DEPARTMENT OF BOTANY

PROGRAMME OUTCOME

1. Aware the students about Diversity of Plants in terms of structure, function, Reproduction and ecological roles.
2. Gain knowledge about the evolution and assessment of plant diversity.
3. Study of the economic importance of algae fungi and Lichen and some plant diseases with special reference to the causative agents, Symptoms, etiology and control measures.
4. Micro preparation of stems, roots and Leaves of Dicot and Monocot plants.
5. Giving opportunities to the students to conduct experiments practically both in fields and Laboratory.
6. Awarness about the production of synthetic seeds and their significance.
7. Awarness about the role of Tissue culture in crop improvement.
8. To develop understanding about the economic products with special reference to the botanical name, family, morphology of useful plant parts and their uses.
9. Gain knowledge on sensory photobiology .
10. Application of biotechnology in plants, animals, human welfare and IPR, biosafety, biopiracy, bioterrorism and bioethics.
11. Aware the students about the study of medical science, paramedicdal science, bio-technology forestry, Agriculture and researches in all such fields.
12. Formulate new concept for a green world sustainable development, betterment of human health specifically from medicinal plants, new forrmulation of phyto-chemical contents to meet specific need and ecofriendly environment.

PROGRAMME SPECIFIC OUTCOME

1. Basics and importance of microbiology.
2. Bacterial nutrition and growth are very important for their useful for growth and control in diseases.
3. Knowledge on different types of Algae and their application on different fields.
4. Knowledge on cyanobacteria and their economic importance.
5. The basics of cell and its components.
6. Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies.
7. Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of bryophyte, Pteridophyta and gymnosperms.
8. Examine the internal anatomy of plant systems and their organs.
9. Evaluate the adaptive and protective system of plants.
10. Understand core concepts of economic botany and relate with environment, populations, communities and ecosystems.
11. Develop an understanding of phytogeography and phytogeographical division of India.
12. Have a conceptual understanding of laws of inheritance, genetic basis of loci and alleles and their linkage.
13. Examine the structure, function and replication of DNA.
14. Analysis of the structures and chemical properties of DNA and RNA through various historic experiments.

15. To understand core concept of biotic and abiotic components.
16. To classify plant systematic and recognize the importance of herbarium and virtual herbarium.
17. To interpret the rules of ICBN.
18. To know the structure and development of dicot and monocot embryos.
19. To understand water relation of plants with respect to various physiological processes.
20. To differentiate anabolic and catabolic path ways of metabolism.
21. To interpret biological Nitrogen fixation in metabolism.
22. To learn the microsporogenesis and megasporogenesis.
23. To Understand plant Tissue culture techniques.
24. To learn the principles of microscopy.
25. To understand the role of biotechnology in crop improvement.
26. To analysis plant stress due to environmental factors.
27. Students will acquire communication skill, soft skill, social awareness and entrepreneurship skill.
28. It aims for work within the fields of research, public administration, governmental and non-governmental organizations, Industry and education.

Semester-I

Core-1 (microbiology and phycology)-Theory

Course Outcome

1. Microbial world, microbial nutrition, growth and metabolism with practical.
2. Virology and immunology with practical.
3. Bacteria and cyanobacteria and their economic importance.
4. Evolutionary significance of prochloron.
5. Different types of algae with their ecology, evolution and their role in environment, agriculrure, biotechnology and industry.

Practical

Microbiology

i. Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/photographs of Lytic and Lysogenic Cycle.
ii. Types of Bacteria to be observed from temporary/permanent slides/photographs.
iii. Examination of bacteria from natural habitat(curd) by simple staining.
iv. Electron micrographs of bacteria, binary fission, endospore, conjugation, root Nodule (live materials and photographs).
v. Gram staining.

Phycology

Study of vegetative structures of Nostoc, Chlamydomonas (electron micrographs), Volvox, Oedogonium, Coleochaete, Chara, Vaucheria, Ectocarpus, Fucus and Polysiphonia, Prochloron, Diatoms through electron micrographs, temporary preparations and permanent slides (based in availability of materials).

Core- 2 (Biomolecules and cell Biology)-Theory

Course Outcome

1. Water ,P^h, buffer, chemical bonds and structure and function of different biomolecules including proteins, lipids, nucleic acids, and carbohydrates.
2. Basic concepts of enzymes and their mechanism of action
3. Acquire knowledge base of metabolic pathways occurring inside living cells.
4. This introductory section aims to give the students an overview of basic cell biology including cell structure, types and its application in and around the work place.
5. Key components that constitute living cells, dynamic attributes of cell including cell interaction, cell adhesion and cellular signaling.
6. Structure of DNA and RNA and their role in living body.
7. Biological roles of protein.
8. Structure and function of lipid.
9. The significance of cell division inside living body.

Practical

i. Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins.
ii. Study of plant cell structure with the help of epidermal peel mount of Onion/*Roheo*.
iii. Demonstration of the phenomenon of protoplasmic streaming in *Hydrilla* leaf.
iv. Counting the cells per unit volume with the help of haemocytometer(Yeast/pollen grains).
v. Study the phenomenon of plasmolysis using aceto carmine and aceto orcine method.
vi. Study different stages of mitosis and meiosis using aceto carmine and aceto orcine method.

Semester-II

Core- 3 (Mycology and Phytopathology) –Theory

Course outcome

1. The students will study different types of fungi along with their affinities with plants
2. They will study their classification along with ecology and classification.
3. Role of fungi in biotechnology and mushroom cultivation.
4. Application of fungi in food industry in pharmaceutical preparations and in biological control.
5. Geographical distribution of diseases and host-pathogen relationship.
6. Prevention and control of plant diseases.

Practical

i. Introduction to the world of fungi (Unicellular, coenocytic/septate mycelium, ascocarp & basidiocarps).
ii. *Rhizopus*: study of asexual stage from temporary mounts and sexual structures through permanent slides.
iii. *Aspergillus* and *Penicillium*: study of asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs.

iv. *Agaricus*: Specimens of button stage and full grown mushroom; sectioning of gills of *Agaricus*, and fairy rings are to be shown.
v. *Albugo*: Study of symptoms of plants infected with *Albugo*; asexual phase study throughsection/ temporary mounts and sexual structures through permanent slides.
vi. Phytopathology: Herbarium specimens of bacterial diseases; Citrus Canker; Viral diseases: Mosaic disease of ladies finger, papaya, cucurbitas, moong, black gram, Fungal diseases: Blast of rice, Tikka disease of ground nut, powdery mildew of locally available plants and White rust of crucifers.

Core -4 (Archegoniates) – Theory

Course Outcome

1. Unifying features of archegoniates.
2. Origin of land plants and adaptation to land habit.
3. Range of thallus organization, ecology and economic importance of bryophytes and gymnosperms.
4. Classifications, evolution, stellar evolution and economic importance of pterophytes and gymnosperms.
5. Geological time scale, fossils and fossilization process.

Practical

i. Morphology of thallus and anatomy of *Riccia, Marchantia, Anthoceros, Funaria-*
ii. *Psilotum-* Study of specimen, transverse section of synangium (permanent slide).
iii. *Selaginella-* Morphology, whole mount of leaf with ligule, transverse section of stem, whole mount of strobulus, whole mount of microsporophyll and megasporophyll (temporary slides), longitudinal section of strobilus (permanent slide).
iv. *Equisetum-* Morphology, transverse section of internode, longitudinal section of strobulus, transverse section of strobulus, whole mount of sporangiophore, whole mount of spores (wet and dry) (temporary slide), transverse section of rhizome (permanent slide).
v. Study from permanent slides of *Ophioglossum* (L.S. of spike), *Marselia* (L.S. of sporocarp) and *Lycopodium* (L.S. of strobilus).
vi. *Pteris* Morphology, transverse section of rachis, vertical section of sporophyll, whole mount of sporangium, whole mount of spores (temporary slides). Transverse section of rhizome, whole mount of prothallus with sex organs and young sporophyte (permanent slide).
vii. *Cycas-* Morphology (coralloid roots, bulbil, leaf). Whole mount of microsporophyll and meghaspore, T.S Root, leaflet.
viii. *Pinus-* Morphology (long and dwarf shoots, whole mount of dwarf shoot, male and female cones), T.S. of Needle, stem, L.S. of male cone, whole mount of microsporophyll, whole mount o0f Microspores (temporary slides), L.S. of female cone.
ix. *Gentum-* Morphology (stem, male & female cones), transverse section of stem, vertical section of ovule (permanent slide)
x. Study of some fossil slides/ photographs as per theory.
xi. Botanical excursion/study tour.

