

SYLLABUS PLAN (2019-20)
SEMESTER WISE

ACADEMIC PLANNER (2019-20) Odd Semester
 B.Sc. (Medical) Part-1(**Semester-I**)
 BOTANY Paper No: III (PAPER I: DIVERSITY OF MICROBES)
 Teacher Name: Prof. Rajdeep Singh Dhaliwal (Assistant Professor)

MONTH	THEORY	PRACTICAL
JULY	Fungi: General characters and classification. Economic importance of Fungi. General characteristics and life cycle of Albugo, Phytophthora (Kingdom Chromista); Rhizopus (Zygomycota); Saccharomyces, Pencilium and Peziza (Ascomycota); Puccinia, Ustilago, Agaricus (Basidiomycota); Cercospora and Colletotrichum	Study of the genera included under fungi: a) Albugo: Asexual stage from temporary mount b) Phytophthora: Specimen/ Photograph and tease mount c) Rhizopus and Penicillium: Asexual stage from temporary mounts, sexual structures through permanent slides d) Saccharomyces: Electron Micrographs/ Photographs of Sexual and Asexual reproduction e) Peziza: Specimen/ Photograph, temporary mount of fruiting body f) Puccinia and Ustilago: Specimen of Rusts and Smuts of wheat. Section/tease mounts of spores on Wheat and permanent slides. g) Agaricus: Specimens of button stage and full grown mushrooms; sectioning of Gills of Agaricus
AUGUST	Viruses: Discovery, General characters, General structure, classification and replication; General account of DNA virus (T- phage) and RNA virus (TMV). Economic importance of viruses. A brief account of Mycoplasma.	Observation of disease symptoms in hosts infected by Bacteria (Citrus canker), Fungi (White rust of crucifer, Late blight of potato, Loose smut of wheat, Brown rust of wheat, Yellow stripe rust of wheat, Tikka disease of groundnut, Red rot of sugarcane), Viruses (Yellow vein mosaic of bhindi) and Mycoplasma (Little leaf disease of brinjal). Examination of diseased material and identification of pathogens
SEPTEMBER	Bacteria: Discovery, general characteristics, ultra-structure, classification, reproduction- vegetative asexual and recombination (Conjugation, transformation and transduction).	Electron Micrographs/ Photographs of viruses- T-Phage and TMV, Line drawing/ Photograph of Lytic and Lysogenic Cycle. Electron Micrographs/ Photographs - Types of Bacteria, Binary Fission, Conjugation and structure of Root Nodules. Gram staining of bacteria.
OCTOBER	Nutritional types and economic importance bacteria. General account of cyanobacteria with emphasis on oscillatoria Lichens: Structure, morphology, reproduction and economic importance.	Study of vegetative and reproductive structures of Oscillatoria (Electron Micrograph). Study of growth forms of crustose, foliose and fruticose lichen thalli.
NOVEMBER	Mycorrhiza: General account, ectomycorrhiza and endomycorrhiza and their significance.	Mycorrhiza: Ectomycorrhiza and Endomycorrhiza (Photographs).

ACADEMIC PLANNER (2019-20) Odd Semester

B.Sc. (Medical) Part-1(**Semester-I**)

BOTANY Paper No: III (PAPER II: DIVERSITY OF CRYPTOGAMS) Teacher Name:

Prof. Rajdeep Singh Dhaliwal (Assistant Professor)

