Department of Botany, RTU, 2025
Sullabus for Ph. D. Course Work
Botany (General)
PAPER-III
(Compulsory Paper)

Code: BOT-CP
Credit:4 (40 Lectures)

Marks:100

1. **Plant Systematics:** Aims, objectives and scope of taxonomy, Nomenclature and classification.Taxonomic literature, Evolutionary trends and variations, ICN, phylogenetic classifications, APG system of classification, species concepts, speciation, Biosystematics,biosystematic categories.

2. **Plant Physiology & Biochemistry:** Water relations and membrane transport, photosynthesis and respiration, nitrogen metabolism, hormones, Stress physiology and tolerance mechanisms, strategies used for development of stress resistant. Carbohydrates, Lipids, Proteins, Nucleic acid, Enzymes, Enzyme kinetics; Metabolism of carbohydrates, Lipids, Proteins.

3. **Cell Biology:** Chromosome organization, DNA replication and repair, Chromatin organization, protein synthesis, transcriptional and translational regulation, Protein targeting. Organization of plant cell and its inclusions, Cell membrane, Structural models of Cell membrane, cytoskeleton, cell cycle, apoptosis, signal transduction in cells.

4. **Genetics & plant breeding:** Mendelian genetics, concept of gene, Linkage, Crossing over and recombination, extra chromosomal inheritance, chromosome banding and painting, Mutation, Physical and chemical Mutagens, Mutation breeding, role of polyploidy in plant breeding, genetically engineered plants. Aims and Objectives of plant breeding, Methods and types of hybridization.

5. **Plant Ecology:** Structure, types and functions of Ecosystem, Ecological succession, habitat & Niche concept. Biomes, population & community ecology, plant interactions, phytogeography, endemism, Endangered species, IUCN categories, Ecological modelling . Biodiversity, Natural resources, Forest types & protected area. Wetlands, GIS and Remote sensing.

6. **Environmental Biology**: Air, water & soil Pollution, Pollution indicator species, Ecorestorationwithreference to plants and microbes,Environmental Assessment, Ecotoxicology, waste & sewage treatment, carbon sequestration. National and International conventions and laws for protection and conservation of biological resources. Climate change .

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7. **Molecular biology and tissue culture**: Plant tissue culture techniques, Micropropagation, cell, tissue and organ culture, Elicitation and secondary metabolites production. Enzymes in genetic engineering, cloning vectors, Agrobacterium mediated gene transfer, characterization of transformants, Gene Bank and cDNA library, DNA sequencing.

8. **Bioprospecting & Ethnobotany:** Types of Bioprospecting, Phytochemicals used in aroma, flavour and medicines. Active biomolecules. Plant resources and natural products, Exploration of lower and higher plant for standardization of herbal medicines as per US-FDA.

9. **Tools and Techniques**: Microtomy, Chromatography, Electrophoresis, Centrifugation, Microscopy, Chromatographic techniques – column, HPLC, GCMS, Immunological and Electrophoretic techniques, Spectroscopy. Fluorescence and co focal microscopy, SEM and TEM.

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DEPARTMENT OF BOTANY

OptionalPaper:-Cytology, Genetics, Molecular Biology, Tissue culture & Plant Breeding
Code: BOT-OPT-1
Credit:4 (40 Lectures)

Marks:100

Unit-I:Cytology: Cell division-Mitosis & meiosis and their types and significance. Cell cycle, Synaptonemal Complex (SC), Ultrastructure of Prokaryotic and Eukaryotic cell, Apoptosis and programmed cell death, different types of stains for chromosome coloration, Squash technique, Details of Binocular light microscope.

Unit-II:-Genetics:- Chromosome morphology and chemistry and its type. Karyotype and chromosome counting- ACL and TCL, microscopic measurement of chromosome. Polyploidy and its types& it significance. Evolution of plants through polyploidy, Polyploidy breeding. Genetic interaction of different types. Principles of inheritance-Laws of Mendel. Fine structure of gene-classical and modern concept, parthenogenesis and apogamy.