Core- 5 (anatomy of angiosperms)Theory

Course Outcome

1. Scope of plant anatomy, applications in systematic, forensics and pharmacognosy.
2. Idea on tissue and cyto differentiation of tracheary elements.
3. Organization of root, shoot and stem apices.
4. Seasonal activity of cambium.
5. Normal and anomalous secondary growth.
6. Adaptive and protective tissue systems and also secretory tissue system.
7. Anatomical adaptations of xerophytes and hydrophytes.

Practical

i. Study of distribution and types of parenchyma, collenchymas and sclerenchyma, Xylem: Tracheary elements-tracheids, vessel elements; thickenings' perforation plates; xylem fibres, Phloem: Sieve tubes-sieve plates ; companion cells; phloem fibres.
ii. Wood: ring porous; diffuse porous; tyloses; heart-and sapwood.
iii. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular.
iv. Root: monocot, dicot-primary and secondary growth; periderm; lenticels.
v. Stem: monocot, dicot – primary and secondary growth; periderm; lenticels.
vi. Leaf: isobilateral, dorsiventral, C_4 leaves (Kranz anatomy).

Semester-III

Core- 6 (Economic Botany) Theory

Course Outcome

1. Centers of origin, domestications, loss of genetic diversity, evolution of new crops/ varieties and importance of germplasm activity.
2. Economic importance of cereals, legumes, sugars and starches, spices.
3. Therapeutic and habit-forming drugs.
4. Uses and health hazards of tobacco.
5. Classification, extraction, uses and health implications of oil-bearing seeds.
6. Rubber, timber and fibre yielding plants and their uses and extraction.

Practical

i. Cereals. Rice (habit sketch, study of paddy and grain, starch grains).
ii. Legumes: Soya bean/moong, bean/black gram, Groundnut, (habit, fruit, seed structure, micro-chemical tests).
iii. Sugars & Starches: Sugarcane (habit sketch; cane juice-micro-chemical tests). Potato (habit sketch, tuber morphology, T.S. of tuber to show localization of starch grains, starch grains, micro-chemical tests).

iv. Spice and Beverages: clove, black pepper, Tea (plant specimen, tea leaves). Coffee (plant specimen, beans)
v. Oils & Fats: Groundnut, Mustard-plant specimen, seeds: tests for fats in crushedseeds.
vi. Drug-yielding plants:: Specimens of *Digitalis*, *Papaver* and *Cannabis*,
vii. Woods: *Tectona*, *Pinus*/Sal: Specimen, Section of young stem.
viii. Fiber-yielding plants: Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fibre and test for cellulose). Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fibre).

Core- 7 (Genetics) Theory

Course Outcome

1. Describing gene linkage sex influence and linkage.
2. Explaining genetic anomalies caused by changes in chromosome number.
3. Summarizing genetic anomalies caused by changes in chromosome structure.
4. Describing genetic deviations from mendelian principles of genetic analysis.
5. Differentiating between essential genes and both dominant and recessive lethal alleles.
6. Explaining the environmental influences on gene expression.
7. Listing examples of non-mendelian inheritance.

Practical

i. Meosis through temporary squash preparation.
ii. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square analysis.
iii. Chromosome mapping using test cross data.
iv. Pedigree analysis for dominant and recessive autosomal and sex linked traits.
v. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
vi. Blood Typing: ABO groups & Rh factor.
vii. Chromosome anomaly : Translocation Ring, Laggards and Inversion Bridge, break etc.

Semester – IV

Core – VIII (Molecular Biology) Theory

Course Outcome

1. Biochemical nature of nucleic acids
2. The process and models of DNA replication and the involvement of enzymes.
3. Deciphering and salient features of genetic code.
4. Processing and modification of RNA.
5. Mechanism of transcription and its regulation.
6. The process of transcription and various steps of protein synthesis.

Practical

i. Preparation of L.B medium and raising E. coli.
ii. Isolation of genomic DNA from E. coli./onion roots.
iii. RNA estimation by oreinol method.
iv. DNA estimation by diphenylamine reagent/UV Spectrophotometry.
v. Photographs establishing nucleic acid as genetic material (Messelson and Stahl's. Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments).
vi. Study of Barr body from bucccal smear preparation.

Core- 9 (Plant Ecology and phytogeography) Theory

Course Outcome

1. Inter-relationships between the living world and the environment.
2. Role of climate in soil development.
3. States of water in environment and its importance.
4. Structural and functional aspects of and ecosystem.
5. Principles of phytogeography.
6. Phytogeographical division of India.

Practical

i. Determination of pH of various soil and water samples (pH meter, universal indiacator/Lovibond comparator and pH paper)
ii. Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests.
iii. Determination of dissolved oxygen of water samples from polluted and unpolluted sources.
iv. Study of mophological adaptations of hydrophytes, xerophytes, halophytes (two each)
v. Determination of minimal quadrat size for the study of herbaceous vegetation for density and abundance in the college campus.
vi. Quantitative analysis of herbaceous vegetation for density and abundance in the college campus.
vii. Field visit to familiarize students with ecology of different sites.

Core-10 (Plant Systematics) Theory

Course Outcome

1. Identification, classification and nomenclature of plants.
2. Taxonomic hierarchy and species concept.
3. Principles and rules of botanical nomenclature.
4. Systems of classification by eminent scientists.
5. Phylogenetic tree and cladogram for the study of phylogeny of angiosperms.

Practical

i. Study of vegetative and floral characters of available materials of the following families (Description, V.S. flower, section of ovary, floral diagrams, floral formulae and systematic position according to Bentham & Hooker's system of classification): Mangnoliaceae, Rosaceae, Rubiaceae, Liliaceae, Poaceae, and Orchidaceae as per theory Syllabus.
ii. Field visit, plant collection and herbarium preparation and submission. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book)

Semester – V

Core- 11 (Reproductive Biology of Angiosperms) Theory

Course Outcome

1. Mechanism of pollination and role of anther by studying pollen biology
2. Types and structure of mature embryo sac.
3. Basic concepts and methods to overcome self-incompatibility.
4. Intra ovarian and invitro pollination.
5. Embryo and endosperm relationship
6. Importance and dispersal mechanism of seed.
7. Causes and application of polyembryony and apomixes.

Practical

i. Anther: Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads, uninucleate, bicelled and dehisced anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation.
ii. Pollen grains: Fresh and acetolyzed showing ornamentation and aperture, pseudomonads, polyads, pollinia (slides/photographs, fresh material), ultrastructure of pollen wall (micrograph); pollen viability; Tetrazolium test, Germination: Calculation of percentage germination in different media using hanging drop method.
iii. Ovule: Types- anatropous, orthotropous, amphitropous, hemianatropous & circinotropous, unitegmic, bitegmic; Tenuinucellate and crassinucellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides specimens/photographs). Female gametophyte through permanent slides/photographs: Types, ultrastructure of mature egg apparatus.
iv. Embryogenesis: Study of development of dicot embryo through permanent slides; dissection of developing seeds of embryos at various developmental stages; Study of suspensor through electron micrographs.

Core – 12 (Plant physiology) Theory

Course Outcome

1. Ascent of sap and mechanism of stomatal movement
2. Trans membrane pathway of water movement.
3. Source-sink relationship.
4. Mineral nutrition, role of essential elements and mineral deficiency symptoms in plants
5. Chemical natures and bio assay of plant hormones.
6. Physiological roles of auxin, gibberellins, cytokinin etc.