MONTH	THEORY	PRACTICAL
JULY	Algae: General characteristics, range of thallus organisation, algal cell structure, photosynthetic pigments, cell wall, flagella, reserves food materials, nutrition and reproduction; life cycle pattern, classification and economic importance of algae.	Study of vegetative and reproductive structures of genera included under algae: Volvox; Spirogyra; Chara; Vaucheria; Ectocarpus; Sargassum; Batrachospermum through temporary preparations and permanent slides.
AUGUST	Morphology and life cycle of Volvox, Chara and Spirogyra (Chlorophyceae); Vaucheria (Xanthophyceae); Ectocarpus, Sargassum (Phaeophyceae); Batrachospermum (Rhodophyceae).	Study of the genera included under Bryophyta: a) Marchantia: Morphology of thallus, W.M. (Whole mount) Rhizoids and scales, V.S.thallus through gemma cup, W.M. Gemmae (all temporary slides), V.S. Antheridiophore, Archegoniophore, L.S. Sporophyte (all permanent slides).
SEPTEMBER	Bryophyta: General characteristics, adaptations to land habit, Classification (up to family), Evolution of sporophytes in Bryophytes. Economic importance of Bryophytes	b) Anthoceros: Morphology of thallus, W.M. Rhizoids and scales, (all temporary slides), V.S. Antheridiophore, Archegoniophore, L.S. Sporophyte (all permanent slides).c) Funaria: Morphology, W.M. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, L.S. capsule and protonema.
OCTOBER	Bryophyta: Morphology, anatomy and reproduction of Marchantia (Hepaticopsida); Anthoceros (Anthocerotopsida); Funaria (Bryopsida) (developmental stages are excluded). Pteridophyta: General characteristics, Classification (up to family).	Study of the genera included under Pteridophyta: a) Lycopodium: Morphology, W.M. leaf with ligule, T.S. Stem, W.M. strobilus (temporary slides), L.S. Strobilus (permanent slide). b) Selaginella: Morphology, W.M. leaf with ligule, T.S. Stem, W.M. strobilus, W.M. microsporophyll and megasporophyll (temporary slides), L.S. strobilus (permanent slide). c) Equisetum: Morphology, T.S. internodes, L.S. strobilus, T.S. strobilus, W.M. sporangiophore, W.M. spores (wet and dry) (temporary slides); T.S. rhizome
NOVEMBER	Pteridophyta: Brief account of Heterospory and Seed habit, Stellar evolution. Morphology, anatomy and reproduction of Rhynia (Psilopsida); Lycopodium, Selaginella (Lycopsida); Equisetum (Sphenopsida) and Pteris and Marsilea (Pteropsida) (developmental stages are excluded).	d) Pteris: Morphology, T.S. rachis, V.S. sporophyll, W.M. sporangium, W.M. spores (temporary slides), T.S. rhizome, W.M. prothallus with sex organs and young sporophyte (permanent slide). e) Marsilea: Morphology, T.S. stem (temporary slides), V.T.S. & V.L.S. sporocarp (permanent slide).

Academic Planner (2019-20, Even Semester) for B.Sc. Medical I **Semester II**
 Subject: Botany Paper VIII;
 PAPER III Cell Biology & PAPER IV: Genetics and Evolution
 (Theory and Practical) Prof. R. S. Dhaliwal, Assistant Professor in Botany

Month	Syllabus	
	Theory	Practical
January	<p>Paper III General account on Microscopy Techniques: Light Microscopy; Phase Contrast microscopy; Fluorescence Microscopy; Electron Microscopy (SEM and TEM).</p> <p>Paper IV Cell as a Unit of life: The Cell Theory; Prokaryotic and Eukaryotic Cells; Cell size and shape; Eukaryotic Cell components. Genetic material: DNA structure; types of DNA; DNA replication in Prokaryotes and Eukaryotes (in brief); DNA – protein interaction; the nucleosome model. Satellite and repetitive DNA; Cell division: Mitosis; meiosis.</p>	<p>To study cell structure from onion leaf peels.</p> <p>Examination of electron micrographs of eukaryotic cells with special reference to organelles.</p>
February	<p>Paper III Structure and function of Cell Organelles: Nucleus: Ultrastructure of nuclear membrane, nuclear pore; nucleolus. Chloroplast, Mitochondria, Plastids, Ribosomes, Golgi body, Endoplasmic Reticulum, Peroxisomes, Vacuoles, Lysosomes.</p> <p>Paper IV Transcription (Prokaryotes and Eukaryotes); Types of structures of RNA (mRNA, rRNA, tRNA), RNA polymerase- various types; Translation (Prokaryotes and Eukaryotes; Genetic code. Regulation of gene expression: Structure of gene; Prokaryotes: Lac operon, Tryptophan operon and in Eukaryotes (in brief). Protein structure.</p>	<p>Examination of various stages of mitosis and meiosis using appropriate plant material (e.g. onion root tips, onion flower buds).</p> <p>Study of special types of chromosomes from slides/photographs.</p>
March	<p>Paper III Cell Membrane and Cell wall: Structure, composition and functions of cell wall and plasma membrane in microbes and plants. Extra nuclear genome: Presence and function of mitochondrial and plastid DNA.</p> <p>Paper IV Genetic inheritance: Mendelism; laws of segregation and independent assortment; linkage and crossing over; Polygenes- Quantitative inheritance; allelic (Incomplete dominance, Codominance, Multiple alleles, Lethal genes and Pleiotropic genes) and non-allelic interactions (Duplicate genes, Polymeric or Additive genes, Complementary genes, Supplementary genes, Epistasis and Inhibitor genes).</p>	<p>Preparation of karyotypes from dividing root tip cells of <i>Allium</i>.</p> <p>Study of pollen mitosis of <i>Impatiens balsamina</i>.</p>

