changes; Synonyms and Basionyms. Botanical keys, their uses and construction, Botanical line drawings and photoplates.

Unit 2

Floristics and monographs; Taxonomic literature; Botanical Collections. Flora of Uttar Pradesh; Role of micromorphology in plant taxonomy; Centers of taxonomic work in India.

Ethnobotany and Traditional Knowledge: Concept, history, importance of ethnobotany and development of Ethnobotany in India.

Unit 3

Phylogenetic systematics: Phylogenetic data analysis, DNA barcoding and its practical implications. Application of DNA markers in angiosperm taxonomy.

Unit 4

Introduction to GIS and Remote Sensing, its applications in vegetation pattern analysis. Concept of biodiversity and conservation strategies.

Practicals

1Live plants/ Herbarium specimens of the families provided in the class for description and identification (classification based on APG)
2. Determination of relationship on the basis of anatomical characters (trichome, stomata, internal deposition and floral anatomy).
3. Determination of relationship on the basis of pollen morphology.
4. Techniques in molecular systematics.
6. Basics of GIS and Remote sensing data – visual and digital interpretation for vegetations.
7. Field survey and visit to Taxonomic Institutes of India.

Course Outcome

CO1. Students will be able to learn the basics of plant systematic, developmental and evolutionary studies.
CO2. They will be able to explore the floristic diversity of the country.
CO3. To understand how to make monographs and herbaria of our area.
CO4. To understand ex-situ conservation of plants.

BOT-606N
ADVANCE PLANT PHYSIOLOGY

Unit 1

Plant life

- Cell architecture
- The seed plant body plan (Epidermis, ground tissue and vascular system; Form and function of organ systems; Growth and development of new organs)
- Genome organization and expression
- Molecules, metabolism and energy

Germination

- Seed to seedling: germination and mobilization of food reserves
- Metabolism of reserves: respiration and gluconeogenesis, Control and integration of respiratory carbon metabolism
- Translocation in phloem

Unit 2

Emergance

- Light perception and transduction (Phytochrome, Physiological responses to blue and ultraviolet light, Circadian and photoperiodic control)
- Photosynthesis (Photosystem II and the oxygen-evolving complex, Light reaction and carbon reaction; Photorespiration)
- Photosyntheis: Physiological and ecological consideration
- Stomatal Biology

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Unit 3

Growth and development

- Phyto-hormones and other signals
- Cell origins and growth, Embryogenesis
- Growth and differentiation of roots and leaves
- Induction of flowering
- Seed and fruit development

Unit 4

Plant-envioronment Interaction

- Responses to abiotic stresses (water, light, temperature, salinity)
- Responses to biotic stresses (systematic aquired resistance, A range of generic local and systemic stress responses are invoked by herbivory, predation and wounding)
- Senescence, ripening and cell death
- Environmental influences on programmed senescence and death

PRACTICALS:

1. Cellular Respiration: Do Plants Use Cellular Respiration to Produce Energy?.
2. To assess viability, vigor and the purity of seeds.
3. To examine structure, shape and stomatal frequency in both mono and dicot leaves
4. To determine qunatum yield (Fv/Fm) of photosystem-II, and efficency of oxygen-evolving complex in plants.
5. Anatomical comparision of C_3, C_4 and CAM leaves.
6. To determine pollen viability, pollen tube growth and stigma receptivity in both self and cross pollinated crops
7. To detrmine relative water content and membrane dynamics of plants in abiotic stresses.
8. To detrmine photosynthetic pigments pool in both fresh and senescence leaves

Based on above

Course outcome-

CO1.Students will learn in detail aspects of nitrogen metabolism.

CO2. Production of Secondary metabolites, seed and stress physiology.

CO3. Production and conservation of seeds.

BOT-607N
PLANT MUTATION BREEDING

Unit 1

Mutation and its history: A brief history of plant mutagenesis, mutation categories: genome mutation, chromosome mutation, and gene mutation. Spontaneous and induced mutations. Micro and macromutations.