Practical

i. Determination of osmotic potential of plant cell sap by plasmolytic method.
ii. Determination of water potential of given tissue (potato tuber) by weight method.
iii. Study of the effect of wind velocity and light on the rate of transpiration in exercised twig/leaf.
iv. Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and xerophytes.
v. To calculate the area of an open stoma and percentage of leaf area open through stomata in a mesophyte (both surfaces).
vi. To study the phenomenon of seed germinaton (effect of light)
vii. To study the induction of amylase activity in germinating barley grains.
viii. To demonstrate suction due to transpiration.

Semester – VI

Core -13 (Plant Metabolism)Theory

Course Outcome

1. Anabolic and catabolic pathways of plant metabolism.
2. Mechanism of signal transduction.
3. Carbon assimilation in green plants and role of photosynthetic pigments for this process.
4. Carbon oxidation.
5. Mechanism of ATP synthesis taking into consideration of different experiments.
6. Gluuconeogenesis and its role in mobilization of lipids during seed germination.
7. Physiology and biochemistry of nitrogen fixation.

Practical

i. Isolation and quantitization of photosynthetic pigments.
ii. Experimental demonstration of Hill's reaction.
iii. To study the effect of light intensity on the rate of photosynthesis.
iv. Effect of carbon dioxide on the rate of photosynthesis.
v. To compare the rate of respiration in different parts of a plant.
vi. Demonstration of absorption spectrum of photosynthetic pigments.

Core- 14 (Plant Biotechnology) Theory

Course Outcome

1. The process and applications of recombinant DNA technology.
2. The role of restriction endonucleases in gene manipulation.
3. The applicability of different kinds of cloning vectors.
4. The use of genomic libraries in gene detection and characterization.
5. The process of restriction mapping.
6. The process of southern blot analysis.
7. Summarizing methods used for DNA sequencing.
8. The principles of the polymerase chain reaction (PCR) and their applications.

Practical

i. (a) Preparation of tissue culture (MS) medium.
   (b) Demonstratoin of in vitro sterilization and inoculation methods using leaf and nodal explants of tobacco, Datura, Brassica etc.
ii. Study of anther culture.
iii. Preparation of artificial seeds.
iv. Testing and study of Bt cotton.
v. Isolation of plasmid DNA.
vi. Gel electrophoresis (demonstration).

DSE – 1 (Analytical Techniques in Plant Sciences)

Course Outcome

1. Imaging and related techniques (light microscopy, fluorescence microscopy, flow cytometry).
2. Cell fractionation and centrifugation.
3. Chromatography, x-ray crystallography and electrophoresis.
4. Principles and application of spectrophotometry in biological research.
5. Characterization of proteins and nucleic acids.

DSE –2(Plant breeding)

Course Outcome

1. Aims and objectives of plant breeding.
2. Important achievements and undesirable consequences of plant breeding.
3. Centres of origin and domestication of crop plants.
4. A celimatization.
5. Selection methods for self and cross pollinated plants and vegetatively propagated plants.
6. Hybridizatiohn techniques for self, cross and vegetatively propagated plants.
7. Mechanism of quantitative inheritance.

8. Genetic basis of inbreeding depression and heterosis.
9. Role of mutation, polyploidy, Distant hybridization and biotechnology in crop improvement.

DSE -3(Stress Biology)

Course Outcome

1. Acclimation and adaption due to plant stress.
2. Mediation of insect and disease resistance by Jasmonates.
3. Plant stress due to environmental factors (water stress, salinity stress, Highlight stress, Temperature stress).
4. Stress sensing mechanisms in plants.
5. Phospholipid signaling.
6. Developmental and physiological mechanisms that protect plants against environmental stress.
7. Production and scavenging mechanism of reactive oxygen species.

DSE -4(Project)

Course Outcome

1. To select the topic.
2. Literature survey for the topic of the project.
3. Skill in practical work, experiments, use of biological tool and techniques.
4. Handle instruments for analysis and discuss their experimental results.
5. To prepare project reports and present it using power point presentation.
6. Work within a small team to achieve a common research goal.
7. To enable the students to develop deeper knowledge, understanding, capabilities and attitude in the context research.

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