<p>April</p>	<p>Paper III Chromosome organization: Morphology; centromere and telomere; chromosome alterations – deletions, duplications, translocations, inversions. Variations in chromosome number – aneuploidy, polyploidy. Special type of Chromosomes: Polytene and Lampbrush Chromosomes.</p> <p>Paper IV Genetic Variations: Mutations – Mechanism of spontaneous and induced; transposable genetic elements. Evolution: Brief account of Origin of life, evolutionary theories of Lamarck, Darwin, De Vries and Modern Theory, evidences for organic evolution.</p>	<p>Working out the laws of inheritance using seed mixture data provided using Chi-square methods.</p> <p>Study of special types of chromosomes from slides/photographs. (repeat)</p> <p>Examination of electron micrographs of eukaryotic cells with special reference to organelles. (repeat)</p>
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ACADEMIC PLANNER, B.SC.-II (MED.), **SEMESTER-III** Odd Semester, (Session 2019-20) SUBJECT-
BOTANY Paper No. BSMD 302

PAPER V: DIVERSITY AND SYSTEMATICS OF GYMNOSPERMS and PAPER VI: DIVERSITY AND SYSTEMATICS OF ANGIOSPERMS, Teacher Name: Prof. Rajdeep Singh Dhaliwal

MONTH	THEORY	PRACTICAL
July	<p>1. Origin and evolution of Angiosperms giving suitable examples. Primitive and Advanced characters of Angiosperms.</p> <p>2. Introduction to plant taxonomy: Angiosperm taxonomy; brief history, aims and fundamental components (α- taxonomy, β-taxonomy and Ω-taxonomy). Functions of Herbarium, important herbaria and botanical gardens of the world and India. Documentation: Flora, identification keys: single access and multi-access.</p>	<p>Angiosperms: The following species are suitable for study. This list is only indicative. Teachers may select plant available in their locality.</p> <ol style="list-style-type: none"> 1. Ranunculaceae: <i>Ranunculus, Delphinium</i>. 2. Brassicaceae: <i>Brassica, Iberis</i>. 3. Malvaceae: <i>Hibiscus, Abutilon</i>. 4. Rutaceae: <i>Murraya, Citrus</i>. 5. Fabaceae: Faboideae: <i>Lathyrus, Trigonella</i>; Caesalpiniodeae: <i>Cassia</i>; Mimosoideae: <i>Acacia, Albizzia</i>. 6. Apicaceae: <i>Coriandrum</i>. 7. Acanthaceae: <i>Adhatoda</i>. 8. Apocynaceae: <i>Vinca, Thevetia</i>.
August	<p>3. 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> <p>Classification: Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series).</p> <p>4. Diagnostic features and technical description of flowering plants as illustrated by members of families Ranunculaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae, Apiaceae, Cucurbitaceae, Rosaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Asteraceae, Lilliacae and Poaceae.</p>	<ol style="list-style-type: none"> 9. Asclepiadaceae: <i>Calotropis</i>. 10. Solanaceae: <i>Solanum, Withania</i>. 11. Euphorbiaceae: <i>Euphorbia, Phyllanthus</i>. 12. Asteraceae: <i>Ageratum, Tridax and Sonchus</i>. 13. Lamiaceae: <i>Ocimum, Salvia</i>. 14. Chenopodiaceae: <i>Chenopodium</i>. 15. Liliaceae: <i>Asparagus, Allium</i>. <p>16. Mounting of a properly dried and pressed specimen (up to 20) of wild plants with herbarium label (to be submitted in the record book).</p>
September	<p>1. General features of gymnosperms and their classification (up to family); evolution and diversity of gymnosperms; geological time scale, fossilization and fossil gymnosperms (<i>Lyginopteris, Williamsonia, Cycadeoidea</i>). Distribution, Cytology and Economic Importance of Indian Gymnosperms.</p> <p>2. General characters of Pro-Gymnosperms, morphological features of <i>Arachaeopteris</i> and <i>Aneurophyton</i>; origin and evolution of seed</p>	<p>Cycas</p> <ol style="list-style-type: none"> I. Study of microsporophyll, megasporophyll and mature seed. II. Study through permanent slides - normal root (T.S.) and ovule (L.S.) III. Study through hand sections- coralloid root (T.S.), rachis (T.S.), leaflet (V.S.), pollen grains (W.M.). <p>Pinus</p> <ol style="list-style-type: none"> I. Study of morphology (long and dwarf