Mutagenic Radiations: Ionizing and non-ionizing radiation; X-rays, ionizing particles and Ultra Violet, gamma irradiation, ion beam radiation mutagenesis, effects of radiation on living cells and plants.

Unit 2

Chemical Mutagenesis: Chemical mutagens: their properties and mode of action. Mutagenesis of alkylating agents in plants, concentration of mutagens, pH and exposure time, handling the M_1 and M_2 generations, other chemical mutagens.

Unit 3

Mutagenic Treatment: Methodology for physical and chemical mutagenic treatments, Effects of mutagens in the M_1 generation- plant injury in the M_1 generation: seedling height and root length, lethality and sterility. Methods in determining dose effects: sowing methods, data collection, determination of LD_{50} and RD_{50}, factors influencing mutagenic effects- genetic factors, environmental factors, radio-sensitivity of plant species.

Unit 4

Phenotyping of Mutants: Phenotypic evaluation of quantitative and qualitative traits in M_1 and M_2 generations.

Molecular techniques: Molecular techniques and methods for mutation detection and screening in plants. Discovery of chemically induced mutations by TILLING. Applications of DNA marker techniques in plant mutation research.

PRACTICALS:

Based on above

Course outcome-

CO1.Students will learn about mutation breeding in plants.

CO2. Students will learn about Crop improvement methods.

CO3. Students will learn about Development of mutant population.

BOT-608N
NUTRACEUTICAL BIOMOLECULES

Unit -1

Nutraceuticals:

Definition of Nutraceuticals, structure and nutraceutical potential of biomolecules viz. polyphenols, flavonoids,tannins, saponins, phytoestrogens, alkaloids; Nutraceutical market, Regulation of nutraceutical industry,Institute working in nutraceuticals: CFTRI, National Institute of Nutrition, CDRI, CIMAP, NBRI.

Unit-2

Proteins and Lipids:

Bioactive Proteins: Protein concentrates from leaves, fruits and seeds, bioactive peptides,bioactive peptide production, Antihypertensive peptides, Lunasin.

Bioactive lipids: Fatty acids, Monounsaturated and Polyunsaturated Fatty acids, Omega-3 and Omega-6 Fatty acids; Structure and role in health promotion.

Unit-3

Gut Microbiology:

Gut microbiome, Concept of Prebiotics, Probiotics and Synbiotics, Structure and role of Beta-glucans, Inulin,Fructo-oligosaccharides,Lactulose, Resistant Starch as prebiotics; Probiotic micro-organism strains; Nanotechnology in drug delivery.

Unit-4

Free Radical Biology:

Free radicals, types of free radicals in biological system, Antioxidants, methods of measuring free radical scavenging activity viz. DPPH assay, ABTS assay, FRAP assay; structure and role of antioxidant molecules in biological system: Anthocyanins, Carotenoids, Vitamin C and Vitamin E etc.

COURSE OUTCOME

On completion of course student will learn about

CO1 - types of different biofunctional molecules found in plants

CO 2- role of lipids and proteins as nutracuticals

CO3- importance of gut microbiology and free radicals in food.

BOT-609N
WATER RESOURCES MANAGEMENT

Unit 1

Distribution of Water, Water Resources, Diversity of Aquatic Habitats, Lentic and Lotic Ecosystems, Aquifers, Hydrological Cycle, Disposition of Water, Catchment Infiltration, Watershed Management

Unit2

Quality of Water, Physico-chemical Properties of Freshwater, Water Quality Parameters and Standards, Water Pollution and its Sources, Groundwater Contamination, Threats to Surface Water Resources.

Unit3

Water and Plants, Aquaculture, Water Stress Adaptations in Plants, Role of Plants in Water Management, Water Borne Diseases, Eutrophication.Water Management Strategies, Management of Ground Water, Rain Water Harvesting, Recharging of Ground Water, Recycling of Waste Water,

Unit 4

The Water (Prevention and Control of Pollution) Act, 1974, Ramsar Convention. Treatment Technologies, Treatment of Drinking Water (Ion-Exchange, Reverse Osmosis and Disinfection of Water), Treatment Technologies for Domestic Waste Water, Biological Treatment of Waste Water.

Course outcomes:

CO1. Students will learn details of distribution of water, water resources, quality of water.
CO2. Physico-chemical properties of freshwater, aquaculture and water (prevention and control of pollution) act.
CO3. The role of contaminants of Water resource and its control measures.

BOT-610N

APPLIED PHYCOLOGY

Unit-1

Utilization of algae: human food, animal feed, hydrocolloids (agar, alginates, and carrageenans), cosmetics, functional foods and nutraceuticals, algae in a bio-based economy.

Unit-2

Microalgae as renewable resources for agriculture: algae as bio-fertilizers (N_2-fixation and P-solubilization), biostimulants, soil conditioners, bio-control agents; algae for plastic biodegradation and bioplastics production, bioactive compounds from algae, algal biofuels.

Unit-3

Algal culturing: collection, storage, and preservation, culture types, culture parameters, media choice and preparation, sterilization of culture materials, culture methods.

Unit-4

Algae as tools for bioremediation: heavy metals and food industry wastewater, the roles of algae in biogeochemistry, minimizing carbon footprint via microalgae, algae as tools for environmental monitoring, Harmful algal blooms and toxins, algae and earth cooling.

PRACTICALS: Based on the above.

Course outcome:

CO1.Students will learn the role of algae in bio-based economy.

CO2. Students will learn how algae contribute as renewable resources for agriculture.

CO3. Students will learn how algae minimize carbon footprint.

CO4. Students will learn culturing algae.

BOT-611N
FOREST ECOLOGY

Unit 1

Human evolutionary dependence on forests: scope and relevance.; forest types of India; Ecological morphology of rain forest flora.

Unit 2

Structure of forest ecosystem: Photosynthetic efficiency; leaf area and growth Nutrient cycling in tropical forest ecosystems.

Unit 3

Reproductive strategy of tropical trees; Natural and artificial regeneration; Factors destructive to forest ecosystems; causes and effects of deforestation; systems; Role of trees in combating air pollution.

Unit 4

Physico-chemical properties of forest soil; ecological significance of soil texture; soil biology and soil fertility; Comparison of forest and grassland.Accumulation and decomposition of forest litter; forest humus; the geochemical, biogeochemical cycling of nutrients.

Course Outcome-

CO1. Students will get detail idea of advanced aspect of forest ecology viz. forest types of India, forest ecosystem, reproductive strategies of tropical trees.

CO2. Detailed study of forest and grassland soil.

CO3. Effects of deforestation on community and nation at large.

CO4. Cycling of nutrients

PRACTICAL:

1. Ecological herbarium collection of plant throughout the study period with notes on the habitat andphenology of plant. Preparation of chart.
2. Determination of frequency, density, relative frequency and relative density of component speciesof a forest vegetation.
3. Determination of importance value index of tree species if the forest vegetation by point centeredquarter method.
4. Gradient analysis of forest vegetation by belt transects method.
5. Study of life forms and biological spectrum of the forest community.
6. Preparation of profile diagram and study of stratification.
7. Determination of leaf area index of the given species.
8. Identification of shade tolerant and shade- intolerant species and a comparison of their adaptivefeatures.
9. Estimation of reproductive effort of a ground layer species.
10. Determination of pH, organic matter and nitrate content of the soil.
11. Determination of total soluble salts of soil samples.
12. Measurement of soil respiration.
13. Estimation of nitrate nitrogen of given samples.
14. Estimation of total nitrogen to given samples.
15. Study of soil profile under forest cover.

BOT-612N
ADVANCE MOLECULAR GENETICS

Unit 1

Genome organization: from nucleotides to chromatin. DNA protein interaction: DNA binding motifs, zinc fingers basic leucine zipper (bZIP), basic helix-loop-helix (bHLH) motif.

