Ph.D COURSE WORK
(With effect from 2013-14)

The Syllabus is common to Ph.D. Students of Botany, Plant Biology and Plant Biotechnology and Herbal Science

Paper – 1: Research Methodology –I

Paper – 2: Research Methodology –II

Paper – 3: Advances in Botany
(Papers 1, 2 & 3 are common to all)

Paper – 4: Field of Specialization

(Student should opt any one of the following papers based on their field of research)

A. PLANT PHYSIOLOGY
B. BIODIVERSITY, BIOSYSTEMATICS AND PALYNTOLOGY
C. CYTOGENETICS AND PLANT BREEDING
D. PLANT BIOTECHNOLOGY
E. ALGAL BIOTECHNOLOGY
F. BIO-PROSPECTING OF MEDICINAL AND AROMATIC PLANTS
G. MICROBIOLOGY
H. ENVIRONMENTAL BIOLOGY
I. ALLELOPATHY AND WEED SCIENCE

MICROMETRY: Stage and Ocular Micrometers, Haemocytometer, Camera Lucida.

MICROTOMY: Paraffin Microtomy – Rotary and Rocking microtomes, Sledge microtome, hand microtome, Ultra microtome, Freezing edge microtome.

CYTOLOGICAL TECHNIQUES: Pre treatment, Fixation, Staining, Mounting, Detailed schedule for making permanent slides of microtome sections, Procedures for making permanent slides of hand sections, Detailed schedule for making root tip squash, Detailed procedure for making smear of anthers.


CENTRIFUGE: Ultracentrifugation – Ultracentrifuge, refrigerated centrifuge, Cell fractionation.


CONDUCTIMETRY: Conductimetric measurements, Application of conductimetric measurements.

ECOLOGICAL INSTRUMENT: Uses of Luxmeter, Anemometer, Rain gauge, Air samplers and Bomb Colorimeter.


REFERENCE BOOKS
Paper -2: Research Methodology-II


REFERENCE BOOKS

Unit – I
Applications of microbiology in agriculture, industry and medicine. Important crop diseases caused by viruses, bacteria, mycoplasma, fungi and nematodes. Modes of infection and dissemination; Molecular basis of infection and disease resistance/defence- Plant quarantine. Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms - structure and reproduction from evolutionary viewpoint. Type of fossils and their study techniques.

Unit - II
Taxonomic hierarchy; Numerical taxonomy and chemotaxonomy; Origin and evolution of angiosperms; Domestication and introduction of crop plants; Plants as sources for food, fodder, fibre, spices, beverages, edible oils, drugs, narcotics, insecticides, timber, gums, resins and dyes, latex, cellulose, starch and its products- Morphogenesis- Totipotency, polarity, symmetry and differentiation; Cell, tissue, organ and protoplast culture; Somatic hybrids and Cybrids; Micropropagation; Somaclonal variation and its applications.

Unit-III
Prokaryotic and eukaryotic cells - structural and ultrastructural details; Molecular basis of cell cycle; Gene versus allele concepts (Pseudoalleles); Quantitative genetics and multiple factors; Sex chromosomes and sex-linked inheritance, sex determination and molecular basis of sex differentiation; Mutations (biochemical and molecular basis); Methods of plant breeding and use of apomixes in plant breeding; Genetic code and regulation of gene expression; DNA sequencing; Genetic engineering – methods of transfer of genes; Transgenic crops and biosafety aspects; Development and use of molecular markers in plant breeding.

Unit - IV
Photosynthesis; photophosphorylation and carbon fixation pathways; Mechanism of phloem transport; Respiration electron transport chain and oxidative phosphorylation; Nitrogen fixation and nitrogen metabolism; Photoperiodism and flowering, vernalization, senescence; Stress physiology (heat, water, salinity, metal); Fruit and seed physiology; Dormancy, storage and germination of seed; Fruit ripening – its molecular basis and manipulation.

Unit - V
Concept of ecosystem; Ecological factors; Concepts and dynamics of community; Plant succession; Concept of biosphere; Ecosystems; Conservation; Pollution and its control; Plant indicators; Environment (Protection) Act. Forest types of India - Ecological and economic importance of forests, afforestation, deforestation and social forestry; Endangered plants, endemism, IUCN categories, Red Data Books; Biodiversity and its conservation; Convention on Biological Diversity. Global warming
and climatic change; Invasive species; Environmental Impact Assessment; Phytogeographical regions of India.