	habit.	<p>shoots, male and female cones and winged seeds).</p> <p>II. Study through permanent slides - root (T.S.), Male cone (L.S.), female cone (L.S.), ovule (L.S.).</p> <p>III. Study through hand sections and preparation of permanent slides Dwarf shoot (T.S.), young stem (T.S.), old stem (T.S., T.L.S. and R.L.S.), needle (T.S.), pollen grains (W.M.).</p> <p>Ephedra</p> <p>I. Study of morphology (male and female cones). II. Hand sections - Stem (T.S.), maceration to show vessel structure; pollen grains (W.M.)</p>
October	3. General characters of Cycadales and Coniferales. Morphology, anatomy, reproduction and life cycle of <i>Cycas</i> and <i>Pinus</i> (Developmental details not to be included).	<p>Cycas: Study of microsporophyll, megasporophyll and mature seed. Study through permanent slides – normal root (T.S.) and ovule (L.S.) Study through hand sections– coralloid root (T.S.), rachis (T.S.), leaflet (V.S.), pollen grains (W.M.)</p> <p>Pinus: Long and dwarf shoot, male and female cones, winged seeds. Study through permanent slides – root (T.S.), Male cone (L.S.), female cone (L.S.), ovule (L.S.), embryo (W.M.) showing polycotyledonous condition. Study through hand sections and preparation of permanent studies in young stem (T.S.), old stem (T.S., T.L.S. and R.L.S.), needle (T.S.), pollen grains (W.M.).</p>
November	4. General characters of Ephedrales and Gnetales. Morphology, anatomy and reproduction and life cycle of <i>Ephedra</i> and <i>Gnetum</i> (Developmental details not to be included).	<p>Ephedra: Structure of male and female cones. Hand sections – Stem (T.S.), maceration to show vessel structure; pollen grains (W.M.)</p>

MONTH	THEORY	PRACTICAL
JANUARY	Tissues Systems: Epidermal: stomata, guard cells, idioblasts, trichomes, nectaries, hydathodes. Fundamental: parenchyma, collenchyma, and sclerenchyma; Vascular System.	1. To study the anatomy of Dicot and Monocot root, stem and leaves from the locally available material. 7. Study of Pollen viability using glycerol-acetocarmine. 11. Percentage seed viability through tetrazolium chloride and actual seed germination.
FEBRUARY	The root system: The root apical meristem and its histological organization; anatomical details of Dicot and Monocot roots.	2.. Study of anomalous secondary growth in <i>Boerhavia</i> , <i>Nyctanthus</i> , <i>Bougainvillea</i> , <i>Mirabilis</i> . 4. Study of stomata from epidermal peel. 10. Simple experiments to show vegetative propagation (leaf cuttings in <i>Bryophyllum</i> ; stem cuttings in rose, money plant, sugarcane and <i>Bougainvillea</i>). 12. Study of placentation, fruit types and seed types.
MARCH	The shoot system: The shoot apical meristem and its histological organization. Anatomical details of Dicot and Monocot stems. Secondary Growth: Cambium and its functions. Secondary growth in stem and root including anomalous secondary growth (<i>Boerhavia</i> , <i>Nyctanthus</i> , <i>Bougainvillea</i> , <i>Mirabilis</i>). Wood (heartwood and sapwood).	5. Examination of flowers for their pollination mechanism (<i>Salvia</i> , <i>Ficus</i> , <i>Calotropis</i> , <i>Triticum</i>). 6. Structure of anther, microsporogenesis (using slides) and pollen grains and pollinia (using whole mounts). 8. Structure of ovule and embryo sac. (Permanent slides / Photographs)
APRIL	Leaf: Anatomy in Dicots and Monocots and modification with special reference to their function. Study of stomatal types.	9. Nuclear and cellular endosperm. Embryo development in monocots and dicots.(Permanent slides/ Photographs) 3. Maceration of wood to study different tracheary elements.