Unit 2

Control of gene expression by chemical modification of DNA: types of chemical modifications and nucleosome remodeling.Regulatory RNA: riboswitches, micro RNA, siRNA: RNA interference.

Unit 3

Tools for analyzing gene expression: antisense technology, analysis of DNA protein interactions – EMSA, ChIP, DNase I foot printing, analysis of protein-protein interactions– Pull down assay, yeast two hybrid assay, Coimmunoprecipitation assay, FRET.

Unit 4

Transposable elements: their types and role in genome evolution.Molecular markers and their importance, molecular analysis of genes:Southern blotting, Northern blotting, DNA sequencing. PCR, RT-PCR and DNA microarray technology, *In situ* hybridization techniques: FISH, GISH, CRISPR Cas 9 technology

Course Outcome-

CO1. Students will get detail knowledge of genome organization gene expression and its control.

CO2.Various tools for analysis of gene expression and recombinant DNA technology.

CO3. Role of Recombinant technology in Plant Breeding.

BOT-613N

ENVIRONMENTAL MANAGEMENT AND TECHNOLOGY

UNIT 1

Basics of Environmental Science: Origin of Earth, Biotic-abiotic interaction, Decline in Biodiversity and the consequences. Environmental Phenomenon and Episodes: Ozone layer depletion, Green House Effect, Climatic change, Bhopal gas tragedy and Chernobyl episode. Occupational Health Hazards: Silicosis, Asbestosis, Carcinogens, Mutagens, Teratogens and Toxicity of Heavy Metals.

UNIT 2

Non-conventional Energy: Hydrogen, Alcohol, Bio-diesel, Wind and Solar energy Water Management Technologies: Hydrological cycle, Water quality standards, Major sources of water pollution, basics of ground and surface water, Analysis of selected physico-chemical properties of water (DO, BOD, COD, Nitrate, Phosphate, Chloride, pH, Acidity, Alkalinity, Turbidity, Electrical Conductivity, Temperature), Eutrophication and Aquaculture.

UNIT 3

Air Quality Monitoring and Management: Composition of air, Major sources of air pollution, in-door air pollution, Monitoring of SOx, NOx and O3. Solid Waste Management Technologies: Sources of solid waste, Solid waste disposal, Vermicomposting, R3 Principle. Noise Pollution and Abatement: Sources of noise pollution, Noise standards, Biological and behavioural effects of noise pollution. Environmental

Biotechnology: Use of Micro-organisms in waste treatment, Biodegradation of petroleum pollutants, Production of microbial enzymes (Cellulases and Proteases)

UNIT 4

International Agreements on Environment: Treaties and Protocols of United Nations
Conference on Human Environment-UNCHE (Stockholm, 1972), United Nations. Conference on Environment and Development- UNCED (Rio de Janeiro, 1992), World Summit on Sustainable Development-WSSD (Johannesburg, 2002). Environmental Legislation: Powers and functions of Central and State Pollution Control Boards, Wildlife Protection Act 1972, The Water (Prevention and control of pollution) Act 1974, Prevention and Control of Air Pollution Act 1981. Environmental Economics: Valuation of natural resources, cost benefit analysis and integrated economic modelling.

Course outcome-

CO1.Students will learn about various aspects of basics of environmental science, non- conventional energy sources, air quality monitoring and management.

CO2. International agreements on environment Protection.

CO3. The hazards of pollution and control measures.

BOT 614N (GENERAL PRACTICAL),

BOT 615N (ELECTIVE PRACTICAL),

BOT 616N –TRAINING/PROJECT

BOTANY SEMESTER-IV

Paper-I
(Paper Code: BOT-617N)

MOLECULAR BIOLOGY AND BIOTECHNOLOGY Total Credits: 04

Unit 1

Nucleic acids : Structure and form of DNA, Circular DNA in bacteria and chloroplast, packaging of DNA, DNA melting (Tm), DNA annealing $C_o t$ curves, Genome complexity (unique, moderately repetitive, and highly repetitive or satellite DNA) C-value and C-value paradox.

Gene Replication: DNA replication in prokaryotes and eukaryotes (initiation, elongation, termination and regulation), fidelity of replication.

Unit 2

Gene Mutation: Mutagenic agents, mechanisms of mutagenesis, DNA damage and repair mechanism, uses of mutation.

Genetic Code: Codon assignment, code in mitochondria, initiation and termination codons.

Unit 3

Gene Expression: Mechanism of transcription and translation in prokaryotes and eukaryotes

(initiation, elongation and termination), transcription activators and repressors. Post transcriptional modifications and RNA transport, translational proof reading, translational inhibitors, post translational modification of proteins.

Regulation of Gene Expression: Concept of operon, *lac* operon in detail, *trp*operon, attenuation, role of chromatin in gene regulation, gene silencing: miRNA and siRNA.

Unit 4

Genetic Engineering: Enzymes (endonucleases, ligases) and, vectors *viz.*, plasmids, phages, cosmids, BAC, YAC and *Agrobacteriumtumefaciens*, gene cloning; Methods of gene transfer. Biotechnology of Transgenic plants .

Tissue and Organ Culture: Micropropagationsomaclonal variation, haploid production, protoplast culture and somatic hybridization. Application of Tissue culture in modern era.

Application of Biotechnology in agriculture: disease resistance, pesticide resistance,abiotic stress tolerance and production of useful products and secondary metabolotes.

Course Outcome-

CO1.Students will be able to learn biotechnological concepts of crop improvement, tolerance, and resistance.

CO2. Development of new transgenics.

CO3. Use of Mutation in plant improvement and its yield.

BOTANY SEMESTER-IV

Paper-II

(Paper Code: BOT-618N)

PLANT RESOURCE UTILIZATION AND CONSERVATIONTotal Credits: 04

Unit-1

Plant biodiversity for Man and their importance; History, Botany, cultivation and processing of: Cereals (Wheat, Rice, Maize), Legumes and Pulses, Forage crops, Fiber plants and their products.

Unit 2

Medicinal plants, Drugs and narcotics, Fumitories and mastigatories, Beverage yielding plants, Important wood and timber yielding plants, Sugar and sugar yielding plants, Tropical and subtropical fruits.

Unit 3

Spices and flavoring materials, Vegetables, Gum and dye yielding plants, Latex yielding plants, teal coffee, rubber and Insecticide yielding plants. Origin of cultivated plants: center of origin, criteria and Vavilov's center of origin. Origin and cultivation of wheat, rice, maize, sugarcane,

mustard andpotato.

Unit 4

Principles of conservation; In situ conservation: Sanctuaries, national parks, biosphere resaves, wet lands, mangroves and coral reef, *Ex- situ* conservation: principles and practices, National seed corporation (NSC), Botanic gardens, role and impact of NSC, botanical survey of India (BSI), NBPGR (National Bureau of plant Genetics• Resource), ICAR (Indian Council of Agriculture Research), Council of Scientific and Industrial Research (CSIR), Department of Science and Technology (DST) and Department of Biotechnology (DBT) and Germplasm conservation.

Course outcome

CO1. This course work provides knowledge, utilization and their conservation with practical application.

CO2. It opens the areas of plant based industries like food industry, pharmaceutical industry and their bioprospection for nature and ecological services.

CO 3 this course will enable the students to know about different agencies involved in research and development of plant genetic resources

BOTANY SEMESTER-IV
Paper-III
(Paper Code: BOT-619N)
CYTOGENETICS AND PLANT BREEDING Total Credits: 04

Unit 1

Structural Changes in Chromosomes: Deletion, duplication, inversion (paracentric and pericentric), and translocation: cytology, genetics and their role in genome evolution. Robertsonian Translocation.

Numerical changes in chromosomes: Aneuploidy and Euploidy-cytology and genetics, their role in crop improvement.

Unit 2

Introduction to plant breeding; Domestication; plant introduction and acclimatization, kinds of germplasm, Methods of selection and hybridization; Techniques of selfing andcrossing.

Unit 3

Cytoplasmic male sterility; Heterosis and hybrid seed production; Mutant breeding; Polyploidy in plant breeding; Breeding for nutritional quality.

Unit 4

Experimental designs in plant breeding: randomized block design (RBD), completely randomized designs (CRD), latin square design (LSD), split plot design (SPD), lattice design (LD), and augmented design (AD).

Course Outcomes-

CO1. The students will be able to apply the concept of the biostatistics in their research work.
CO2. The cytological knowledge of genetics will provide an opportunity to develop new crop varieties.
CO3. Knowledge of plant breeding will help to improve crop varieties by plant introduction, mutation breeding and utilize other techniques of hybridization for crop improvement.

BOTANY SEMESTER-IV

Paper-IV

(Paper Code: BOT-620N)

BIOSTATISTICS AND DATA HANDLING **Total Credits: 04**

Unit-1

Sampling techniques, summarization of data, classification and tabulation of data, diagrammatic and graphical representations.

Unit-2

Measures of central tendency: Mean, Median and Mode; Measures of dispersion: Standard deviation, Standard error, Mean deviation. Analysis of variance.

Unit-3

Correlation and regression: statistical hypothesis, null hypothesis, two types of error, statistical significance, parametric and nonparametric hypotheses, critical region, level of significance,

Unit-4

Practical application of simple test of significance viz.,'t'- test and 'F'- test, Chi-square (X^2) test as a goodness of fit, conditions for application of X^2 test. Elementary idea of probability, combination and permutations, continues and discontinuous variables.

Practicals: Based on the above topics

Course Outcomes- on completion of course

CO1- student with learn sampling of complex data

CO2- student will learn analysis of variance and data computation

CO3- student will learn correlation of various data in biological sciences

BOT 621N-PRACTICALS

BOT 622N–TRAINING/PROJECT /DISSERTATION

Open Minor Elective Courses (OMEs) (For Semester I and Semester II Students)

BOT 623N

BIODIVERSITY & ITS CONSERVATION Credit: 04

Unit-1

Biodiversity- concept and definition, scope of biodiversity science, distribution of biodiversity around the globe, factors responsible for determination of biodiversity of any ecosystem, types of biodiversity (alpha, beta and gamma diversity), levels of biodiversity (species diversity, ecosystem diversity, and genetic diversity etc.). Hot-spots of biodiversity.

Unit-2

Biodiversity in India, values and uses of biodiversity, threats to biodiversity- extinction, causes of extinction (habitat degradation and fragmentation, overexploitation, species invasion, pollution and climate change), mass extinctions, sixth extinction, extinction vortex, loss of genetic diversity, species diversity, ecosystem diversity, and agrobiodiversity.

Unit-3

Genetic diversity- nature and origin of genetic variations, measurement of genetic diversity, role of genetic diversity in biodiversity explosion, loss of genetic diversity in small populations, genetics and the fate of endangered species, genetically viable populations, and population viability analysis (PVA). Genetic issues in endangered populations.

Unit-4

Conservation of biodiversity- species and landscape approaches to conservation, ecosystem approaches to conservation. Protected areas: goals, limitations, and design.Restoration of damaged ecosystems and endangered populations.Organisations associated with biodiversity management: IUCN, UNEP, UNESCO, WWF and FAO. Convention on biological diversity.

BOT 624N

IPR, BIO-SAFETY & BIOETHICS Credit: 04

Unit-1

IPR, sovereignty right, CBD, bioethics and patenting, general agreement on trade and tariffs, Indian sui generis system for plant variety and farmer's rights protection act.

Unit-2

Biosafety definition, requirement, biosafety and biodiversity, biosafety for human health and environment, social and ethical issues, biosafety in relation to transgenics, ethical issues pertaining to transgenics.

Unit-3

Patenting of higher plants and animals, transgenic organisms and isolated genes, patenting of genes and DNA sequences.

