

Ewing Christian College

(An Autonomous College of University of Allahabad)

Curriculum structure of Botany (2015-16)

Three Year Undergraduate Degree Course (06 Semesters)

Academic year	Semester No.	Paper No.	Title of the Paper	Course Content of Paper
B.Sc. 2	III	1	Morphology, anatomy and economic utilization of Angiosperms	Morphology, Anatomy and Economic Botany of Angiosperms
		2	Cytogenetics genetics and plant breeding	Cytogenetics, Genetics and Plant breeding
		3	*PRACTICALS BASED ON PAPER 1 AND 2	
	IV	1	Angiosperms (taxonomy and embryology) and Biodiversity	Taxonomy and embryology of Angiosperms and Biodiversity
		2	Plant physiology growth and development	Physiology, Metabolism and Morphogenesis of plants
		3	*PRACTICALS BASED ON PAPER 1 AND 2	
		2	Applied Microbiology	Microbial diversity, Microbiological techniques And Applied Microbiology
		4	*PRACTICALS BASED ON PAPER 1, 2 AND 3 and SEMINAR PRESENTATION (25 marks)	

B.Sc. Part II
SEMESTER III

Paper 1

Max Marks : 60

**TITLE : MORPHOLOGY, ANATOMY AND ECONOMIC UTILIZATION OF
ANGIOSPERMS**

Unit 1 : Morphology

15 marks

Morphology of root, stem, leaf and their modification. Inflorescence type and their modification, flower as modified shoot, fruit types, morphology of seeds, Insectivorous plants, Morphological adaptation in xerophytes and hydrophytes.

Unit 2 : Anatomy

25 marks

Tissues : Classification of tissues; Simple and complex tissues.

Stem : Organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory)

Types of vascular bundles; Structure of dicot and monocot stem.

Root : Organization of root apex (Apical cell theory, Histogen theory); Quiescent centre;

Root cap; Structure of dicot and monocot root;

Secondary growth : An account of normal secondary growth in herbaceous and woody plants.

Anomalous anatomy : Primary anomaly and anomalous secondary growth as exemplified by structure of *Boerhaavia*, *Pyrostegia* (*Bignonia*) *Leptadenia* and *Dracaena* stem.

Root-stem transition.

Unit 3 : Economic Botany

20 marks

Use of Plants and Plant products with special reference morphological part, family, processing (if desired) important phytochemicals (if known) and economic importance of the following :

Food Plants : Cereals (Wheat, Rice, and Maize), pseudocereals, millets, Legumes (Pigeon pea, Ground nut, Gram), (g) Edible oils : *Arachis*, *Coconut*, *Brassica*, *Ricinus*. Sugar-cane and fruits.

Food adjuncts : Beverages (Tea and Coffee), Spices and condiments (*Piper nigrum, Capsicum, Curcuma, Zinziber, Crocus sativus, Coriandrum sativum, syzygium aromaticum*)

Masticatories & Fumicatories (*Piper betel, Areca catechu, Acacia catechu, Pittosporum tobacum*).

Timber : Teak, Sal, Shisham; **Fibre :** Cotton, Jute, Sunn hemp and Coir; **Rubber :** *Hevea* and *Ficus*.

Tannins : *Acacia*; **Gums :** *Acacia, Sterculia*; **Resins and oleo gum resin;** **Dye yielding plants**

Pharmacognosy : pharmacognosy and its importance in medicine, Drug yielding plants : drugs, narcotics : (*Cinchona, Aconitum, Atropa, Artemisia, Rauwolfia, Cannabis sativa, Papaver somniferum*)

Elementary knowledge of Ethnobotany

SEMESTER III

Paper 2

Max. Marks : 60

TITLE : CYTOGENETICS, GENETICS AND PLANT BREEDING

Unit 1 : Cytogenetics

20 marks

Chromatin organization : Types of Chromatin, Chromatin structure and DNA packaging in eukaryotic chromosome, B chromosome, Polytene and Lampbrush chromosome, Centromere, and Kinetochore, telomere structural organization and function.

Cell mechanics : Cell cycle and its molecular regulation, mitosis, meiosis and concept of apoptosis and cancer (brief idea).

Variation in chromosome number and structure : Chromosomal aberrations, aneuploidy and polyploidy

Unit 2 : Genetics

20 marks

Principles of genetics : Elements of heredity and variation, Mendel and his experiments principles of segregation and independent assortment, test and back cross, polygenic inheritance in plants.

Genetic interactions : Genetic interactions with special reference to modified monohybrid & modified dihybrid ratio, various types of intra and intergenetic interactions; Multiple alleles, Pleiotropy, Penetrance and expressivity, Numericals; Polygenic inheritance.

Linkage and crossing over : Linkage and crossing over – Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numericals based on gene mapping.

Gene mutation : Spontaneous and induced mutations, Frame shift mutation; Molecular basis of Mutations; Mutagens – physical and chemical (tautomerization, Base analogs, deamination, alkylation and intercalating agents)

Extra nuclear inheritance : Chloroplast mutation : Variegation in Four o'clock plant; Mitochondrial mutations in yeast; Maternal effects-shell coiling in snail; Infective heredity – Kappa particles in *Paramecium*.

Sex determination in Plants

Unit 3 : Plant breeding

20 marks

Introduction : Definition, Scope achievement and future prospects challenges of plant breeding, Vavilovs concept of center of origin of crop plants.

Methods of Plant Breeding : Domestication, Introduction, Selection (Mass and Pure line selection).

Hybrid production for crop improvement : Methods of hybridization and selection of hybrids (Pedigree, Bulk selection and back cross method)

Natural emasculation devices in plant breeding : Genetic basis and role of Male sterility and self incompatibility plant breeding.

Heterosis : Heterosis and Inbreeding depression, genetic basis and significance, Biotechnological approach in plant breeding (elementary idea).

SEMESTER IV

Paper 1

Max.Marks : 60

TITLE : ANGIOSPERMS (TAXONOMY AND EMBRYOLOGY) AND BIODIVERSITY

Unit 1 : Taxonomy of Angiosperms

25 marks

Botanical nomenclature : Principles and rules (ICBN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations;

Systems of classification : Classification systems of Bentham and Hooker (up to series) and Comparative study of the classification system proposed by Linnaeus, Engler and Prantl, Hutchinson and Takhtajan. Introduction to APG System.

Taxonomic studies of the following families : Ranunculaceae, Malvaceae, Papaveraceae, Capparidaceae, Cucurbitaceae, Fabaceae, Myrtaceae, Apiaceae, Rubiaceae, Acanthaceae, Asclepiacaceae, Solanaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Liliaceae, Orchidaceae, Poaceae.

Unit 2 : Biodiversity

15 marks

Biodiversity : Concept and definition, types of biodiversity, endemism, endangered and threatened species, Hot spots of Biodiversity, Red data book, Biodiversity of India and Uttar Pradesh, Conservation of biodiversity.

Phytogeography : Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India; Forest types of India, Vegetation of Allahabad.

Unit 3 : Embryology of Angiosperms

20 marks

Structure of Angiosperm flowers : Structure of androecium and gynoecium and placentation.

Anther and male gametophyte : Development of anther, structure of anther wall, microsporogenesis and pollen development anther dehiscence and viability.

Ovule and female gametophyte : Structure and types of ovule, special ovular structures (endothelium aril, caruncle, hypostase megasporogenesis and mono, bi-and tetrasporic type of embryo sac, megagametogenesis)

Pollination and fertilization : Agencies of pollination, contrivances of self and cross pollination, pollen-pistil interaction growth of pollen tube up to entry in embryo sac. Syngamy and triple fusion. Apomixis.

Endosperm : Development, structure and function of endosperms. Type of haustoria, endosperm and embryo relationship.

Embryogeny : Types of embryogeny, development of mono-and dicot embryo, Polyembryony.

SEMESTER IV

Paper 2

Max. Marks : 60

TITLE : PLANT PHYSIOLOGY GROWTH AND DEVELOPMENT

Unit 1 : Physiology of Plants

20 marks

Plant water relationship : Water Potential and its components, water absorption by roots, pathway of water movement, symplast, apoplast, root pressure, guttation. Ascent of sap-cohesion-tension theory. Transpiration and factors affecting transpiration, antitranspirants, mechanism of stomatal movement (potassium ion influx).

Organic translocation : General Principles and mechanism of translocation of organic substances.

Mineral nutrition : Essential and beneficial elements, macro and micronutrients, methods of study and use of nutrient solutions, mineral deficiency symptoms, roles of essential elements,

Physiology of flowering : Photoperiodism, flowering stimulus, florigen concept, vernalization, seed dormancy.

Plant movement : Movement with special reference to paratonic movements.