Academic Planner for B.Sc. Medical II **Semester IV** (Even Semester) **2019-20**
 Botany Paper No. : BSMD 402 (PAPER VIII: Development and Reproduction in Flowering Plants,
 (Theory Only) Teachers Name: Prof. Rajdeep Singh Dhaliwal

Month	Syllabus	
	VIII only Theory paper	Practical with Prof. Sandeep kaur
January	Vegetative Reproduction: Various methods of vegetative propagation and applications in floriculture and horticulture. Apomixis: a general account.	
February	Flower: a modified shoot; structure, development of flower; Inflorescence types; structure of anther and pistil; Structure and types of Ovules.	
March	Male and female gametophytes; types of embryo sac; types of pollination; pollen-pistil interaction, self incompatibility. Double fertilization.	
April	Post fertilization changes, endosperm and embryo development; seed structure, development, dormancy and dispersal; fruit development and types.	

Academic Planner for B.Sc. Medical III **Semester V Session 2019-20 (Odd Semester)**

Subject: Botany Paper BSMD 502

Botany PAPER IX Plant Physiology & PAPER X: Plant Growth, Development
And Biotechnology (Theory and Practical) Teachers Name: Rajdeep Singh Dhaliwal

Month	Syllabus	
	Theory	Practical
January	<p>Paper IX: 1. Plant-water relations: Importance of water to plant life; diffusion and osmosis; absorption, transport of water and transpiration; mechanism of stomatal (opening and closing).</p> <p>2. Mineral nutrition: Essential macro- and micro- elements and their role; mineral uptake; Deficiency and toxicity symptoms.</p> <p>Paper X: 1. Growth, phases of growth, growth kinetics; plant hormones: discovery, bioassay, physiological effects and application of auxins, gibberellins, cytokinins, abscisic acid and ethylene.</p> <p>2. Photomorphogenesis, discovery, structure, physiological role and mechanism of action of phytochrome and cryptochrome.</p>	<p>1. To study the permeability of plasma membrane using different concentrations of organic solvents.</p> <p>2. To study the effect of temperature on permeability of plasma membrane.</p> <p>3. To study the enzyme activity of catalase and peroxidase.</p> <p>4. To demonstrate of the rate of respiration of various plants.</p> <p>5. Separation of chloroplast pigments by solvent method.</p>
February	<p>Paper IX: 3. Transport of organic substances: Mechanism of phloem transport; source-sink relationship; factors affecting translocation.</p> <p>4. Basics of enzymology: Discovery and nomenclature; characteristics of enzymes; concepts of holoenzyme, apoenzyme, coenzyme and cofactors; regulation of enzyme activity; mechanism of action. (Michaelis Menten Equation, Lock and Key Hypothesis; Induced Fit Hypothesis), Factors influencing enzyme activity.</p> <p>Paper X: 3. Photoperiodism, vernalization, biological clocks, physiology of senescence and abscission.</p> <p>4. Physiology of seed dormancy and seed germination; plant movements.</p>	<p>6. Demonstration of the osmotic potential of vacuolar sap by plasmolytic method.</p> <p>7. Demonstration of the water potential of any tuber.</p> <p>8. Separation of amino acids in the mixture by paper chromatography and their identification by comparison with standard. (Demonstration only).</p> <p>9. Demonstration of the technique of micropropagation by using different explants e.g. auxiliary buds, shoot meristems.</p> <p>10. Demonstration of the techniques of anther culture. (Demonstration only).</p> <p>11. Isolation of protoplasts from different tissues using commercially available enzymes (Demonstration only).</p>