**Books:**

10. Phillip Sheeler; Donald E. Bianchi 2004; Cell and Molecular biology; John Wiley & Sons.
Ph.D - FIELD OF SPECIALIZATION

PAPER – 4 (A): PLANT PHYSIOLOGY


References:

Unit – I Biodiversity: Concepts and components of biodiversity, genetic, species and ecosystem diversity; Biodiversity as an important resource, human population growth and its implications on biodiversity, biodiversity indices, value of biodiversity – Elements/ types of biodiversity – genetic, species (alpha, beta, gamma), Ecological diversity – Biodiversity hotspots in the world, National and Global red data lists, categories of species and their management, biodiversity prospecting.


Reference Books
Paper- 4 (C): CYTOGENETICS AND PLANT BREEDING

Unit -I

Chromosome: Structure and components, cell division- Events of cell divisions and Difference between Mitosis and Meiosis, Chromosome banding and chromosome painting, FISH characteristics of chromosome in different plant groups and sex chromosome differentiation in plants, Karyotype analysis.

Unit- II


Unit -III


Unit- IV

DNA structure, Methods of breeding in self and cross pollination crops. Polyploidy in plant breeding: Types of changes in chromosome number – Application of Auto and Allopolyploidy in crop improvement – Origin and evolution of polyploidy – Recent advances in plant genetic engineering - Applications and limitations of mutation breeding.

Unit-V

Principles of plant breeding, Methods of selection, Polyploidy in Plant breeding, Heterosis, Male Sterility and its application- Hybridization – Intergeneric and interspecific hybridization, viability and germination, Mutation breeding in crop improvement.

REFERENCES

Paper -4 (D): PLANT BIOTECHNOLOGY

Unit – I

Unit- II
Tissue culture –Principles of tissue culture- Totipotency of plant cell, Micropropagation – shoot and root culture, explants, nutrient medium , establishing and maintenance of culture, hardening techniques. Somatic embryogenesis, Protoplast culture, Somatic hybridization, Haploid culture, in vitro secondary metabolites production, synthetic seed production.

Unit – III

Unit – IV

Unit – V
Nanotechnology – Introduction, basic principles, scope and importance of nano-technology. Role of computer in nano-tech. Carbon nanotube, Nano DNA- tech, Biosynthesis – Metal nanoparticles, Microscopic measurement and characterization of nanoparticles. Therapeutic applications of nano particles.

Reference Books
Paper- 4(E): ALGAL BIOTECHNOLOGY

Unit-I

Unit – II

Unit – III

Unit – IV

Unit – V

Reference:-
Unit – I:


Unit – II:


Unit – III:


Unit – IV:

Unit – V:


References:

Paper –4 (G): MICROBIOLOGY

Unit I
Identification of bacteria and fungi: Classification, Morphology, staining methods, Culture media, culture methods. Microbial Physiology: Microbial growth, photosynthesis, respiration and fermentation.

Antimicrobial assays: Diffusion and dilution techniques – Various types of diffusion and dilution techniques, Merits and demerits and its application.


Unit II
Chemotherapy: General features, Mechanism of antimicrobial activity. Antibiotics: general features, Sources, Classification, Bactericidal, Fungicidal, Bacteriostatic and Fungistatic based on mechanism of action and Mechanism of drug resistance.

Unit III

Unit IV
Bioremediation- Role of microbes in remediation, Microbial degradation of environmental pollutant, Bioremediation practices & Technologies, Molecular basis of bioremediation. In situ Bioremediation , Ex situ Bioremediation, Solid and Slurry –Phase bioremediation, Liquid – phase Bioremediation.

Unit V:

Reference Book


Paper – 4 (H): ENVIRONMENTAL BIOLOGY


Unit – II Environmental Pollution: Pollution – Definition, causes, effects, control measures of air, water, soil, radioactive and noise pollution. Impact of pollution on vegetation. Climate change, Acid rain, global warming – Ozone layer depletion – Deforestation. Floods, Volcanoes, Earthquake, Cyclone, Tsunami, Landslide – cause, effect and productive measures.

Unit – III Heavy Metals and Industrial Effluents: Industrial effluents as source of water pollution – Major effluent discharging industries. Primary, secondary and tertiary treatments to industrial effluents. Effluent toxicity in Agricultural crop plants. Types of heavy metals, Sources of heavy metals, Metal toxicity in crop plants.


Unit – V Environmental law: Common laws against pollution, the legislation relating to conservation and protection of forest, wild life and endangered, species, marine life, coastal ecosystem and lakes. Law relating to environmental protection – National environmental tribunal and national environmental appellate authority. Reliefs against smoke and noise pollution.

References


UNIT-IV: WEED SCIENCE: Introduction to weed science-Classification of weeds- grassy, broad leaf, aquatic, forest, crop field weeds and their distribution-population dynamics of weeds and their impacts on quantity and quality crop yield. Biology and bionomics of monocot and dicot crop field weeds of the country- Invasive alien weeds – characteristics and their impacts on natural and native flora.


Reference Books: