

Teaching plan for Academic Session 2022-2023(Even Semester)
Department of Botany

Name of Teacher:	Class/Semester 2 nd SEM Hons.	Name of the Paper : C3 T : Mycology and Phytopathology	Topics/ Unit Plan	Syllabus Allotted
Prof. Mahanga Singh			Unit- 1: Introduction to true fungi	General characteristics; Affinities with plants and animals; Thallus organization; Cell wall composition; Nutrition; Classification.
			Unit- 2: Chytridiomycota and Zygomycota	Characteristic features; Ecology and significance; Thallus organisation; Reproduction; Life cycle with reference to Synchytrium, Rhizopus .
			Unit-3: Ascomycota	General characteristics (asexual and sexual fruiting bodies); Ecology; Life cycle, Heterokaryosis and parasexuality; Life cycle and classification with reference to Saccharomyces, Aspergillus, Penicillium, Alternaria, Neurospora and Peziza.
			Unit- 4: Basidiomycota	General characteristics; Ecology; Life cycle and Classification with reference to black stem rust on wheat Puccinia (Physiological Specialization), loose and covered smut (symptoms only), Agaricus; Bioluminescence, Fairy Rings and Mushroom Cultivation with special reference to Oyster Mashroom..
			Unit- 5: Allied Fungi	General characteristics; Status of Slime molds, Classification; Occurrence; Types of plasmodia; Types of fruiting bodies.
			Unit- 6: Oomycota	General characteristics; Ecology; Life cycle and classification with reference to Phytophthora, Albugo.
			Unit -7: Symbiotic associations	Lichen – Occurrence; General characteristics; Growth forms and range of thallus organization; Nature of associations of algal and fungal partners; Reproduction; Mycorrhiza-Ectomycorrhiza, Endomycorrhiza and their significance.
			Unit- 8: Applied Mycology	Role of fungi in biotechnology; Application of fungi in food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Secondary metabolites (Pharmaceutical preparations); Agriculture (Biofertilizers); Mycotoxins; Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Medical mycology.

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			Unit- 9: Phytopathology	Terms and concepts; General symptoms; Geographical distribution of diseases; Etiology; Symptomology; Host-Pathogen relationships; Disease cycle and environmental relation; prevention and control of plant diseases, and role of quarantine. Bacterial diseases – Citrus canker and angular leaf spot of cotton. Viral diseases – Tobacco Mosaic viruses, vein clearing. Fungal diseases – Early blight of potato, Black stem rust of wheat, White rust of crucifers.
Prof. Mahanga Singh		C3P: Mycology and Phytopathology		<p>1. Introduction to the world of fungi (Unicellular, coenocytic/septate mycelium, ascocarps & basidiocarps). 2. Rhizopus: study of asexual stage from temporary mounts and sexual structures through permanent slides. 3. Aspergillus and Penicillium: study of asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs. 4. Peziza: Ascobolus sectioning through ascocarp. 5. Alternaria: Specimens/photographs and temporary mounts. 6. Puccinia: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; sections/ mounts of spores on wheat and permanent slides of both the hosts. 7. Agaricus: Specimens of button stage and full grown mushroom; sectioning of gills of Agaricus, fairy rings and bioluminescent mushrooms to be shown. 8. Study of phaneroplasmodium from actual specimens and /or photograph. Study of Stemonitis sporangia. 9. Albugo: Study of symptoms of plants infected with Albugo; asexual phase study through section/ temporary mounts and sexual structures through permanent slides. 10. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. Study of thallus and reproductive structures (soredia and apothecium) through permanent slides. Mycorrhizae: ectomycorrhiza and endomycorrhiza (Photographs) 11. Phytopathology : Herbarium specimens of bacterial diseases; Citrus Canker; Angular leaf spot of cotton, Viral diseases: TMV, Vein clearing, Fungal diseases: Early blight of potato, Black stem rust of wheat and White rust of crucifers.</p>

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Name of Teacher:	Class/Semester 4 th SEM Hons.	Name of the Paper : C8T: Molecular Biology	Topics/ Unit Plan	Syllabus Allotted
Prof. Mahanga Singh			Unit- 1: Nucleic acids: Carriers of genetic information	Historical perspective; DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel-Conrat's experiment.
			Unit -2. The Structures of DNA and RNA / Genetic Material	DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation, cot curves; Organization of DNA- Prokaryotes, Viruses, Eukaryotes.RNA Structure- Organelle DNA -- mitochondria and chloroplast DNA.The NucleosomeChromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin.
			Unit- 2:The replication of DNA	Chemistry of DNA synthesis (Kornberg's discovery); General principles – bidirectional, semiconservative and semi discontinuous replication, RNA priming; Various models of DNA replication, including rolling circle, θ (theta) mode of replication, replication of linear ds-DNA, replication of the 5' end of linear chromosome; Enzymes involved in DNA replication.
			Unit- 3: Central dogma and genetic code	Key experiments establishing-The Central Dogma (Adaptor hypothesis and discovery of mRNA template), Genetic code (deciphering & salient features)
			Unit 4: Transcription	Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation; Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in E.coli. Eukaryotes:transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing.
			Unit 5: Processing and modification of RNA	Split genes-concept of introns and exons, removal of introns, spliceosome machinery, splicing pathways, group I and group II intron splicing, alternative splicing eukaryotic mRNA processing(5' cap, 3' polyA tail); Ribozymes; RNA editing and mRNA transport.

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			Unit 6: Translation	Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation; Inhibitors of protein synthesis; Post-translational modifications of proteins.
Prof. Mahanga Singh		C8P: Molecular Biology		1. Preparation of LB medium and raising E.Coli. 2. Isolation of genomic DNA from E.Coli. 3. DNA isolation from cauliflower head. 4. DNA estimation by diphenylamine reagent/UV Spectrophotometry. 5. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication). 6. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs. 7. Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments) 8. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.

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Name of Teacher:	Class/Semester 6 th SEM Hons.	Name of the Paper : C13T: Plant Metabolism	Topics/ Unit Plan	Syllabus Allotted
Prof. Mahanga Singh			Unit 1: Concept of metabolism	Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric ,covalent modulation and Isozymes).
			Unit 2: Carbon assimilation	Historical background, photosynthetic pigments, role of photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centres, photochemical reactions, photosynthetic electron transport, PSI, PSII, Q cycle, CO ₂ reduction, photorespiration, C ₄ pathways; Crassulacean acid metabolism; Factors affecting CO ₂ reduction.
			Unit 3: Carbohydrate metabolism	Synthesis and catabolism of sucrose and starch.
			Unit 4: Carbon Oxidation	Glycolysis, fate of pyruvate, regulation of glycolysis, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, regulation of PDH, NADH shuttle; TCA cycle, amphibolic role, anaplerotic reactions, regulation of the cycle, mitochondrial electron transport, oxidative phosphorylation, cyanide-resistant respiration, factors affecting respiration.
			Unit 5: ATP-Synthesis	Mechanism of ATP synthesis, substrate level phosphorylation, chemiosmotic mechanism (oxidative and photophosphorylation), ATP synthase, Boyers conformational model, Racker's experiment, Jagendorf's experiment; role of uncouplers.
			Unit 6: Lipid metabolism	Synthesis and breakdown of triglycerides, β -oxidation, glyoxylate cycle, gluconeogenesis and its role in mobilisation of lipids during seed germination, α oxidation.
			Unit 7: Nitrogen metabolism	Nitrate assimilation, biological nitrogen fixation (examples of legumes and non-legumes); Physiology and biochemistry of nitrogen fixation; Ammonia assimilation and transamination.

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			Unit 8: Mechanisms of signal transduction	Receptor-ligand interactions; Second messenger concept, Calcium calmodulin, MAP kinase cascade.
Prof. Mahanga Singh		C13P: Plant Metabolism		1. Chemical separation of photosynthetic pigments. 2. Experimental demonstration of Hill's reaction. 3. To study the effect of light intensity on the rate of photosynthesis. 4. Effect of carbon dioxide on the rate of photosynthesis. 5. To compare the rate of respiration in different parts of a plant. 6. To demonstrate activity of Nitrate reductase in germinating leaves of different plant sources. 7. To study the activity of lipases in germinating oilseeds and demonstrate mobilization of lipids 1. during germination. 8. Demonstration of fluorescence by isolated chlorophyll pigments. 9. Demonstration of absorption spectrum of photosynthetic pigments.

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Name of Teacher:	Class/Semester 6 th SEM Hons.	Name of the Paper : DSE-3T: Industrial and Environmental Microbiology	Topics/ Unit Plan	Syllabus Allotted
Prof. Mahanga Singh			Unit 1: Scope of microbes in industry and environment	
			Unit 2: Bioreactors / Fermenters and fermentation processes	Solid-state and liquid-state (stationary and submerged) fermentations; Batch and continuous fermentations. Components of a typical bioreactor, Types of bioreactorslaboratory, pilot scale and production fermenters; Constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter. A visit to any educational institute/ industry to see an industrial fermenter, and other downstream processing operations.
			Unit 3: Microbial production of industrial products	Microorganisms involved, media, fermentation conditions, downstream processing and uses; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying; Hands on microbial fermentations for the production and estimation (qualitative and quantitative) of Enzyme: amylase or lipase activity, Organic acid (citric acid or glutamic acid), alcohol (Ethanol) and antibiotic (Penicillin)
			Unit 4: Microbial enzymes of industrial interest and enzyme immobilization	Microorganisms for industrial applications and hands on screening microorganisms for casein hydrolysis; starch hydrolysis; cellulose hydrolysis. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase).
			Unit 5: Microbes and quality of environment.	Distribution of microbes in air; Isolation of microorganisms from soil, air and water.
			Unit 6: Microbial flora of water.	Water pollution, role of microbes in sewage and domestic waste water treatment systems. Determination of BOD, COD, TDS and TOC of water samples; Microorganisms as indicators of water quality, check coliform and fecal coliform in water samples.

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			Unit 7: Microbes in agriculture and remediation of contaminated soils.	Biological fixation; Mycorrhizae; Bioremediation of contaminated soils. Isolation of root nodulating bacteria, arbuscular mycorrhizal colonization in plant roots.
Prof. Mahanga Singh		C13P: DSE-3P: Industrial and Environmental Microbiology		1. Principles and functioning of instruments in microbiology laboratory 2. Hands on sterilization techniques and preparation of culture media.

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Name of Teacher:	Class/Semester 6 th SEM Hons.	Name of the Paper : DSE4T: Research Methodology	Topics/ Unit Plan	Syllabus Allotted
Prof. Mahanga Singh			Unit 1: Basic concepts of research	Research-definition and types of research (Descriptive vs analytical; applied vs fundamental; quantitative vs qualitative; conceptual vs empirical).Research methods vs methodology. Literature-review and its consolidation; Library research; field research; laboratory research.
			Unit 2: General laboratory practice	Common calculations in botany laboratories. Understanding the details on the label of reagent bottles. Molarity and normality of common acids and bases.Preparation of solutions. Dilutions. Percentage solutions. Molar, molal and normal solutions.Technique of handling micropipettes; Knowledge about common toxic chemicals and safety measures in their handling.
			Unit 3: Data collection and documentation of observations	Maintaining a laboratory record; Tabulation and generation of graphs. Imaging of Tissue specimens and application of scale bars. The art of field photography.
			Unit 4: Overview of Biological Problems	History; Key biology research areas, Model organisms in biology (A Brief overview): Genetics, Physiology, Biochemistry, Molecular Biology, Cell Biology, Genomics, Proteomics Transcriptional regulatory network.
			Unit 5: Methods to study plant cell/tissue structure	Whole mounts, peel mounts, squash preparations, clearing, maceration and sectioning; Tissue preparation: living vs fixed, physical vs chemical fixation, coagulating fixatives, non-coagulant fixatives; tissue dehydration using graded solvent series; Paraffin and plastic infiltration; Preparation of thin and ultrathin sections.
			Unit 6: Plant microtechniques	Staining procedures, classification and chemistry of stains. Staining equipment. Reactive dyes and fluorochromes (including genetically engineered protein labeling with GFP and other tags). Cytogenetic techniques with squashed plant materials.
			Unit 7: The art of scientific writing and its presentation	Numbers, units, abbreviations and nomenclature used in scientific writing. Writing references. Powerpoint presentation. Poster presentation. Scientific writing and ethics, Introduction to copyright-academic misconduct/plagiarism.
Prof. Mahanga Singh		DSE4P: Research		1. Experiments based on chemical