<p>March</p>	<p>Paper IX: 5. Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effect; concept of two photosystems; Z-scheme; photophosphorylation; Calvin cycle; C₄ pathway; CAM plants; photorespiration.</p> <p>6. Respiration: aerobic and anaerobic respiration; Glycolysis, pentose phosphate pathway, Krebs's cycle; electron transport mechanism (chemiosmotic theory) redox potential; ATP- the biological energy currency; oxidative phosphorylation.</p> <p>Paper X: 5.Tools and techniques of recombinant DNA technology with special reference to restriction enzymes, gel electrophoresis, Southern blotting, cloning vectors and PCR. Genomic and cDNA library.</p> <p>6. Techniques of gene mapping and chromosome walking; methods of gene transfer in plants.</p>	<p>12. Demonstration of root and shoot formation from the apical and basal portion of stem segments in liquid medium containing different hormones. (Demonstration only).</p> <p>13. Preparation of synthetic seeds in potato and sugarcane. (Demonstration only).</p> <p>14. Separation of proteins of a given sample through Gel Electrophoresis. (Demonstration only).</p> <p>15. Demonstration of necessity of light, CO₂, and Chlorophyll for photosynthesis.</p> <p>16. Demonstration of rate of transpiration by Ganong's apparatus.</p>
<p>April</p>	<p>Paper IX: 7. Nitrogen metabolism: Biology of nitrogen fixation; importance of nitrate reductase and its regulation; ammonium assimilation.</p> <p>8. Lipid metabolism: Structure and function of lipids; fatty acid biosynthesis; saturated and unsaturated fatty acids. Beta oxidation of Fatty acids</p> <p>Paper X: 7. Basic concept of plant tissue, culture, totipotency, micropropagation, anther culture, embryo culture, synthetic seeds and somatic hybridization.</p> <p>8. Biotechnology and its application in human welfare with particular reference to industry, plant breeding and molecular farming.</p>	<p>17. Comparison of loss of water from two surfaces of leaf by 4 leaf method.</p> <p>18. Demonstration of path of Ascent of sap by eocin ringing experiment.</p> <p>19. Demonstration of phototropism and geotropism.</p> <p>20. Demonstration of the presence of reducing sugars, fats and proteins in plant tissue by micro-chemical tests.</p> <p>21. To determine the seed viability through Triphenyl Tetrazolium chloride and actual germination Tests.</p>

Academic Planner for B.Sc. Medical III **Semester VI (2018-19) Even Semester**
 Subject: Botany Paper No. BSMD 602 **Prof. R. S. Dhaliwal, Assistant Professor in Botany**
 Botany PAPER XI: Plant Ecology & XII: Plant Utilization (Theory and Practical)

Month	Syllabus	
	Theory	Practical
January	<p>Paper XI: Concept of ecology and its scope. Environmental factors: climatic, edaphic, topographic and biotic, Shelford's law of tolerance.</p> <p>Population ecology: Characteristics, positive and negative interaction, growth forms, carrying capacity, ecotypes and ecads.</p> <p>Paper XII: fibres: surface fibres (cotton), soft fibres (Jute), hard fibres (Sisal).-morphology, extraction and uses.</p> <p>Forest products: Wood, properties, seasoning and importance, important timber plants of India with special reference to Teak, Sal, Shisham, Deodar and Blue Pine.</p> <p>Brief history of origin of food plants; cultivation practice and recommended varieties of wheat, rice, potato and sugarcane with particular reference to Punjab.</p>	<ol style="list-style-type: none"> 1. To determine minimum number of quadrats required for study of a grassland. 2. To study the frequency of herbaceous species in grassland and to compare the frequency distribution with Raunkiaer's Standard Frequency Diagram. 3. To estimate Importance Value Index (IVI) for grassland species on the basis of relative frequency, relative density and relative biomass in protected and grazed grassland. 17. Fibres: Study of cotton flower, sectioning of the cotton ovules/developing seeds to trace the origin and development of cotton fibres. Microscopic study of cotton and test for cellulose. Sectioning and staining of jute stem showing the location and development of fibres. Microscopic structure. Tests for ligno-cellulose. 16. Food Plants: Study of the morphology, structure and simple micro chemical tests of the food storing tissues in rice, wheat, maize, potato and sugarcane. Microscopic examination of starch in these plants (excepting sugarcane).
February	<p>Paper XI: Community ecology: Community characteristics, frequency, density and abundance, cover, life forms. Ecological succession (Hydrosere, Xerosere). Gause principle of competitive exclusion.</p> <p>Structure and concept of ecosystem, ecological pyramids, food chain, food web, ecological energetics, ecological productivity.</p> <p>Paper XII: Cultivation practices and use of soyabean, sunflower, mustard and groundnut.</p>	<ol style="list-style-type: none"> 4. To measure the vegetation cover of a grassland through point frame method. 5. To measure the above ground plant biomass in a grassland. 6. To determine Kemp's constant for dicot and monocot leaves and to estimate the leaf area index of a grassland community. 7. To determine diversity indices (Richness, Simpson, Shannon Wiener) in grazed and protected grassland.