Unit 2 : Plant Metabolism

20 marks

Respiration : Glycolysis, fate of pyruvate, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, TCA cycle, amphibolic role, mitochondrial electron transport, oxidative phosphorylation, respiratory substrates factors affecting respiration.

Photosynthesis : Photosynthetic pigments, role of photosynthetic pigments (chlorophylls and accessory pigments), antenna molecules and reaction centres, photochemical reactions, photosynthetic electron transport, PSI, PSII, Q cycle, CO₂ reduction, photorespiration C₄ pathways; Crassulacean acid metabolism;

Unit 3 : Plant Morphogenesis

20 marks

Plant morphogenesis : Concept of morphogenesis, growth differentiation and development, Regulation of morphogenesis.

Photomorphogenesis and role of phytochrome.

Plant growth regulators : Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxin, gibberellins, Cytokinin, Abscisic acid, Ethylene. Brassinosteroids and Jasmonic acid. Plant hormone as morphogenetic regulator and cell signaling.

An elementary knowledge of polarity symmetry and their role in plant morphogenesis.

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B.Sc. 1	I	1	Diversity of cell organization in plants and general botany	Viruses, Prokaryotes, Eukaryotic cell organization, Scope and history of Botany
		2	Diversity of algae and bryophytes	Algae and Bryophytes
		3	*PRACTICALS BASED ON PAPER 1 AND 2	
	II	1	Diversity of Pteridophytes and Gymnosperms	Pteridophytes and gymnosperms
		2	Mycology and Phyto-pathology	Fungi, Lichen, Mycorrhiza and Plant Pathology
		3	*PRACTICALS BASED ON PAPER 1 AND 2	

SEMESTER I

Paper 1

Max. Marks : 60

TITLE : GENERAL BOTANY AND DIVERSITY OF CELL ORGANIZATION IN PLANTS

Unit 1 : General Botany

15 marks

Scope of Botany : Characteristics of plants, Branches of Plant Sciences, Botanical institutions. Important herbaria and botanical gardens of the world and India; Plant kingdom diversity and classification, Curious plants, Scope and future prospects of plant sciences.

History of Botany : Brief history of Plant Sciences and contributions of the following Indian Scientists in their specific fields – Winfield. Dudgeon, E. J. Butler, M.O.P. Iyengar, K.C. Mehta, and S.R. Kashyap, Birbal Sahni, Divya Darshan Pant, P. Maheshwari, R. Mishra, R. N. Singh, J. S. Singh, Govindjee, H. G. Khorana, M. S. Swaminathan.

Unit 2 : Viruses and Prokaryotes

25 marks

Viruses : Discovery, General description, classification Structure and chemical composition of Viruses, Structure and multiplication of Tobacco mosaic virus (TMV), Structure of Bacteriophage, Lytic and Lysogenic cycles of Bacteriophages, Cynophages, Viroids and Prions Transmission of viruses, Economic importance.

Bacteria : Discovery, General characteristics, classification, types-archaebacteria, eubacteria, cell structure and cell wall composition of Eubacteria, shape, flagellation, pili, plasmid and episome, wall-less forms (Mycoplasma), Nutritional types, Differential Gram staining. Reproduction vegetative asexual (endospore and binary fission), Genetic recombination (Transformation), conjugation and Transduction), Economic importance.

Cynobacteria : Cell structure and organization, affinities with eubacteria and algae.

Unit 3 : Eukaryotic Cell Organization

20 marks

Plant Cell Organization : Concept of R.N.A. world and origin of eukaryotic cells, Cell theory and concept of organism, Structure and function of cell and its components, cell membrane, endoplasmic reticulum, Golgi apparatus, Lysosomes, Peroxisomes. Hydrogenosome, Ribosomes, Mitochondria, Chloroplast, and Nucleus.

Fungal Cell Organization : Structure, composition and division of fungal cell, sensitivity of fungal cell against antibiotic.

SEMESTER I

Paper 2

Max. Marks : 60

TITLE : DIVERSITY OF ALGAE AND BRYOPHYTES

Unit 1 : Diversity of Algae

30 marks

General Account and Classification : General characters, economic importance (Food, Phycocolloid agar, carageenan, Diatomite, biofertilizer), Principles of Classification, Fritch's Classification and recent trends in classification, types of life cycles in algae.

Cyanophyceae : General characteristic, heterocyst and mechanism of nitrogen fixation, chromatic adaptation, Morphology and life cycle of *Oscillatoria* and *Nostoc*.