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	Methodology Industrial and Environmental Microbiology		calculations. 2. Plant microtechnique experiments. 3. The art of imaging of samples through microphotography and field photography. 4. Poster presentation on defined topics. 5. Technical writing on topics assigned.
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Name of Teacher:	Class/Semester 6 th SEM Gen	Name of the Paper : DSE2T: Research Methodology	Topics/ Unit Plan	Syllabus Allotted
Prof. Mahanga Singh			Unit 1: Basic concepts of research	Research-definition and types of research (Descriptive vs analytical; applied vs fundamental; quantitative vs qualitative; conceptual vs empirical).Research methods vs methodology. Literature-review and its consolidation; Library research; field research; laboratory research.
			Unit 2: General laboratory practice	Common calculations in botany laboratories. Understanding the details on the label of reagent bottles. Molarity and normality of common acids and bases.Preparation of solutions. Dilutions. Percentage solutions. Molar, molal and normal solutions.Technique of handling micropipettes; Knowledge about common toxic chemicals and safety measures in their handling.
			Unit 3: Data collection and documentation of observations	Maintaining a laboratory record; Tabulation and generation of graphs. Imaging of Tissue specimens and application of scale bars. The art of field photography.
			Unit 4: Overview of Biological Problems	History; Key biology research areas, Model organisms in biology (A Brief overview): Genetics, Physiology, Biochemistry, Molecular Biology, Cell Biology, Genomics, Proteomics Transcriptional regulatory network.
			Unit 5: Methods to study plant cell/tissue structure	Whole mounts, peel mounts, squash preparations, clearing, maceration and sectioning; Tissue preparation: living vs fixed, physical vs chemical fixation, coagulating fixatives, non-coagulant fixatives; tissue dehydration using graded solvent series; Paraffin and plastic infiltration; Preparation of thin and ultrathin sections.
			Unit 6: Plant microtechniques	Staining procedures, classification and chemistry of stains. Staining equipment. Reactive dyes and fluorochromes (including genetically engineered protein labeling with GFP and other tags). Cytogenetic techniques with squashed plant materials.
			Unit 7: The art of scientific writing and its presentation	Numbers, units, abbreviations and nomenclature used in scientific writing. Writing references. Powerpoint presentation. Poster presentation. Scientific writing and ethics, Introduction to copyright-academic misconduct/plagiarism.
Prof. Mahanga Singh		DSE2P: Research		1. Experiments based on chemical

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	Methodology		calculations. 2. Plant microtechnique experiments. 3. The art of imaging of samples through microphotography and field photography. 4. Poster presentation on defined topics. 5. Technical writing on topics assigned.
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TEACHING PLAN OF EVEN SEMESTER (2ND, 4TH & 6TH)