Unit-III: **Molecular Biology & Tissue culture**:-DNA-RNA, types & its forms, chemistry, Watson and Crick double helical structure of DNA, C-value &C-value paradox, DNA replication and its mechanism. Method of DNA isolation (SDS-PAGE), purification and quantification. Cell free DNA (cfDNA) and its isolation technique.one gene one polypeptide hypothesis, Mutation-Physical and chemical mutagens and their effects. Molecular basis of gene mutation. Transcription and epigenetic modification. Tissue culture techniques, culture media, micropropagation-anther culture. Haploid production. Protoplast culture and somatic hybridization

Unit-IV: **Plant Breeding**:- Aims and objective of plant breeding, hybridization &its types & techniques Crop improvement through selection techniques. Back cross method of crop improvement, self-incompatibility, hybrid vigor, male sterile plants,Heritability, Hardy Weinberg Law of equilibrium. Significance of plant breeding.

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DEPARTMENT OF BOTANY

OptionalPaper-PlantTaxonomy

Code: BOT-OPT-2
Credit:-4(40Lectures)
Marks=100

UNIT-I:Taxonomyand Systematics-Basiccomponentsoftaxonomy,advancementlevelsof taxonomy; Digital databases of Plant Taxonomy; Post-Darwinian and APG systems of Classification.

UNIT-II: Cladistic Taxonomy- Cladistic Concepts (Plesiomorphic and apomorphic characters; homology and analogy; parallelism and convergence; monophyly, paraphyly and polyphyly, diagrammatic representation of phylogenetic relationships), OETs (Operational Evolutionary Units), Character and their coding, Measurement of similarity, evaluating consensus tree.

UNIT-III: Character concepts; Variation and Speciation- Phenotypic plasticity, types of variation, variance analysis, isolating mechanism, speciation, vicariance biogeography and endemism;exoticelementsinIndia;ProcessofIdentification-Fieldwork,Herbariummethods, Identification (taxonomic literature, taxonomic keys, computers in identification).

UNIT-IV: Botanical Nomenclature- Principles of Nomenclature and codes; Names of taxa(genus, species, infraspecific categories); Rules of Priority and its limitation; Type concepts;
EffectiveandValidpublication;authorcitation;namesofhybrids,namesofcultivatedplants.
Phenetic Taxonomy- Principles, OTUs, taxonomic characters and their coding, application of phenetic approaches in angiosperms.

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Optional Paper-Ecology
Code: BOT-OPT-3
Credit:-4(40 Lectures)
Marks=100

Unit-I:FieldSurvey. FieldSampling(Soil,PlantandWaterSamples),Safetymeasuresduring fieldvisit/trip,Foodsecurity,Self-care,Avoidinfields,Carefromwildanimals,Procedurefor collection of hazardous samples, First Aid in the fields. Physicochemical analysis of Soil, Water and Plant samples, Overview of phytosociological methods used in ecological study.

Unit-II:LaboratoryMaintenanceandLabSafetyMeasures,Codeofconduct-Whileentering in the lab, While working with the chemicals, While working with the Instruments, While disposalofchemicals,StorageanddisposalofChemicalWastes,HazardouswastesandBroken Glasswares.Howtoperformexperimentsandrecordingofobservations,Propermaintenance of data book. Basic biostatistics for ecological research.

Unit- III: Instrumentation- Microscopy: Principles and Applications of Phase contrast, Fluorescence, Microscope, Spectrophotometry and Chromatography: Principle and Applicationsof UV-VIS,OpticalRotatoryDispersion,Infraredspectroscopy,NMR,AAS, FluorescenceSpectrophotometer, TLC, GCMS, HPLC, LCMS,Luxmeter, Relative humidity, Max-Minthermometer,RainGauge,Soilandwateranalysistoolkit,Anemometer.Data analysis(MS-Excel&SPSS)andinterpretation.Carbonsequestrationandcarbonstock analysis,Climatechangeanditsrelevantissues,Moderntrendsinecosystemmodeling. Practical applications of GIS, GPS and Remote Sensing in ecosystem analysis.

Unit-IV: Biodiversity research in regional prospective. Degraded Ecosystem research in NE India-Currentstatusandfuturedirection.Useofalgae,microbesandplantsforremediationof degraded ecosystem, Stress Ecology- biotic and abiotic, Plant-animal and plant microbe interaction-keyconceptandmethodsofstudy.Biologicalmethodsfortreatmentofwastewater and solid waste. Biodegradation - key concept, xenobiotics, parent compounds, intermediate products and toxicity assay, bioaccumulation, Ecological Risk Analysis.

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