Chlorophyceae : Important general features of chlorophyceae, occurrence, structure reproduction and life cycles of (a) *Volvox* (b) *Oedogonium* (c) *Coleochaete* (d) *Chara*.

Xanthophyceae : Important general features of xanthophyceae, occurrence, Morphology, reproduction and life history of *Vaucheria*.

Bacillariophyceae : General account, cell structure, cell division sexual reproduction auxospore formation and life cycle in reference to the Diatoms.

Phaeophyceae : Important general features of Phaeophyceae, occurrence structure, reproduction and life cycles of *Ectocarpus*.

Rhodophyceae : Important general features of Rhodophyceae, occurrence, structure, reproduction cystocarp development and life cycles of (i) *Batrachospermum* (ii) *Polysiphonia*.

Unit 2 : Diversity of Bryophytes

30 marks

General account : General characters of Bryophytes, Amphibious nature, affinities of bryophytes, classification of bryophytes up to class with diagnostic features, Economic importance of bryophytes, evolution of sporophyte in bryophytes.

Hepaticopsida : Comparative account of gametophyte (morphology and anatomy) structure, reproduction, sporophyte development spore dispersal and alternation of generation in *Riccia* with *Marchantia* and *Pellia* with *Porella*.

Anthocerotopsida : Occurrence, gametophyte structure (morphology and anatomy) reproduction, sporophyte development, spore dispersal and alternation of generation in *Anthoceros*, synthetic nature and affinities of hornworts.

Bryopsida : Occurrence, gametophyte structure (morphology and anatomy) reproduction, sporophyte structure, spore dispersal and alternation of generation in *Sphagnum* and *Funaria*, p.

SEMESTER II

Paper 1

Max. Marks : 60

TITLE : DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS

Unit 1 : Pteridophytes

30 marks

General Account : General characters of Pteridophytes, Pteridophytes as early land plant, Classification with diagnostic characters and examples, economic importance.

Fossil Pteridophyte : Structural features, Geographical distribution and new reconstruction *Aglaophyton* and *Rhynia*.

Life History : Distribution, Habit, Habitat, Range of morphological and anatomical variation, reproduction and structure of gametophyte in (i) *Lycopodium* and *Selaginella* (comperative account) (ii) *Equisetum* (ii) *Marsilea* (iv) *Pteris/Dryopteris*

Special topics : Telome and Stellar Theory, Heterospory and origin of seed-habit.

Unit 2 : Gymnosperms

30 marks

General Account : Affinities, general characters, classification (D.D. Pant, 1957) with diagnostic features and economic importance.

Comperative account of distribution, morphology and anatomy of root, stem, leaves, male and female reproductive parts, structure and development of male and female gametophyte and gametes, pollination, fertilization, Embryogeny and phylogeny of *Cycas*, *Pinus* and

Ephedra. female
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SEMESTER II

Paper 2

Max. Marks : 60

TITLE : MYCOLOGY AND PHYTOPATHOLOGY

Unit 1 : Fungi

30 marks

General Account : General Characters of fungi, hyphal forms, fungal spore forms, Sexual reproduction, classification (Ainsworth system), Economic importance.

Mastigomycotina : Diagnostic feature, classification and life cycle with reference to *Albugo*.

Zygomycotina : Diagnostic features, life cycle and Zygosporangium formation in *Rhizopus*.

Ascomycotina : Diagnostic features, classification, Ascus development and types of ascocarps, Life cycle with reference to *Eurotium (Aspergillus)*, *Neurospora* and *Peziza*.

Basidiomycotina : Diagnostic features, classification types and development of basidium, Life cycle with reference to *Puccinia*, and *Agaricus*.

Deuteromycotina : Diagnostic features and life cycle of *Collectotrichum*.

Myxomycotina : Diagnostic features of slime molds.

Special topics : Heterokaryosis and Parasexuality in fungi.

Unit 2 : Fungal Association

12 marks

Lichens : General characters, Thallus organization, nature of association of algal and fungal partners, Reproduction and economic importance.

Mycorrhiza : General characters, types and importance.

Unit 3 : Plant Pathology

18 marks

General Plant Pathology : Koch's postulate, Symptoms of plant diseases (Bacterial, viral and fungal); Defense mechanisms in plants, Prevention and control measures of plant diseases (Chemical, biological and integrated)

Symptoms, causal organisms etiology and control measures of following diseases : Leaf curl of Papaya, Citrus canker, Late and early blights of potato, Powdery mildew of cucurbits, Smut of cereals, Leaf spot disease of ground nut.