SESSION -2022-2023

DEPARTMENT OF BOTANY

NAME OF THE TEACHER- MR. HAPPY DAS

SEMESTER –II		
SYLLABUS ALLOTTED – CC 4T & CC4P Archegoniate	CC 4P (TOTAL LECTURE-15)	CC 4T (TOTAL LECTURE-30)
TERM I (CC4P- LECTURE-5) (CC4T- LECTURE-10)	<p>1. <i>Riccia</i> – Morphology of thallus.</p> <p>2. <i>Marchantia</i>- Morphology of thallus, whole mount of rhizoids & Scales, vertical section of thallus through Gemma cup, whole mount of Gemmae (all temporary slides), vertical section of Antheridiophore, Archegoniophore, longitudinal section of Sporophyte (all permanent slides).</p> <p>3. <i>Anthoceros</i>- Morphology of thallus, dissection of sporophyte (to show stomata, spores, pseudoelaters, columella) (temporary slide), vertical section of thallus (permanent slide).</p> <p>4. <i>Pellia</i>, <i>Porella</i>- Permanent slides.</p> <p>5. <i>Sphagnum</i>- Morphology of plant, whole mounts of leaf (permanent slide only)</p>	<p>Unit 1: Introduction : Unifying features of archegoniates; Transition to land habit; Alternation of generations.</p> <p>Unit 2: Bryophytes : General characteristics; Adaptations to land habit; Classification; Range of thallus organization.</p>
TERM II (CC4P- LECTURE-5) (CC4T- LECTURE-10)	<p>6. <i>Funaria- Pogonatum/ Polytrichum</i> Morphology, whole mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, longitudinal section of capsule and protonema. 7. <i>Psilotum</i>- Study of specimen, transverse section of synangium (permanent slide).</p> <p>8. <i>Selaginella</i>- Morphology, whole mount of leaf with ligule, transverse section of stem, whole mount of strobilus, whole mount of microsporophyll and megasporophyll (temporary slides), longitudinal section of strobilus (permanent slide).</p> <p>9. <i>Equisetum</i>- Morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores (wet and dry) (temporary slide), transverse section of rhizome (permanent slide). 10. <i>Pteris</i>- Morphology, transverse section of rachis, vertical section of sporophyll,</p>	<p>Unit 3: Type Studies- Bryophytes :Classification (up to family), morphology, anatomy and reproduction of <i>Riccia</i>, <i>Marchantia</i>, <i>Pellia</i>, <i>Porella</i>, <i>Anthoceros</i>, <i>Sphagnum</i> and <i>Funaria</i>; <i>Pogonatum</i>, Reproduction and evolutionary trends in <i>Riccia</i>, <i>Marchantia</i>, <i>Plagichasma</i> <i>Anthoceros</i> and <i>Funaria</i> . Ecological and economic importance of bryophytes with special reference to <i>Sphagnum</i>.</p> <p>Unit 4: Pteridophytes: General characteristics; Classification; Early land plants (<i>Cooksonia</i> and <i>Rhynia</i>)</p>

	wholemount of sporangium, whole mount of spores (temporary slides), transverse section of rhizome, whole mount of prothallus with sex organs and young sporophyte (permanent slide)	
TERM III (CC4P- LECTURE-5) (CC4T- LECTURE-10)	<p>11. <i>Cycas</i>- Morphology (coralloid roots, bulbil, leaf), whole mount of microsporophyll, transverse section of coralloid root, transverse section of rachis, vertical section of leaflet, vertical section of microsporophyll, whole mount of spores (temporary slides), longitudinal section of ovule, transverse section of root (permanent slide).</p> <p>12. <i>Pinus</i>- Morphology (long and dwarf shoots, whole mount of dwarf shoot, male and female cones), transverse section of Needle, transverse section of stem, longitudinal section of / transverse section of male cone, whole mount of microsporophyll, whole mount of Microspores (temporary slides), longitudinal section of female cone, tangential longitudinal section & radial longitudinal sections stem (permanent slide).</p> <p>13. <i>Gnetum</i>- Morphology (stem, male & female cones), transverse section of stem, vertical section of ovule (permanent slide)</p>	<p>Unit 5: Type Studies- Pteridophytes :Classification (up to family), morphology, anatomy and reproduction of <i>Psilotum</i>, <i>Selaginella</i>, <i>Equisetum</i> and <i>Pteris</i> (Developmental details not to be included).Apogamy, and apospory, heterospory and seed habit, telome theory, stelar evolution; Ecological and economic importance.</p> <p>Unit 6: Gymnosperms :General characteristics, classification (up to family), morphology, anatomy and reproduction of <i>Cycas</i>, <i>Pinus</i> and <i>Gnetum</i> ,Ecological and economic importance.</p>
SYLLABUS ALLOTTED – GE-2T & GE-2P Plant Ecology and Taxonomy	GE-2P (TOTAL LECTURE-15)	GE-2T (TOTAL LECTURE-15)
TERM I (LECTURE-5)	Study of vegetative and floral characters of the following families <i>Brassicaceae</i> - <i>Brassica</i> , <i>Alyssum</i> / <i>Iberis</i> ; <i>Asteraceae</i> - <i>Sonchus</i> / <i>Launaea</i> , <i>Vernonia</i> / <i>Ageratum</i> , <i>Eclipta</i> / <i>Tridax</i>	<p>Unit- 6: Introduction to plant taxonomy: Identification, Classification, Nomenclature.</p> <p>Unit- 7 : Identification: Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access</p> <p>Unit 8 : Taxonomic evidences from palynology, cytology, phytochemistry and molecular data</p>
TERM II (LECTURE-5)	Study of vegetative and floral characters of the following families <i>Solanaceae</i> - <i>Solanum nigrum</i> , <i>Withania</i> ; <i>Lamiaceae</i> - <i>Salvia</i> , <i>Ocimum</i>	<p>Unit 9 : Taxonomic hierarchy: Ranks, categories and taxonomic groups</p> <p>Unit 10: Botanical nomenclature: Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations</p>
TERM III (LECTURE-5)	Study of vegetative and floral characters of the following family <i>Liliaceae</i> - <i>Asphodelus</i> / <i>Lilium</i> / <i>Allium</i> .	<p>Unit 11: Classification: Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series).</p> <p>Unit 12: Biometrics, numerical taxonomy and cladistics: Characters; variations; OTUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences).</p>