	<p>Vegetables, and Fruits: Botanical name, family, season and area of cultivation of potato, tomato, brinjal, carrot, ladyfinger, pea, mango, apple, banana, guava, kinnow, grapes and ber</p>	<p>19. Field Visits: To study sources of firewood (10 plants), timber-yielding trees (10 trees) and bamboos. A list to be prepared mentioning special features.</p> <p>18. Vegetable Oils: study of hand sections of groundnut, mustard and coconut and staining of oil droplets with Sudan III and Sudan Black.</p>
March	<p>Paper XI: Environmental issues: Brief idea of air, water, noise and soil pollution. Global warming and ozone depletion. International efforts for mitigation of global climate change.</p> <p>Biodiversity: Types and conservation, concept of hot spots, biomes, phytogeographic regions of India, vegetation types (Forests, Grasslands, Wetlands).</p> <p>Paper XII: Spices: General account pertaining to botanical name, family and part used in case of cloves, cardamom, black pepper, turmeric, cumin and ginger.</p> <p>Medicinal Plants: General account pertaining to botanical name, family, part used and active principle in case of belladonna, neem, tulsi, <i>Stevia</i>, <i>Rauwolfia</i>, Ashwagandha, Glycyrrhiza, Isabgol (<i>Plantago ovata</i>), <i>Cinchona</i>, <i>Taxus</i>, <i>Catharanthus roseus</i>, <i>Adhathoda vasica</i>, <i>Asafoetida</i> and Turmeric.</p>	<p>8. To estimate bulk density and porosity of grassland and woodland soil.</p> <p>9. To determine moisture content and water holding capacity of grassland and woodland soil.</p> <p>10. To study the vegetation structure through profile diagram.</p> <p>11. To estimate transparency, pH and temperature of different water bodies.</p> <p>20. Spices: Examine Black pepper, cloves, cinnamon (hand sections) and open fruits of cardamom and describe them briefly.</p> <p>21. Preparation of an illustrated inventory of 10 medicinal plants and use their in indigenous systems of medicine of allopathy: Write their botanical and common names, parts used and diseases/disorders for which they are prescribed.</p>
April	<p>Paper XI: Ecological adaptations in xerophytes, hydrophytes and halophytes.</p> <p>Biogeochemical cycles with particular reference to C, N and P.</p> <p>Paper XII: Beverages: Cultivation practices, botanical name, family and active ingredients of tea and coffee.</p> <p>Rubber: Major sources; Para Rubber: cultivation, processing and uses of Para rubber.</p> <p>Narcotics: Cannabis, tobacco and opium.</p>	<p>12. To measure dissolved oxygen content in polluted and unpolluted water samples.</p> <p>13. To estimate salinity of different water samples.</p> <p>14. To determine the per cent leaf area injury of different leaf samples collected around polluted sites.</p> <p>15. To demonstrate dust holding capacity of the leaves of different plant species.</p> <p>22. Beverages: Section of boiled coffee beans and tea leaves to study the characteristic structural features.</p>