Unit-4

Biosafety for human heatlh and environment: designing and management of laboratory and culture room as per the norm of GLP, GMP and FDA.

BOT 625N

PHARMACOGNOSY AND HEALTH CARE PRACTICES **Credit: 04**

UNIT 1

Definition, history and scope of Pharmacognosy including indigenous system of medicine. Drugs & Drug discovery: Various systems of classification of drugs of natural origin.Adulteration and drug evaluation; significance of Pharmacopoeial standards.

UNIT 2

Pharmaceutical applications: Brief outline of occurrence, distribution, outline of isolation, identification tests, therapeutic effects. Pharmaceutical applications of alkaloids, terpenoids, glycosides, volatile oils, tannins and resins.

UNIT 3

Therapeutic efficacy: Occurrence, distribution, organoleptic evaluation, chemical constituents including tests wherever applicable and therapeutic efficacy of following categories of drugs.

Laxatives: Aloes, Rhuburb, Castor oil, Ispaghula, Senna.

Cardiotonics-Digitalis, Arjuna.

Carminatives & G.I. regulators-Umbelliferous fruits, Coriander, Fennel,

Astringents -Catechu.

Drugs acting on nervous system-Hyoscyamus, Belladonna, Aconite, M Ashwagandha, Ephedra, Opium, Cannabis, Nuxvomica.

UNIT 4

Therapeutic efficacy: Occurrence, distribution, organoleptic evaluation, chemical constituents including tests wherever applicable and therapeutic efficacy of following categories of drugs.

Antihypertensives-Rauwolfia.

Antitussives-Vasaka, Tolu balsam, Tulsi.

Antirheumatics-Guggul, Colchicum.

Antitumour-Vinca.

Antileprotics-Chaulmoogra Oil.

Antidiabetics -Pterocarpus, Gymnema.

BOT 626N

GREENHOUSE MANAGEMENT **Credit: 04**

UNIT 1

Greenhouse: Introduction of Greenhouse, Greenhouse effect, History of Greenhouse, Status of Greenhouse in world, Status of Greenhouse in India, Importance of Greenhouse.

UNIT 2

Types of Greenhouses: Classification of greenhouse based on cost, shape, utility, construction, covering material, environmental control mechanism.

UNIT 3

Greenhouse Operation: Environmental Control, Instruments for Monitoring the Greenhouse Environmental Parameter, Irrigation in Greenhouse, Fertigation in Greenhouse. Greenhouse Pest Management and Diseases: Pest and soil organisms of greenhouse plants, Diseases of greenhouse plants, Management of pest and diseases.

UNIT 4

Natural Method of Plant Propagation: Equipment and media, Propagation by specialized vegetative structures, Apomixis, Seed germination. Artificial Method of Plant Propagation: Cutting, Layering, Grafting, Budding, Pant Division, Tissue culture.

BOT 627N

Air Pollution and Climate Change Credits: 4

UNIT 1

Atmospheric composition and climate; Gaseous and particulate pollutants, emission trends and scenarios; climate change, drivers of climate change, greenhouse gas emission scenarios; indoor air pollution. Major green house gases and their role in climate change.

UNIT 2

Stratospheric ozone depletion: Phenomenon, causes, irradiation scenarios; effects of enhanced UV-B on plants, microbes and human health, biological actionspectra. Greenhouse effects: Process; consequences, global warming, sea level rise, albedo, oceanic influences

UNIT 3

Effect of climate change on Agriculture, natural vegetation; effects of increased CO2 on plants; humanimplications. Acid rain: Formation, dispersion and deposition, trends; consequences on soil fertility, rivers and lakes; effects on plants, leaf injury, buffering, reproduction; forest decline; effects onfisheries.

UNIT 4

Biomonitoring of air pollution: Concept, active and passive monitoring; bioindicator parameters; air pollution tolerance indices; control of air pollution by plants. Major Agencies working on climate change. Climate change and food security.