SYLLABUS ALLOTTED – DSC-1B (CC -2) Plant Ecology and Taxonomy	DSC 1B (C2P)	DSC 1B (C2T)
TERM I (LECTURE-5)	Study of vegetative and floral characters of the following families Brassicaceae - <i>Brassica</i> , <i>Alyssum</i> / <i>Iberis</i> ; Asteraceae - <i>Sonchus</i> / <i>Launaea</i> , <i>Vernonia</i> / <i>Ageratum</i> , <i>Eclipta</i> / <i>Tridax</i>	Unit- 6: Introduction to plant taxonomy: Identification, Classification, Nomenclature. Unit- 7 : Identification: Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access Unit 8 : Taxonomic evidences from palynology, cytology, phytochemistry and molecular data
TERM II (LECTURE-5)	Study of vegetative and floral characters of the following families Solanaceae - <i>Solanum nigrum</i> , <i>Withania</i> ; Lamiaceae - <i>Salvia</i> , <i>Ocimum</i>	Unit 9 : Taxonomic hierarchy: Ranks, categories and taxonomic groups Unit 10: Botanical nomenclature: Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations
TERM III (LECTURE-5)	Study of vegetative and floral characters of the following family Liliaceae - <i>Asphodelus</i> / <i>Lilium</i> / <i>Allium</i> .	Unit 11: Classification: Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series). Unit 12: Biometrics, numerical taxonomy and cladistics: Characters; variations; OTUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences).

SEMESTER –IV		
SYLLABUS ALLOTTED – CC 10 T & CC 10 P Plant Systematics	CC 10P (TOTAL LECTURE-15)	CC 10T (TOTAL LECTURE-15)
TERM I (LECTURE-5)	Study of vegetative and floral characters of the following families 1. Ranunculaceae - <i>Ranunculus</i> , <i>Delphinium</i> . 2. Brassicaceae - <i>Brassica</i> , <i>Alyssum</i> / <i>Iberis</i> . 3. Malvaceae – <i>Sida</i> Sp. <i>Urena lobata</i> . 4. Myrtaceae - <i>Eucalyptus</i> , <i>Callistemon</i> 5. Umbelliferae - <i>Coriandrum</i> / <i>Anethum</i> / <i>Foeniculum</i> . 6. Asteraceae - <i>Sonchus</i> / <i>Launaea</i> , <i>Vernonia</i> / <i>Ageratum</i> , <i>Eclipta</i> / <i>Tridax</i>	Unit 1: Significance of Plant systematic: Introduction to systematics; Plant identification, Classification, Nomenclature. Evidences from palynology, cytology, phytochemistry and molecular data. Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Documentation: Flora, Monographs, Journals; Keys: Single access and Multi-access. Unit 2: Taxonomic hierarchy: Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary
TERM II (LECTURE-5)	Study of vegetative and floral characters of the following families 7. Solanaceae - <i>Solanum nigrum</i> / <i>Withania</i> , <i>Nicotina</i> , <i>Plumbaginefolia</i> . 8. Lamiaceae - <i>Salvia</i> / <i>Ocimum</i> .	Unit 3: Botanical nomenclature: Principles and rules (ICN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of

	<p>9. Euphorbiaceae - <i>Euphorbia hirta</i>/<i>E.milii</i>, <i>Jatropha</i>.</p> <p>10. Fabaceae – <i>Tephrosia</i> Sp.,<i>Crotalaria</i> Sp.,</p> <p>11. Caesalpiniaceae – <i>Cassia</i> Sp.</p>	<p>hybrids</p> <p>Unit 4: Systems of classification: Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series); Brief reference of Angiosperm Phylogeny Group (APG III) classification</p>
TERM III (LECTURE-5)	<p>Study of vegetative and floral characters of the following families</p> <p>12. Asclepiadaceae- <i>Pesgularia Gygnema</i></p> <p>13. Apocynaceae – <i>Hollorhen</i>, <i>Catharanthus</i>.</p> <p>14. Rubiaceae – <i>Oldenladeae</i>, <i>Spermoeoeae</i>,</p> <p>15. Liliaceae - <i>Asphodelus</i>/<i>Lilium</i>/<i>Allium</i>.</p> <p>16. Poaceae - <i>Triticum</i>/<i>Hordeum</i>/<i>Avena</i></p>	<p>Unit 5: Biometrics, numerical taxonomy and cladistics: Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences).</p> <p>Unit 6: Phylogeny of Angiosperms: Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms; Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram)</p>

SEMESTER –VI		
SYLLABUS ALLOTTED – CC 14 T & CC 14 P Plant Biotechnology	CC 14 P (TOTAL LECTURE-15)	CC 14 T (TOTAL LECTURE-15)
TERM I (LECTURE-5)	<p>1. (a) Preparation of MS medium. (b) Demonstration of in vitro sterilization and inoculation methods using leaf and nodal explants of tobacco, Datura, Brassica etc.</p> <p>2. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs.</p> <p>3. Isolation of protoplasts</p>	<p>Unit -1: Plant Tissue Culture: Historical perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm Conservation)</p>
TERM II (LECTURE-5)	<p>4. Construction of restriction map of circular and linear DNA from the data provided.</p> <p>5. Study of methods of gene transfer through photographs: <i>Agrobacterium</i>-mediated, direct gene</p> <p>6. transfer by electroporation, microinjection, microprojectile bombardment</p>	<p>Unit- 2: Recombinant DNA technology: Restriction Endonucleases (History, Types I-IV, biological role and application); Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pUC 18 and pUC19, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC).</p> <p>Unit- 3: Gene Cloning: Recombinant DNA, Bacterial Transformation and selection of recombinant clones, PCRmediated gene cloning; Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony</p>

		hybridization; PCR
TERM III (LECTURE-5)	<p>7. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.</p> <p>8. Isolation of plasmid DNA.</p> <p>9. Restriction digestion and gel electrophoresis of plasmid DNA.</p>	<p>Unit- 4: Methods of gene transfer: <i>Agrobacterium</i>-mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; Selection of transgenics– selectable marker and reporter genes (Luciferase, GUS, GFP).</p> <p>Unit - 5: Applications of Biotechnology: Pest resistant (Bt-cotton); herbicide resistant plants (RoundUp Ready soybean); Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillase, Protease, Lipase); Genetically Engineered Products– Human Growth Hormone; Humulin; Biosafety concerns</p>